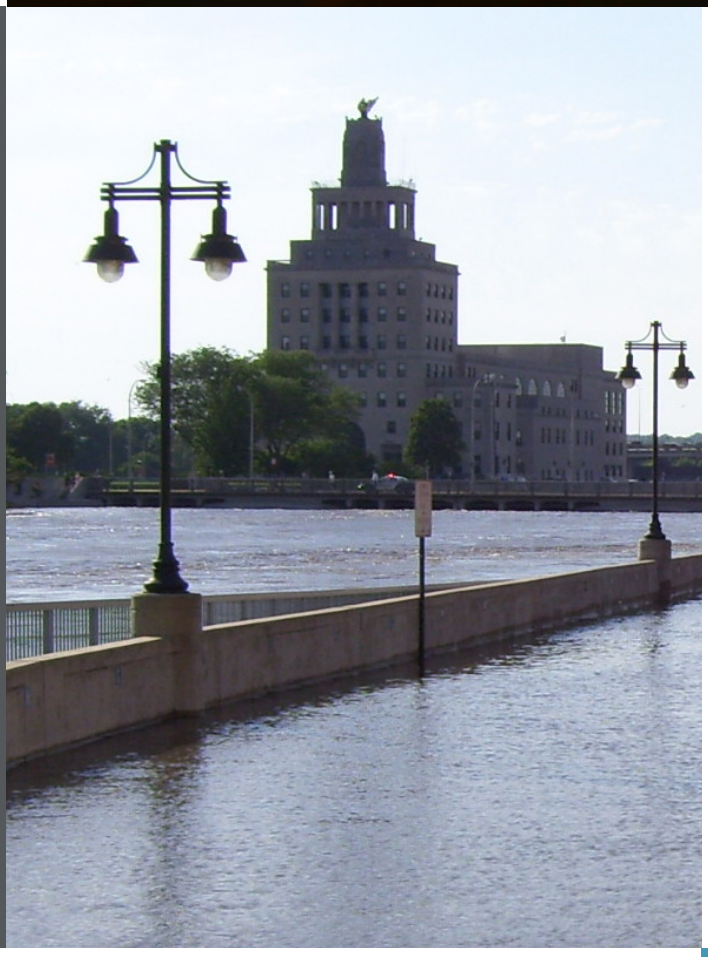


May

2016

CEDAR RAPIDS
City of Five Seasons

Stormwater Master Plan

City of Cedar Rapids

Cedar Rapids, Iowa

HDR ANDERSON BOGERT

Introduction

It has been nearly 20 years since the City last completed a Stormwater Master Plan. At that time, the estimated $14.4 million for recommended improvements was beyond funding capabilities and numerous recommendations were never implemented.

On June 29 and 30 of 2014, **3.5 to 5.5 inches of rain** fell on the City of Cedar Rapids **in less than 6 hours.** Rainfall intensities peaked above 8 inches per hour for short periods in some locations.

Torrential Overnight Rains Cause Significant Flooding Across Eastern Iowa

Massive overnight rain totals have left residents across Eastern Iowa dealing with flash flood damage, with additional heavy rain in the forecast today.

The torrential rains, which hit areas around Highway 20 around 9 pm Sunday and areas around Cedar Rapids around 11:30 pm, caused massive sewer backups and washed out several area roads...

-The Gazette
June 30, 2014

Extreme events like this are becoming more and more frequent in Iowa and across the Midwest, leaving cities with little immediate recourse or response.

The localized flooding that occurred during the June 2014 event was significant and widespread throughout the City causing substantial damage to private property. The magnitude of the damages and increasing frequency of these extreme events prompted the City to review and reemphasize the capacity and condition of its stormwater infrastructure.

This Executive Summary provides an overview of the results from a nine-month effort to develop a hydraulic model of the City's stormwater system and provide an initial update to the City's prior Stormwater Master Plan. The intent is to move forward with capital improvements to address the highest priority stormwater needs while taking the initial steps to produce a living Master Plan that will become more comprehensive through additional effort over the next several years.

The initial Master Planning effort reflects the collaborative effort of City and consultant staff to bring a fresh perspective and innovative thought to accomplish the following, which are detailed on the following pages:

1. Reflect the **City's vision** for the future as presented in EnvisionCR
2. Develop a **hydraulic model** that can serve as a platform to better define needs and consider cost-effective solutions
3. Reflect City staff's efforts to maintain and preserve the existing stormwater system through **asset management**
4. Prioritize and recommend projects for the **capital improvements plan**
5. Identify **financial needs and potential funding** to close the gap between revenues and needs
6. Consider potential **policy solutions** to address fundamental issues that contribute to current flooding problems
7. Establish the foundation for **annual updates** to expand and improve upon the initial plan

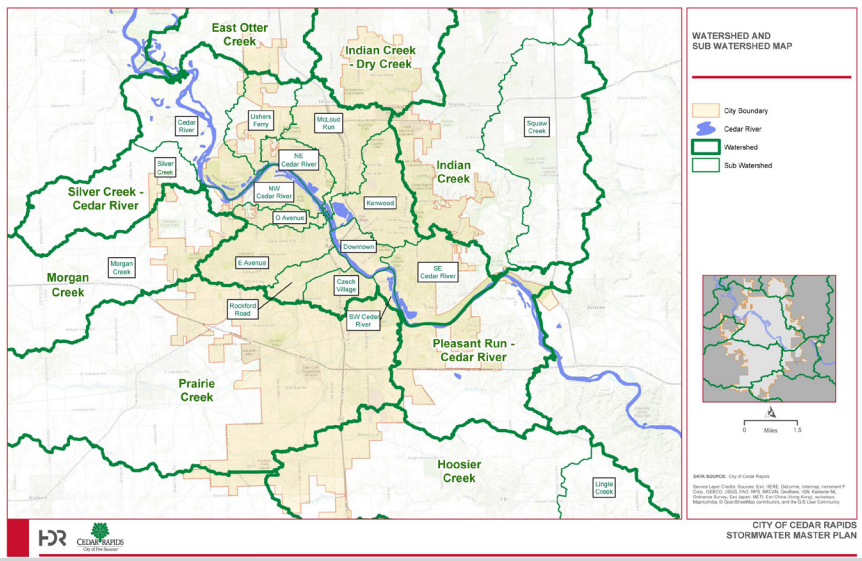
The City's existing stormwater system is intended to protect against regularly recurring damage, reduce street maintenance costs, and provide an orderly urban drainage system.

Metro Area Design Standards indicate that the stormwater system should:

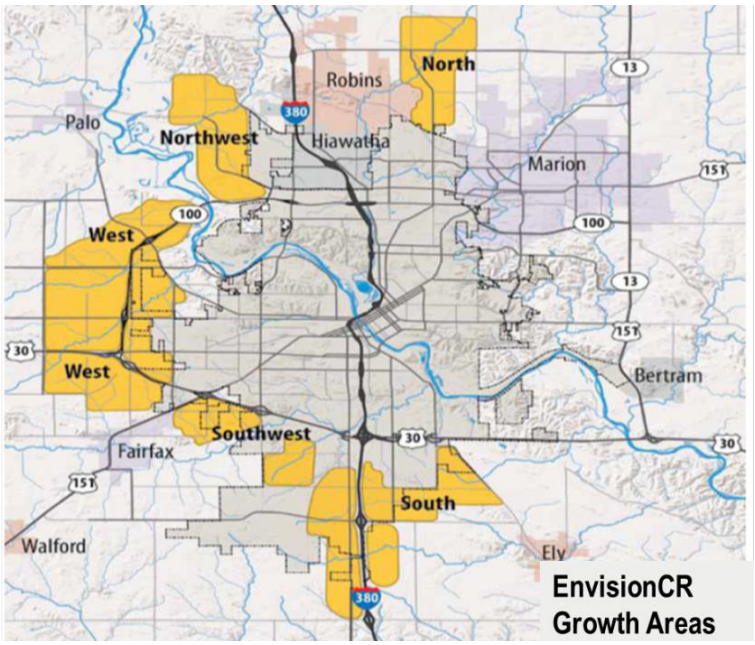
- Contain and convey the runoff from a minor storm event (an event with a return interval of 5 years or less)
- Prevent major property damage or loss of life from the runoff associated with a major storm event (an event with a return interval of 100 years or less).

Given a history of flooding, the City has already, or is in the process of constructing permanent berms and floodwalls and developing a Flood Response Plan. The Flood Response Plan outlines specific tasks to be performed at specific stages (that is, water surface levels) of the Cedar River. All are intended to mitigate flood damage.

EXISTING SYSTEM. The existing stormwater system includes more than 500 miles of conveyance structures; nearly 800 detention basins, three constructed wetlands; and 127 miles of open channels and ditches; The system serves eight watersheds further subdivided into 13 west side and 10 east side sub watersheds. All but one are tributary to the Cedar River; one is a tributary to the Iowa River.



1. Reflect the City's Vision



ENVISIONCR GROWTH AREAS

Continued growth in Cedar Rapids is a reflection of the City's resiliency.

EnvisionCR identifies the City's vision for the future, targeting growth areas to the West, Southwest, South, North, and Northwest. EnvisionCR also includes several specific stormwater-related initiatives including watershed planning, capital improvements planning, policy refinement, best management practices, and sustainability.

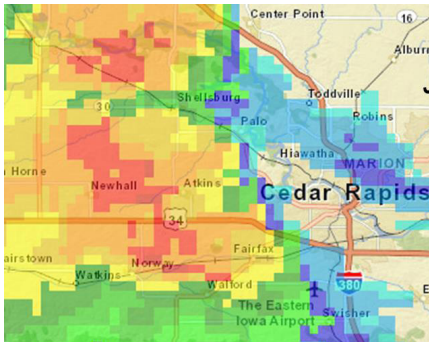
2. Develop Hydraulic Model to Better Define Needs

Major components of the City's stormwater conveyance system were incorporated into a Citywide **"macro-scale"** model. Additional detail and surface topography were incorporated into a **"basin-scale"** model for the Kenwood Basin. Macro model results differentiate pipes that flow full because they are actual bottlenecks (undersized) or surcharged by downstream bottlenecks from those that flow more than or less than half full. Basin model results do the same, but also identify and differentiate surface ponding areas to indicate surface ponding depths.

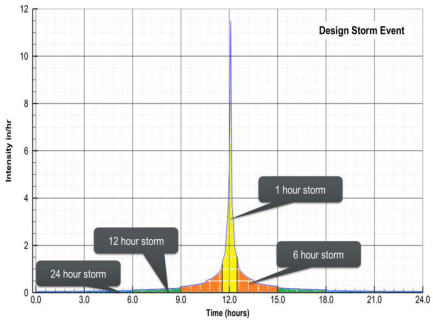
Both models were used to simulate stormwater system performance for the June 2014 storm event, as well as 5- and 100-year design storm events. The Citywide macro model provided a broad overview of the performance of major conveyance components of the stormwater system. The Kenwood basin model provided a broad overview of the extent of surface ponding, as well as the performance of conveyance components. In both cases, June 2014 model results were compared with anecdotal information from the actual event to validate the models.

STORMWATER COLLECTION AND CONVEYANCE SYSTEM MODELING. Macro-scale model provided broad overview of performance of major conveyance components.

JUNE 2014 STORM. June 2014 model results were compared with anecdotal information from the actual event to validate the models.

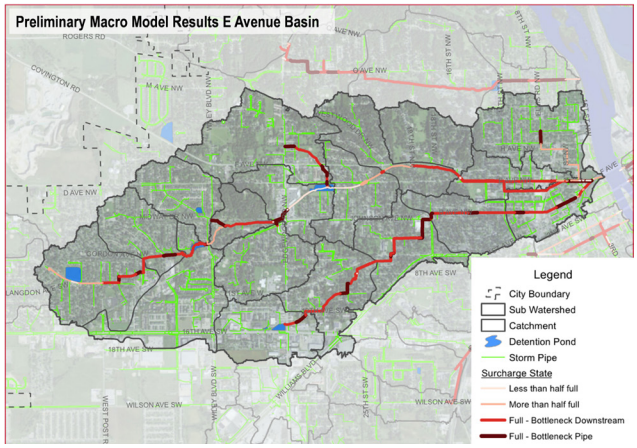


DESIGN STORM EVENTS. Models were also used to simulate stormwater system performance during design storm events.



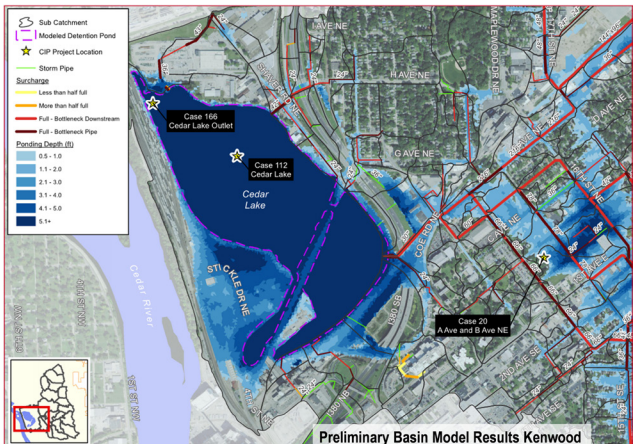
Preliminary Macro Model Results

- Much of the existing stormwater collection system cannot contain and convey the five-year rainfall event identified by the Metro Area Standards.
- Significant ponding and overland flow beyond the public right of way are likely during the 100-year event.



Preliminary Kenwood Basin Model Results

- There are numerous pipe bottlenecks and extensive areas of surface ponding.
- The more prominent areas of concern within and beyond the public right of way.



The intent is to develop basin models for Cedar Rapids over the next several years to evaluate individual projects as well as basin wide mitigation alternatives, including the potential merits of green infrastructure, local and regional detention, and/or conveyance improvements. Future model results will also be used to inform and improve the capital improvement plan (CIP). This multi-year strategy will also allow the models to be improved and updated as more data become available.

3. Maintain and Preserve System through Asset Management

While much of the public focus has been on identifying and implementing capital improvements to address flooding problems, the Public Works Department is also charged with operating and maintaining the existing stormwater system. The Department is in the process of significantly overhauling practices, procedures, and policies for maintaining and preserving the City's existing stormwater infrastructure. **Significant operational changes will be implemented to inventory assets, assess the condition, perform maintenance, and refine management policies.** Additional recommendations have been provided to further enhance management of existing stormwater assets through standardizing maintenance activities using the Iowa Stormwater Management Manual and benchmarking of other utilities to refine existing O&M standards.

Asset Management Overhaul

- Updating the City's Geographic Information System (GIS) with current asset information
- Transitioning to EnerGov for computerized maintenance management
- Implementing new CUES digital inspection equipment
- Integrating all three to avoid duplication

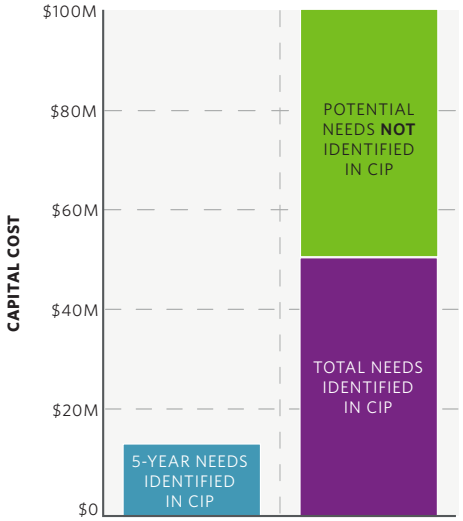
4. Prioritize for Capital Improvements Plan

As shown in the figure below, the current capital improvements plan (CIP) reflects nearly $50 million of capital needs that have been identified to date, primarily in response to flooding in June 2014 and prior studies.

Current Capital Improvements Plan (CIP):

$11 Million short-term (5-year) improvements

$50 Million total improvements



CAPITAL NEEDS. Preliminary modeling results indicate that there are likely additional capacity related needs not yet reflected in the CIP. Those additional needs could increase the overall magnitude to a range of $75 to $100 million. Further model development over the next few years will more fully inform this number and assist with prioritization of the CIP.

As the City continues to refine and implement its Asset Management Program, condition related needs will be more accurately identified and reflected in the CIP as well. Doing so could also warrant a significant increase in total capital need moving forward to maintain and preserve the City's investment in the existing system.

To match anticipated funding, annual expenditures of $2.10 million to $2.34 million are identified for fiscal years 2017 through fiscal year 2022. The capital projects have been selected using criteria that consider first a project's priority and then evaluate a project's readiness.

With a few exceptions, the City's CIP does not include expenditures to address growth related stormwater infrastructure. Given the magnitude of funding needs, it is **critical that growth areas be served by stormwater infrastructure paid for by the associated development(s).** This will require conceptual planning to identify stormwater needs in growth areas. It will also require due diligence to assure that growth related stormwater infrastructure is adequate for both initial development and future growth in the surrounding watershed.

PRIORITY CRITERIA

- Health and Safety
- Cost Benefit
- Current Capacity
- Asset Functionality
- Water Quality & Environmental
- Associated / Other Considerations
- Sanitary Sewer Inflow Conveyance
- Future Growth & Sustainability

READINESS CRITERIA

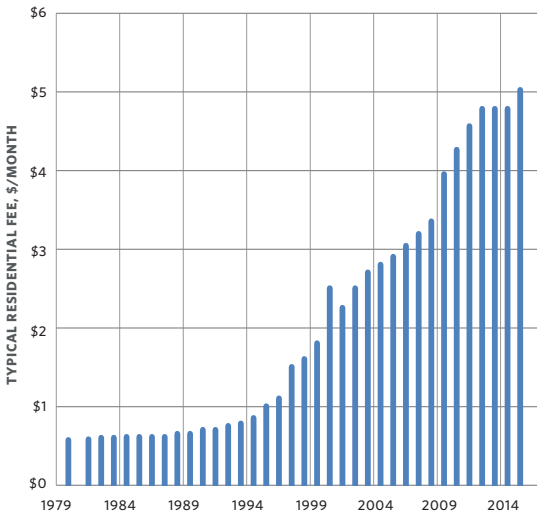
- Land Acquisition
- Prior Commitments
- Funding sources

CRITERIA. The capital projects have been selected using criteria that consider first a project's priority and then evaluate a project's readiness.

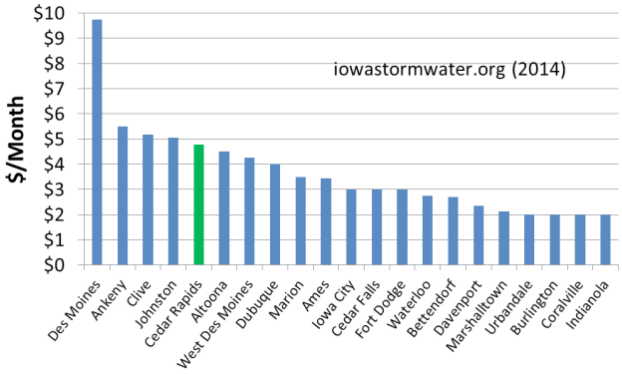
5. Identify Financial Needs and Potential Funding

As shown in the following graphs, the stormwater utility fee has evolved over the years from a flat rate to a tiered structure, and it falls in line with other stormwater utility fees in Iowa.

CEDAR RAPIDS HISTORICAL STORMWATER UTILITY FEE. The stormwater utility fee has evolved over the years from a flat rate to a tiered structure.



