Agenda Item Executive Summary

Title: 2013 Sanitary Sewer Evaluation Study Final Report

Presenter: Steven M. Saunders, Director of Public Works/Village Engineer

Agenda Date: 10/21/2014

Consent: ☐ YES ☑ NO

☐ Ordinance
☐ Resolution
☐ Bid Authorization/Award
☑ Policy Direction
☐ Informational Only

Item History:

In 2013, the Village engaged the services of Baxter & Woodman Consulting Engineers (B&W) to perform detailed investigations of eight sanitary sewer basins that exhibited significant wet-weather Inflow and Infiltration (I/I) during flow monitoring. These eight basins also contain clusters of homes that experienced sanitary sewer backups during the extreme July, 2011 flood event. The detailed evaluation included manhole inspections, smoke testing, dyed-water testing, and sewer televising to identify potential defects and sources of I/I into the system. B&W has completed its final report on the detailed inspection program.

Executive Summary:

B&W performed detailed manhole inspections of 184 manholes on the public sanitary system throughout the eight basins. Of the 184 manholes inspected, 177 exhibited one or more sources of I/I, including open pickholes, leaking frame or chimney seals, or leaking walls. B&W also performed smoke testing on all sewers in the eight basins. Smoke testing is a means of identifying direct connections to the sanitary sewer system that can allow rainwater to enter the system. Through smoke testing, B&W identified 67 locations where smoke was observed in the storm sewer system, and 86 locations in the private sewer system – either downspouts, area drains, window well drains, or other building connections – that allow I/I to enter the sanitary sewer system. The 67 locations where smoke was observed in the storm sewer system required further investigation, because there are a variety of possible migration pathways. These locations were further investigated by flooding the identified storm sewers with dyed water to surcharge levels, and televising adjacent sanitary sewers, using the Village's televising equipment, to identify actual I/I sources. During these televising activities, 70 leaking private service laterals were identified, along with 49 locations where joints in the public sewer were leaking, and 1 broken sewer pipe.

The sum of the estimated leakage from all of the identified I/I sources is about 2,435 gallons per minute (gpm) system-wide during a sustained rain event. In the eight study areas, 38% of the system-wide estimated I/I is related to public sources while 62 % is related to private sources. B&W has estimated the cost to address all of these I/I sources, as $1,338,000, with $960,000 being attributable to improvements on the Village system and $378,000 being attributable to repairing private sources of I/I.

Based on the information contained in this report there are several follow-up steps to be taken. First, staff has already contacted property owners with identified improper downspout, area drain, window well, and sump connections requiring that these be eliminated. Second, staff has also prepared bidding documents for all of the required manhole repairs. Bids were recently opened and an award recommendation for the contract will be presented at the October 21, 2014 Council Meeting. Finally, staff has proposed funding for the recommended leaking joint repairs in the FY 2015 budget and for FY 2016 in the Capital Improvement Plan to address the remaining public I/I associated with leaking mainline pipe joints. Most of these repairs will be accomplished by sewer lining.

These actions will address all of the identified I/I sources in the eight areas, except for the leaking private sewer laterals. Unfortunately, these 70 leaking private laterals account for about 35% of the system I/I. Further, these private laterals are not owned or maintained by the Village, and a significant portion of each lateral is located on private property. Municipalities and sewer districts have taken a variety of approaches toward addressing private services, from cost-sharing programs to simply requiring repairs, to joint contracting, and other variations. Staff will compile research about the variety of options for addressing these laterals and schedule a discussion for a future Study Session for policy direction.

Recommendation:

Review and discuss the Draft Final Report for the 2013 Sanitary Sewer Evaluation Study.

Attachments:

Agenda Report
1. Study Area Map
2. 2013 Sanitary Sewer Evaluation Study Final Report (DRAFT)
3. Manhole Rehabilitation Location Map
4. Mainline Sewer Repair Location Map

Agenda Report

Subject: **2013 Sanitary Sewer Evaluation Study Final Report**

Prepared By: Steven M. Saunders, Director of Public Works/Village Engineer

Date: October 15, 2014

Background:

In 2013, the Village engaged the services of Baxter & Woodman Consulting Engineers (B&W) to perform detailed investigations of eight sanitary sewer basins that exhibited significant wet-weather Inflow and Infiltration (I/I) during flow monitoring. These eight basins, shown in **Attachment #1 – Study Areas,** also contain clusters of homes that experienced sanitary sewer backups during the extreme July, 2011 flood event. The detailed evaluation included manhole inspections, smoke testing, dyed-water testing, and sewer televising to identify potential defects and sources of I/I into the system. B&W has completed its final report on the detailed inspection program, which is shown in **Attachment #2 – 2013 Sanitary Sewer Evaluation Study Final Report.**

Manhole Inspections. B&W performed detailed manhole inspections of 184 manholes on the public sanitary system throughout the eight basins. Of the 184 manholes inspected, 177 exhibited one or more sources of I/I, including open pickholes, leaking frame or chimney seals, or leaking walls. The sum of the estimated leakage from all of the identified manhole defects is about 662 gallons per minute (gpm) system-wide during a sustained rain event.

Smoke Testing. B&W performed smoke testing on all sewers in the eight basins. Smoke testing is a means of identifying direct connections to the sanitary sewer system that can allow rainwater to enter the system. Through smoke testing, B&W identified 67 locations where smoke was observed in the storm sewer system, and 86 locations in the private sewer system – either downspouts, area drains, window well drains, or other building connections – that allow I/I to enter the sanitary sewer system. The estimated I/I contribution from the 86 private system locations is 650 gpm.

Dyed-water Testing/Televising. The 67 locations where smoke was observed in the storm sewer system required further investigation, because there are a variety of possible migration pathways. These locations were further investigated by flooding the identified storm sewers with dyed water to surcharge levels, and televising adjacent sanitary sewers, using the Village's televising equipment, to identify actual I/I sources. During these televising activities, 70 leaking *private* service laterals were identified, along with 49 locations where joints in the public sewer were leaking, and 1 broken sewer pipe. Combined, these locations produce an estimated 1,123 gpm of I/I, with 863 gpm, or 77%, attributable to leaking *private* service laterals.

Summary. A summary of I/I sources is shown in the following table:

I/I Source	Number of Sources	Estimated I/I (gpm)
Manholes	177	662
Public Sewers		
- Leaking Mainline Pipe Joints	49	230
- Hole in Mainline Sewer	1	30
TOTAL PUBLIC SOURCES	***227***	***922 (38%)***
Private Sources		
- Downspouts	38	519
- Area Drains	15	9
- Window Well Drains	10	1
- Connected Sump Pumps	4	120
- Missing/Defective Cleanout Caps	3	1
- Leaking Private Service Laterals	70	863
TOTAL PRIVATE SOURCES	***140***	***1,513 (62%)***
TOTAL I/I SOURCES	***367***	***2,435***

As can be seen, in the eight study areas, 38% of the system-wide estimated I/I is related to public sources while 62 % is related to private sources. B&W has prepared estimated costs to address these I/I sources, as follows:

Source	Village Cost	Private Cost	I/I Removed
Manhole Repairs			662 gpm
Cover Replacement (60)	$27,000		
Install Chimney Seal (11)	$5,500		
Manhole Coating (162)	$290,000		
Mainline Sewer Repairs	$445,500		260 gpm
Private Lateral Repairs		$278,000	863 gpm
Downspouts and other private I/I		$24,500	650 gpm
Subtotal (Construction)	$768,000	$302,500	
Engineering Design (5%)	$38,400	$15,000	
Engineering Inspection (10%)	$76,800	$30,250	
Contingencies (10%)	$76,800	$30,250	
Total Estimated Cost	$960,000	$378,000	2,435 gpm

Proposed Next Steps:

Based on the information contained in this report there are several follow-up steps to be taken. First, staff has already contacted property owners with identified illegal downspout, area drain, window well, and sump connections to the sanitary sewer system, requiring that these connections be eliminated. 8 properties have completed repairs, with an additional 8 properties having repairs in progress. Most of the remaining properties have responded to the Village's notifications and are in the process of researching and identifying preferred solutions. Only 7 properties have not responded to the two Village notification letters to date. A final notice is being prepared for these properties prior to taking necessary enforcement actions.

