Keith Creek Watershed Assessment

Introduction

Material presented in the following summary documents current stormwater management and flooding issues for the Keith Creek Watershed. Information presented is based on a review of available information related to current conditions in the drainage basin. No comprehensive analysis of stormwater management and flooding issues in the watershed has been performed in the last 20 years.

Watershed Description

Description and Land Use

The Keith Creek watershed is located in the northern part of the City of Rockford on the east side of the Rock River. The watershed drains approximately 9,000 acres at its mouth. Roughly three-quarters of the watershed is located within the City of Rockford. The remaining portion of the watershed extends into the Village of Riverside and unincorporated Winnebago and Boone Counties. The watershed is very long and narrow, with Keith Creek entering the Rock River within the commercial center of the City.

Watershed Statistics: Keith Creek	
Total Area:	9,000 ac.
Total Area within City:	6,600 ac.
% of City within Watershed:	73%
Other Stakeholders:	Riverside
No. of Detention Facilities	70
No. of Outfalls	65

The Keith Creek watershed is about 70% developed. The majority of the current development has occurred in the southwest and central portions of the watershed. The watershed is densely populated in these areas and contains heavy urbanization near the City center. A mix of commercial and retail development dominates the southwest corner, with dense residential mixed in. Rapid development of the watershed in recent years has increased the number of roads and structures crossing the Creek. Some homes within the watershed have been built adjacent to the creek so that it serves as a focal point for their lawns and yards. In the northeast corner of the watershed there is agricultural development interspersed with residential land. The City anticipates that development will extend to the moderately developed northeastern corner of the watershed area within the City limits in the coming years.

Topography and Soils

The topography of the Keith Creek watershed is typical of the long, narrow watersheds within the eastern part of the City of Rockford. Ground elevations within the watershed range from about 980 feet NAVD to the east of the Winnebago-Boone County Line, to about 700 feet NAVD near the creek's confluence with the Rock River. Variations in elevation across the watershed (perpendicular to the stream) range from 875 feet in the relatively flat upper areas east of Mulford Road to 750 feet in the well-defined valley sections to the west.

Soils within the Keith Creek watershed consist primarily of type B soils, with thin pockets of type D soils surrounding the creek bed. Type B soils are soils with moderately low runoff potential when thoroughly wet. Water can be transmitted through these soils without impediment. Type B soils typically have less than 20 percent clay, and between 50 and 90 percent sand with a loamy sand or sandy loam textures. These soils have moderately fine to moderately coarse textures. Type D soils are characterized by properties that restrict water movement through the soil. Type D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. They have high runoff potential when thoroughly wet.[26] The predominance of type B soils in the Keith Creek watershed should facilitate infiltration of rainfall in pervious areas, thereby contributing to lower runoff volumes and rates than in basins with less pervious soil types.

Primary Receiving Stream

Keith Creek is the primary receiving stream for the Keith Creek watershed. There is approximately 96,000 feet (18.2 mi.) of creek running through the watershed. It exists in predominantly a natural state with certain areas having been reinforced with concrete bank walls and riprap bank stabilization to minimize erosion. It also passes through conduits at two locations, 8' x 10' and 8' x 28', where it flows beneath parking lots, buildings, and streets. Keith Creek has a stream bed elevation of 691 feet (NAVD) at its mouth, and 859 feet (NAVD) at its origin. The creek is moderately steep, with an average fall of 20 feet per mile. The profile of the stream is shown in the Flood Profile extracted from the 2006 Flood Insurance Study for Winnebago County and Incorporated Areas.

Alpine Dam is the only significant on-stream impoundment of Keith Creek within the watershed. The Dam was completed in the late 1940's and is a dry detention structure to protect the areas downstream by holding back up to 100-year storm floodwaters. The City contracted HNTB Corporation to inspect the Dam in 2008. They found the dam embankment and soil strength under the dam to be adequate. However, the concrete overflow spillway was determined to need significant repair to address safety concerns.

[26] Burke, Christopher and Thomas Burke. HERPICC Stormwater Drainage Manual. West Lafayette, Indiana: Purdue Research Foundation, 1994.

Readily available flow data for the Keith Creek watershed is presently limited to calculated flood flows published in the Flood Insurance Study for Winnebago County and Incorporated Areas are summarized in Table KtC-1 below. It is important to note that these flows are based on analyses performed more than 30 years ago and likely do not reflect current conditions in the watershed.

