Staff Report

SANITARY SEWER SYSTEM EVALUATION UPDATE

May 19, 2015

BACKGROUND:

The ability of the sanitary sewer system to convey wastewater well into the future is dependent on the removal of the current large amount of infiltration and inflow (I/I) into the system that occurs during rain events. In order to minimize the need for costly expansions to the City's Water Pollution Control (WPC) facility, as well as to convey flows from new developments as the City grows, the City must work to reduce the overall infiltration and inflow into the system. **This is "clean" water that doesn't need to be treated and is using valuable capacity in the sewer system and at the treatment plant.**

As a part of a 2011 agreement with the Iowa Department of Natural Resources, the City was required to "conduct a sanitary sewer system evaluation, a sewer rehabilitation program, and a long-range water pollution control facility plan as general described in Ames' Capital Improvements Plan for 2011-2016."

In March 2012 the City entered into an Engineering Services Agreement with Veenstra & Kimm, Inc., (V&K) of West Des Moines, Iowa. **The engineering worked involved with this agreement required a comprehensive and systematic evaluation for identifying the defects that could contribute I/I across the entire City-wide sanitary sewer system. It also involved prioritizing those defects and estimating rehabilitation costs so that repairs can be made as part of the Capital Improvements Plan.**

The Sanitary Sewer System Evaluation (SSSE) program generally consists of the following tasks: data collection, flow monitoring, sewer televising, smoke testing, manhole inspection, siphon inspection, survey grade elevations of pipes and manholes, GPS location of system elements and system modeling. Not only does the SSSE identify sources of I/I, it also identifies areas of aging infrastructure in need of repair to prevent unexpected failures and emergency repairs, as well as potential capacity issues that may develop over time.

This evaluation has been underway for several years. With the data collection phase complete, it is evident that there are over $25 million worth of immediate structural improvements needed in the sanitary sewer system. Future CIP projects for the sanitary sewer system will be based on the results of this evaluation. **Work will include rehabilitation, such as the lining of existing mains or spray lining of existing structures, as well as complete removal and replacement of deteriorated structures and sanitary sewer mains. These projects are shown in the CIP**

beginning in 2014/15. Funding comes from the State Revolving Fund (SRF) in the amount of $3,470,000 for each year with and annual increase of 5% for inflation. Repayment of the SRF loans will be from revenues generated in the Sanitary Sewer Fund.

An SRF Planning and Design Loan for $375,000 was approved by City Council at the March 25, 2014, meeting. This loan was secured in order to hire a consultant(s) to help determine the best action plan for implementation of system repairs, as well as for design services for the first two years of the projects.

At the September 23, 2014, meeting, City Council approved the engineering services agreement with V&K for the services listed above along with WHKS & Company of Mason City, Iowa, to assist in the evaluation of the data.

DATA COLLECTION AND ENGINEERING ANALYSIS:

Flow Metering

Six permanent flow meters and 12 temporary flow meters were installed during the study to collect pipe flow data. These meters help to determine what extent rain events affect the flows within the system. The temporary meters were installed during the 2012 season. However, due to the unseasonably dry conditions, the meters were reinstalled in spring 2013 which had more typical rainfall events. This actual flow data was utilized to calibrate the sanitary sewer model for the evaluation of flows and capacity. These meters will also be utilized to verify the amount of I/I that is removed from the system.

Smoke Testing

Smoke testing is a method to determine where they are points within the system that are not sealed or have other issues such as being cross connected to the storm sewer system. When testing was completed, it showed 363 locations where smoke ex-filtrated from the system. These locations included, sewer service clean outs (privately owned), storm intakes, pavement joints or coming out through the ground.

Sewer Model

V&K, in conjunction with a sub-consultant, has developed a new sanitary sewer model based on new flow meter and pipe elevation data. The model currently reflects existing conditions and takes in to account future development needs based on the current Land Use Policy Plan and identifies areas where there are and could be capacity issues in the system. One of the final intentions of the model is for Staff to be able to input the proposed development flows to determine downstream impacts and to verify the ability to serve the property with sanitary sewer without the need to contact a consultant to run the model. This will provide better customer service to the developer due to the ability to quickly analyze the information provided. Staff will be receiving training in the use of the model in the near future.

RATING SYSTEM:

The pipes and manholes were inspected according to the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP). This program sets national standards for coding pipe defects which includes detailed training to become a certified inspector.

The pipes were evaluated for structural deficiencies such as cracks and off-set pipe joints, root infiltration, grease, chemical damage, and service connections that protrude into the main which can limit the flow through the pipe.

The manholes were similarly inspected documenting I/I as well as structure or chemical damage. Structural damage included missing bricks (typically older manholes), cracks within the structure, adjustment rings around the pavement adjacent to the manhole.

Each pipe and manhole was given a rating from 1 to 5 in accordance with the national standards in accordance with the following descriptions:

1 - Excellent condition; no further current action is needed
2 - Good condition; no immediate action needed
3 - Fair condition; no eminent concerns, continue monitoring
4 - Poor condition; defects and deficiencies need to be addressed in the near future
5 -There is an immediate need to repair or rehabilitate the pipe or sections of the pipe within the next 12 months.