Second, staff has also prepared bidding documents for all of the required manhole repairs. Bids were recently opened and an award recommendation for the contract will be presented at the October 21, 2014 Council Meeting. These manhole repairs are shown in **Attachment #3 – Manhole Rehabilitation Location Map**.

Finally, staff has proposed funding for the recommended leaking joint repairs in the FY 2015 budget and for FY 2016 in the Capital Improvement Plan to address the remaining public I/I associated with leaking mainline pipe joints. Most of these repairs will be accomplished by sewer lining. These mainline repairs are shown in **Attachment #4 – Mainline Sewer Repair Location Map**.

These actions will address all of the identified I/I sources in the eight areas, except for the leaking private sewer laterals. Unfortunately, these 70 leaking private laterals account for 863 gpm, or 35% of the system I/I. Further, these private laterals are not owned or maintained by the Village, and a significant portion of each lateral is located on private property. Municipalities and sewer districts have taken a variety of approaches toward addressing private services, from cost-sharing programs to simply requiring repairs, to joint contracting, and other variations. Staff will compile research about the variety of options for addressing these laterals and schedule a discussion for a future Study Session for policy direction.

Recommendation:

Review and discuss the Final Report for the 2013 Sanitary Sewer Evaluation Study.

Attachments:

1. Study Area Map
2. 2013 Sanitary Sewer Evaluation Study Final Report
3. Manhole Rehabilitation Location Map
4. Mainline Sewer Repair Location Map

Attachment 1
Study Area Map

EXHIBIT A


VILLAGE OF WINNETKA, ILLINOIS
2013 SANITARY SEWER EVALUATION STUDY
STUDY AREA
LEGEND
STUDY AREA
0 350 700 1,050 1,400 Feet
1 inch = 350 feet
BAXTER & WOODMAN
Consulting Engineers
10/01/2014

Attachment 2
2013 Sanitary Sewer Evaluation Study Final Report

Village of Winnetka, Illinois

2013 Sanitary Sewer Evaluation Study




Prepared by:

BAXTER & WOODMAN
Consulting Engineers

www.baxterwoodman.com

October 2014

Village of Winnetka, Illinois
2013 Sanitary Sewer Evaluation Study

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Exhibit

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B Sanitary Sewer Manhole Rehabilitation Location Map

C Recommended Mainline Sewer Repairs

LIST OF ABBREVIATIONS

CIPP	-	cured-in-place pipe
Village	-	Village of Winnetka
GIS	-	geographical information system
gpm	-	gallons per minute
I/I	-	infiltration/inflow
MGD	-	million gallons per day
MWRDGC	-	Metropolitan Water Reclamation District of Greater Chicago
SSES	-	sanitary sewer evaluation survey

LIST OF DEFINITIONS

Infiltration

Water other than wastewater that enters a sewage collection system (including sewer service connections) from the ground through such sources as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow.

Inflow

Water other than wastewater that enters a sewage collection system (including sewer service connections) from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm water, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.

Surcharge

A condition where the water level in a sewer is higher than the top of the pipe.

1. INTRODUCTION

1.1 General

The Village of Winnetka, Illinois is located approximately 20 miles north of the City of Chicago in Cook County. The US Census bureau estimates the 2012 population as 12,370 people and encompasses approximately 3.81 square miles. The Village owns and operates its own separate sanitary sewer system. Wastewater conveyed from the Village's sanitary sewer system flows into an interceptor sewer system owned and maintained by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) and is transported to their facilities for treatment.

The sanitary sewer system performs well during dry-weather conditions. However, during moderate to heavy rainstorms, inflow (stormwater) and infiltration (groundwater) enter the sanitary sewers. This excess flow exceeds the capacity of the sanitary sewer system in some areas, causing sewers to surcharge and sewage to backup into homes under extreme conditions. One such occurrence was experienced on July 23, 2011. That event produced over six inches of rain in less than a three hour period and caused significant street flooding and basement backups. In response to this event, the Village commissioned Strand Associates, Inc. to conduct a flow monitoring study to analyze the dry and wet weather flow characteristics of the Village's sanitary sewer system, identify the areas within the system that allow the largest amounts of I/I into the system, and provide recommendations for further investigation. The recommendations identified eight "pilot" areas for a sanitary sewer evaluation study (SSES) based on the flow monitoring data and a flood survey completed by Village residents.

This investigation focuses on identifying inflow and infiltration (I/I) sources within eight areas that were determined to experience the worst problems during heavy wet-weather events.

1.2 Study Purpose and Scope

The purpose of the Sanitary Sewer Evaluation Study (SSES) is to identify I/I sources in the sanitary sewer system and to determine the cost to eliminate the defects from the system. The investigation tasks selected for this study included manhole assessments; smoke testing and dyed-water testing/sewer televising.

1.3 Methodology

1.3.1 Manhole Assessments

Manholes can be a large contributor of both inflow and infiltration into a sanitary sewer system. Surface runoff through open pickholes and missing bolts in a cover can increase flows almost immediately after the start of a rainstorm. This source of inflow is further increased in areas where water can pond over the manhole. As the ground becomes saturated, groundwater can enter through defects in the adjusting rings, joints, walls and bottom of the manhole.

The manhole assessments include opening all accessible manholes in the study area and performing a visual inspection of the materials and condition of each structure. A field report is completed for each manhole, which contains the following information: (1) the material type and condition of each component of the manhole; (2) potential I/I sources or evidence of leakage within the manhole; (3) potential for stormwater to pond over the manhole; and (4) identification of the orientation and sizes of all pipes connected to the manhole. This information is collected electronically, which allows simple integration into a GIS program.

1.3.2 Smoke Testing

Smoke testing is used to identify defects and inappropriate connections in both mainline sewers and building lateral connections to the system users. Of particular significance is the ability to identify connections that allow stormwater to directly enter the sanitary sewer system, which can cause immediate and significant increases in flow. These sources include building downspouts, window well drains, area drains, foundation drains and connections to the storm sewer system. The photo on the left provides a visual of this process.