Table KtC-1
FLOOD INSURANCE STUDY FLOWS (1976)
KEITH CREEK WATERSHED, ROCKFORD, ILLINOIS

	50-year Flow		100-year Flow	
Cross Section Location	**Flow (cfs)**	**Flow (cfs/acre)**	**Flow (cfs)**	**Flow (cfs/acre)**
At Alpine Dam	970	0.230	1,144	0.271
At Mulford Road	760	0.290	900	0.343

Source: Flood Insurance Study, Winnebago County and Incorporated Areas, Federal Emergency Management Agency. 2006. Flows based on 1976 analysis.

Given the character of the watershed, flooding within Keith Creek is of a flashy nature. Localized flooding along the creek is aggravated by the number of small bridges, culverts, and vegetative debris along the stream channel. The major problem area is between Seventh Avenue and Charles Street. This is the first area where flooding usually occurs. This, in addition to the two box culverts that pass 595 feet and 1000 feet under Charles street and a shopping center, respectively. As shown in Figure KtC-1, the floodplain along Keith Creek is relatively narrow over most of the length of the stream, except for two isolated areas around:

- 13^{th} St.
- Dawn St.

Records maintained by the Federal Emergency Management Agency (FEMA), indicate that no letters of map revision (LOMRs) have been issued for development projects in the Keith Creek watershed during the past 30 years.

Water Quality and NPDES Discharges

Keith Creek is a clear, spring-fed stream. The waters are generally cool and clear and are good enough to support a diversity of aquatic life. Agricultural production has increased the silt load on the stream, and urbanization along the banks of the creek has increased damaging man-made runoff, including storm sewer outfalls, road salt and oil, and city street residue.

Within the Keith Creek watershed three sites have been monitored under the SCORE sampling program. Two sites (T3 and T4) are the locations of a full suite of water quality analyses and bioassessment (macroinvertebrate). One site (R3) is a storm water sampling site. Figure KtC-3 shows the location of the sampling sites; Table KtC-2 provides metadata for each site.