TYPICAL MONTHLY RESIDENTIAL STORMWATER UTILITY FEES (IOWA). Currently at $5.02 per month for a typical residential customer, Cedar Rapids' rate is above the median, but well below the highest rate of $9.74 per month for the larger communities in Iowa, based on 2014 survey results from iowastormwater.org.



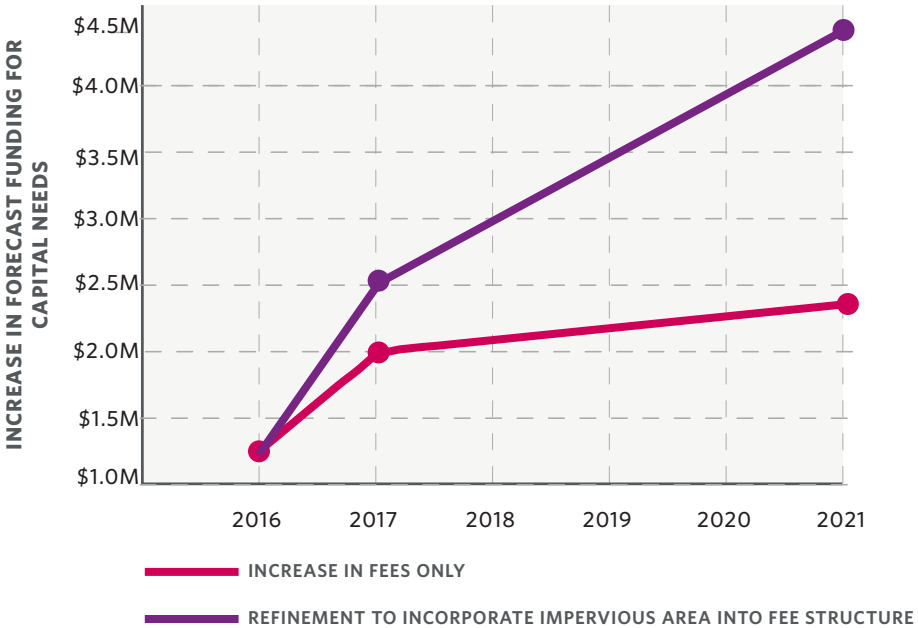
Note: Cedar Rapids' rate is slightly below the median calculated in a national survey by Black & Veatch that included 78 participants with average monthly single-family rates ranging from $0.24 to $26.58 in 2014.

Over the past eight years, stormwater utility fees have generated approximately $1.5 to $3 million per year for stormwater capital improvements. CDBG funding has provided approximately $9 million of additional funding over the last several years. **With the aforementioned capital needs of $50 to $100 million or more, there is a significant gap between available funding and capital needs.**

Other stormwater utilities share many of the same needs and challenges as Cedar Rapids. National survey results indicate that most utilities fund stormwater management in whole or in part through stormwater user fees that account for more than all other funding sources combined. Survey results also indicate that nearly all stormwater utilities use cash in lieu of debt financing, and that the majority indicate they do not have adequate funding to meet their total needs.

The current stormwater financial plan includes a 3.0 percent increase in stormwater utility fees in FY 2017 and a 5.0 percent increase in annual fees thereafter. It does not include borrowing. With the increase in fees, the plan increases the forecast funding for capital needs as shown in the graph below.

INCREASE IN FORECASTED FUNDING FOR CAPITAL NEEDS. With the increase in fees, forecast funding for capital needs increases from the current $1.3 million in fiscal year 2016 to approximately $2.0 million in fiscal year 2017 and $2.4 million per year by fiscal year 2021. The refinement to incorporate impervious area into the fee structure is forecast to generate an additional $0.5 million in fiscal year 2017 increasing to an additional $2.0 million by fiscal year 2021, subject to actual implementation timing and phasing.



Other potential funding sources have been used by other stormwater utilities and are potentially available to the City of Cedar Rapids. Towards that end, the City should proceed with the following:

- Continue to monitor and aggressively seek grant or other special funding opportunities as they arise.
- Consider other potential funding sources to provide a significant longer-term revenue source for stormwater (and other infrastructure) needs. *One possibility would be extension of the local option sales tax once the City has caught up with street reconstruction needs.*
- Continue to refine the stormwater utility fee structure so that it more accurately reflects stormwater quantities and cost of service.
- Prepare basin plans to identify regional stormwater needs in growth areas and refine the stormwater management impact fee as appropriate to pay for growth.
- Address localized stormwater needs in collaboration with street reconstruction, water, sewer, and other public projects to realize economies of scale.
- Work collaboratively with a neighborhood and a large commercial property on a pilot assessment district and a pilot cost share, respectively.
- Continue to provide the public with information on the benefits provided by the City's stormwater management program, along with the associated costs and funding challenges.

Other Potential Funding Sources

- Taxes
- Grants
- Permitting and other taxes
- Special tax districts
- New development impact fees
- Sales taxes and other fees

6. Recommend Policies to Address Fundamental Issues

Increasing efforts to incorporate "green infrastructure" into existing stormwater management and other infrastructure policies tops the list of policy recommendations. This is consistent with the guidelines of EnvisionCR and is consistent with what other communities are doing regionally and nationally. Green infrastructure provides a more holistic stormwater management approach that mimics aspects of the natural hydrological cycle, including retention, infiltration, and evapotranspiration. Promoting stormwater infiltration and runoff reduction postpones indefinitely or delays the need for future grey infrastructure projects.

Other policy related issues for consideration to enhance the City's existing policies follow in no particular order. These recommendations typically originate as Public Works staff respond to citizen requests and target the safety and welfare of residents:

- Develop a private cross connect program that considers the increased stormwater flows.
- Implement a post construction grading survey for all development sites to assure that planned grading is achieved.
- Implement a "Soil Quality Plan" to reduce runoff to each area of infiltration post development.
- Incentivize green practices.
- Develop a funding policy to clarify liability for non-City stormwater property losses.
- Require low-level openings and lot corner grades on site development plans that reflect the associated drainage plans.
- Move towards regional rather than individual style detention basins for economies of scale.
- Develop a policy to discourage facilities encroaching on drainage easements.
- Consider targeted buy-outs in lieu of more expensive mitigation for flood prone properties.
- Increase Educational Program Awareness.

GREEN STORMWATER DETENTION

FACILITIES ENCROACHING ON DRAINAGE EASEMENT

7. Update Plan to Improve and Expand

The Stormwater Master Plan is intended to be a living document with regular updates to maintain and progress the plan. The primary responsibility for implementation lies with the Public Works Sewer Utility Engineering Manager. The Sewer Superintendent, Project Engineers, and Stormwater Coordinator will provide implementation support. The City Council, City Manager's Office, Stormwater Commission, Public Works Department, and Development Services all have a role and must have a vested interest in implementation to maintain regulatory compliance, meet public needs, and address the associated financial constraints.

With the stormwater related needs already identified, avoiding additional future growth related capital needs is critical. Growth should be targeted to areas that can be cost-effectively served, the appropriate regional stormwater facilities should be identified and sized, and stormwater facilities associated with specific developments must be consistent with the broader regional plan.

Stormwater related regulations continue to evolve at both the Federal and State levels. The Cedar River flood control system will have significant operations and maintenance requirements. Both could prompt significant staffing and operations and maintenance needs not currently reflected in the City's stormwater management financial plan.

CEDAR RAPIDS
City of Five Seasons

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Technical Memorandum

Date:	Friday, May 06, 2016
Project:	Stormwater Master Plan Update
To:	City of Cedar Rapids
From:	David Dechant, Mike Butterfield, Mike Schubert, Brice Stafne/HDR Bill Bogert, Terry Tiedemann/Anderson-Bogert
Subject:	Stormwater Master Plan Executive Summary

On June 29 and 30 of 2014, 3.5 to 5.5 inches of rain fell on the City of Cedar Rapids in less than 6 hours. Rainfall intensities peaked above 8 inches per hour in some locations. The localized flooding that occurred during this event was significant and widespread throughout the City causing substantial damage to private property. Unfortunately, extreme events like this are becoming more and more frequent in Iowa and across the mid-west leaving City officials with little immediate recourse or response. Figure 1 illustrates only a fraction of the damaged properties evaluated following that event. The magnitude of the damages and frequency of these extreme events has led the City to review and reemphasize the capacity and condition of its stormwater infrastructure.

This Executive Summary provides an overview of a nine-month effort to develop a hydraulic model of the City's stormwater system and provide an initial update to the City's Stormwater Master Plan previously prepared in 1998. The intent is to identify and move forward with capital improvements to address the highest priority stormwater needs while producing a living Master Plan that will become more comprehensive through additional modeling and master planning effort over the next several years.

The Executive Summary is organized as follows.

- Objective
- Existing System
- Asset Management
- Macro Modeling
- Basin Modeling
- Capital Improvements Plan
- Financial Needs
- Policy Recommendations
- Future Considerations

Attachments

- A – FY 2017 Capital Improvements Plan
- B – Stormwater Improvements Prioritization Template
- C – FY 2017 Financial Plan

Objective

The primary objectives of this initial Master Planning effort are as follows.

- Bring a fresh perspective and innovative thought to recommend projects for the FY2017 budget cycle based on criteria and projects identified to date
- Proceed with development of living Stormwater Master Plan that will become more comprehensive and expansive with time
- Obtain available GIS and other available information to facilitate higher level hydraulic modeling Citywide with more detailed hydraulic modeling in priority areas
- Develop a Capital Improvements Plan that clearly communicates the priorities, rationale, and timeline to address known stormwater issues
- Identify funding needs and develop a financial plan that closes the gap between current revenues and capital needs
- Understand and incorporate the City's vision as reflected in EnvisionCR
- Understand and incorporate City staff's vision for asset management
- Engage and work collaboratively with Public Works staff to identify potential stormwater policy solutions to fundamental issues that have contributed to current flooding problems
- Establish the framework for annual updates to expand and improve upon the initial plan

This Executive Summary provides an overview of work completed to date. The following Technical Memoranda provide additional detail and supporting information corresponding to the sections in this Executive Summary.

- TM 1.0 Existing System
- TM 2.0 Asset Management
- TM 3.1 Macro Modeling
- TM 3.2 Basin Modeling
- TM 4.0 Capital Improvements Plan
- TM 5.0 Financial Needs
- TM 6.0 Policy Considerations
- TM 7.0 Future Considerations

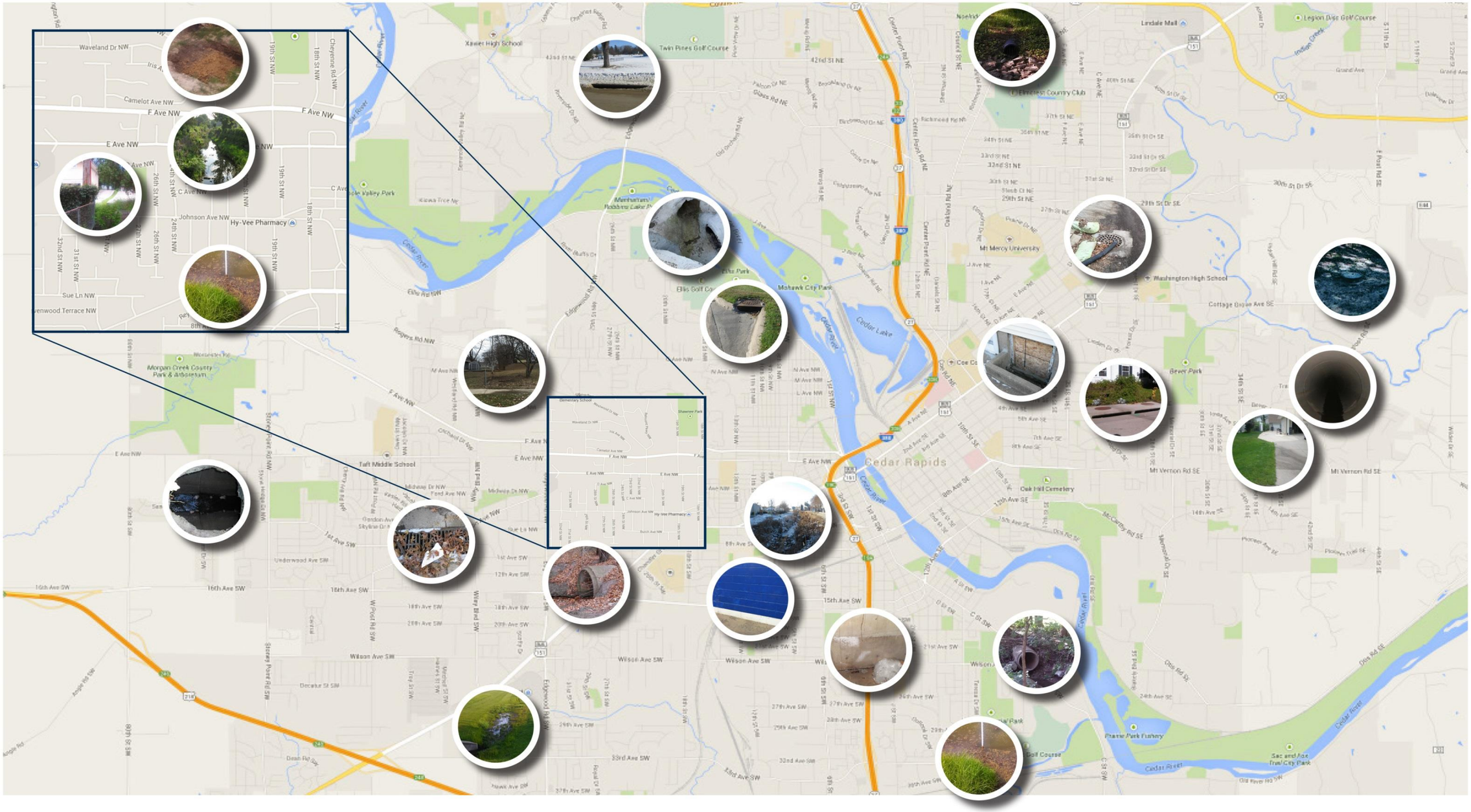


Figure 1 – Damaged Properties from June 2014 Event

Existing System

This section provides an overview of the components that comprise the City's existing stormwater system, identifies operations and maintenance responsibilities and activities, summarizes EnvisionCR targeted growth areas, and describes the baseline provided by the 1998 Stormwater Master Plan.

Stormwater System

The City's stormwater system is comprised of multiple assets, including more than 500 miles of conveyance structures; nearly 800 detention basins 95 of them public and the remainder private; three constructed wetlands; 127 miles of open channels and ditches; and flood mitigation berms and levees. The stormwater system is intended to:

1. Protect against regularly recurring damage; reduce street maintenance costs; provide an orderly urban drainage system; and provide public conveyance from the runoff associated with a minor storm event (that is, an event with a return interval of 5 years or less)
2. Prevent major property damage or loss of life from the runoff associated with a major storm event (that is, an event with a return interval of 100 years or less).

Figure 2 and Table 1 show and inventory the stormwater conveyance system.

Table 1 – Stormwater Conveyance System

Pipe Shape	Pipe Height (inches)	Total Length (miles)
Unknown	Unknown	0.2
Arched (with flat bottom)	Unknown	2.3
	18 – 24	0.04
	24 – 36	0.3
	36 – 48	1.1
	48 – 72	1.5
	72 – 108	0.4
Circular	Unknown	110.2
	2 – 18	256.6
	18 – 24	40.5
	24 – 36	51.6
	36 – 48	21.6
	48 – 72	13.9
	72 – 108	6.9
	108 – 148	0.3
Oval or Elliptical	Unknown	0.3
	27 – 78	0.2
	Total	**508**

For master planning purposes, the City has been divided into eight watersheds and further subdivided into 13 west side and 10 east side sub watersheds as shown in Figure 3 and summarized in Table 2. One, west side, sub watershed is tributary to the Iowa River. The remainder of the west side, sub watersheds, and all of the east side, sub watersheds are tributary to the Cedar River.

Table 2 – Watersheds

Watershed	Sub Watershed	Section of City	Receiving Water	Acres	Acres in City	% in City
West Side						
Morgan Creek	Morgan Creek	NW	Morgan Creek	12,152	1,294	11%
Prairie Creek	Prairie Creek	SW	Prairie Creek	35,471	12,795	36%
Hoosier Creek	Hoosier Creek	SW	Hoosier Creek	16,927	3,211	19%
	Lingle Creek	SE	Hoosier Creek	5,379	-	0%
Prairie Creek	Prairie Creek	SW	Prairie Creek	35,471	12,795	36%
	Silver Creek	NW	Cedar River	5,177	175	3%
	NW Cedar River	NW	Cedar River	1,508	1,207	80%
	O Avenue	NW	Cedar River	808	735	91%
	E Avenue)	NW, SW	Cedar River	2,919	2,919	100%
	Rockford Rd	SW	Cedar River	994	994	100%
	Czech Village	SW	Cedar River	1,158	1,158	100%
	SW Cedar River	SW	Cedar River	307	307	100%
Pleasant Run – Cedar River	Pleasant Run	SW	Cedar River	9,622	2,252	23%
East Side						
East Otter Creek	E Otter Creek	NE	Otter Creek	25,699	610	2%
Indian Creek	Indian Creek	SE, NE	Indian Creek	30,695	2,471	8%
	Squaw Creek	NE	Indian Creek	9,252	-	0%
Indian Creek - Dry Creek	Dry Creek	NE	Indian Creek	20,139	2,509	12%
Silver Creek - Cedar River	Usher Ferry	NE	Cedar River	2,233	1,207	54%
	NE Cedar River	NE	Cedar River	1,253	1,201	96%
	McLoud Run	NE	Cedar River	3,249	2,811	87%
	Kenwood	SE, NE	Cedar River	3,019	3,019	100%
	Downtown	SE	Cedar River	1,005	1,005	100%
	SE Cedar River	SE	Cedar River	3,626	2,480	68%