Smoke Testing Process

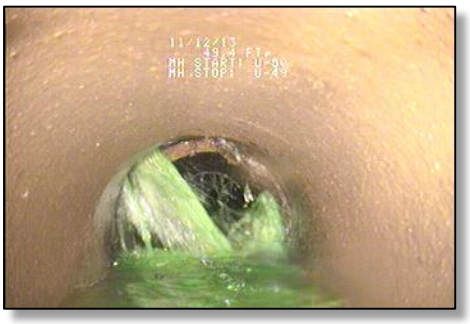
The testing work consists of injecting a non-toxic chemical smoke under pressure into the sewer system using a high capacity blower. During the test, all smoke emission points are noted and recorded in field reports. Additionally, digital photographs are taken of each inappropriate emission point. It is expected that the smoke will be discharged at locations such as building vent stacks and adjacent sanitary sewer manhole covers. Other emission points, such as storm sewer inlets and storm sewer manholes, show where smoke transfers from the sanitary sewer system into the storm sewer system. This suggests that stormwater may also transfer from the storm sewers into the sanitary sewers during rainstorm events. Smoke testing is also a valuable tool for focusing other more expensive investigative tasks such as dyed-water testing and sewer televising.

1.3.3 Dyed-Water Testing and Sewer Televising

Dyed-water testing is typically performed in the areas where smoke was identified in the storm sewer system. This test involves isolating the section(s) of storm sewer that emitted smoke with inflatable plugs. The storm sewer is then filled with dyed-water up to the ground surface, simulating a surcharged condition that may occur during an actual rainstorm. Historically, storm sewers were not constructed to be watertight. Therefore, stormwater (dyed-water in this test) exfiltrates the pipes to the surrounding ground and becomes a source of infiltration for nearby

defects in the sanitary sewer system. During this process, the adjacent sanitary sewers are monitored to determine if the dyed-water is transferred from the flooded storm sewer.

In those areas where dyed-water enters the sanitary sewer line or where it is suspected that sewer sections under waterways may allow I/I to enter the system, a television inspection is performed in conjunction with dye-testing. The inspection equipment consists of a closed circuit television camera that is passed through the sewer for the purposes of locating and identifying I/I source(s) and observing the condition of the pipe. The following photo provides a visual of an inflow source found from dyed-water testing.



Dyed Water Inflow

The sewer sections to be televised are first cleaned by a water-jetting process to enable proper viewing of the sewer. Another benefit to televising a sewer is that structural defects that can escalate into a pipe failure can be readily identified.

2. FIELD INVESTIGATIONS AND RESULTS

2.1 Manhole Assessments

All accessible sanitary sewer manholes in the study area were opened and inspected. A total of 184 manholes were inspected within the study area shown in Exhibit A. The manhole inspection procedure included the following observations:

- Location and identification number.
- Manhole inside diameter.
- Amount of debris (if any) in manhole.
- Surcharging or evidence of surcharging.
- Cover type, condition and number; and size of pickhole openings.
- Potential for ponding over manhole.
- Frame type, condition, sealed or unsealed, and evidence of inflow.
- Type and thickness of adjusting ring(s), condition, sealed or unsealed and evidence of I/I.
- Corbel material, construction, condition and evidence of I/I.
- Material and condition of steps.
- Wall and joint construction, condition and evidence of I/I.
- Bench/trough construction, condition and evidence of I/I.
- Pipe seal construction, condition and evidence of I/I.
- Sizes, depths and direction of all pipes connected to manhole.

A complete set of manhole inspection reports is included in Appendix A. There are 60 manholes in the study area with at least one open pickhole. Nine of these are also subject to ponding. These nine have the potential to contribute up to 389 gpm (0.560 MGD) of inflow during a sustained rainstorm. This is based upon the hydraulic equation for fluid through an orifice, which is the equation used to calculate storm inlet capacities. It is also likely that the covers with open pickholes that are not subject to ponding will allow stormwater flowing over the cover to enter some of the manholes. However, quantifying this amount is difficult since inflow rates depend on local drainage paths, characteristics of the surrounding ground surface and intensity of the storm.

Manhole frames and adjusting rings that are not sealed or have deteriorated seals can be a significant source of I/I. Saturated soil conditions around manholes make the structures susceptible to water entering through openings between the unsealed frames and rings. There are 108 manholes in the study area that have leaking frames and/or adjusting rings.

Other I/I sources identified during the manhole inspections include cracks or holes in the walls and corbel and leaking joints, pipe seals, bench and steps. Stormwater and/or groundwater can seep into the manholes through any of these defects. Table 1 lists the 177 manholes that contain various defects which allow I/I to enter, including the manholes with covers containing open pickholes that

are also subject to ponding. The sum of the estimated leakage for all of the identified manhole defects, including open pickhole covers, is approximately 662 gpm (0.953 MGD) during a sustained rainstorm.

TABLE 1

Summary of Manhole Defects

MH Number	Open Pickhole	Frame	Adjusting Rings	Steps	Corbel	Wall	Joints	Bench
hs5-n			X					
hs5-1						X		
hs5-2						X		
hs5-3						X		
hs5-3s						X		
hs5-5						X		
hs5-6						X		
hs5-7						X		
hs5-7x			X					
hs5-10						X		
hs5-11						X		
hs5-12						X		
hs5-20					X			
hs5-21						X		
hs5-22						X		
hs5-23						X		
hs5-24						X		
hs5-25								X
hs5-26			X					
hs5-27						X		
hs5-35						X		X
ir-1	X					X		
ir-2						X		
ir-3						X		
ir-4						X		
ir-5						X		
ir-6						X		

MH Number	Open Pickhole	Frame	Adjusting Rings	Steps	Corbel	Wall	Joints	Bench
ir-12			X					
ir-13						X		
ir-14	X				X			
ir-23						X		
kp1-17			X					
kp1-18		X					X	
kp1-19	X	X	X					
kp1-20						X		
kp1-25							X	
kp1-26							X	
Kp1-27						X		
kp1-28	X					X		
kp1-29					X			
kp1-30						X		
kp1-31						X		
kp1-32						X		
kp1-33						X		
kp1-34						X		
kp1-37						X		
kp1-39						X		
kp1-40						X		
kp1-42						X		
kp1-43						X		
kp1-44						X		
kp1-45						X		
kp1-46						X		
kp1-46w	X							X
kp2-3					X	X		X
kp2-4								X
kp2-5						X		X
kp2-6						X		
kp2-7						X		
kp2-8						X		
kp2-9						X		

MH Number	Open Pickhole	Frame	Adjusting Rings	Steps	Corbel	Wall	Joints	Bench
kp2-10	X					X		
kp2-11					X			
kp2-12					X			
kp2-13					X			
kp2-14					X			
kp2-19					X			
kp2-20					X			
kp2-21	X	X						X
kp2-22	X							X
kp3-1					X			
kp3-2						X		X
kp3-11	X					X		X
kp3-12						X		
kp3-13								X
kp4-5		X			X	X		X
kp4-16		X			X	X		
kp4-17		X			X	X		X
kp4-18		X			X	X		X
kp4-19		X			X	X		X
kp4-20		X			X	X		X
kp4-21		X			X	X		X
ml-7		X			X			X
ml-8		X			X			X
ml-9		X			X			
ml-10						X		
ml-11	X							
ml-12		X			X			
ml-13							X	
ml-14		X			X			
ml-15		X						X
ml-16								X
ml-17						X		X
ml-18						X		X