Figure KtC-3
Sample Site Locations

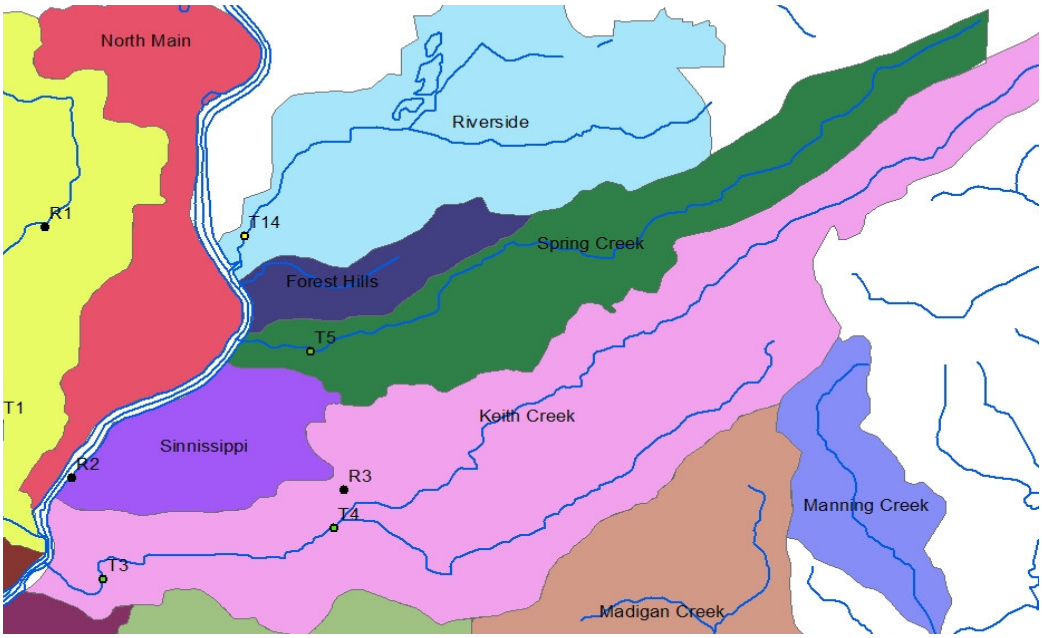


Table KtC-2
SAMPLING SITES
KEITH CREEK WATERSHED, ROCKFORD, ILLINOIS

Station	Location	Station Type	Number of Samples (2003-2008)	Parameters Measured
T3	Keith Creek at Tenth Avenue Park	Full water quality analyses & bioassessment	40	DO, pH, Temp, Conductivity, Fecal Coliform, BOD, COD, TSS, TDS, Hardness, Ammonia-N, Nitrate-N, P, Discharge
T4	Keith Creek at Dahlquist Park	Full water quality analyses & bioassessment	45	DO, pH, Temp, Conductivity, Fecal Coliform, BOD, COD, TSS, TDS, Hardness, Ammonia-N, Nitrate-N, P, Discharge
R3	Fairview Blvd. and Crosby St.	Storm water	15	pH, Fecal Coliform, BOD, COD, TSS, TDS, FOG, Hardness, Ammonia-N, Nitrate-N, TKN, P, Cyanide, Cu, Cd, Zn, Pb, phenol

At T3 and T4 field measurements of dissolved oxygen (DO), pH, conductivity and temperature were measured when samples were collected. Flow measurements were made on many of these occasions as well. Results for both sites showed that Keith Creek was in compliance with General Use Water Quality Standards for DO and pH. There are no water quality standards for conductivity; however, T4 had the highest average conductivity measures in comparison to the other tributary streams. Both T3 and T4 exceeded the water quality standard for total dissolved solids (TDS) during the 6-year sampling period. T4 exceeded the 1,000 mg/L standard once; T3 exceeded the standard twice (35 Ill. Admin. Code 302.208). The high TDS levels occurred during winter, and may be due to street salt applications and runoff.

Total suspended solids (TSS) results for T3 and T4 are similar to the other tributaries sampled within the MS4 service area. The storm water collection at R3 showed that R3 had the lowest mean TSS concentration in comparison to the other storm water sampling sites. R3 collects the water from the drainage of a 510-acre watershed that is largely residential.

Nitrogen concentrations (Ammonia N and Nitrate N) were not significantly different than other tributary streams. Total phosphorus concentrations at T3 were significantly higher than two (out of five) MS4 tributary streams sampled.

Figures KtC-4 and KtC-5 are fecal coliform load duration curves for the two monitoring sites on Keith Creek[27]. Among the five monitored tributaries within the MS4 service area, T3 and T4 had the highest coliform concentrations. At T3, at Tenth Ave. Park, 15 of 19 load measurements exceeded the water quality standard for fecal coliform (Figure 2). At T4, at Dahlquist Park, 15 of 18 load measurements exceeded the water quality standard for fecal coliform (Figure 3). At both sites, the coliform standard was exceeded during all hydrologic conditions (from high flows to zero flow). Keith Creek has not been added to the Illinois 2008 impaired water's list although fecal coliform levels are high and the stream does not support contact recreational use. Waterfowl, including Canada goose, have been identified as a nonpoint source contributor to fecal coliform levels in this and other watersheds.

[27] Streamflow measurements have been made along with sample collections since October 2005. From this data, load duration curves were prepared for Keith Creek. The target load duration curves for monitoring sites T3 and T4 were developed from the flow records of the decommissioned USGS gage on Keith Creek at 8th Street.