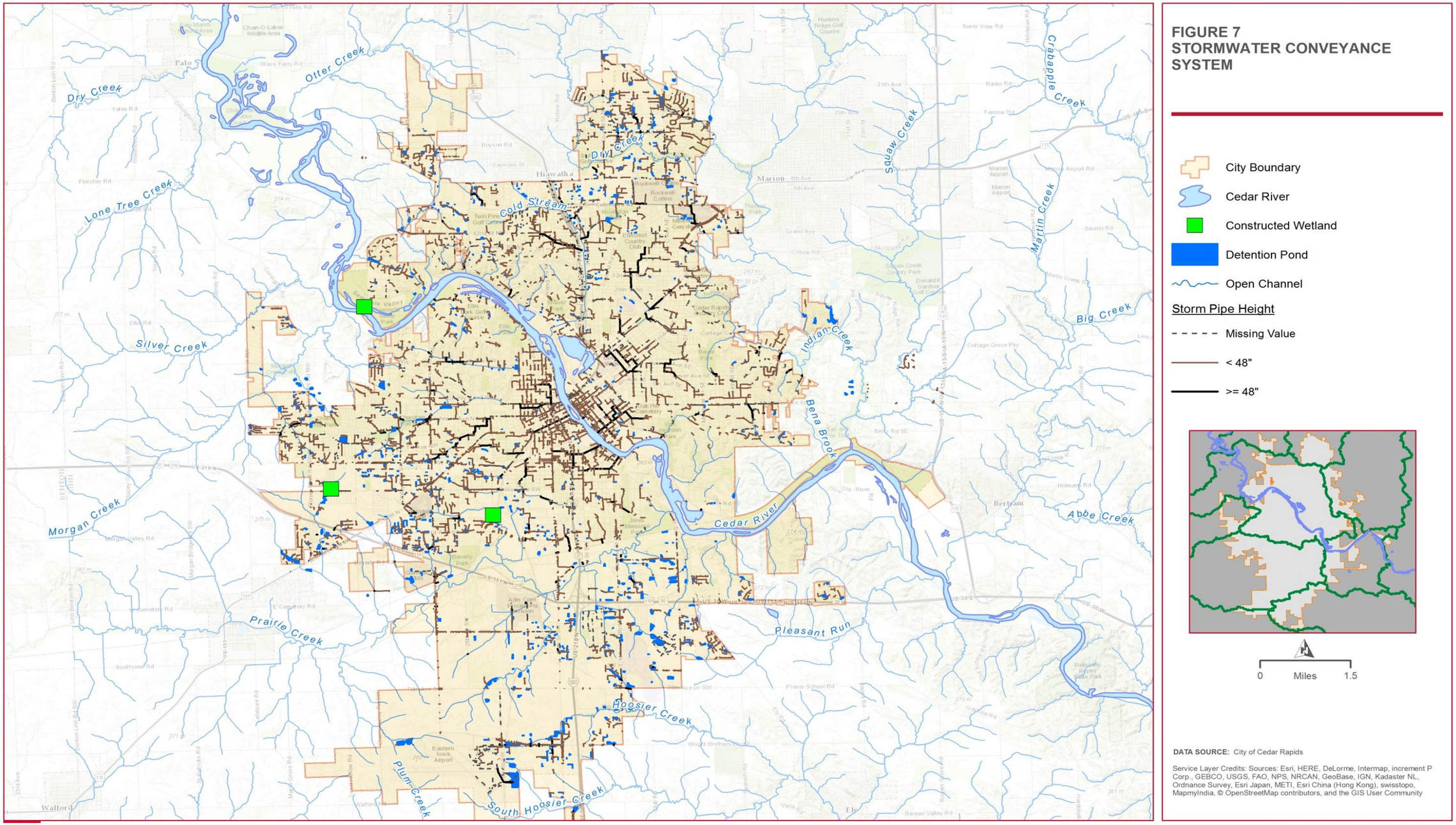


Figure 2 – Stormwater Conveyance System

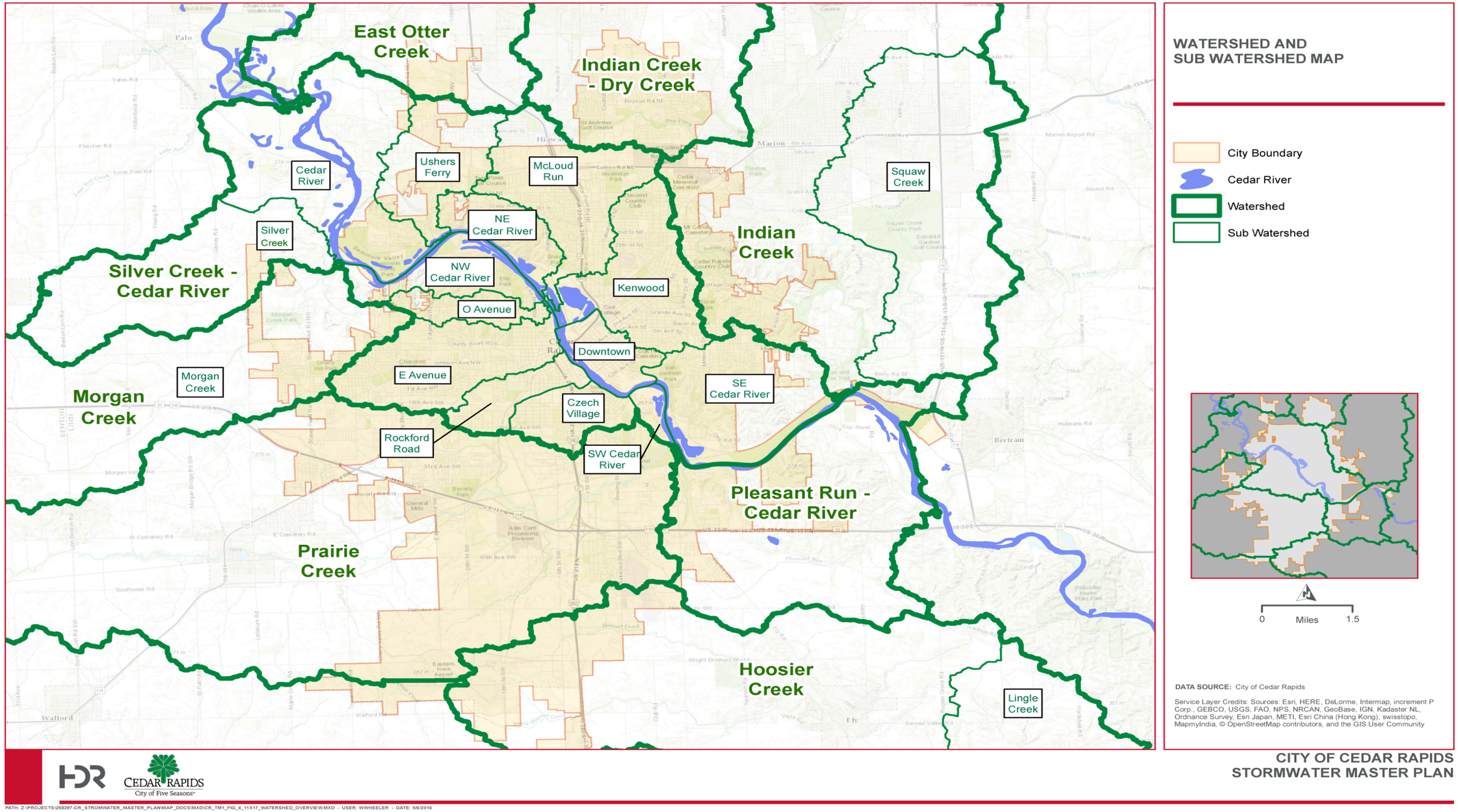


Figure 3 – Watershed and Sub watershed Map

Operations and Maintenance
The Sewer Maintenance Division of the City's Public Works Department operates and maintains the City's stormwater system and has drafted procedures for routine operations and maintenance activities. The procedures include inspections, minor repairs, mowing, street sweeping, and educational outreach. The procedures also include reactive responses to the public, cleaning and clearing, and minor repairs.

Given a history of both Cedar River and localized tributary flooding, the City has implemented a number of measures to mitigate flood damage. These mitigation measures include construction of permanent berms and floodwalls and a Flood Response Plan. The Flood Response Plan outlines specific tasks performed at specific stages (that is, water surface levels) of the Cedar River. It has evolved with experience over the years to include tasks such as closing flood gates, plugging storm sewers to prevent backflow from the River, installing portable pumps, closing roads, placing sand bags, shutting down traffic signals, evacuating neighborhoods, and installing temporary barriers. The ongoing Flood Control System Master Plan will implement permanent flood protection systems over the next 20 years.

EnvisionCR Growth Areas
Continued growth in Cedar Rapids, in spite of considerable flood damage, is a reflection of the City's resiliency. The City's comprehensive plan, EnvisionCR, identifies the City's vision for the future. That vision targets a number of growth areas as follows and as reflected in Figure 4.

- **West.** Orienting development in response to the Iowa Highway 100 expansion, and incorporating the natural environment as an amenity.
- **Southwest.** Dedicating land for industrial projects and establishing a network of streets for emerging neighborhoods.
- **South.** Dedicating land for major employer and large parcel projects, while completing a network of projects that would relate to Kirkwood Boulevard, while setting the stage for future growth past the southern ridgeline, which necessitates improved infrastructure.
- **North.** Dedicating land for residential development and a continuous parkway that connects neighborhoods and parks.
- **Northwest.** The concept completes the street network for neighborhoods and discourages development past the ridgeline, which necessitates improved infrastructure.

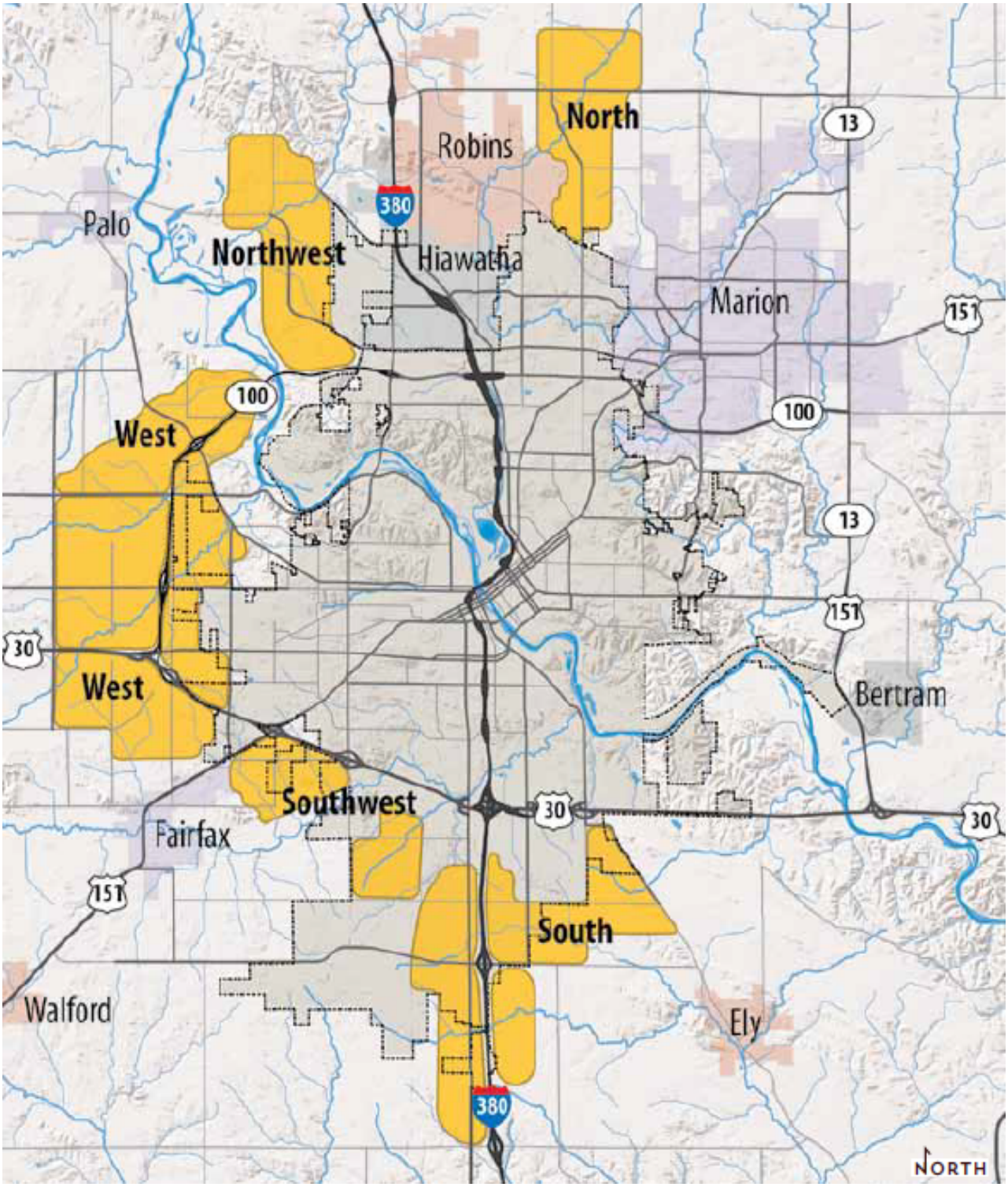


Figure 4 Growth Areas

EnvisionCR also includes several specific stormwater-related initiatives as follows.

- Prepare watershed management plans that provide improved aquatic habitats, recreational opportunities, and increased public access to natural resources, while maintaining necessary levels of flood control through coordination with appropriate stakeholders, including state and federal agencies, and other jurisdictions.
- Develop a stormwater master plan to measure, monitor, and manage stormwater drainage for the City's watersheds.
- Prepare a capital improvements plan that addresses both the needs of existing core neighborhoods and the future infrastructure needs in planned growth areas.
- Refine existing stormwater management regulations to enhance clarity and adaptability.
- Identify, evaluate, and acquire technology, equipment, and facilities to improve infrastructure and service delivery
- Analyze and define organizational structure to reflect best management practices in areas of staffing, operations, and equipment.
- Use sustainable practices for the maintenance, rehabilitation, and construction of public facilities prior to adoption of a green building program.

1998 Stormwater Master Plan Baseline

A 1998 Stormwater Master Plan for the Cedar Rapids Metropolitan Area prepared by Camp Dresser McKee provides relevant insight with respect to historical, current, and future challenges and needs. It focused on 201 outfalls 36-inches in diameter and larger, identified and characterized 26 drainage problems, provided discussion and recommendations on a number of policy / planning issues, and recommended improvements. The recommended improvements included additional storm sewers, flood protection measures, new detention basins, and enforcement of existing policies. The estimated $14.4 million of construction costs was beyond funding capabilities at the time and numerous recommended improvements were never implemented. The 1998 Stormwater Master Plan provided a baseline for drainage issues, recommended improvements, and a number of policy and planning topics relative to this 2015 Stormwater Master Plan Update.

Asset Management

The Public Works Department is in the process of overhauling the City's entire asset management program; significant operational changes will be implemented in the coming years. Likewise, practices and procedures for stormwater asset management are evolving nationwide. Used in conjunction with the Iowa Stormwater Management Manual, the asset management program will determine the best and right practices, procedures, and policies for maintaining and preserving the City's stormwater infrastructure.

Asset Management (AM), as defined by the International Infrastructure Management Manual, Version 4, 2011, is: "The systematic and coordinated activities and practices of an organization to optimally and sustainably deliver on its objectives through the cost-effective lifecycle management of assets".

The same manual defines Asset Management Plans (AM Plans) as: “Long-term plans (usually 10-20 years or more for infrastructure assets) that outline the asset activities and programs for each service area and resources applied to provide a defined level of service in the most cost effective way.”

The City of Cedar Rapids’ current AM program for the stormwater system includes:

- Asset Inventory
- Condition Assessments
- Maintenance
- Asset Management Policies

The Public Works Department is implementing a variety of improvements to the City’s asset management program. Most notably:

- Updating the City’s geographic information system (GIS) and inventory management system (IMS) with current asset information using ArcGIS software.
- Transitioning to EnerGov as the primary software platform for the City’s computerized maintenance management system (CMMS).
- Implementing use of new digital inspection equipment manufactured by CUES for condition assessments of public assets; CUES GraniteNet software will be used as the repository for condition assessments.
- Integrating the ArcGIS, EnerGov, and CUES GraniteNet systems so that all three systems are up-to-date with the most current inventory and asset information.

TM 2.0 Asset Management provides additional recommendations for further enhancement of the stormwater asset management program, including:

- Standardize maintenance activities using the Iowa Stormwater Management Manual.
- Conduct benchmarking of other utilities to refine existing O&M standards in use for Cedar Rapids. A few other utilities have created very specific guidance tied to Estimated Expected Live (EEL) and Level of Service (LOS).
- Use the Stormwater Master Plan as that platform to look longer term; it should be a living document with periodic updates.
- Develop a Stormwater Asset Management Program to complete and standardize the stormwater system inventory, provide system-wide condition assessments (through a combination of field assessment and desktop extrapolation), calculate Business Risk Exposure values, adjust thresholds and define mitigation actions that fit the City’s desired LOS. Define O&M standards and CIP plans around these City specific analyses to develop near- and long-term action plans and financial budgets.

Macro Modeling

Components of the City's stormwater collection and conveyance system have been modeled hydraulically using InfoWorks ICM software. The first step focused on a Citywide "macro-scale" model incorporating the large pipes (48" and larger), open channels, and major detention facilities of City's stormwater conveyance system. The results provide the City a broad overview of the performance of major conveyance components of the stormwater system.

The resulting macro-scale model also provides a foundation for more detailed "basin-scale" models developed in subsequent phases. The basin-scale models include a much more extensive pipe network (12" and larger), and simulate overland flow as well as pipe and channel flow.

The macro model is based on GIS data provided by the City of Cedar Rapids, including topography, soil type, land use, pipe network data, and additional survey data. All seven watersheds and 20 sub-watersheds were included along with 45.4 miles of pipe, 9.5 miles of open channel, 13 detention facilities, and 52 outfalls. The resulting one-dimensional flow network is shown on Figure 5.

A total of 236 catchments were delineated based on previously delineated boundaries and reconciled with LiDAR data and pipe network data. Time of concentration and curve numbers were developed from the data provided. Based on these characteristics and rainfall, the model calculated a runoff hydrograph, which it applied to the one-dimensional (1D) network. Downstream boundary conditions include both free outfall conditions and fixed water levels.

The 1D network was developed primarily based on the GIS-data provided and additional pipe survey data. Relatively large gaps in data (pipes without data and pipes that are apparently missing) were resolved by inferring geometric and attribute data based on upstream and downstream reaches. Open channel sections connecting pipe sections were included as approximated trapezoidal channels with similar capacity to the bounding pipe sections.

For macro model validation purposes, it was initially used to simulate the June 29-30, 2014 event shown in Figure 6. The June 2014 event had rainfall depths varying from 3.5 to 5.5 inches in Cedar Rapids, most of which fell in one hour. 5-minute rainfall intensities developed from the radar reconstructions of the event peaked above 8 inches per hour (8 in/hr over a 5-minute period) in some locations. Based on the 1-hour rainfall total, this event was similar in magnitude to a 500-year 1-hour duration rainfall event. Model predicted results were reviewed and discussed with City staff and found to generally coincide with anecdotal information from that event.