MH Number	Open Pickhole	Frame	Adjusting Rings	Steps	Corbel	Wall	Joints	Bench
ml-19	X					X		X
ml-20						X		X
ml-21		X				X		
ml-22		X				X		
q-2	X							
q-3	X				X			X
q-4	X							X
q-5	X				X			
q-6								X
q-7	X							X
q-8	X							X
q-9	X				X			
q-x					X			
r-1	X				X			
r-2	X				X			
r-3	X				X			
r-4								X
r-5	X				X			X
r-6			X					X
r-7	X				X			
r-8					X			
r-9					X			X
r-10								X
r-11								X
r-12					X			
r-13	X					X		X
r-14	X					X		
r-15								X
r-16	X							X
r-17	X							X
r-18	X							X
r-19	X				X			X
r-20					X			

MH Number	Open Pickhole	Frame	Adjusting Rings	Steps	Corbel	Wall	Joints	Bench
r-21	X				X			X
sdc-12	X							
t-2								X
t-3	X					X		
t-4								X
t-5								X
t-6					X	X		X
t-7							X	X
t-16	X							
t-17								X
t-18					X			X
t-19	X				X			
t-20	X					X		
t-21							X	X
t-22	X						X	X
t-23	X							X
t-24								X
t-25	X							X
t-26						X		
t-27	X		X					
t-28	X		X					
u-3	X							
u-5	X		X					
u-6								X
u-7			X					
u-8	X							X
u-9	X							X
u-10	X							X
u-11					X	X		X
u-22	X	X			X		X	X
u-23		X						X
u-24	X	X						X
u-25								X
u-27							X	X
u-28	X		X			X		
u-32					X			X

MH Number	Open Pickhole	Frame	Adjusting Rings	Steps	Corbel	Wall	Joints	Bench
u-32e	X							X
u-33	X						X	X
u-34	X				X			X
u-35				X		X		X
u-36	X				X	X		X
u-36s	X				X		X	X
u-37	X							
u-38						X		X
u-46	X				X	X		X
u-47	X				X	X		X
u-48	X				X	X		X
u-49	X				X	X		X
u-50	X					X		X
w-4	X		X					

2.2 Smoke Testing

Smoke testing is an effective method for identifying inflow sources such as building downspouts, window well drains, area drains, foundation drains and storm sewer cross connections to the sanitary sewer system. Smoke testing may also identify structural damage and leaking joints in the sewers and building laterals if the ground conditions allow. The best results are obtained when the moisture content in the ground is minimal. This creates optimum conditions for smoke exiting a defective pipe section to pass through the overlying soil to the ground surface.

A notification letter was prepared and mailed to all addresses in the study area before the smoke testing was conducted. The letter advised the residents of the upcoming smoke testing, reasons for conducting these tests, proper precautions to reduce the likelihood of smoke entering the building and what to do in the event smoke does enter the home. The precautions included pouring water into all seldom used drain traps, which blocks the smoke. A copy of the notification letter is shown in Figure 1. Additionally, door hangers were prepared and hand delivered to each address which contained the same basic information as the notification letter. A copy of the door hanger is shown in Figure 2. The smoke testing was performed between July 22 and July 29, 2013, during dry-weather periods.

FIGURE 1

Resident Notification Letter

VILLAGE·OF·WINNETKA

Incorporated in 1869

July 9, 2013

Subject: Smoke Testing of Sewers in Your Neighborhood

Dear Resident:

During rainstorms and other times when the ground is wet, rain and ground water can enter the sanitary sewer system through defective piping, sometimes in very large quantities. Because sanitary sewers are not designed for clear water flow, this can cause sewage backups in homes, sewer overflows into lakes or streams and/or reduced water pollution control efficiencies at the wastewater treatment facilities.

As you may be aware, the Village is conducting a program to find and eliminate sources of clear water entering the sanitary sewer system in your area. The consulting engineering firm of Baxter & Woodman, Inc. has been hired to help with this work by smoke testing of the sanitary sewers. Smoke testing consists of pressurizing the sanitary sewers with a non-toxic smoke. The smoke then will be seen coming from sanitary sewer manholes and vent stacks located on the top of your home. Smoke may also be seen where defects in the sewers exist and at inappropriate connection to the storm sewer.

The smoke used will not leave a residue and should not enter your home unless you have a floor drain or bathroom fixture trap that has become dry due to lack of use; or have defective sewer piping that allows sewer gases to directly enter the home. The smoke testing will identify these potentially hazardous sources within the home. To reduce the risk of having smoke enter your house, pour one-half (1/2) gallon of water down each drain, especially every floor drain. Do not forget the drains in your basement.

Exposure to the smoke for a short time is not harmful to most people. Should you have a dry drain trap and smoke does enter your house, it is most likely to have a mild odor and perhaps cause minimal irritation to the throat. Should you experience smoke in your house, open some windows to dissipate the smoke, take children and pets outside, and contact the smoke testing crew that will be working nearby. If you have any doubt whether smoke is coming from the smoke testing or from a fire, do not hesitate to call the Fire Department at 911. As a precaution, we ask that pets, children, and disabled or invalid persons not be left alone in an unventilated area of the house (i.e. closed basement with no opened windows) when smoke testing is taking place.

The smoke testing work will tentatively be taking place in your neighborhood between July 22 and August 2, 2013, depending upon weather conditions. There will be signs posted in your neighborhood the day the work will be conducted. Door hangers will also be issued approximately one week before the smoke testing begins as a reminder.

Smoke testing is a procedure that has been widely and safely used for many years and is an important tool used in controlling water pollution. Your cooperation with this program is greatly appreciated. If you have questions or concerns regarding the upcoming smoke testing work, please contact Eric Murauskas, Project Manager, Baxter & Woodman Engineers, at 815/459-1260, or Steve Saunders, Director of Public Works/Village Engineer, at (847) 716-3534.