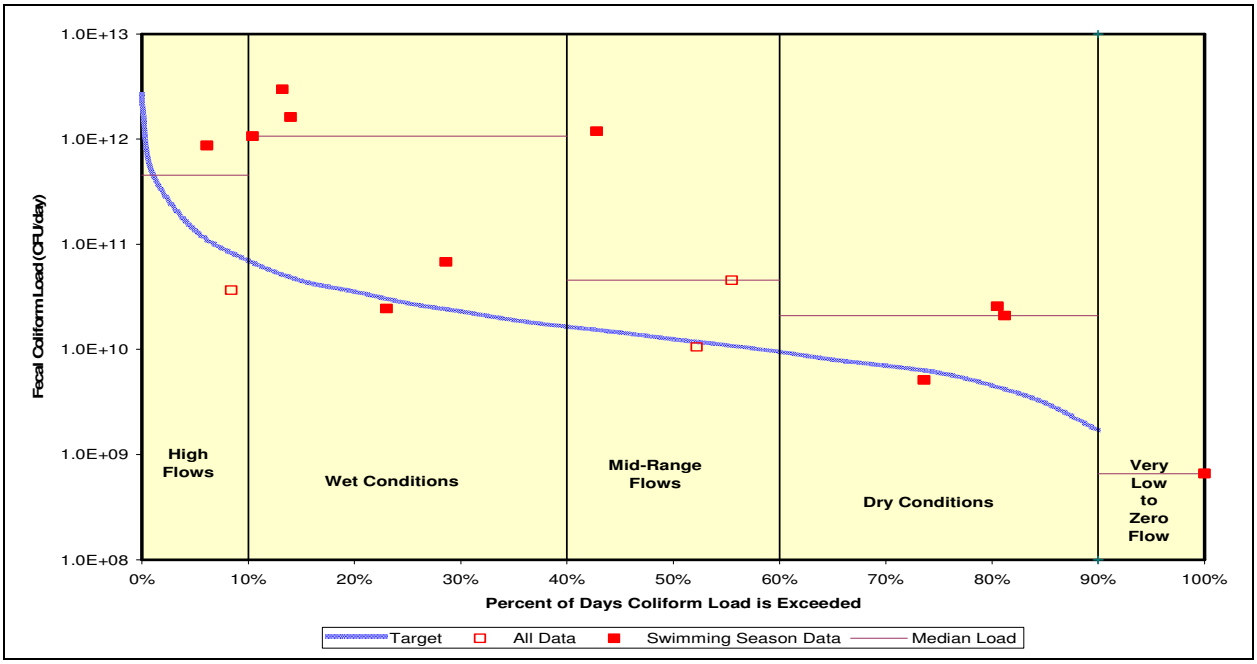


Figure KtC-4. Fecal Coliform Load Duration Curve, Site T3, Keith Creek at 10th Ave. Park, 2005-2007