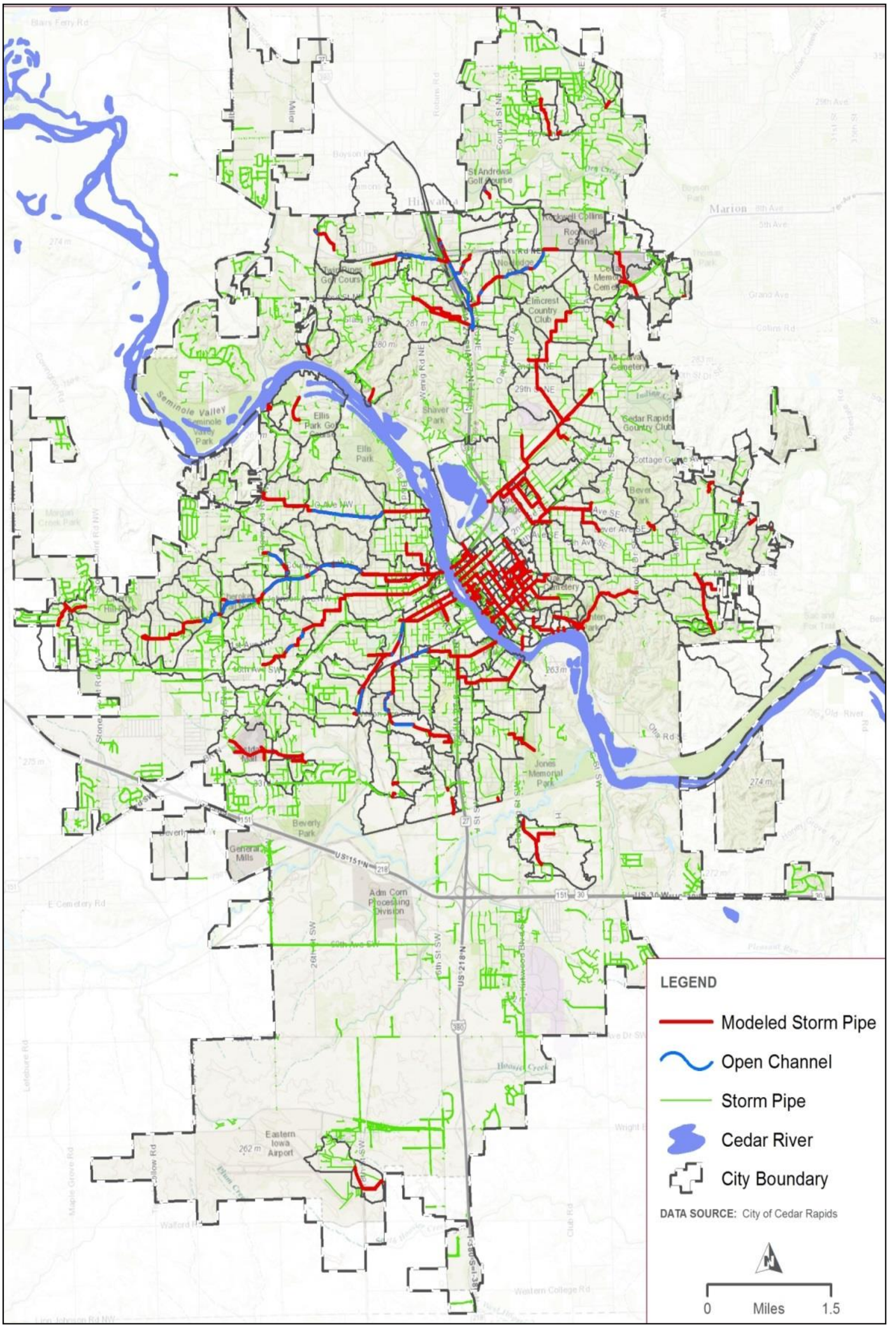


Figure 5 – Macro Model Flow Network

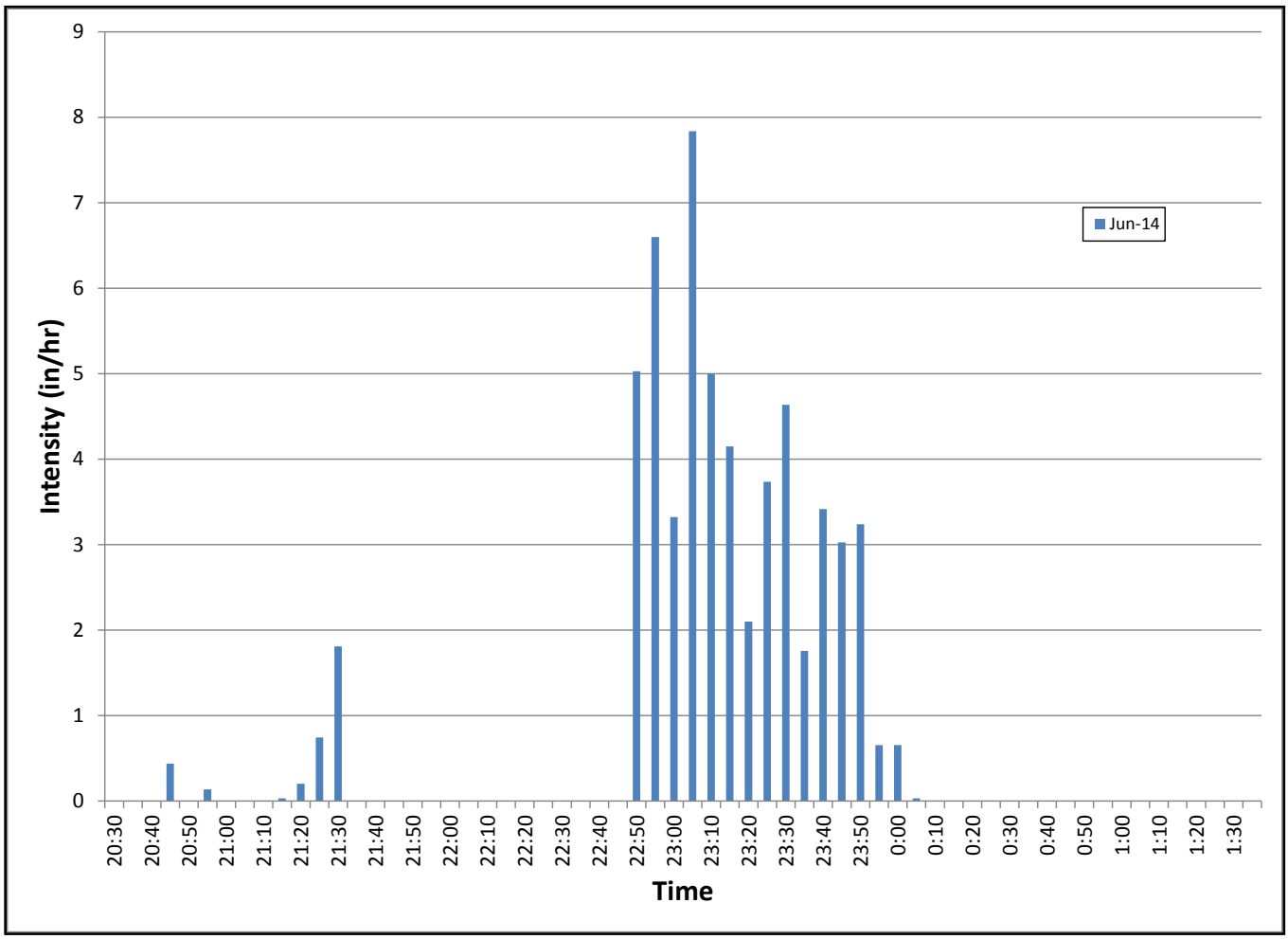


Figure 6 June 2014 Storm Event

The macro model was used to simulate the 5- and 100- year 24-hour storm events. The 5- and 100- year storm events were constructed by nesting NOAA Atlas 14 rainfall depths for durations of 5 minutes, 15 minutes, 1 hour, 2 hours, 3 hours, 6 hours, 12 hours, and 24 hours are shown in Figure 7. Simulations assumed uniform distribution of the event over the entire City. Both the nesting and uniform distribution are conservative in that they likely over estimate rainfall and runoff from any given 5- or 100-year storm event. However, the uniformly distributed nested storm is a useful tool in identifying the level of service provided in the system because it produces the same flow return interval throughout all points of the system, independent of catchment size or time of concentration. By evaluating the system under these assumptions, specific elements within the system are evaluated for a return interval with one simulation.

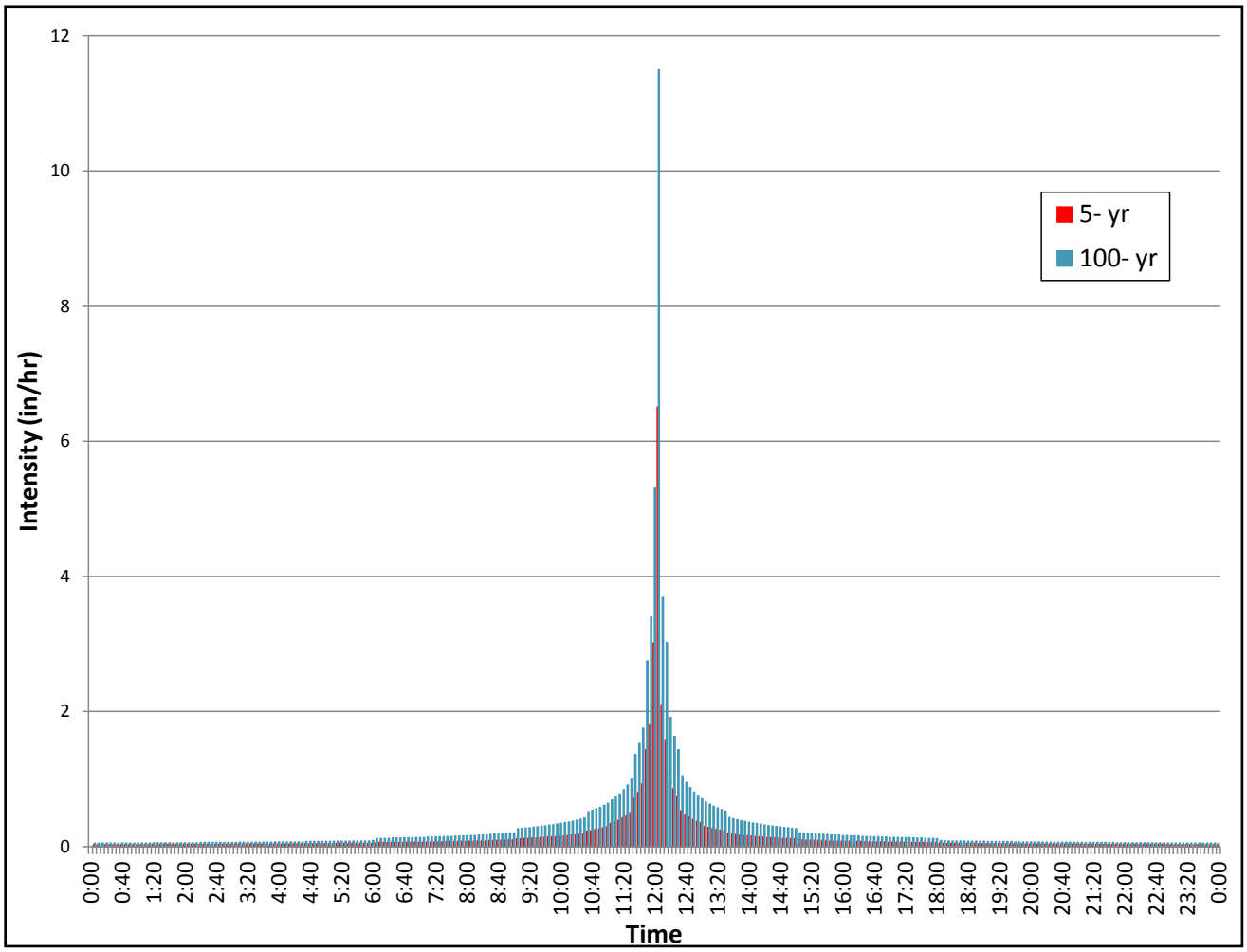


Figure 7 – 5- and 100-Year, 24-Hour Nested Storm Event

Macro model results from these two events are included as Figures 8 and 9. The figures color code existing pipes to differentiate between the following.

- Pipes that flow full because they are an actual bottleneck (undersized)
- Pipes that flow full because they are surcharged by a downstream bottleneck
- Pipes that are flowing more than half full
- Pipes that are flowing less than half full

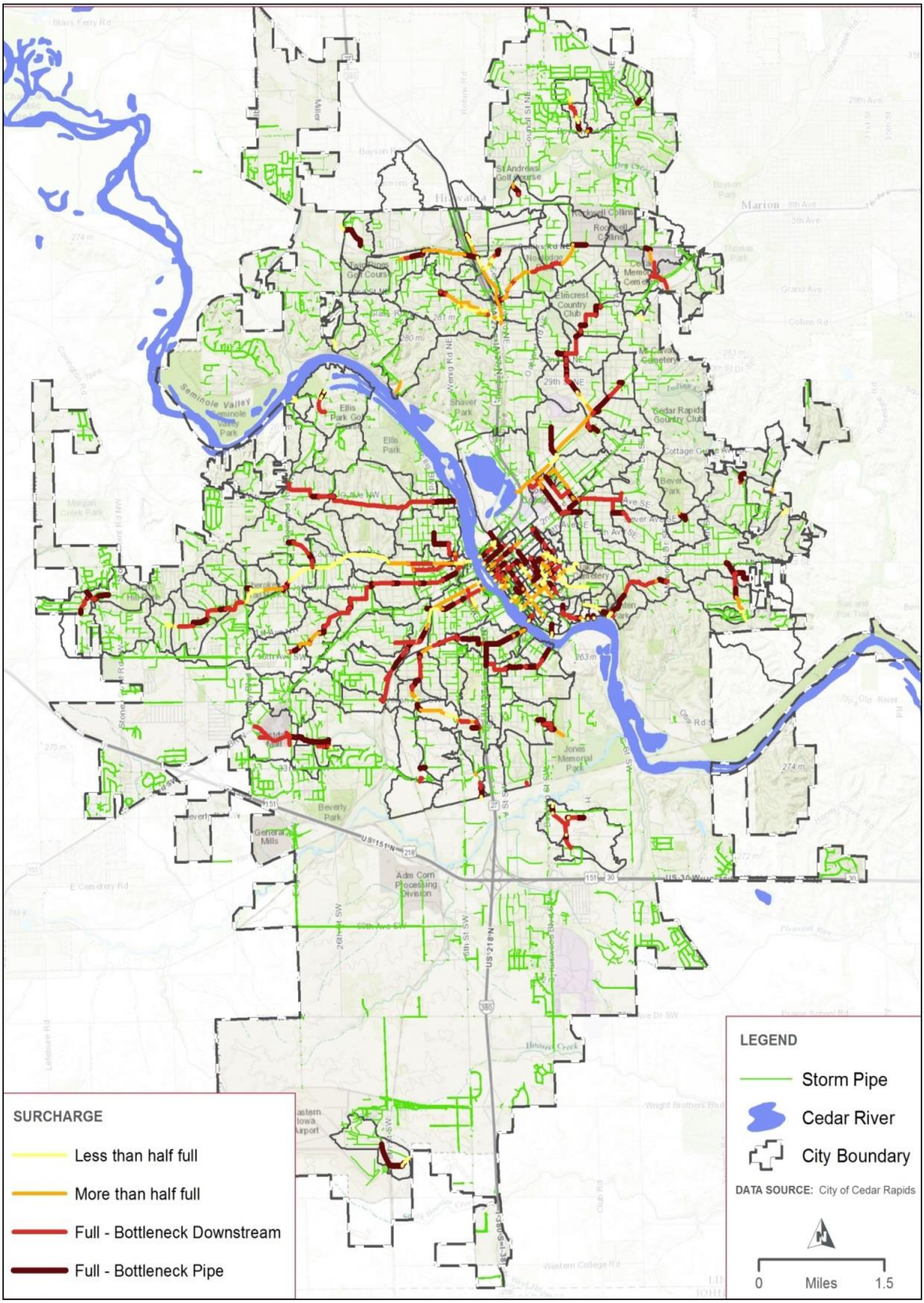


Figure 8 – Macro Model 5-year Results

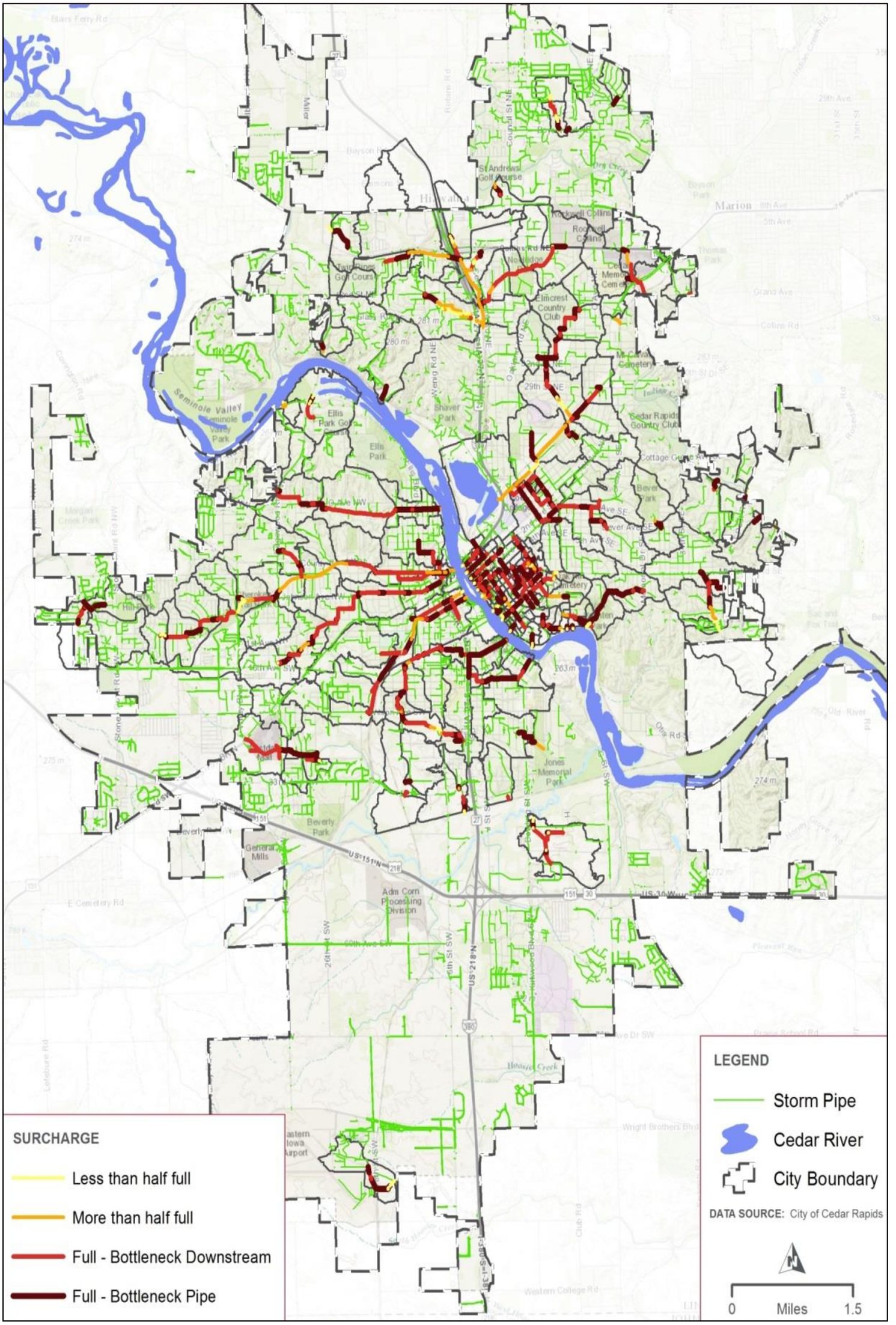


Figure 9 – Macro Model 100-year Results

As both the 5- and 100-year results indicate, much of the existing system is flowing full with a significant part of the system being a bottleneck and much of the rest being upstream of a bottleneck. More particularly, the 5-year results indicate that much of the existing stormwater collection system cannot contain and convey the five-year rainfall event as identified by the Metro Area Standards. The 100-year results likely indicate significant ponding and overland flow beyond the public right of way. The extent of ponding and overland flow will subsequently be simulated in basin-scale modeling to determine whether the 100-year event can be conveyed without property damage as identified by the Metro Area Standards.

Kenwood Basin Model

Detailed basin-scale models add a second, overland flow, dimension, and additional detail to the one-dimensional macro-scale model developed Citywide. Basin models will simulate ponding and overland flow for stormwater flows exceeding the existing capacity of the storm sewer system. As basin models are developed over multiple years to evaluate individual projects and basin wide mitigation alternatives, the results will be used to inform and improve the capital improvement plan (CIP). This multi-year strategy will also allow the macro scale model to be improved and updated as more data becomes available.