CATEGORIES OF DEFICIENCIES:

The projects/deficiencies that were assigned a rating of 4 or 5 were divided into the following four categories:

Sewer Pipe

The overall condition of the pipes is consistent with other similarly aged systems. The majority of the pipes are vitrified clay pipe (VCP) with non-sealed joints. As such, much of the pipe is in good condition, but the pipe joints are failing due to infiltrating tree roots. With root issues being the number one cause of sewer blockages, the sections with high root infiltration will continue to cause issues. (See Attachment A)

Manholes

The manholes were evaluated for I/I (See Attachment B), as well as structural damage and chemical damage (See Attachment C) and categorized/prioritized based on these defects. There are some of the manholes that are yet to be inspected due to accessibility issues, difficulty in locating or having been previously abandoned. Based on the findings, approximately 7% of the manholes in the system have either structural defects or chemical damage. It was found that 78% of the manholes had signs of I/I or

damage around the pavement casting that can lead to I/I issues. It is estimated that approximately 6,400 gallons of non-sanitary sewer water per minute could enter the system through these manholes.

Siphons
While overall the pipes were in good structural condition, the siphons were laden with debris which required a lot of cleaning and jetting prior to final inspections. The structures were in generally poor condition. Over half of the gates encountered were inoperable due to deterioration which makes them suspect for failure or overflows. (See Attachment D)

Railroad Crossings
These areas were of particular interest due to the need to repair/replace these pipes in coordination with the railroad. Overall, these crossing were in decent condition however, some have reduced capacity due to build-up within the pipes. The removal process of this build-up often times reveals that the pipe needs to be lined immediately following the removals to improve the structural integrity of the pipe without causing failure of the pipe. (See Attachment D)

PROJECT PRIORITIZATION:

Based on the ratings system previously discussed and the consultants' experience with other SSSE studies, it was determined that a decision matrix/risk analysis would be performed to prioritize which lines/manholes and which areas were to be rehabilitated/replaced. **This matrix involved two categories, 1) the likelihood of failure and 2) the consequence of failure.** Within these categories, several factors were determined and percent weights were assigned to each. A summary of these categories, factors and percentages are shown below:

Weight	60%	+	40%	=Total
Factor	Consequence	+	Likelihood	=Risk

Likelihood of failure: To determine the likelihood of failure, areas analyzed include the structural condition, observed I/I, and the percentage of flow capacity being utilized.

Consequence of failure: The factors considered include determining if the segment serves major/critical users*, projecting whether future development will need to be accommodated, identifying if the segment is within a sensitive area, and estimating the amount of on-going maintenance required to preserve an acceptable service condition.**

* Examples of major users: USDA, ISU, ISU Research Park, hospitals, schools, skilled care facilities

** Environmental/Sensitive/Cultural Impact Areas and Easement/Access Issues

This prioritization process will allow staff to schedule the project priorities in the next Capital Improvement Program (CIP). Attachment E includes a map reflecting the anticipated project locations for the first five years of improvements.

ENVIRONMENTALLY SENSITIVE AREAS:

There are areas that were considered environmentally sensitive due their proximity or being contained within natural features, such as Munn Woods. These areas still have sections that need to be investigated and evaluated. The evaluation team felt the invasive nature of the work to be done to provide equipment access to the manholes should be carefully planned out. This includes outreach to the neighboring adjacent property owners and coordination with Parks & Recreation to develop an appropriate plan.

IMPACTS ON GROWTH:

Recently, staff was approached regarding additional development within the Campustown area. The drainage basin for this particular area is from the Iowa State Center, near Lincoln Way and Beach Avenue, on the south side of Lincoln Way continuing west to the corporate limits and south taking a diagonal line from U.S. 30 and South Dakota to C.Y. Stephens Auditorium.

By using the first iteration of the sewer model, it was initially thought that the ability to serve additional development in this area would not be allowed without addressing a capacity issue near the Iowa State Center. Since that time, the model information has been updated and calibrated and now shows this area can be served with sanitary sewer taking into account future anticipated growth based on the current Land Use Policy Plan and known projects. Additionally, the first rehabilitation project is within this area and the effects of reducing I/I provided some additional capacity to the area**. This is a case where development could have been halted or delayed if the model did not reflect the ability to serve it and caused a need for upsizing of the downstream system.**

One area of concern that has been identified with this sewer analysis involves the area north of the Scenic Valley Subdivision. The model shows that in the downstream basins, additional loading could create issues such as surcharging (pressurization of the pipes), sanitary sewer overflows, or sewer service backups. It appears that the City will not be able to serve future developments in this area with the existing system, unless other improvements are identified to provide the needed capacity.

The new model will allow the staff to identify other areas of concern as specific new developments are proposed. This information might result in:

1) the denial of the new development;
2) reprioritization of the City's sewer projects in the CIP to provide service to these developments; or
3) the initiation of developer-financed improvements.