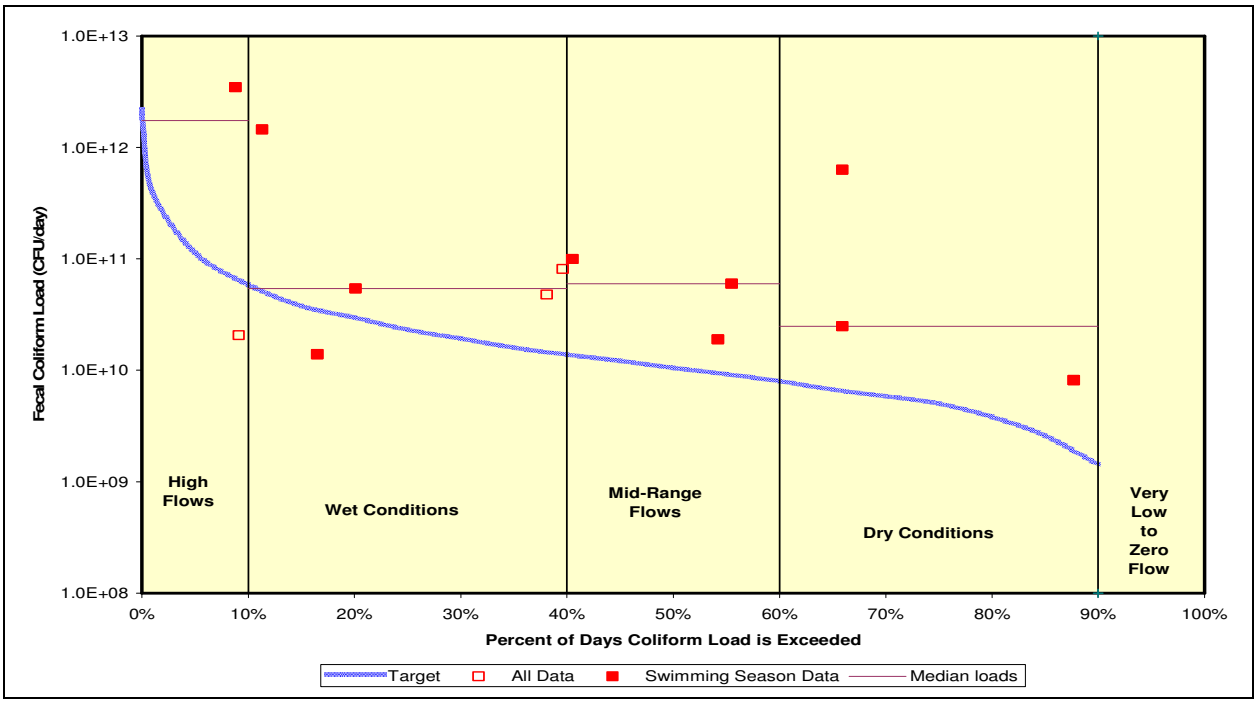


Figure KtC-5. Fecal Coliform Bacteria Load Duration Curve, Site T4, Keith Creek at Dahlquist Park, 2005-2007

With few exceptions, concentrations of heavy metals in the MS4 tributary streams and in storm water are low and suggest that runoff from industrial and commercial areas is reasonably well managed. Public sector investments in BMPs may therefore provide greater water quality benefits if they control other pollutants such as fecal coliform bacteria.

Physical habitat, as evaluated according to the Stream Habitat Assessment Procedure (SHAP), is lowest at T3 and T4. Low scores indicate poor habitat quality. The benthic communities are similar between all tributaries sampled within the MS4 service area.

Table KtC-3 provides the NPDES-permitted point sources in the watershed using the USEPA's water quality modeling program, BASINS.

Table KtC-3
NPDES POINT SOURCES LOCATED WITHIN THE KEITH CREEK WATERSHED ROCKFORD, ILLINOIS

NPDES Permit #	Facility Name	Receiving Water
IL0003671	Valspar Corporation - Rockford	Rock River
IL0024350	St. Mary's of the LK Seminary	St. Marys Lake
IL0055069	Swedish American Hospital	Rock River Via Storm Sewer
IL0060640	Peterson-Kruse, Inc.	Rock River
IL0062294	Testor Corp.	Rock River
IL0067377	Elco Textron - Rockford	Kishwaukee River
IL0069337	Zerox Corp – Des Plaines	Des Plaines River
IL0070513	Testor Corporation - Rockford	Storm Sewer Trib to Keith Creek

Runoff from industrial sites is a potential pollutant source for receiving waters. Table KtC-4 lists the industrial sites within the Keith Creek watershed. One CERCLA, or Superfund, site is listed within the watershed although it is not on the NPL. The site, Sparkle Cleaners, is located on Third Avenue and was a contamination threat due to the use of solvents. According to the USEPA's query program, Envirofacts, enforcement and cleanup actions for this site were time critical and were to be completed by April 2008.[28]

[28] Source: U.S. EPA. Envirofacts website. www.epa.gov/enviro/html/cerclis/cerclis_query.html. Accessed 12/11/08.

Table KtC-4
INDUSTRIAL SITES LOCATED WITHIN THE KEITH CREEK WATERSHED ROCKFORD, ILLINOIS

Name	Street	Land Use Code	Description
Androck Hardware Corporation	19th St.	3400	Fabricated Metal Prod. (wet)
Spider Company	Woodruff Ave.	3950	Miscellaneous Manufacturing (Dry)
Rockford Auto Parts	Seminary St.	4100	Transportation Services
Behr Precious Metals, Inc.	Seminary St.	3500	Machinery Mfg. (wet shop)
Color Corporation of America	Nelson Blvd.	2800	Pnt. Chem. Oil & Grease – Mfg. & Reclm.
First Group Rockford	Spring Creek Rd.	6512	Office Bldg. – Shopping Center
Stannes Place	Brendenwood Rd.	R001	Not listed
AAA Quality Limousines, Ltd.	Phelps Ave.	4100	Transportation Services
Park Strathmoor	Strathmoor Dr.	8061	Nursing Homes
Philips Automotive, Inc.	Mulford Rd.	4100	Transportation Services
Ephraim, LLC.	Mulford Rd.	6000	Financial – Insurance – Real Estate
Fabricators & Manufacturing Assn.	Featherstone Rd.	6512	Office Bldg. – Shopping Center
Rockford College	State St.	8210	Educational Facilities w/o SP, FC
Pep Boys	State St.	5000	Wholesalers & Retail Outlets
OSF Center for Health	State St.	6513	Medical Centers
OilX Change	State St.	4100	Transportation Services
Advanced Autoparts	State St.	5000	Wholesalers & Retail Outlets
OSF Saint Anthony Medical Center	State St.	8060	Hospitals
Fairview Plaza	Arnold Ave.	8061	Nursing Homes
Auto Clinic of Rockford	State St.	4100	Transportation Services
Crash 1 Auto Repair	Morsay Dr.	4100	Transportation Services
Fairview Shopping Center Ste. 212	State St.	5000	Wholesalers and Retail Outlets
Certified Technology, Inc.	22nd St.	3400	Fabricated Metal Prod. (wet)