As part of the initial master planning effort, a basin-scale model was developed for one of the 20 sub watersheds. The other 19 basins will be modeled in subsequent years in priority order. The Kenwood sub watershed was selected as the initial basin-scale model for several reasons. Most notably, Kenwood was selected because in June 2014 it had the highest reported densities of flooding incidents and the highest number of calls to dispose of flood damaged materials as solid waste. The Kenwood basin also had a flooding related loss-of-life. Furthermore, the Kenwood area is nearly fully developed, among the older neighborhoods, and issues and potential solutions are not well understood. Finally, this area is the largest contributor to Cedar Lake and stormwater alternatives may impact or influence any potential Cedar Lake restoration goals.

The basin model was developed based on GIS data provided by the City, including topography, soil type, land use, pipe network data, and additional survey data. The 1D flow network in the Kenwood basin model includes approximately 27 miles of pipe, over 900 junctions, 900 linear feet of open channel, four detention facilities, Cedar Lake, and the associated outfalls to Cedar Lake and the Cedar River. The resulting one-dimensional flow network is shown on Figure 10.

A total of 379 catchments were developed based on previously delineated boundaries and reconciled with LiDAR data and pipe network data. Time of concentration and curve numbers were developed from the provided spatial and elevation data. Based on these characteristics and rainfall, the model calculated a runoff hydrograph to apply to the one-dimensional (1D) network. The model includes the Kenwood system outfall to Cedar Lake and Cedar Lake, which allowed Cedar Lake to change appropriately during a rainfall event. The downstream boundary was a fixed water surface elevation at the Cedar Lake outfall to the Cedar River.

The 1D network was developed based on the GIS-data and additional pipe survey data provided. Generally, pipe diameter and invert data were available for approximately 30% of the pipe junctions in the GIS database. Of the pipe junctions in the model, approximately 50% of the inverts and pipe diameters were either confirmed or documented with survey data. Any remaining gaps in data (pipes without data) have been resolved at this point by inferring geometric and attribute data based on upstream and downstream reaches. Open channels connecting pipe sections were included as 1D elements with cross sectional shapes which were determined using LiDAR data and surveyed cross sections in select key locations.

The two-dimensional (2D) flow domain was used to predict overland flow and conveyance across the ground surface. The surface model was developed based on LiDAR topographic data. Triangular mesh polygons that make up the 2D flow domain were developed from LiDAR, building, and roadway GIS data. The resulting mesh polygons generally represent the elevations present in overbank areas and roadways, but do not include the detail required to represent curb flow lines or other influential flow features. Resolution in roadway areas was increased (compared to other overland areas) to better represent the geometry.

A grouped-inlet approach was used to connect the 1D and 2D domains. This approach groups several inlets close in proximity, and connects the 1D and 2D domains at a single node without considering individual inlet capacity. The grouped-inlet approach is useful for evaluating storm sewer conveyance independent of inlet capacity, because it prevents an inlet capacity limitation from masking a sewer conveyance limitation. It also reduces the amount of field verification necessary to inform model inputs.

The model was used to simulate the same 5-year and 100-year 24-hour nested storm events used in macro modeling, again assumed uniformly over the Kenwood basin. Kenwood basin model results from these two events are included as Figures 11 and 12. Both figures also identify current stormwater CIP project locations and case numbers as previously developed by City staff.

Again, the figures color code existing pipes to differentiate between pipes that are flowing full because they are a bottleneck (undersized), flowing full because they are upstream of a bottleneck, flowing more than half full, and flowing less than half full. The figures also color code ponding areas various shades of blue to indicate ponding depths ranging from 0.5 to over 5.1 feet.

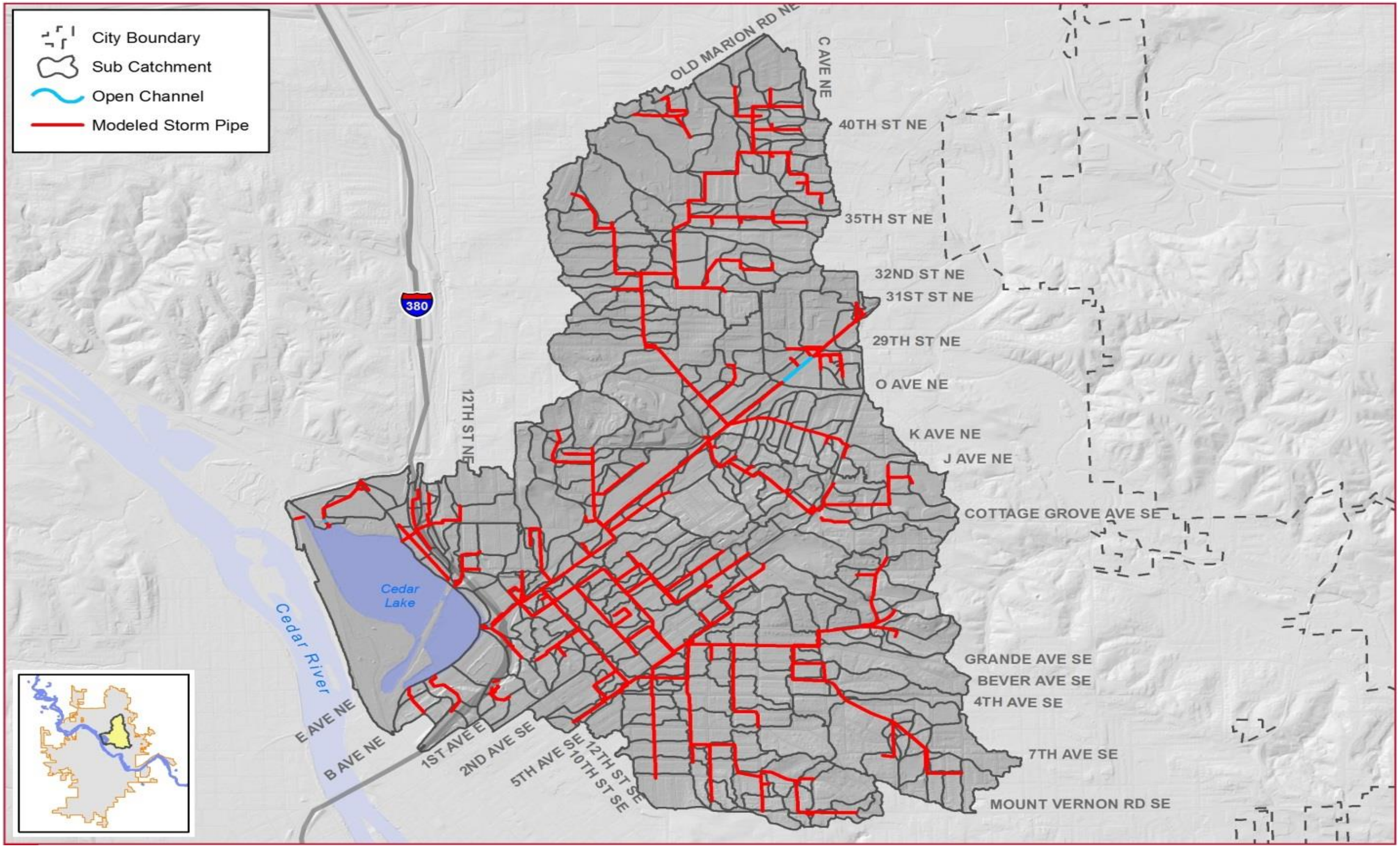


Figure 10 – Kenwood Basin Model 1D Pipe Network

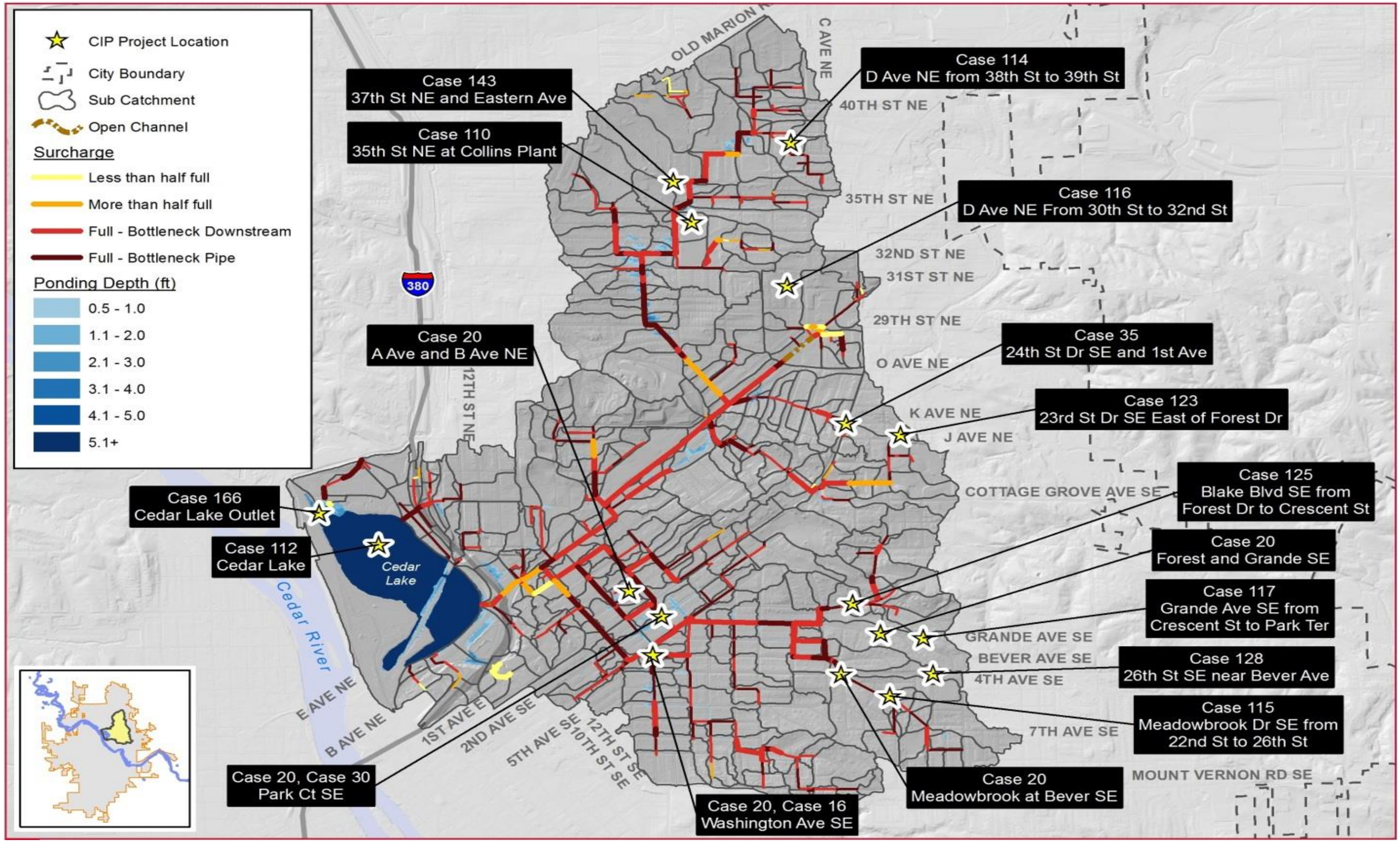


Figure 11 – Kenwood Basin Model 5-year Results

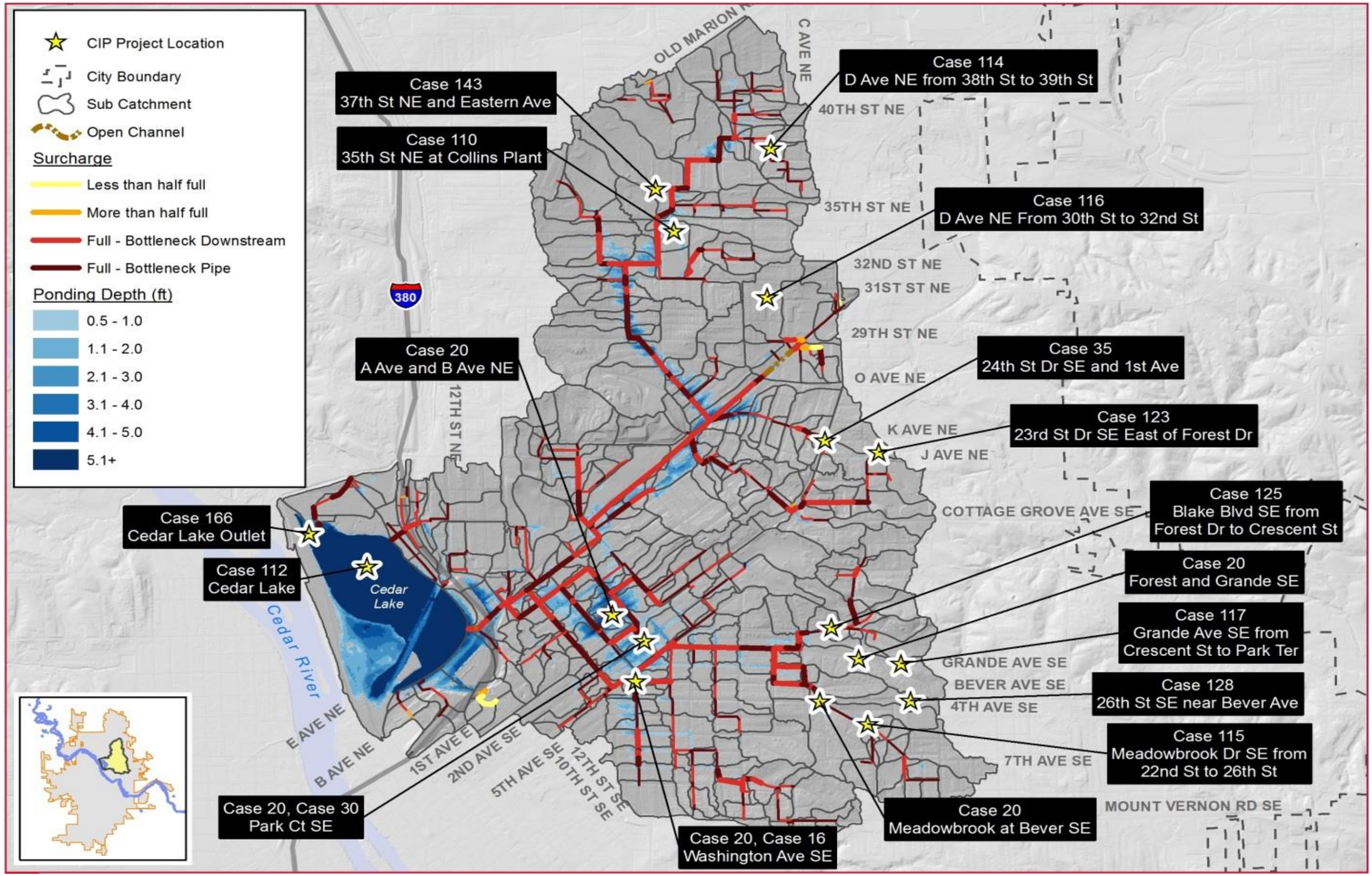


Figure 12 – Kenwood Basin Model 100-year Results

Table 3 – FY 2017 Capital Improvements Plan Summary

ID	Watershed	Location	Quadrant	Issue	Proposed Scope of Work	Est. Total Cost	Available Funding	Prioritized Rank	2016 CIP	2017 CIP	2018 CIP	2019 CIP	2020 CIP	2021 CIP	Total CIP 2016-2021	Project Complete within 5-Year CIP Plan
-	-	-	-	Annual Misc. Storm Water Projects	Repair and rehabilitation	-	-	0	$250,000	$200,000	$200,000	$200,000	$200,000	$200,000	$1,250,000	
-	-	-	-	Stormwater BMP Cost Share	City Cost Share for Private BMPs	-	-	0		$25,000	$25,000	$25,000	$25,000	$25,000	$125,000	
-	-	-	-	Storm Sewer Inlet Modification	Safety Guards on Stormwater Inlets	-	-	0		$50,000	$50,000	$50,000	$50,000	$50,000	$250,000	
-	-	-	-	FY Recurring Drain Tile Program	Drain Tile Improvements	-	-	0		$50,000	$50,000	$50,000	$50,000	$50,000	$250,000	
-	-	-	-	Stormwater BMP's Streets	Green Infrastructure Projects	-	-	0		$200,000	$100,000	$100,000	$100,000	$100,000	$600,000	
-	-	-	-	Annual Master Plan Updating	Modeling and updating	-	-	0	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$600,000	
-	-	-	-	Hwy 100 Edgewood to Hwy 30		$135,000		0	$0	$135,000					$135,000	YES
Case 18	Morgan Creek	Rockhurst Drive SW	SW	Overland and residential flooding within the Stoney Point subdivision	Construct an upstream detention basin	$1,152,000	None	1	$271,000	$880,000					$1,151,000	YES
Case 23	O Avenue	Detention basin west of 11th Street NW and south of N Avenue	NW	No suitable overland flow path from the detention basin near Harrison Elementary overtops. Outlet structure from basin does not meet design standards	Model drainage area to compare upstream basin vs overland path	$1,500,000	None	2	$270,000	$300,000					$570,000	YES
Case 12	Prairie Creek	27th Street SW north of 29th Avenue	SW	Failure of undersized culvert	Replaced 132-inch steel-plate culvert with triple 12'x7' RBC	$776,000	FY2015	4	$560,000						$560,000	YES
Case 101	Ushers Ferry	Gibson Drive NE	NE	Detention basins are undersized resulting in overtopping and flooding of yards.	Reconstruct detention basins.	$500,000	FY2015	6			$400,000				$400,000	YES
Case 102	Prairie Creek	18th Street SW at 29th Avenue	SW	Existing culvert is aging and is undersized.	Replace Existing Culvert.	$700,000	None	7			$200,000	$500,000			$700,000	YES
Case 20	Kenwood	Forest and Grande SE	SE	Conveyance capacity limited resulting in flooded neighborhood		$4,000,000	None	11			$400,000	$350,000	$800,000	$800,000	$2,350,000	NO
Case 29	E Avenue	Johnson Avenue NW Hy-Vee and B Avenue NW	NW	Flooding due to undersized box culvert and inadequate overland flow path	Model drainage area and expand upstream detention	$3,000,000	None	15			$400,000	$309,000	$800,000	$800,000	$2,309,000	NO
Case 111	Rockford Road	18th Street SW south of 16th Avenue	SW	Regional detention basin required as part of development agreement	Construct Regional Detention Basin	$650,000	FY2015	23	$249,000	$400,000					$649,000	YES
Case 25	Prairie Creek	12th Street SW near 32nd Avenue	SW	No overland path results in flooding of business	Construct swale in 11th street ROW from 29th Street south to 32nd Avenue. Construct culvert crossing 12th Street SW	$641,000	None	25			$175,000	$466,000			$641,000	YES
Case 38?	Czech Village	6th Street SW 1200 Block	SW	Conveyance capacity limited resulting in flooded neighborhood	Construct Detention Basin	$1,000,000	None	29					$85,000	$135,000	$220,000	NO
									$2,350,000	$2,340,000	$2,100,000	$2,150,000	$2,210,000	$2,260,000	$12,760,000	

Results were reviewed with City staff, and anecdotally replicated staff's recollection of the magnitudes of surface water ponding in areas where stormwater complaints and damages were observed in the past.