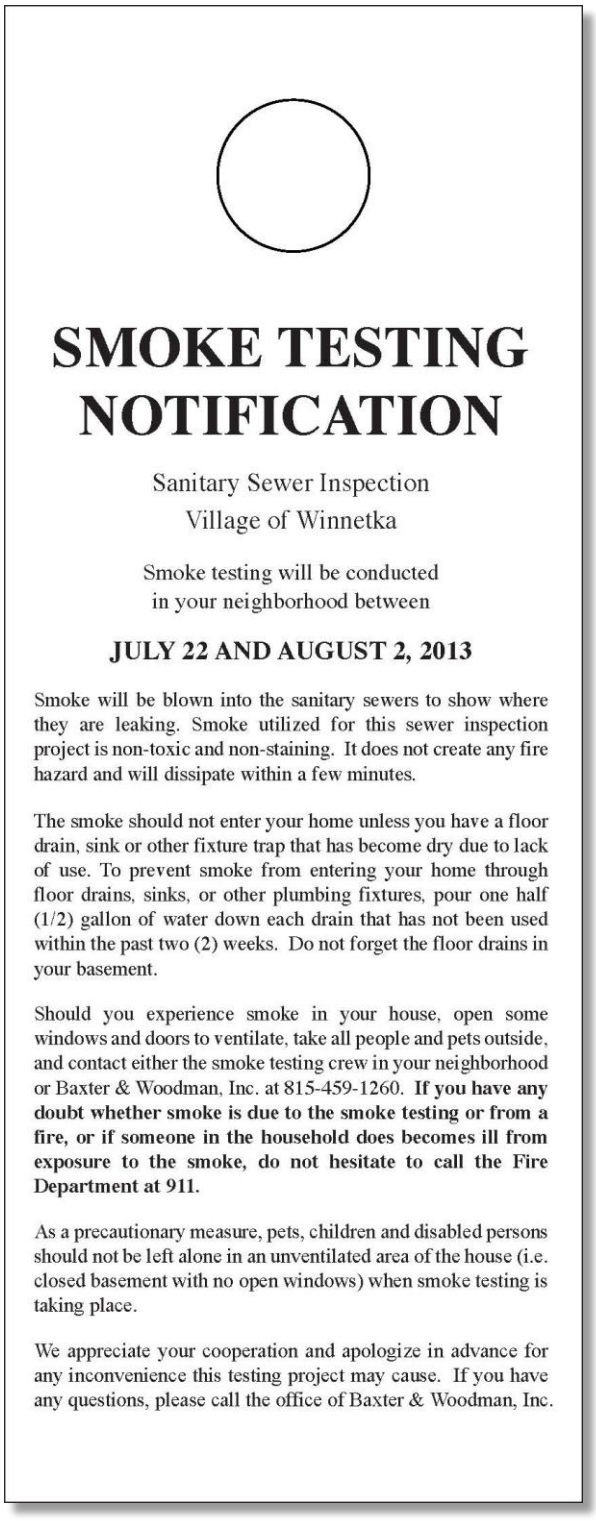
Sincerely,

Steven M. Saunders

Steven M. Saunders
Director of Public Works/Village Engineer

FIGURE 2

Smoke Testing Door Hanger



SMOKE TESTING NOTIFICATION

Sanitary Sewer Inspection
Village of Winnetka

Smoke testing will be conducted
in your neighborhood between

JULY 22 AND AUGUST 2, 2013

Smoke will be blown into the sanitary sewers to show where they are leaking. Smoke utilized for this sewer inspection project is non-toxic and non-staining. It does not create any fire hazard and will dissipate within a few minutes.

The smoke should not enter your home unless you have a floor drain, sink or other fixture trap that has become dry due to lack of use. To prevent smoke from entering your home through floor drains, sinks, or other plumbing fixtures, pour one half (1/2) gallon of water down each drain that has not been used within the past two (2) weeks. Do not forget the floor drains in your basement.

Should you experience smoke in your house, open some windows and doors to ventilate, take all people and pets outside, and contact either the smoke testing crew in your neighborhood or Baxter & Woodman, Inc. at 815-459-1260. **If you have any doubt whether smoke is due to the smoke testing or from a fire, or if someone in the household does becomes ill from exposure to the smoke, do not hesitate to call the Fire Department at 911.**

As a precautionary measure, pets, children and disabled persons should not be left alone in an unventilated area of the house (i.e. closed basement with no open windows) when smoke testing is taking place.

We appreciate your cooperation and apologize in advance for any inconvenience this testing project may cause. If you have any questions, please call the office of Baxter & Woodman, Inc.

The results of the smoke testing have been summarized and grouped into three categories according to the apparent type of defect. These categories are listed below. The smoke testing results are summarized by type of defect in Table 2, and are also detailed in Appendix B. Photos were taken at most locations where smoke was observed to aid in the identification, location and severity of the problems. An electronic version of the smoke testing results spreadsheet (with links to all of the photos) is included on a CD, provided separately from this report.

TABLE 2

Summary of Smoke Testing Results – Number of Defects Found

Category	Defect/Inappropriate Connection	Number Identified	Estimated I/I Contribution, gpm
A	Storm Sewer System	67	See Dye Testing
B	Downspouts	38	519
B	Area Drains	15	9
B	Window Well Drains	10	1
B	Connected Sump Pump	4	120
B	Missing/Defective Cleanout Caps	3	1
C	Building Laterals/Foundation Drains	16	N/A

Category A – Defects that allow smoke to transfer from the sanitary sewer to the storm sewer either directly or indirectly. When smoke passes from the sanitary sewer system, the possibility exists that stormwater could flow from the storm sewer to the sanitary sewer.

Category B (Private Property) – Inappropriate connections to the sanitary sewer including downspouts, area drains, window well drains and open cleanouts. These sources are directly connected to the sanitary sewer and allow surface runoff to quickly enter the sewer system.

Category C (Private Property) – Probable broken building laterals and connected foundation drains. Smoke is typically emitted from the ground surface near the lateral or the building foundation.

Category A sources are direct or indirect storm sewer system connections to the sanitary sewer system. There were 67 locations where smoke exited the storm sewer, primarily from curb inlets and storm manholes. Where smoke was identified in the storm sewer system, dyed-water testing of the storm sewer and simultaneous televising of the adjacent sanitary sewers were conducted to locate the actual I/I source(s). Potential I/I sources in the sanitary sewer system that are influenced by the storm sewer system are usually significant and can be readily identified by this testing procedure. It should be noted that storm sewers are not constructed to be watertight. Surface water draining into the storm sewers can exfiltrate to the surrounding subsurface and enter an adjacent sanitary sewer through defects. The I/I contribution from the Category A sources was determined during the dyed-water testing.

Category B consists of sources that are on private property and directly connected to the sanitary sewer system. This category includes downspouts, area drains, window well drains, connected sump pumps and building lateral cleanouts that emitted smoke. There were a total of 70 sources found including 38 properties with downspouts, 15 with area drains, 10 with window well drains, 4 suspected sump pump connections and 3 missing/defective cleanout caps. The estimated I/I contribution from the sources was made using the rational method for stormwater runoff. The total tributary area of the downspouts, area drains, and defective cleanouts is approximately 29,700 square feet. Based on a three-year frequency, two-hour duration rainstorm (1.94 inches/hr.), and approximately 70% of the tributary area being impervious, it is possible for these sources (downspouts, area drains, cleanout caps) to contribute up to 530 gpm (0.763 MGD) of I/I. In addition, the estimated discharge rate of each of the four sump pumps is approximately 30 gpm. The I/I contribution from connected window well drains is minimal and generally not considered cost effective to remove from the system. Therefore, the total amount of directly connected I/I identified by the smoke testing is 650 gpm (0.936 MGD).

Category C sources include defective building laterals that emitted smoke from the ground surface (typically resulting from a broken pipe or offset joint) and smoke observed along building foundations. The latter case will almost always allow more I/I into the sewer system since smoke observed along the foundation may be from a connected footing drain. The function of this type of drain is to remove or reduce subsurface water around the building foundation. The effects from a moderate rainstorm, due to the sources in this category, can typically be seen shortly after the storm begins and may continue to contribute I/I long after the rain has stopped. During the testing, 16 such lateral and foundation drain defects were observed. It is difficult to determine the actual I/I rate for the 16 Category C sources since observation of smoke only indicates that some type of leak exists. Determination of the actual I/I amounts from each of these sources would require flooding the tributary areas of each defect found and visually observing the amount of water that is discharged from the service lateral to the sewer system. An offset joint or minor crack in a sewer line may only allow a few gallons per minute into the system. However, a partially collapsed line or connected foundation drain located in areas of high groundwater may allow water to enter in the tens of gallons per minute range, on a continuous basis.