Existing Drainage Network

The upper reach of Keith Creek originates in a large rural area in the northeast then flows through the city to serve as a natural drainage channel for extensive urban areas. Drainage within the Keith Creek watershed occurs through a mix of surface drainage paths, storm sewers, and creek channels. In the less developed northeastern part of the watershed, surface drainage is the primary mode of stormwater conveyance. This can be seen in Figure KtC-2 with the prevalence of surface detention, and lack of sewers in this area. It is also largely rural. The southwestern and central portions of the Keith Creek watershed are drained by extensive networks of storm sewers as shown in Figure KtC-2. The South Branch of Keith Creek in this area also provides drainage. These differences in drainage mechanisms are analogous with the respective development in these sections of the watershed.

Figure KtC-2 also shows the general location of identified detention basins and storm sewer outfalls within the Keith Creek watershed. The Keith Creek watershed has 70 identified detention facilities including the regional Spring Lake impoundment. These facilities are distributed through the south central and northeastern part of the watershed. The 65 identified storm sewer outfalls within the watershed are located generally west of Mulford Road with the largest number concentrated in the area between Alpine Road and the Rock River, along the Creek.

Available Data Resources

Previous Drainage Studies

A review of available data identified no recent, comprehensive studies of drainage issues within the Keith Creek watershed. Previous drainage studies that included consideration of the watershed are listed below:

"A Master Drainage Plan for the Rockford Regional Area: Rockford-Winnebago County Regional Drainage Plan and Study." Espey, Huston & Associatse, Inc. November 1981.

"Rock River, Rockford & Vicinity Final Report Technical Appendices." US Army Corps of Engineers: Rock Island District. April 1981.

"City of Rockford Comprehensive Storm Drainage Plan and Report." Warren & Van Praag, Inc. November 1955.

"Keith Creek Feasibility Project Management Plan." US Army Corps of Engineers: Rock Island District. **Ongoing**.

Historic Flow Data

No source of historic flow data has been identified for the Keith Creek watershed.

Historic Water Quality Data
No source of historic water quality data has been identified for the Keith Creek watershed. (pending input from David Pott)

Other
Floodplain and Floodway:
Flood Insurance Study: Winnebago County and Incorporated Areas, (FEMA, 2006)

Soil Characteristics:
"Soil Survey Geographic (SSURGO) database for Winnebago County, Illinois."
Fort Worth: U.S. Department of Agriculture, Natural Resources Conservation Service, 2007. URL:<http://SoilDataMart.nrcs.usda.gov/>

"Rockford and Cherry Valley Flood of 8/6/07 – 8/7/07 Surveillance Report." Illinois Department of Natural Resources: Office of Water Resources, September 2007.

"Inspection Report Alpine Dam, Rockford IL." HNTB Corporation. July 2008.

Drainage Issues

Table KtC-5 (on the following page) provides a summary listing of current identified drainage issues and projects within the Keith Creek watershed. The general locations of these issues and projects are shown on Figure KtC-5.