PIPE RATING OF 4 OR 5 AMES, IOWA

Legend

- Sanitary Sewer
- PACP Rating of 4 or 5

US Highway 69

Interstate 35

East Lincoln Way

US Highway 30

N
W E
S

1" = 1/2 Mile
Feet

0 1,320 2,640 5,280

CITY OF ames

whks
engineers + planners + land surveyors

V&K
VEENSTRA & KIMM, INC.

Attachment A

MANHOLE INFILTRATION
AMES, IOWA

Legend

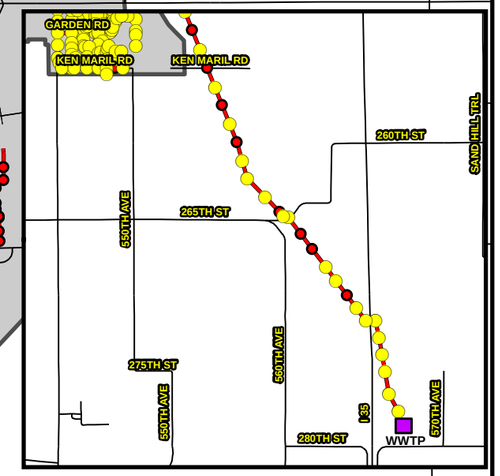
- Sanitary Sewer
- Sanitary Manholes
- Manholes with Infiltration

US Highway 69

Interstate 35

US Highway 30

INSET MAP
1" = 1 MILE



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Attachment B

MANHOLE DAMAGE STRUCTURAL/CHEMICAL AMES, IOWA

Legend

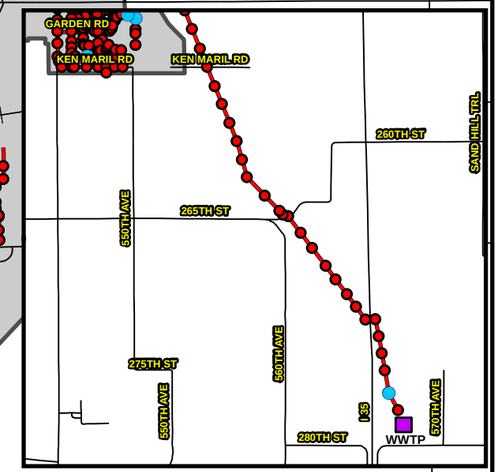
- Sanitary Sewer
- Sanitary Manholes
- Manhole Damage Structural/Chemical

US Highway 69

Interstate 35

US Highway 30

INSET MAP
1" = 1 MILE



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W E
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V&K VEENSTRA & KIMM, INC.

Attachment C

SIPHONS AND RAILROAD CROSSINGS AMES, IOWA

Legend
- Sanitary Sewer
- Siphons

US Highway 69

Interstate 35

Veenker West

Veenker East

High School

S Duff

Nikkol

East Lincoln Way

US Highway 30

Railroad Crossing

Railroad Crossing

Railroad Crossing

Railroad Crossing

Railroad Crossing

Railroad Crossing

N
W E
S

1" = 1/2 Mile
Feet
0 1,320 2,640 5,280

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VEENSTRA & KIMM, INC.

Attachment D

Priority Projects by Risk Analysis

Sanitary Sewer System
Ames, Iowa

Legend

- Priority Projects by Risk Analysis
- Siphons
- Manholes within 2010 Flood Zone
- Areas 2, 5, & 6 Smoke Test Defects
- Areas 2, 5, & 6 Highlighted

Public Sanitary Main Risk of Failure

- 0 (Private or Abandoned)
- 1 (Lowest Risk)
- 2
- 3
- 4
- 5 (Highest Risk)

Project C:
Area 3/4 Trunkline Expansion & Rehab

Project D:
Areas 7/2/9/14 Flood Prone Structures

Project B1:
Area 6 Trunkline Expansion & Rehab:
Upsizing/Rehab of Existing Mains

Project F: Miscellaneous Projects:
Repair pipes 1188,1190,1191
Replace flow meter @ Lincoln & Beach

Project A:
East Lincoln Way & South Duff

Project B2: (Alternate to B1)
Area 6 Trunkline Expansion & Rehab:
New Trunkline

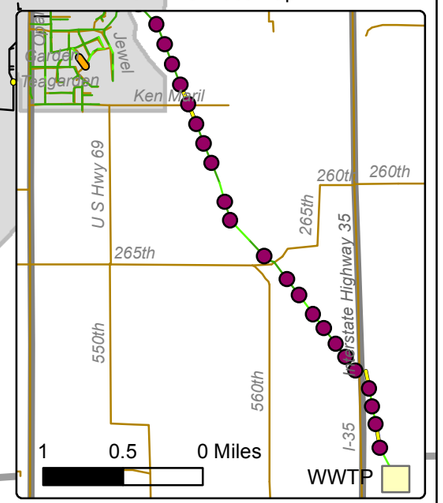
Project E:
Areas 2, 5, & 6 Smoke Test Defects

Veenker West
Veenker East
High School
East Lincoln Way
Duff
Nikkol
US Highway 30
Highway 35

0 0.25 0.5 1 1.5 2 Miles

See Trunkline Inset Map

Trunkline Inset Map



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Attachment E