2.3 Dyed-Water Testing and Sewer Televising

In those areas where smoke was observed in the public storm sewer system (from Category A sources), dyed-water testing and simultaneous sewer televising of adjacent sanitary sewers were performed to identify the actual I/I sources. These include cross-connections with the storm sewer system, sanitary sewer pipe defects and leaking building service laterals.

The dyed-water testing and simultaneous televising was accomplished using the Village's televising crew. Each public storm sewer section that emitted smoke during smoke testing was first isolated using inflatable plugs, and then filled with dyed water to create a surcharged condition. Sufficient time was allowed after the storm sewer was surcharged before the televising began to ensure that

all potential leaks in the sanitary sewer were active. There were a total of 45 sanitary sewers televised. Table 3 is a summary of the I/I sources found.

TABLE 3

Summary of Dyed-Water Testing/Television Inspection Results – I/I Sources

I/I Source	No. of Sources	Total I/I, gpm
Leaking Private Building Laterals	70	863 (77%)
Leaking Public Mainline Pipe Joints	49	230 (20%)
Hole in Public Mainline Sewer	1	30 (3%)
Total	120	1,123

A summary of the defects identified by the internal inspection/dyed-water testing is included in Appendix C.

As the table shows, a significant amount of I/I was identified during the testing. The highest total contribution identified was from defective building laterals. Since the building laterals are privately owned, the Village is not responsible for the maintenance or repair of these pipelines. However, due to the amount of I/I contributed by these sources and the rate at which building laterals will continue to deteriorate, it is encouraged that the Village work with the homeowners to rehabilitate this privately owned portion of sanitary sewer system.

Infiltration was also identified in the mainline sewer through leaking joints and cracked pipe. These sources usually have a delayed response after the onset of a rain event due to the time it takes for rainwater to percolate through the ground. However, the response can be immediate if the ground is saturated or high groundwater exists. Infiltration through joints can continue long after a rain event stops, particularly in the spring when the groundwater levels are typically at their highest.

In addition to the leaks identified, 31 of the 45 sewers televised contained cracks that were not leaking, but will require rehabilitation. It is important that the structural integrity of the sewers be maintained to avoid operational problems as well as possible collapse in the future.

The total I/I rate for all sources identified during dyed-water testing/simultaneous sewer televising is approximately 1,123 gpm or 1.62 MGD. Repairing these defects will result in a significant decrease in peak wet-weather rates in the sanitary sewer system.

3. RECOMMENDATIONS AND CONCLUSIONS

With the authorization of the Village of Winnetka, Baxter & Woodman has completed this investigation to locate I/I sources in specific areas of the sanitary sewer system. The investigation included manhole assessments, smoke testing, and dyed-water testing/sewer televising.

A significant amount of I/I was identified as part of this SSES. Typically, a study of this type includes a cost-effective analysis to compare the estimated cost to rehabilitate each source to the amount of I/I that will be eliminated. This cost is then compared to the cost to transport and treat the extraneous clear flow. However, because of the problems experienced as a result of recent extreme storm events, most of the I/I sources identified are recommended for rehabilitation. The costs provided below are construction costs only. Total project costs, including engineering and contingencies, are listed in Section 4.

3.1 Manhole Rehabilitation

The manhole condition assessments identified 177 manholes that have defects that allow I/I to enter during wet-weather conditions. During a sustained rainfall, up to approximately 662 gpm (0.953 MGD) of clear water can leak into the manholes through open pickholes and leaks in the adjusting rings, steps, corbel, walls, joints and bench. The following is a description of the recommended rehabilitation methods needed to repair each deficiency found.

Replace Cover – There are 60 manholes that contain covers with at least one open pickhole. Nine of these covers are also subject to ponding. The estimated replacement cost is $450 per cover.

Install Chimney Seal – There are 11 manholes that contain leaking adjusting rings and/or frames that can be rehabilitated using a chimney seal or "rubber boot" between the bottom on the frame and top of the corbel. This type of product would only be used where the entire manhole will not be coated. The estimated cost for this type of repair is $500 per manhole.

Coat Manhole – There are 162 manholes that contain leaks through the adjusting rings, walls, corbel, joints between manhole sections and bench. There are a number of products available for sealing a manhole to eliminate leaks. Some of the most commonly used products are cement based. These can be spray applied or hand applied with a trowel. The estimated cost to coat a manhole with a cement based product is $175 per vertical foot.

The total estimated cost to rehabilitate the 177 manholes is $322,500. Table 4 lists the defective manholes that should receive each recommended rehabilitation method. A sanitary sewer manhole rehabilitation program has been developed and is being bid for construction. The work is scheduled to be completed by the end of spring 2015. A copy of the construction drawings are included as Exhibit B.

TABLE 4

Recommendations for Manhole Rehabilitation

MH Number	Replace Cover	Install Chimney Seal	Full Manhole Coating
hs5-1			X
hs5-2			X
hs5-3			X
hs5-3s			X
hs5-5			X
hs5-6			X
hs5-7			X
hs5-71		X	
hs5-n		X	
hs5-10			X
hs5-11			X
hs5-12			X
hs5-20			X
hs5-21			X
hs5-22			X
hs5-23			X
hs5-24			X
hs5-25			X
hs5-26		X	
hs5-27			X
hs5-35			X
ir-1	X		X
ir-2			X
ir-3			X
ir-4			X
ir-5			X
ir-6			X
ir-12		X	
ir-13			X
ir-14	X		X
ir-23			X
kp1-17		X	
kp1-18			X
kp1-19	X	X	
kp1-20			X
kp1-25			X

MH Number	Replace Cover	Install Chimney Seal	Full Manhole Coating
kp1-26			X
kp1-27			X
kp1-28	X		X
kp1-29			X
kp1-30			X
kp1-31			X
kp1-32			X
kp1-33			X
kp1-34			X
kp1-37			X
kp1-39			X
kp1-40			X
kp1-42			X
kp1-43			X
kp1-44			X
kp1-45			X
kp1-46			X
kp1-46w	X		X
kp2-3			X
kp2-4			X
kp2-5			X
kp2-6			X
kp2-7			X
kp2-8			X
kp2-9			X
kp2-10	X		X
kp2-11			X
kp2-12			X
kp2-13			X
kp2-14			X
kp2-19			X
kp2-20			X
kp2-21	X		X
kp2-22	X		X
kp3-1			X
kp3-2			X
kp3-11	X		X
kp3-12			X
kp3-13			X

MH Number	Replace Cover	Install Chimney Seal	Full Manhole Coating
kp4-5			X
kp4-16			X
kp4-17			X
kp4-18			X
kp4-19			X
kp4-20			X
kp4-21			X
ml-7			X
ml-8			X
ml-9			X
ml-10			X
ml-11	X		
ml-12			X
ml-13			X
ml-14			X
ml-15			X
ml-16			X
ml-17			X
ml-18			X
ml-19	X		X
ml-20			X
ml-21			X
ml-22			X
q-2	X		X
q-3	X		X
q-4	X		X
q-5	X		X
q-6			X
q-7	X		X
q-8	X		X
q-9	X		X
q-1			X
r-1	X		X
r-2	X		X
r-3	X		X
r-4			X
r-5	X		X
r-6			X
r-7	X		X