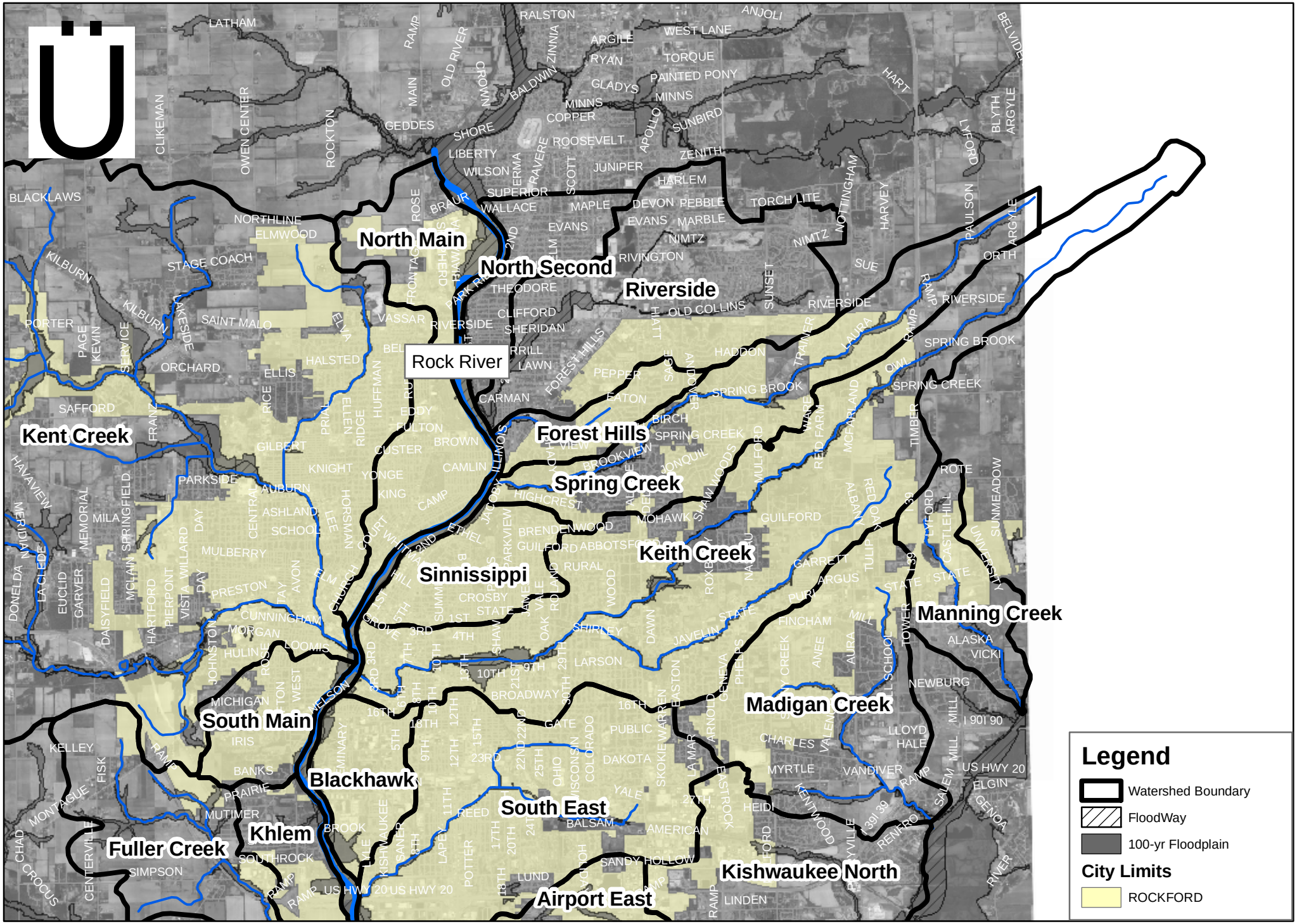
Flooding within the Keith Creek watershed is caused by intense wet weather events which stimulate flash floods downstream. The floods can stem from overtopping of Alpine Dam on the North Branch, or from high flows from the uncontrolled South Branch. There has been such intense development in the Keith Creek floodplain that it has deteriorated the capacity for handling surface runoff.

The stormwater flows and floods have caused physical damages to businesses, commercial centers and recreational areas. In 1952 over 40 city blocks were inundated with water from the Creek as a result of a storm event. Residential units are usually built up on terraces, so, often are flooded as a result of backwater from storm drains. Flooding within Keith Creek watershed has caused more damage to the City's infrastructure than any other watershed.

The City also receives backyard flooding complaints from the Keith Creek watershed in response to major storm events and responds to the best of their ability. Further evaluation of site-specific

stormwater management/flood control improvement needs is required to provide a basis for effective planning, budgeting, and prioritization of potential projects.