Results from the 5-year rainfall simulation indicate that there are multiple pipe bottlenecks and areas of ponding. The more prominent areas of concern based on 5-year model results are as follows.

- Forest Ave SE and Grand Ave SE
- Mound View/ Wellington Heights Neighborhoods
- Kenwood park / Rockwell Collins 35th Street Campus
- Eastern Ave Trunk Sewer Alignment
- F Ave NE/24th St NE
- 24th St NE and 1St Ave SE

Results from the 100-year rainfall simulation indicate more severe surface ponding. Consistent with Metro Area Standards goal of maintaining the 100-year rainfall runoff within City right-of-way (ROW), evaluation of 100-year results was focused on surface flow and ponding beyond the City ROW. The more prominent areas of concern based on 100-year model results are as follows.

- Mound View / Wellington Heights Neighborhoods
- Areas around the perimeter of Cedar Lake
- East of Elmcrest Country Club
- Kenwood park/ Rockwell Collins 35th Street campus
- Eastern Ave Trunk Sewer Alignment
- F Ave NE/24th St NE
- Tomahawk park/ F avenue

As discussed in the next section, the Kenwood basin model was used to consider flooding mitigation strategies within the basin. The potential mitigation strategies include green infrastructure retrofits, distributed detention, regional storage, and conveyance improvements.

Capital Improvements Plan

As included in Attachment A, the current Capital Improvements Plan (CIP) includes nearly $50 million of capital needs. As summarized in Table 3, the CIP includes expenditures ranging from $2.10 million to $2.34 million annually from FY 2017 through FY2021. The associated projects were identified through a specific prioritization process to match limited available funding.

The process utilized for project prioritization uses two sets of criteria; first to determine a project's priority, and second to evaluate a project's readiness. Criteria to determine priority are as follows (with relative weighting included in parenthesis).

- Health and Safety (6)
- Cost Benefit (4)
- Current Capacity (6)
- Asset Functionality (4)
- Water Quality & Environmental (2)
- Associated / Other Considerations (3)
- Sanitary Sewer Inflow Conveyance (1)
- Future Growth & Sustainability (3)

The readiness criteria accounts for factors such as land acquisition, previous City commitments, and funding sources. This two-scale approach assures that critical issues within a system are addressed while allowing the City flexibility to allocate funds to specific projects as warranted by readiness factors.

At this point, the CIP reflects only capital needs identified to date, primarily in response to flooding in June 2014 and prior studies. Modeling completed to date indicates that there are additional needs not yet reflected in the CIP that will need to be added in the future.

The City-wide macro model developed for major components and the more detailed basin-scale model developed for Kenwood indicate that overall capital needs are likely more extensive than currently identified. Model results suggest that overall capital needs are in the range of $75 to $100 million. With further development over the next few years, the models will be able to fully inform and assist with prioritization of the CIP. Moving forward, the models will also provide a tool to further investigate, consider alternative strategies, and develop and size specific combinations of green infrastructure, detention storage, and conveyance infrastructure to address priority needs.

EnvisionCR targeted growth areas will be served by stormwater infrastructure paid for by the associated development(s). With a few exceptions, the City's current CIP does not include expenditures to address future growth related stormwater infrastructure. To avoid CIP expenditures that address growth needs, the City will need to assure that growth related stormwater infrastructure considers and is adequate for not just the associated growth, but future growth in the surrounding watershed as well. The City should also develop conceptual plans for stormwater infrastructure in EnvisionCR identified growth corridors.

As the existing stormwater system continues to age, capital investment for renewal (rehabilitation and/or replacement) will increasingly be required. While the current stormwater CIP is driven almost exclusively by flooding related needs, it does include $250,000 annually for repair and rehabilitation. As the City continues to refine and implement its Asset Management Program, condition related needs will be more accurately estimated and reflected in the CIP as well. For example, the sanitary sewer system CIP has budgeted an average of $1.6 million per

year over the last 16 years for renewal related capital improvements (lining, repairs, and replacement) and is contemplating a significant increase in this investment out of need moving forward.

The FY 2017 CIP, which was prepared last fall, provides the template for preparing the FY 2018 CIP this coming fall. As the budgeting process begins, the prior plan should be updated to reflect anticipated progress in the current fiscal year, adjust anticipated funding levels based on recent changes to the stormwater utility fee structure, reflect basin modeling and planning needs identified herein, review and validate FY 2018 through 2021 projects, and add specific projects for FY 2022. For example, in August 2016, the CIP should be updated to reflect progress made on the Harrison and Rockhurst detention basins, Kenwood and E Avenue basin modeling priorities, growth corridor planning needs, and new/updated stormwater capital needs identified from modeling results and asset management implementation.

Financial Needs

Historical stormwater related CIP expenditures are summarized in Figure 13. As indicated, annual capital expenditures have ranged from approximately $1.5 to nearly $6 million. Without the approximately $9 million in CDBG funds in fiscal years 2013 and 2014 combined, annual expenditures have ranged from $1.5 to $3 million.

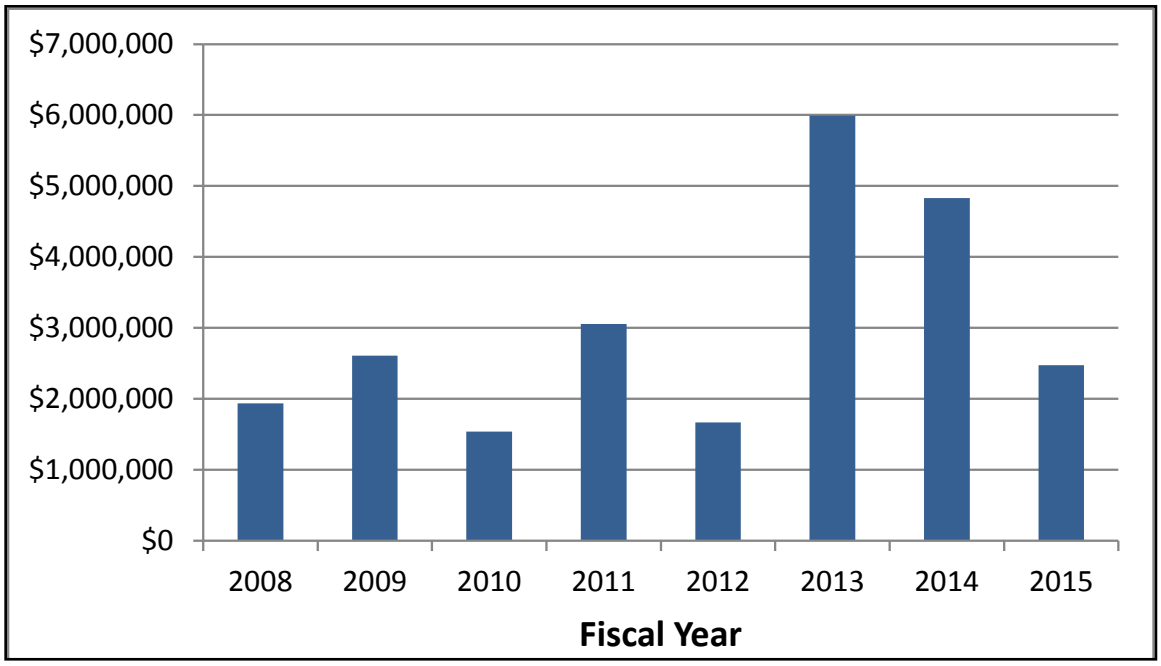


Figure 13 - Stormwater Related Capital Expenditures

Stormwater capital and operations and maintenance expenditures have historically been funded primarily through stormwater utility fees. Figure 14 identifies the stormwater utility fee for a residential property dating back to 1979. As indicated, the typical residential fee has ranged from $0.57 per month to $5.02 per month over that period. The stormwater utility fee generated $3,673,506 from 45,709 stormwater accounts in fiscal year 2015. It is projected to generate approximately $3.8 million in fiscal year 2016.

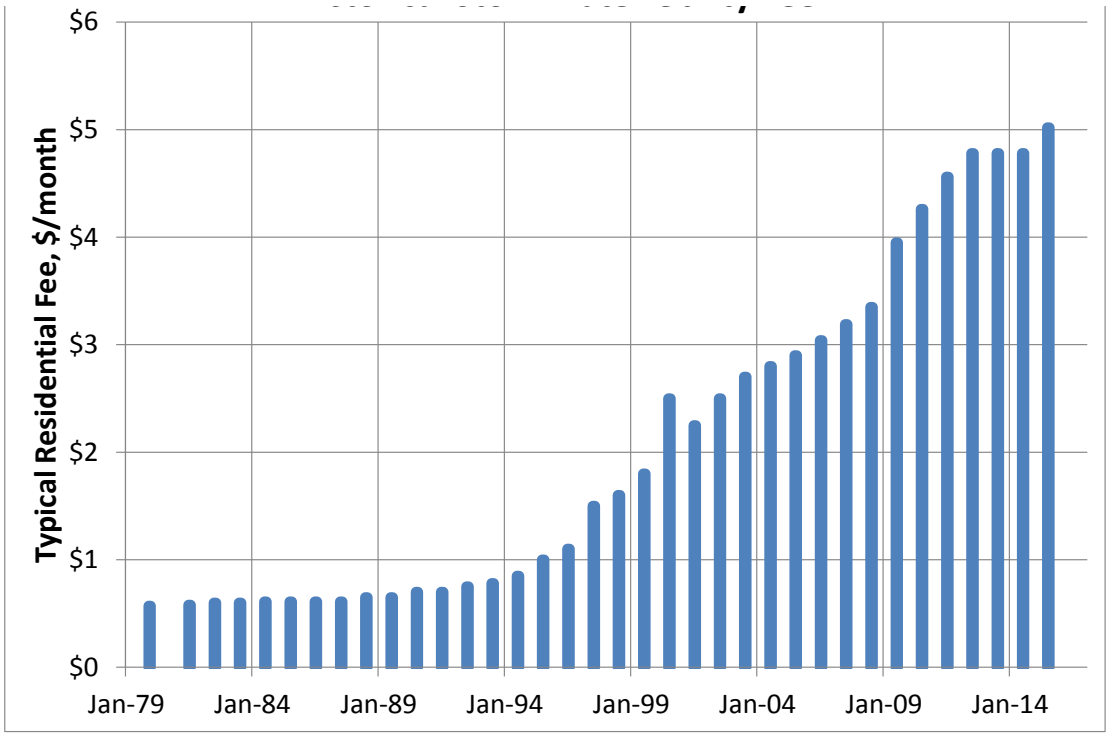


Figure 14 Historical Stormwater Utility Fee

The fee structure has evolved from a flat rate for all property types and sizes to a tiered rate structure considering property size for nonresidential properties beginning July 1, 2013. Further refinements to incorporate pervious area will likely be implemented in the near future.

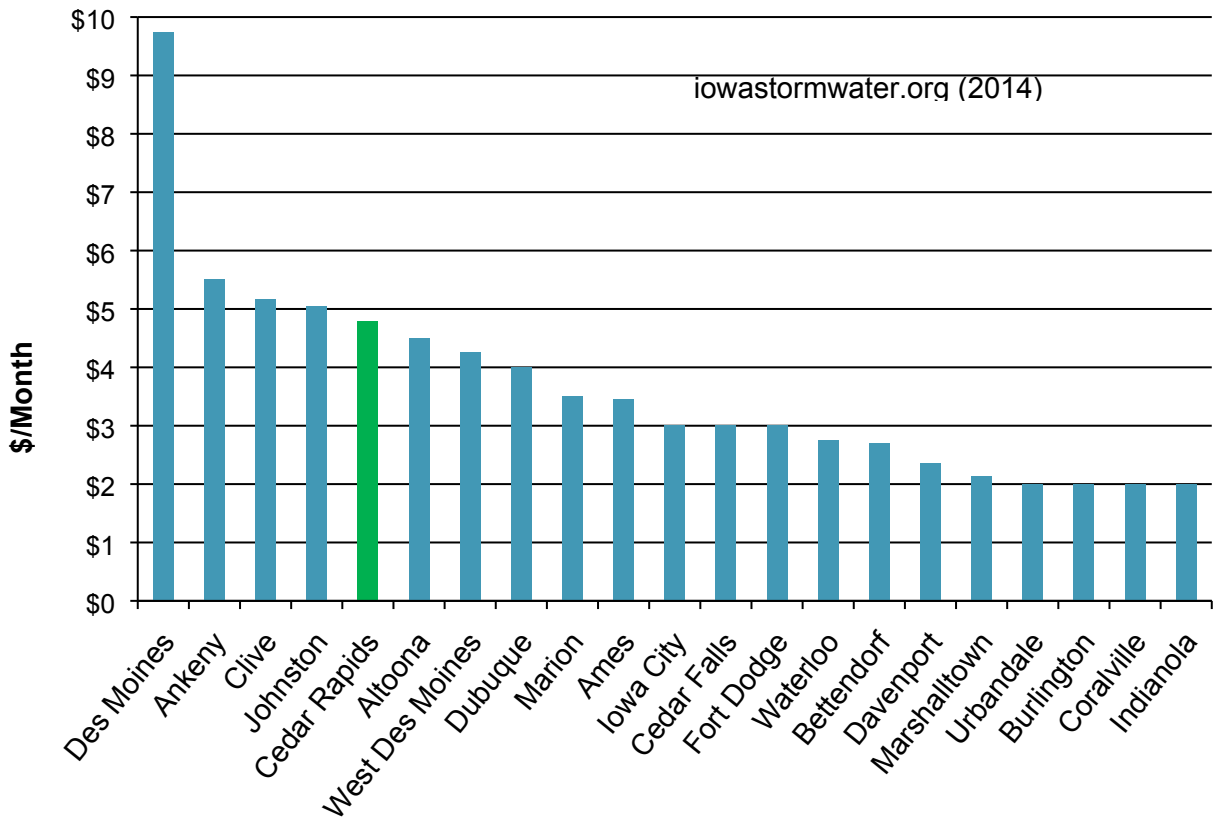
Figure 15 compares typical monthly residential stormwater utility fees for larger cities across the state of Iowa. The 2014 data was collected and published at iowastormwater.org. As indicated, Cedar Rapids typical residential stormwater utility fee in 2014 was above the median value of $3 per month, but well below the highest rate of $9.74 per month.

The 2014 Stormwater Utility Survey by Black & Veatch reflected responses from 78 participants from 25 states. Average monthly single family rates for survey participants range from $0.24 to $26.58 in 2014. Forty-four (56%) had rates above the City of Cedar Rapids' current $5.02/ month residential bill (rate).

The 2015 Southeast Stormwater Utility Survey (Report) disseminates information collected from 76 respondents in the eight states comprising EPA Region 4. Survey participants average

monthly rates ranged from $0.12 to over $9.60 with an average of $3.77 in 2015. Eighteen (24%) had rates at or above the City of Cedar Rapids' current residential bill

Figure 15 Typical Monthly Residential Stormwater Utility Fee



In fiscal year 2015, stormwater utility fees generated approximately $3.7 million used for operating expenditures of approximately $2.2 million and capital improvements of approximately $1.5 million. In recent years grant funding has provided an additional $x million of funding for capital needs.

As noted previously, overall stormwater capital needs are preliminarily estimated to be in the range of $75 to $100 million. As discussed below, future stormwater related regulatory requirements and flood control system requirements will likely increase annual operations and maintenance costs, perhaps significantly. As such, there is a significant funding gap between revenue generated and financial needs of the stormwater system.

Other stormwater utilities share many of the same needs and challenges as Cedar Rapids. Survey results indicate that most stormwater utilities fund stormwater management in whole or in part through user fees, and stormwater user fees account for more than all of the other funding sources combined. Grants, permitting and other taxes, special tax districts, new development impact fees, sales taxes and ad valorem taxes, in that order, account for the rest. The survey results also indicate that nearly all utilities use cash financing in lieu of debt

financing. Finally, the survey results indicate that the majority of the stormwater utilities note that they do not have adequate funding to meet their total needs.

While stormwater rates are typically the main source of revenue, varieties of other financing/funding sources are available. These may be broadly characterized as taxes, grants, permitting and other taxes, special tax districts, new development impact fees, sales taxes, and other fees. These financing/funding sources have been used by other stormwater utilities and are potentially available to the City of Cedar Rapids.

The City's current stormwater financial plan is included as Attachment C and summarized in Table 4. Key assumptions are as follows.

- No additional revenue sources beyond current fees and permits, primarily the stormwater utility fee.
- A 3.0% increase in fees in FY 2017 and a 5.0% increase in annual fees thereafter.
- A 5.0% annual increase in all personal services and non-personal services costs.
- No debt service obligations, existing or new.

It potentially increases the funding for capital needs from the current $1.3 million in fiscal year 2016 to approximately $2.0 million in fiscal year 2017 and $2.4 million per year by fiscal year 2021. The financial plan was prepared prior to the capital improvements plan so capital improvements expenditures in Table 4 are not exact matches for the capital improvements expenditures previously presented in Table 3.

Table 4 Current Financial Plan

Budget Item	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Revenue	$4,179,901	$4,305,298	$4,520,563	$4,746,591	$4,983,921	$5,233,117
Operating Expenditures	$2,287,966	$2,192,364	$2,301,983	$2,417,082	$2,537,936	$2,664,833
Capital Improvements Expense	$1,300,000	$2,000,000	$2,200,000	$2,200,000	$2,300,000	$2,400,000
Debt Service Expenditures	$0	$0	$0	$0	$0	$0
Net Incom/Loss	$541,935	$12,934	($81,420)	$29,509	$45,985	$68,284
Ending Cash Balance	$541,935	$554,868	$473,449	$502,958	$548,943	$617,227

Increasing the stormwater utility fee by 5 percent initially and 10 percent thereafter could potentially increase the funding for capital needs from the current $1.3 million in fiscal year 2016 to approximately $3.0 million per year by fiscal year 2021; $600,000 per year above the current financial plan by fiscal year 2021.

While stormwater utility fees are a key funding source, they are by no means the only funding source. The City should monitor and aggressively seek other grant or other special funding opportunities as they arise. Likewise, consideration should be given to other potential funding sources identified herein. More specifically, the City should consider the following recommendations.

- Increase stormwater utility fees and other user fees.
- Continue to refine the stormwater utility fee structure to better reflect the quantities of stormwater managed.

- Focus stormwater user fee revenue on administrative, operations and maintenance, and current trunk sewer related capital needs, but set aside a small amount for cost sharing to continually capitalize on multipurpose projects to address collector and local stormwater needs.
- Shift street sweeping costs to solid waste.
- Prepare individual basin plans and establish permit, in-lieu of construction, impact, cost sharing, and inspection fees to pay for stormwater needs in the growth areas identified in EnvisionCR.
- Work collaboratively with Public Works to identify additional street reconstruction projects that can incorporate improvements to address collector and localized stormwater needs with sales tax revenue.
- Work collaboratively with Utilities to identify additional Clean Water State Revolving Fund (CWSRF) and Sponsored Project Funding Opportunities.
- If appropriate and applicable, work collaboratively with a neighborhood to implement a pilot special assessment / benefits district project to address a localized stormwater problem.
- Work collaboratively with the owner(s) of a large impervious property(ies) upstream of an identified problem areas to implement a pilot cost share project to implement modifications to reduce the contribution to downstream problems.
- Continue educating the public as to the benefits provided by the City's stormwater management program, along with the costs and funding challenges associated with the program.