MH Number	Replace Cover	Install Chimney Seal	Full Manhole Coating
r-8			X
r-9			X
r-10			X
r-11			X
r-12			X
r-13	X		X
r-14	X		X
r-15			X
r-16	X		X
r-17	X		X
r-18	X		X
r-19	X		X
r-20			X
r-21	X		X
sdc-12	X		
t-2			X
t-3	X		X
t-4			X
t-5			X
t-6			X
t-7			X
t-16	X		
t-17			X
t-18			X
t-19	X		X
t-20	X		X
t-21			X
t-22	X		X
t-23	X		X
t-24			X
t-25	X		X
t-26			X
t-27	X	X	
t-28	X	X	
u-3	X		
u-5	X	X	
u-6			X
u-7		X	
u-8	X		X

MH Number	Replace Cover	Install Chimney Seal	Full Manhole Coating
u-9	X		X
u-10	X		X
u-11			X
u-22	X		X
u-23			X
u-24	X		X
u-25			X
u-27			X
u-28	X		X
u-32			X
u-32e	X		X
u-33	X		X
u-34	X		X
u-35			X
u-36	X		X
u-36s	X		X
u-37	X		X
u-38			X
u-46	X		X
u-47	X		X
u-48	X		X
u-49	X		X
u-50	X		X
w-4	X	X	

The smoke testing identified 70 direct connections that can contribute inflow from private property including 15 properties with area drains, 38 with downspouts, 10 with window well drains, 3 building lateral cleanouts and 4 suspected sump pump connections. Based on a three-year frequency, two-hour duration rainstorm (1.94 inches/hr.) and a total tributary area of 29,700 square feet on these properties, it is possible for up to 650 gpm (0.936 MGD) to be contributed from these sources. However, window well drains are not typically considered cost-effective to remove due to the relatively small I/I contribution compared to the cost to disconnect from the sanitary sewer system. The cost to disconnect these sources from the system varies from house to house, but is generally economical for the homeowner. For the purposes of this investigation, the following costs were used: $10 to install a new cleanout cap; $50 to disconnect a property's downspouts and exterior sump connection; and $1,500 to disconnect an area drain. The total estimated cost to eliminate these sources is $24,500. The Village has contacted and is working with property owners to disconnect these private sources of I/I.

In 16 locations, smoke was emitted from the ground surface along building service laterals. It is difficult to determine the actual I/I rate for these sources since observation of smoke only indicates that some type of leak exists. Further, the exact location of the building lateral defects could not be determined since the only indication of their existence was smoke emanating from the ground surface in the general vicinity of the defects. However, for the purposes of this investigation, the I/I contribution from each leaking building lateral is estimated to be approximately 5 gpm for a total of 80 gpm (0.115 MGD). The preferred method of repair consists of installing a cured-in-place liner from the mainline sewer to the building. This requires the lateral to first be cleaned and televised to identify any defects that would prohibit the liner from being successfully installed. Where collapsed pipe exists, an excavation would be required to install new pipe. The cost to line a building service from the mainline sewer to the building is estimated to be $6,000 each. Since this cost can be a burden on the homeowner, we recommend deferring a decision to repair these until the effectiveness of the other repairs can be confirmed.

Smoke testing also identified direct or indirect connections between the storm and sanitary sewer systems in 67 locations where smoke exited from storm sewers. This indicates that it is possible for groundwater and/or stormwater to enter the sanitary sewer from water in an adjacent storm sewer. In those areas where smoke was identified in the storm sewer system, dyed-water testing and simultaneous sewer televising of adjacent sanitary sewers was performed to confirm the existence of I/I sources, including cross-connections with the storm sewer system, sanitary sewer pipe defects and leaking service laterals. A total of 120 I/I sources were identified in 44 sanitary sewers televised including 70 leaking building laterals, 49 mainline pipe joints, and one section of pipe with a hole in it. The combined I/I rate of all of the sources found is approximately 1,123 gpm (1.62 MGD). Additionally, structural deficiencies were identified in 31 of the sewer televised.

Most of the defects identified in the mainline sanitary sewer can be repaired using cured-in-place pipe (CIPP). This repair process involves inserting a flexible liner into the host pipe through a manhole, expanding the liner to the shape of the pipe, then curing the liner in-place to form a rigid structural repair. The finished product is at least as strong as the original pipe and is expected to have a 50-year design life. Advantages of this repair method are that it is usually significantly less expensive than open cut replacement, causes minimal disruption; and services can be reconnected without excavation. The estimated cost to repair the mainline sewer defects is $445,500, as summarized in Table 5. The estimated cost to repair the leaking building laterals from the mainline sewer to the right-of-way is $278,000, as summarized in Table 6. In total, the estimated cost to rehabilitate all of the sources identified during the dyed-water testing work is approximately $723,500. Exhibit C shows the locations of the recommended mainline sewer repairs.

TABLE 5

Recommended Mainline (Public) Sewer Rehabilitation

Street	Manhole Reach From	To	I/I (gpm)	Recommended Repair	Total Cost
Cherry Street	IR-3	IR-2	30	Grout Hole in Pipe	$ 1,000
Cherry Street	R-4	R-3	3	CIPP Liner	$ 15,592
Elder Lane	KP2-11	KP2-10		CIPP Liner/E&R	$ 27,500
Elder Lane	KP2-12	KP2-11	15	CIPP Liner	$ 19,570
Elder Lane	KP2-12	KP2-13		CIPP Liner/E&R	$ 22,075
Essex Road	KP2-19	ML-15		CIPP Liner	$ 4,535
Fuller Lane	KP4-16	KP4-17	17	CIPP Liner	$ 14,954
Hawthorn Lane	KP1-27	KP1-28		CIPP Liner	$ 9,085
Hawthorn Lane	KP1-27	KP1-26	16	CIPP Liner	$ 21,646
Hawthorn Lane	KP1-29	KP1-30	2	CIPP Liner/E&R	$ 26,554
Hawthorn Lane	KP1-29	KP1-28		CIPP Liner	$ 7,553
Hawthorn Lane	KP1-32	KP1-31	47	CIPP Liner	$ 20,300
Hawthorn Lane	KP1-33	KP1-32	14	CIPP Liner	$ 16,334
Hawthorn Lane	KP1-34	KP1-33		CIPP Liner	$ 16,383
Hill Street	U-50	U-49	24	CIPP Liner	$ 19,050
Myrtle Street	KP2-12	KP3-1	9	CIPP Liner	$ 23,125
Orchard Lane	KP1-42	KP1-41	2	CIPP Liner	$ 17,857
Orchard Lane	KP1-43	KP1-42		CIPP Liner	$ 14,025
Orchard Lane	KP1-44	KP1-43		CIPP Liner	$ 17,942
Orchard Lane	KP1-45	KP1-44		CIPP Liner	$ 14,775
Sunset Road	KP3-13	KP3-12		CIPP Liner	$ 12,466
Sunset Road	ML-12	ML-11		CIPP Liner	$ 12,625
Sunset Road	ML-12	ML-14		CIPP Liner	$ 19,705
Sunset Road	ML-14	ML-15	36	CIPP Liner	$ 20,050
Sunset Road	ML-16	ML-15	7	CIPP Liner	$ 15,225
Willow Road	KP1-20	KP1-19	1	CIPP Liner	$ 12,765
Woodland Avenue	ML-12	ML-13	1	CIPP Liner	$ 9,900
Woodland Avenue	ML-12	ML-9		CIPP Liner	$ 2,209
Woodland Avenue	ML-9	ML-8	1	CIPP Liner	$ 10,700
			225		$445,500