Table KtC-5
SUMMARY OF STORMWATER/FLOOD CONTROL ISSUES AND PROJECTS
KEITH CREEK WATERSHED, ROCKFORD, ILLINOIS



MWH

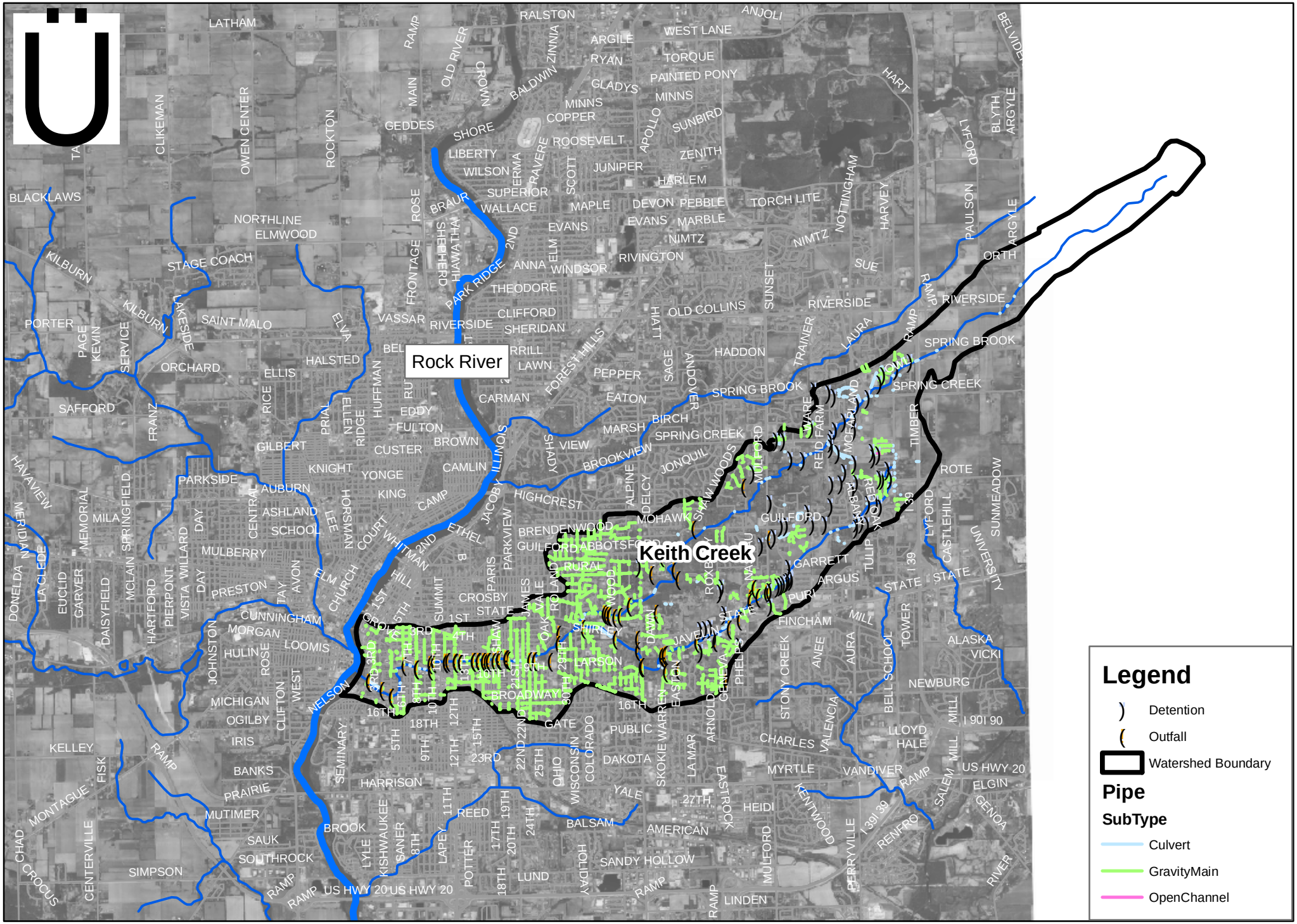
7,500 Feet

Figure KtC - 1

Keith Creek Watershed Flooding Issues

City of Rockford, Illinois

Autumn 2008



MWH

7,500 Feet

Figure KtC - 2

Keith Creek Outfalls, Detention and Storm Sewer

City of Rockford, Illinois

Current Data as of Autumn 2008