Policy Recommendations

In the past, existing regulatory standards and policies have focused upon utilizing gray infrastructure construction (concrete basins, inlets, piping, etc.) to meet water quality requirements and to control and convey runoff. As development continues to create more impervious surfaces, coupled with changing weather patterns and higher rainfall intensities, many communities are discovering their existing stormwater systems are unable to manage the increased runoff intensities. Rather than continuing to construct gray infrastructure, communities are incorporating "green infrastructure" into their existing stormwater management policies.

By incorporating green infrastructure into their existing stormwater management policies, communities have discovered economic, environmental, and community benefits not provided by the traditional approaches. The incorporation of green infrastructure provides a holistic stormwater management approach that mimics aspects of the natural hydrological cycle, including but not limited to: retention, infiltration, and evapotranspiration. The following green infrastructure systems could be used at various levels throughout the City, and should be considerations in subsequent basin-scale planning efforts. Many could be incorporated as retrofits to existing facilities or as part of new facilities.

- **Site level green infrastructure** captures and reuses or infiltrates stormwater at the source. Examples include downspout disconnection, rainwater harvesting, rain

gardens, planter boxes, bioswales, permeable pavements, green streets and alleys, green parking, green roofs, urban tree canopy, and vegetative buffer strips.

- **Neighborhood level green infrastructure** reduces the volume or infiltrates stormwater on a neighborhood level, typically along transportation corridors, parks, and other public property. Examples include infiltration trenches; reduction in impervious surface area associated with streets, sidewalks, and parking, mixed use development with reduced parking requirements, redevelopment of brownfields, increased buffer requirements along streams and waterways.
- **Regional level green infrastructure** reduces the volume or infiltrates stormwater on a regional level by protecting and preserving existing natural areas including wetlands, forested areas, steep hillsides, and buffer areas adjacent to waterways. Examples include land conservation, habitat corridors, and water resource protections.

The City should proceed with green infrastructure as mechanism as an asset management tool to extend the life and capacity of existing grey infrastructure. By promoting stormwater infiltration and runoff reduction, the need for future projects can be postponed indefinitely, or delayed until funding becomes available.

A functional green infrastructure program is not created through a single policy or all at once. The EPA has developed a three-step implementation program based on review of successful green infrastructure programs.

- **First**, develop a funding source, create improved stormwater ordinances, and eliminate code provisions that conflict with green practices.
- **Second**, develop demonstration/pilot projects, provide education and outreach programs, and establish incentives.
- **Third**, use green infrastructure on high profile projects and provide fee discounts to achieve high participation rates.

Promotion of green infrastructure tops the following list of policy recommendations regarding stormwater related issues not adequately addressed within the City's existing policies. Other policy recommendations typically originated as Public Works staff responded to citizen requests, and target the safety and welfare of residents. The policy recommendations follow in no particular order.

- **Develop a Framework for a Green Infrastructure Program as outlined above to effectively infiltrate and reduce stormwater volume consistent with EnvisionCR.**
- **Develop a private cross connect program** so that the Private Service Lateral Program to rehabilitate and reconstruct sanitary sewer laterals, and redirect sump pump, roof drain and foundation drains away from the sanitary sewer does not result in unintended stormwater consequences within the ROW or on adjacent properties.
- **Implement a post construction grading survey** for all development sites to affirm consistency with proposed grading and assure post-construction compliance with design specifications to prevent long-term nuisance difficulties of water runoff and erosion.

- **Implement a "Soil Quality Plan"** with revisions to Chapter 72 – Stormwater Management Ordinance to promote stormwater infiltration and enhance vegetative growth by retaining existing topsoil onsite and requiring the upper layers of soils to be left in an uncompacted state at each development site.
- **Incentivize green practices** by adopting the 'Water Quality and Quantity Credit' provisions for the installation of stormwater infiltration practices with changes to Chapter 72 – Stormwater Management Ordinance related to stormwater utility charges based on impervious surface area.
- **Develop a funding policy for losses to private property** to assure consistency in responding to requests for compensation in response to flood damage.
- **Require low-level openings and lot corner elevations on site development plans** to reduce the number of final lot grading and home elevation related flooding of newly built homes.
- **Move towards regional detention basins** facilitated through a developer cost-share program rather than individual site detention basins for each development site to reduce the number of smaller inaccessible basins currently being 'maintained' by City forces, by developers, or by homeowner associations.
- **Develop a policy for facilities encroaching on drainage easements** to remove, with or without incentive, existing fences, sheds, walls, and other facilities from drainage easements to eliminate impediments to surface flows creating localized flooding issues.
- **Consider targeted buy-outs for flood prone properties** along problematic stormwater channels and/or existing stormwater basins to increase storage volumes, improve maintenance access, and/or provide overland flow path for extreme events.
- **Increase Educational Program Awareness**, potentially in collaboration with the School District, to better inform residents on existing programs and runoff reduction measures such as flood insurance policies, drainage easements, rain garden construction and reimbursement program, prairie grass restoration program discounts, and stormwater fee credits.

Future Considerations

The Stormwater Master Plan is intended to be a living document with regular updates to maintain and progress the plan. This will include annual updates to the prioritized Capital Improvement Project List, periodic updates to reflect additional modeling for each of the major basins and development of a more specific financial plan, and updates that are more comprehensive on a five-year cycle.

The City Council, City Manager's Office, Stormwater Commission, Public Works Department, and Development Services all have a role in implementation of a stormwater management program. All must have a vested interest in regulatory compliance with the NPDES permit, meeting the needs of the public they serve, and the associated financial constraints. The primary responsibility to lead efforts to budget and fund the program, implement, and update the elements of the Master Plan lies with the Public Works Sewer Utility Engineering Manager. The Sewer Superintendent, Project Engineers, and Stormwater Coordinator will provide support.

Anticipated growth areas are identified in the City's 2015 comprehensive plan entitled EnvisionCR. Anticipation and planning for this growth is critical to cost effective implementation of a stormwater management program. Serving growth areas cost effectively is dependent on the following.

- initially targeting growth areas that can be cost effectively served
- identifying the appropriate regional stormwater facilities to do so
- sizing stormwater facilities for specific developments to be consistent with the broader regional plan
- identifying the appropriate stormwater infrastructure cost sharing for each development

Cedar Rapids operates the existing stormwater system under a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS 4) permit. A Construction General Permit (CGP) regulates construction sites with one or more acres of land disturbance. Stormwater related regulations continue to evolve at both the Federal and State levels. In particular, the EPA is currently working on an updated version of its existing stormwater rules. The update stems from a settlement agreement with the Chesapeake Bay Foundation on pollution in the Chesapeake Bay. The proposed rule may affect all Phase I, Phase II, and non-regulated Municipal Separate Storm Sewer Systems. Under the most recent proposal, performance standards for discharges from new and redeveloped sites will be established.

While not currently defined, the Cedar River flood control system will have a significant impact on future operations and maintenance staffing and funding levels. As currently anticipated, levee and floodwall operations and maintenance will be performed by either the Public Works or the Parks & Recreation Departments. Stormwater pump stations operations and maintenance will likely be overseen by the Water Pollution Control Division of the Utilities Department. In any case, regular operation and maintenance will be necessary to maintain system integrity and readiness, to respond to rising river levels, and to continually provide City staff with the training to respond to rising river levels.

Attachment A – Capital Improvements Plan

304 FUND CAPITAL IMPROVEMENT PROJECT SUMMARY (Revised April 2016)

ID	Watershed	Location	Quadrant	Issue	Proposed Scope of Work	Est. Total Cost	Available Funding	Prioritized Rank	Prioritization Score	Other Factors	Currently Allocated (10/9/2015)	2016 CIP	2017 CIP	2018 CIP	2019 CIP	2020 CIP	2021 CIP	Total CIP 2016-2021	Project Complete within 5-Year CIP Plan
-	-	-	-	Annual Misc. Storm Water Projects	Repair and rehabilitation	-	-	0	100			$ 250,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 200,000	$ 1,250,000	
-	-	-	-	Stormwater BMP Cost Share	City Cost Share for Private BMPs	-	-	0	100				$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 125,000	
-	-	-	-	Storm Sewer Inlet Modification	Safety Guards on Stormwater Inlets	-	-	0	100				$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 250,000	
-	-	-	-	FY Recurring Drain Tile Program	Drain Tile Improvements	-	-	0	100				$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 250,000	
-	-	-	-	Stormwater BMP's Streets	Green Infrastructure Projects	-	-	0	100				$ 200,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 600,000	
-	-	-	-	Annual Master Plan Updating	Modeling and updating	-	-	0	100	-		$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 600,000	
-	-	-	-	Hwy 100 Edgewood to Hwy 30		135,000		0	100	Land Acquisition Required Basin Modelling		$ -	$ 135,000					$ 135,000	YES
Case 18	Morgan Creek	Rockhurst Drive SW	SW	Overland and residential flooding within the Stoney Point subdivision	Construct an upstream detention basin	1,152,000	None	1	90	Land Acquisition Required Basin Modelling		$ 271,000	$ 880,000					$ 1,151,000	YES
Case 23	O Avenue	Detention basin west of 11th Street NW and south of N Avenue	NW	No suitable overland flow path from the detention basin near Harrison Elementary overtops. Outlet structure from basin does not meet design standards	Model drainage area to compare upstream basin vs overland path	1,500,000	None	2	79	Basin Modelling		$ 270,000	$ 300,000					$ 570,000	YES
-	Prairie Creek	Beverly Road SW	SW	Culvert failure	Replace failed culvert	216,785	2014 FEMA	3	79									$ -	YES
Case 12	Prairie Creek	27th Street SW north of 29th Avenue	SW	Failure of undersized culvert	Replaced 132-inch steel-plate culvert with triple 12'x7' RBC	776,000	FY2015	4	76	Completed Design (Shive-Hattery)	$ 216,000	$ 560,000						$ 560,000	YES
Case 171	Czech Village	21st Street SW	NW	Aging and undersized truck sewer causing ponding issues	Replace 84-inch brick storm sewer with 7'x5' box storm sewer	650,000	None	5	76	Funded with 304 Reserves		$ 650,000							YES
Case 101	Ushers Ferry	Gibson Drive NE	NE	Detention basins are undersized resulting in overtopping and flooding of yards.	Reconstruct detention basins.	500,000	FY2015	6	72		$ 100,000			$ 400,000				$ 400,000	YES
Case 102	Prairie Creek	18th Street SW at 29th Avenue	SW	Existing culvert is aging and is undersized.	Replace Existing Culvert.	700,000	None	7	71					$ 200,000	$ 500,000			$ 700,000	YES
Case 26	E Avenue	Auburn Drive SW north of 16th Avenue	SW	Flooding due to no overland flow path	Construct additional intakes and a stormwater channel to convey overland flow	260,000	FY2014	8	69									$ -	YES
Case 103	Czech Village	20th Avenue SW	SW	Road closed due to culvert failure	Replace Culvert with 5'x7' RBC	332,925	2014 FEMA	9	69									$ -	YES
Case 169	O Avenue	1521 Hidden Hollow Lane NW	NW	Existing 30" RCP Culvert has pipe seperation and severe erosion. Located in 30-ft easement between two homes.	Culvert failure with severe erosion between two houses within drainage easement. Existing 30" RCP has seperation at joints. Relay culvert, install outlet structure, Install additional culvert in lieu of overland flow path.	115,000	FY 2016	10	69	PROGRESSIVE DAMAGE (Small storms causing continued eriosion between two houses.)	$ 115,000							$ -	YES
Case 20	Kenwood	Forest and Grande SE	SE	Conveyance capacity limited resulting in flooded neighborhood		4,000,000	None	11	62	Basin Modelling				$ 400,000	$ 350,000	$ 800,000	$ 800,000	$ 2,350,000	NO
Case 20	Kenwood	Meadowbrook at Bever SE	SE	Flooding in yards	Model drainage area and construct upstream detention basin(s) to attenuate flow	0		12	62	Basin Modelling								$ -	NO
Case 20, Case 30	Kenwood	Park Court SE	SE	Flooding at Park Ct caused by overland flow		0		13	62	Basin Modelling								$ -	NO
Case 20, Case 16	Kenwood	Washington Avenue SE	SE	Flooding at Washington Avenue SE caused by overland flow		0		14	62	Basin Modelling								$ -	NO
Case 29	E Avenue	Johnson Avenue NW Hy-Vee and B Avenue NW	NW	Flooding due to undersized box culvert and inadequate overland flow path	Model drainage area and expand upstream detention	3,000,000	None	15	62	Basin Modelling				$ 400,000	$ 309,000	$ 800,000	$ 800,000	$ 2,309,000	NO
Case 105	E Avenue	Vinton Ditch at D Avenue	NW	Storm sewer separation causing structure instability of gabion wall.	Repair storm sewer.	100,000	None	16	62	Basin Modelling	$ 100,000							$ -	YES
Case 31	Indian Creek	Between Sunland Court SE and Cottage Grove Parkway	SE	No overland path	Extend storm sewer to reduce backyard flooding.	250,000	None	17	62	Residential Buy-out								$ -	YES
Case 27	E Avenue	31st Street SW between 2nd Avenue and 12th Avenue	SW	Excessive overland flow causing flooding on 2nd Avenue SW.	Construct upstream detention, complete localized grading, expand storm sewer	2,250,000	None	18	62	Basin Modelling								$ -	NO
Case 20	Kenwood	A Avenue and B Avenue NE	NE	Extensive property damage from flash flooding. Location is near the end of the Kenwood watershed.	Regrade for overland flow path or add upstream detention to reduce peak flows. Cost estimate if for overland flow path.	2,450,000	None	19	59	Basin Modelling								$ -	NO
Case 106	Cedar River	Penn Avenue NW at 1st Street NW	NW	Storm sewer is clogged. Requires new manhole to access pipe.	Install manhole with sluice gate. Remove debris from storm sewer. Construct headwall around storm sewer outlet	150,045	2014 FEMA	20	59									$ -	YES
Case 107	Prairie Creek	Lakeview Drive SW north of Beverly Road	SW	Overland flow resulted in erosion	Bank restoration	65,000	2014 FEMA	21	59									$ -	YES

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Case 1	Indian Creek	Clark Road SE	SE	No suitable overland flow path. Structures such as fences, wall, and garages encroach onto drainage easement.	Construct overland flow path. Remove encroachments	460,000	None	22	59	Policy Issue - Drainage Easement Encroachment								$ -	NO
Case 111	Rockford Road	18th Street SW south of 16th Avenue	SW	Regional detention basin required as part of development agreement	Construct Regional Detention Basin	650,000	FY2015	23	59	Previous City Commitment		$ 249,000	$ 400,000					$ 649,000	YES
Case 19	E Avenue	Vinton Ditch at E Avenue NW	NW	Ditch floods at culvert restriction, properties are within FEMA 100-year Floodplain	Construct upstream detention	2,694,204	None	24	59									$ -	NO
Case 25	Prairie Creek	12th Street SW near 32nd Avenue	SW	No overland path results in flooding of business	Construct swale in 11th street ROW from 29th Street south to 32nd Avenue. Construct culvert crossing 12th Street SW	641,000	None	25	57					$ 175,000	$ 466,000			$ 641,000	YES
Case 11	E Avenue	1st Avenue SW at Cleveland Elementary	SW	No suitable overland flow and undersized culvert crossing	Model drainage area, add additional detention, complete culvert replacement, and provide overland path as needed	5,000,000	None	26	57									$ -	NO
Case 109	E Avenue	Edgewood Road SW at 16th Avenue	SW	Overland flow flooding arterial street	Expand detention basin to reduce flow rate, increase pipe capacity under street.	500,000	None	27	55									$ -	NO
Cse 110	Kenwood	35th Street NE at Collins Plant	NE	Potential building flooding	Build berm, extend storm sewer, increase storm capacity	600,000	None	28	55									$ -	NO
Case 38?	Czech Village	6th Street SW 1200 Block	SW	Conveyance capacity limited resulting in flooded neighborhood	Construct Detention Basin	1,000,000	None	29	55							$ 85,000	$ 135,000	$ 220,000	NO
Case 114	Kenwood	D Avenue NE from 38th Street to 39th Street	NE	Localized flooding caused by undersized storm sewer	Expand storm sewer and intake capacity	250,000	FY2015	30	55		$ 30,000							$ -	NO
Case 115	Kenwood	Meadowbrook Drive SE from 22nd Street to 26th Street	SE	Aging and undersized infrastructure. Large areas with no storm sewer. Overland flow caused road damage and flooding in yards.	Replace and expand storm sewer	250,000	FY2015	31	55		$ 35,000							$ -	NO
Case 116	Kenwood	D Avenue NE From 30th Street to 32nd Street	NE	Existing storm sewer is undersized	Replace storm sewer	450,000	None	32	55									$ -	NO
Case 117	Kenwood	Grande Avenue SE from Crescent Street to Park Terrace	SE	Aging and undersized infrastructure	Replace storm sewer	500,000	None	33	55									$ -	NO
Case 120	Rockford Road	South of Jefferson High School west of 18th St SW	SW	Failed storm sewer and flooding in parking lot	Repair existing storm sewer. Install new 24-inch RCP and intakes	215,000	FY2016, Agreement with School District	34	53									$ -	YES
Case 104	Ushers Ferry	Ushers Ferry	NE	Residential development creating excessive stormwater runoff.	Construct Detention Basin	500,000	None	35	52									$ -	NO
Case 47	Czech Village	Wilson Avenue near Murdock Funeral Home	SW	Unsuitable overland flow path	Construct overland flow path through cemetery	491,000	None	36	52									$ -	NO
Case 118	Cedar River (Bel Air)	Between 38th Street and 39th Street SE	SE	Excessive overland flow	Grade overland flow pathway along the backyards	640,000	None	37	52									$ -	NO
Case 119	Czech Village	Detention basin north of Novac Ct SW	SW	Detention basin overtops causing flooding	Increase outlet pipe capacity and size of basin	1,000,000	None	38	52									$ -	NO
Case 122	E Avenue	Johnson Avenue SW from 1st Avenue to West Post Road	SW	Existing storm sewer is undersized	Replace storm sewer	300,000	None	39	52									$ -	NO
Case 167	Czech Village	10th Ave SW at 7th and 8th Street SW	SW	Area is very flat and floods numerous homes. No curb and gutter in the area.	Regrade or add curb and gutter	100,000	None	40	52									$ -	NO
Case 112	Kenwood	Cedar Lake	NE	Cedar Lake sedimentation	Remove potentially contaminated sediment	1,000,000	None	41	50									$ -	NO
Case 125	Kenwood	Blake Boulevard SE from Forest Drive to Crescent Street	SE	Aging and undersized infrastructure	Replace storm sewer	200,000	None	42	50									$ -	NO
Case 121	O Avenue	Schultz Dive NW	NW	Overland flow from Madison School and hill to the south flood houses on this and apartment complex on O Ave	Construct berm, extend storm sewer	250,000	None	43	48									$ -	NO
Case 123	Kenwood	23rd Street Drive SE East of Forest Drive	SE	Drainage issues at 23rd Street SE East of Forest Drive	Expand storm sewer to improve drainage.	150,000	FY2015	44	48									$ -	NO

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Case 124	McLeod Run	Noelridge Park	NE	Additional stormwater detention	Construct new detention basin to reduce down stream impacts caused by new development around Collins Road	340,000	FY2015, SRF	45	48									$ -	YES
Case 40	Rockford Road	Rockford Road near Cargill Plant	SW	Excessive overland flow floods buildings	Regrade Rockford Road to address flooding from overland flow (18th Street detention basin should reduce peak flows to Rockford Road)	2,615,000	None	46	48									$ -	NO
Case 127	Prairie Creek	J Street SW north of Miller Ave	SW	Drainage channel needs clearing, flooded street	Clean drainage way	35,000	None	47	48									$ -	NO
Case 128	Kenwood	26th Street SE near Beaver Avenue	SE	Ponding water on southbound lane	Extend Storm Sewer or Regrade Road	250,000	None	48	48									$ -	NO
Case 132	Morgan Creek	Rockvalley Ln Drainage Channel	NW	Stormwater flow is causing excessive channel erosion	Bank stabilization	200,000	None	49	48									$ -	NO
Case 100	Morgan Creek	Morgan Creek	SW	Morgan Creek detention basin is undersized. No suitable overland flow path to the basin.	Grade swale for path to the basin. Increase basin capacity. Replace outlet structure	175,000	FY2016	50	47	Private Development Issue								$ -	NO
Case 133	Cedar River	Ellis Road NW	SE	Damaged outfall on Ellis Road NW	Remove 12" drain tile and replace with 24" RCP. Install an in-line flood protection valve.	67,680	2014 FEMA	51	47									$ -	YES
Case 126	Cedar River (Van Vechten)	Van Vechten Park	SE	Van Vechten Park – no name stream exposed sanitary line	Bank stabilization	50,000	None	52	45									$ -	NO
Case 14	Prairie Creek	Badger Drive SW	SW	Properties located within Floodplain	Increase storm sewer capacity and regrade drainage path	67,380	None	53	45									$ -	NO
Case 41	Rockford Road	5th Avenue SW east of Rockford Road	SW	Excessive overland flow floods buildings	Install additional intakes to tie into the large box culvert running underneath the road (Initial evaluation shows culvert meets 100-year event. upstream detention at 18th Street should help issue)	100,000	None	54	45									$ -	NO
Case 129	E Avenue	F Avenue NW at 19th Street	NW	Undersized culvert under F Avenue NW	Replace culvert	50,000	None	55	45									$ -	NO
Case 7	Prairie Creek	Handly Court SW	SW	Undersized culvert at Handley Ct SW	Replace 24" culvert with dual 18" culvert	90,000	None	56	45									$ -	NO
Case 36	Indian Creek	30th Street Drive SE	SE	Properties located within Floodplain	Assist in elevating 3 homes	266,850	None	57	45									$ -	NO
Case 130	Morgan Creek	Lakeview Drive SW north of Beverly Road	SW	Retention basin overtopping, culvert may be undersized and overland flowpath needs to be assessed	Replace or extend culvert and regrade an overland flow path	350,000	None	58	45									$ -	NO
Case 131	Prairie Creek	Bowling Street SW at Prairie Creek	SW	Flooded business	Build berm or relocate business	600,000	None	59	45									$ -	NO
Case 168	McLeod Run	West of Noelridge Park Outlet Structure	NE	The overland flow from the pond has flooded out at least one home (perhaps more).	Improve overland flow path	500,000	None	60	45									$ -	NO
Case 35	Kenwood	24th St Drive SE and 1st Avenue	SE	Isolated flooding caused by insufficient overland flow path	Extend storm sewer, or regrade overland flow path	130,000	None	61	43									$ -	NO
Case 135	Cedar River	44th Street SE south of Pioneer Trail	SE	Overland flow flood the street	Construct new culvert and minor bank work	30,000	None	62	41									$ -	NO
Case 136	Morgan Creek	Morgan Creek	SW	Washout caused by overland flow	Replace headwall and wingwall of culvert. Provide rip-rap to limit future erosion.	35,000	2014 FEMA	63	41									$ -	YES
Case 137	Cedar River (Bel Air)	Harold Drive SE at 14th Avenue	SE	Capacity limited overland flow path flooded street	Construct flow path and stabilize or increase detention	500,000	None	64	41									$ -	NO
Case 139	Prairie Creek	Miller Avenue SW east of Vermont Street	SW	Drainage channel needs clearing, flooded street	Clear drainage way	35,000	None	65	41									$ -	NO
Case 13	McLeod Run	Clifton Street NE	NE	Poor drainage due to lack of storm sewer	Extend storm sewer to mitigate drainage issue	50,000	None	66	41									$ -	YES
Case 140	Indian Creek	Green Valley Terrace SE	SE	Damaged 48-inch storm sewer	Repair storm sewer	50,000	None	67	41									$ -	NO
Case 138	Indian Creek	Savannah Court SE	SE	Topography to flat to support outlet flow from street, stagnant water and flooded residential street	Reconstruct of storm sewer	50,000	None	68	40									$ -	NO
Case 44 and 48?	Indian Creek	Skylark Lane at Red Fox Road SE	SE	Overland flow floods yards	Extend storm sewer	66,400	None	69	40									$ -	NO
Case 159	Cedar River	18th Street NW south of Ellis Road	NW	Channel erosion	Construct new piping and repair erosion	100,000	None	70	40									$ -	NO
Case 141	Indian Creek	East of 3900 block 1st Avenue	SE	Overland flow path resulting in flooded parking areas	Increase intake and storm sewer capacity	20,000	None	71	38									$ -	NO
Case 142	McLeod Run	Oriole Court NE to Finch Court	NE	Poor drainage	Extend storm sewer	150,000	None	72	38									$ -	NO

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Case 143	Kenwood	37th Street NE and Eastern Avenue	NE	Storm sewer lacks conveyance capacity causing flooded residential streets	Extend storm sewer, increase detention	250,000	None	73	38									$ -	NO
Case 144	McLeod Run	Cavalier Street NE east of Harding School	NE	Inadequate conveyance piping, flooded residential streets	Install drain tile and extend storm sewer	250,000	None	74	38									$ -	NO
Case 145	McLeod Run	Oakland Road NE south of Elmhurst Drive	NE	Flooding occurs within the street on Oakland Road	Install new storm sewer in Oakland Road to reduce flooding and ponding of stormwater on the street	300,000	None	75	38									$ -	NO
Case 146	McLeod Run	48th Street NE west of Council Street	NE	Inadequate conveyance piping, flooded residential streets and yards	Install drain tile and extend storm sewer	350,000	None	76	38									$ -	NO
Case 147	O Avenue	Granny Smith Lane NW	NW	Overland flow at peak period floods residential road	Reconstruct overland path, reconstruct road sections to support, increase pipe capacity to receive the flow	1,400,000	None	77	38									$ -	NO
Case 150	Czech Village	A Street SW near landfill	SW	Damaged storm sewer outfall	Replace 12-inch DIP storm sewer and reconstruct berm with compacted clay and rip-rap.	31,443	2014 FEMA	78	38									$ -	YES
Case 152	McLeod Run	McLeod Run banks near 42nd Street NE	NE	Bank erosion	Bank stabilization	150,000	None	79	38									$ -	NO
Case 170	E Avenue	Franbrook Terrace at Edgewood Rd	NW	Excessive pond from street	N/A	50,000	None	80	38										NO
Case 148	Cedar River (Bel Air)	Between 38th Street and 39th Street SE	SE	Excessive overland flow	Fill eroded areas, stabilize, and remove debris.	40,000	2014 FEMA	81	36									$ -	YES
Case 149	Czech Village	20th Avenue SW north of Wilson Hy-Vee	SW	Overland flow floods backyards	Modification to inlet structure	25,000	None	82	34									$ -	NO
Case 153	Cedar River (Apple Mesa)	J Avenue NE east of Adirondack Drive	NE	Conveyance limited resulting in street flooding	Construct new culvert and minor bank work	10,000	None	83	34									$ -	NO
Case 154	Cedar River (Van Vechten)	Otis Road SE	SE	Undersized culvert resulting in flooded street	Complete hydraulic modeling. Construct new culvert and minor bank work	50,000	None	84	34									$ -	NO
Case 156	Ushers Ferry	Riverview Road NE west of Miller Road	NE	Channel overtops flooding backyards	Bank stabilization	100,000	None	85	34									$ -	NO
Case 157	Indian Creek	34th Street Drive SE from 1st Avenue to Indian Creek	SE	Poor surface water drainage	Increase capacity of existing storm sewer	300,000	None	86	34									$ -	NO
Case 158	McLeod Run	H Avenue NE to Center Point to I Avenue	NE	Poor drainage	Expand storm sewer to increase capacity and improve drainage from H to Center Point and from Center Point to I Avenue	400,000	None	87	34									$ -	NO
Case 160	O Avenue	Alley between L Ave and K Ave West of Ellis Blvd	NW	Alley is flat resulting in poor drainage	Extend storm sewer	50,000	None	88	34									$ -	NO
Case 162	McLeod Run	G Avenue NE at Center Point Road	NE	No conveyance systems resulting in ponding on arterial street	Extend storm sewer to the location	750,000	None	89	28									$ -	NO
Case 163	McLeod Run	Brookland Drive NE	NE	Insufficient storm sewer capacity causing backyard flooding	Replace storm sewer	1,000,000	None	90	28									$ -	NO
Case 164	Cedar River	Old River Rd SW	SW	Failed culvert headwalls	Replace headwalls	51,684	None	91	28									$ -	NO
Case 165	Indian Creek	40th Street Drive SE	SE	Bank erosion	Bank stabilization	150,000	None	92	28									$ -	NO
Case 166	Kenwood	Cedar Lake	NE	North end of Cedar Lake into Cedar River outlet structure reduced flow to river	Remove sediment, fix structure	150,000	None	93	28									$ -	NO
Case 161	Cedar River	Robbins Lake at Ellis Road NW	NW	Sedimentation from stream along Edgewood Rd affecting fish habitat	Pump out, remove sediment, restock	250,000	None	94	24									$ -	NO
												$ 2,350,000	**$ 2,340,000**	**$ 2,100,000**	**$ 2,150,000**	**$ 2,210,000**	**$ 2,260,000**	**$ 12,760,000**	**$ -**

Attachment B – Stormwater Improvements Prioritization Template

Prioritization Ranking for Urban Drainage Improvements

City of Cedar Rapids, Iowa

Prepared By: _____ Project Location: _____ Date: _____

Project Number: _____ Watershed: _____

Health & Safety

*Type of Risk	Description of Risk	Points, P_{HS}
Presents public safety hazard	Higher health concern if water enters occupied structure, flooding of street is risk to vehicles &/or limits access to emergency services, flooding of parks & sidewalks is risk to pedestrians.	2
Hazard may be mitigated with temp. control		1
No public safety hazard		0

**Competent person must assess site to determine all hazards and potential for hazard mitigation*

P_{HS} = _____

Multiplier: 6

$A = P_{HS} * 6$ 0

Cost-Benefit (Cost of Potential Damage / Cost of Project)

	Comments	Points, P_{CB}
Reference Cost-Benefit Table	Extent of project(s), connectivity of different projects, etc.	2
		1
		0

P_{CB} = _____

Multiplier: 4

$B = CB * 4$ 0

Current Capacity

*Interval	Description of Current Capacity	Points, P_{OI}
Significantly below standard (2+ design intervals)	Recurrence interval/level of service provided to prioritize projects to address problems that occur for rain events less than design standards. Applies to sewers, inlets, and street conveyance. City should be responsible for meeting design standards.	2
Below standard (1 design interval)		1
At standard		0

**Use rainfall intensity and river stage*

P_{OI} = _____

Multiplier: 6

$C = P_{OI} * 6$ 0

Asset Functionality

Condition and Maintenance	Description of Asset	Points, P_I
PACP Grade 5, or Permanent Reduction of Design Capacity, or Problem/Defect recurring annually or more frequent	Applicable to sewers and detention basins. Condition of asset impacting functionality, level of maintenance required to maintain capacity. Service life of asset relative to age of asset? Is operation/maintenance of system improved with the project?	2
PACP Grade 4, or Reduction of Design Capacity, or Problem/Defect recurring every 5 years or more		1
PACP Grade 3 or lower, or No history of recurring problems		0

P_I = _____

Multiplier: 4

$D = P_I * 4$ 0

Prioritization Ranking for Urban Drainage Improvements

City of Cedar Rapids, Iowa

Prepared By: _____ Project Location: _____ Date: _____

Project Number: _____ Watershed: _____

Water Quality & Environmental

Provides Water Quality Benefits	Description of Water Quality Benefits	Points, P_{WQ}
Yes	Sediment/nutrient/organic loading. Waters listed in 303d &/or impacting McLoud Run (temp & sediment)? Indian Creek & Prairie Creek impaired for bacteria. Nitrates are pollutants of concern. Potential for regulatory issues (DNR)?	2
No		0

P_{WQ} = _____

Multiplier: 2 $E = P_{WQ} * 2$ 0

Associated / Other Considerations

*Type of commitment	Description of Commitment	Points, P_{PO}
Specific considerations made to a project	Discussions with citizens on project needs (w/ or w/o timeline commitments)...want to acknowledge past discussions with residents and no resolution or activity on a project. Are there other compelling reasons that would make a project a higher priority? Such as: prior commitments, political pressures, potential to partner with developers, regulatory mandates, multi-use features, quality of life, visual quality of environment, enhance sustainability, low-impact development, consequence(s) of delay, etc.	2
Considerations with no project		1
No commitments		0

**Commitments may be generated internally, by City policy, or to a public bias*

P_{PO} = _____

Multiplier: 3 $F = P_{PO} * 3$ 0

Sanitary Sewer Inflow Conveyance

Site Located in Critical Area	Comments	Points, $P_{I\&I}$
Yes	Is additional storm capacity provided in area where I&I reduction will require more capacity.	2
No		0

$P_{I\&I}$ = _____

Multiplier: 1 $G = P_{I\&I} * 1$ 0

Future Growth & Sustainability

Area Favored for Growth/Redevelopment	Comments	Points, P_{FG}
Yes	Growth or redevelopment area identified by EnvisionCR and/or compatible with City's sustainability initiatives/policies (iGreenCR). Progressive approach to get ahead of development - revisit & enforce development standards.	2
No		0

P_{FG} = _____

Multiplier: 3 $H = P_{FG} * 3$ 0

Normalized Score [(A+B+C+D+E+F+G+H+I) / MaxScore * 100] = 0

Maximum Score = 58

Attachment C – Financial Plan

City of Cedar Rapids, Iowa
Financial Plan
Storm Sewer

Assumptions:

Property Tax valuation increase		1.0220	1.0220	1.0220	1.0220	1.0220
Chargeable revenue increase (licenses/permits, charges for services, rents/royalties)		1.0300	1.0500	1.0500	1.0500	1.0500
Personal services increase		1.0500	1.0500	1.0500	1.0500	1.0500
Non-personal services - discretionary increase		1.0500	1.0500	1.0500	1.0500	1.0500
Non-personal services - non-discretionary increase		1.0500	1.0500	1.0500	1.0500	1.0500

	Fiscal Year 2016	5 Year Plan Grand Total	Fiscal Year 2017	Fiscal Year 2018	Fiscal Year 2019	Fiscal Year 2020	Fiscal Year 2021
OPERATIONS							
Revenue:							
Property taxes	-	-	-	-	-	-	-
Franchise taxes	-	-	-	-	-	-	-
Licenses & permits	-	-	-	-	-	-	-
Intergovernmental	-	-	-	-	-	-	-
Charges for services	4,179,901	23,789,489	4,305,298	4,520,563	4,746,591	4,983,921	5,233,117
Fines & forfeits	-	-	-	-	-	-	-
Use of money & property	-	-	-	-	-	-	-
Rents & royalties	-	-	-	-	-	-	-
Miscellaneous revenue	-	-	-	-	-	-	-
Other financing sources	-	-	-	-	-	-	-
GO Bonds	-	-	-	-	-	-	-
Proceeds from sale of fixed assets	-	-	-	-	-	-	-
Transfers in (listed below)	-						
		-	-	-	-	-	-
Total Operating Revenue	**4,179,901**	**23,789,489**	**4,305,298**	**4,520,563**	**4,746,591**	**4,983,921**	**5,233,117**
Expenditure:							
Personal services	-	-	-	-	-	-	-
Non-personal services - discretionary	374,500	2,172,816	393,225	412,886	433,531	455,207	477,967
Non-personal services - non-discretionary	1,713,466	9,941,381	1,799,139	1,889,096	1,983,551	2,082,729	2,186,865
Transfers Out (listed below)							
To Water CIP for CCB Upgrade	200,000	-					
To Storm CIP(304)	1,300,000	11,100,000	2,000,000	2,200,000	2,200,000	2,300,000	2,400,000
		-	-	-	-	-	-
Subtotal of Expenses Before Capital Outlay	**3,587,966**	**23,214,197**	**4,192,364**	**4,501,983**	**4,617,082**	**4,837,936**	**5,064,833**
Capital Outlay	**50,000**	**500,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**
Total Operating Expenses	**3,637,966**	**23,714,197**	**4,292,364**	**4,601,983**	**4,717,082**	**4,937,936**	**5,164,833**
Net Income/(Loss) from Operations	**541,935**	**75,292**	**12,934**	**(81,420)**	**29,509**	**45,985**	**68,284**
DEBT SERVICE							
Total Debt Service Revenue that is NOT an INTERFUND transfer from operations							
Total Debt Service Expenses		**-**	**-**	**-**	**-**	**-**	**-**

City of Cedar Rapids, Iowa
Financial Plan
Storm Sewer

Assumptions:

Property Tax valuation increase	1.0220	1.0220	1.0220	1.0220	1.0220	1.0220
Chargeable revenue increase (licenses/permits, charges for services, rents/royalties)	1.0300	1.0500	1.0500	1.0500	1.0500	1.0500
Personal services increase	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500
Non-personal services - discretionary increase	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500
Non-personal services - non-discretionary increase	1.0500	1.0500	1.0500	1.0500	1.0500	1.0500

	Fiscal Year 2016	5 Year Plan Grand Total	Fiscal Year 2017	Fiscal Year 2018	Fiscal Year 2019	Fiscal Year 2020	Fiscal Year 2021
OPERATIONS							
Net Income/(Loss) After Debt	**541,935**	**75,292**	**12,934**	**(81,420)**	**29,509**	**45,985**	**68,284**
CAPITAL PROJECTS							
Revenue:							
Federal, State, Local Grants		-					
Charges for services		-					
Interest		-					
Contributions		-					
Special Assessments		-					
Revenue Bonds		-					
TIF Bonds							
GO Bonds		-					
Other Miscellaneous revenue		-					
Miscellaneous revenue		-					
Transfers in (listed below)							
From Ops	1,300,000	11,100,000	2,000,000	2,200,000	2,200,000	2,300,000	2,400,000
		-					
Total CIP Revenue	**1,300,000**	**11,100,000**	**2,000,000**	**2,200,000**	**2,200,000**	**2,300,000**	**2,400,000**
Expense:							
City Staff time		-					
Non-Staff time	1,300,000	11,100,000	2,000,000	2,200,000	2,200,000	2,300,000	2,400,000
Total CIP Expense	**1,300,000**	**11,100,000**	**2,000,000**	**2,200,000**	**2,200,000**	**2,300,000**	**2,400,000**
Net CIP	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net Income/(Loss) - After CIP	**541,935**	**75,292**	**12,934**	**(81,420)**	**29,509**	**45,985**	**68,284**
Beginning Cash Balance 7/1			541,935	554,868	473,449	502,958	548,943
Projected Ending Cash Balance 6/30	**541,935**		**554,868**	**473,449**	**502,958**	**548,943**	**617,227**