TABLE 6

Recommended Lateral (Private) Sewer Rehabilitation

Street	Manhole Reach From	To	I/I (gpm)	Recommended Repair	Total Cost
Ash Street	IR-25	IR-24	100	Lateral Repair	$ 6,500
Ash Street	R-13	R-11	20	Lateral Repair	$ 8,000
Ash Street	R-14	R-13	19	Lateral Repair	$ 16,500
Ash Street	R-15	R-14	48	Lateral Repair	$ 16,500
Ash Street	R-17	R-16	6	Lateral Repair	$ 8,000
Cherry Street	IR-3	IR-2	70	Lateral Repair	$ 32,500
Cherry Street	R-2	R-1	15	Lateral Repair	$ 8,000
Cherry Street	R-3	R-2	2	Lateral Repair	$ 500
Cherry Street	R-4	R-3	45	Lateral Repair	$ 8,000
Cherry Street	R-6	R-5	40	Lateral Repair	$ 26,000
Cherry Street	R-7	R-6	55	Lateral Repair	$ 16,000
Elder Lane	KP2-11	KP2-10	17	Lateral Repair	$ 4,500
Elder Lane	KP2-12	KP2-11	40	Lateral Repair	$ 4,000
Elder Lane	KP2-12	KP2-13	2	Lateral Repair	$ 6,500
Fuller Lane	KP4-16	KP4-17	98	Lateral Repair	$ 20,000
Hawthorn Lane	KP1-27	KP1-26	35	Lateral Repair	$ 8,000
Hawthorn Lane	KP1-29	KP1-30	3	Lateral Repair	$ 8,000
Hawthorn Lane	KP1-29	KP1-28	2	Lateral Repair	$ 4,000
Hawthorn Lane	KP1-31	KP1-33	3	Lateral Repair	$ 4,000
Hawthorn Lane	KP1-32	KP1-31	3	Lateral Repair	$ 4,000
Hawthorn Lane	KP1-33	KP1-32	6	Lateral Repair	$ 8,000
Hawthorn Lane	KP1-34	KP1-33	40	Lateral Repair	$ 8,000
Hill Street	U-50	U-49	27	Lateral Repair	$ 4,000
Orchard Lane	KP1-42	KP1-41	50	Lateral Repair	$ 8,000
Orchard Lane	KP1-44	KP1-43	25	Lateral Repair	$ 4,000
Rosewood Avenue	T-17a	T-17	45	Lateral Repair	$ 12,000
Rosewood Avenue	T-17b	T-17a	21	Lateral Repair	$ 12,000
Sunset Road	ML-12	ML-11	10	Lateral Repair	$ 4,000
Sunset Road	ML-12	ML-14	1	Lateral Repair	$ 4,000
Walnut Street	HS5-34	HS5-25	5	Lateral Repair	$ 4,000
Willow Road	KP1-20	KP1-19	10	Lateral Repair	$ 500
			863		$278,000

4. SUMMARY

The following is a summary of recommendations and costs formulated from the information presented in this report.

TABLE 7

Summary of Recommended Rehabilitation Costs

Source	Opinion of Rehabilitation Cost	Estimated I/I to be Removed
Manhole Repairs:		662 gpm (0.953 MGD)
Cover Replacement (60)	$ 27,000	
Install Chimney Seal (11)	$ 5,500	
Manhole Coating (162)	$ 290,000	
Mainline: E&R/Lining	$ 445,500	260 gpm (0.374 MGD)
Laterals: E$R/Lining (70)	$ 278,000	863 gpm (1.243 MGD)
Area Drains/Downspouts		
Cleanout Caps/Sump Pumps	$ 24,500	650 gpm (0.936 MGD)
Subtotal (Construction)	$1,070,500	2,435 gpm (3.506 MGD)
Engineering Design (5%)	$ 53,500	
Engineering Inspection (10%)	$ 107,000	
Contingencies (10%)	$ 107,000	
Total	$1,338,000	

Attachment 3
Manhole Rehabilitation Location Map

EXHIBIT B

MH No.	Depth, ft.	Inches of Rings	MH Dia., ft.	Replace Cover	Install Internal Chimney Seal	Interior Manhole Sealing (vert. ft.)
hs5-1	10.4	18	4			X
hs5-2	9.9	20	3			X
hs5-3	9.3	4	4			X
hs5-3s	7.8	16	4			X
hs5-5	8.6	12	3			X
hs5-6	8.6	21	4			X
hs5-7	8.9	19	3			X
hs5-7x	8.8	3	5		X	
hs5-n	9.3	4	3		X	
hs5-10	9.0	10	3			X
hs5-11	8.9	19	3			X
hs5-12	9.2	9	3			X
hs5-20	6.9	4	4			X
hs5-21	5.8	8	4			X
hs5-22	9.9	9	4			X
hs5-23	8.8	25	3			X
hs5-24	9.2	3	3			X
hs5-25	9.3	25	3			X
hs5-26	8.1	5	4		X	
hs5-27	7.7	20	3			X
hs5-35	11.0	8	4			X
ir-1	17.8	7	4	X		X
ir-2	9.2	7	3			X
ir-3	9.3	9	3			X
ir-4	10.6	16	3			X
ir-5	8.9	13	3			X
ir-6	8.3	24	4			X
ir-12	8.8	6	4		X	
ir-13	8.8	2	4			X
ir-14	8.7	9	4	X		X
ir-23	6.1	14	4			X
kp1-17	6.7	11	4		X	
kp1-18	5.5	3	4			X
kp1-19	5.0	2	4	X	X	
kp1-20	5.6	17	4			X
kp1-25	9.9	7	4			X
kp1-26	9.7	11	4			X
kp1-27	8.1	10	4			X
kp1-28	7.7	2	4	X		X
kp1-29	7.7	14	4			X
kp1-30	7.8	2	4			X
kp1-31	7.7	25	4			X
kp1-32	7.9	51	4			X
kp1-33	7.6	45	4			X
kp1-34	8.5	15	4			X
kp1-37	7.8	12	4			X
kp1-39	7.0	7	4			X
kp1-40	7.5	3	4			X
kp1-42	9.1	5	4			X
kp1-43	7.8	21	4			X
kp1-44	7.3	48	4			X
kp1-45	7.4	23	4			X
kp1-46	8.0	12	4			X
kp1-46w	7.4	8	3	X		X
kp2-3	11.2	13	4			X
kp2-4	11.6	5	4			X
kp2-5	9.5	3	4			X
kp2-6	10.7	12	4			X
kp2-7	9.1	52	4			X
kp2-8	9.5	8	3			X
kp2-9	10.1	8	4			X
kp2-10	9.4	0	3	X		X
kp2-11	9.6	18	4			X
kp2-12	9.3	11	4			X
kp2-13	8.9	11	4			X
kp2-14	8.2	9	4			X
kp2-19	7.1	15	4			X
kp2-20	8.9	9	4			X
kp2-21	9.6	15	3	X		X
kp3-1	8.9	15	4			X
kp3-2	9.1	8	4			X
kp3-11	6.1	12	4	X		X
kp3-12	9.0	15	4			X
kp3-13	9.1	9	4			X
kp4-5	11.8	18	4			X
kp4-16	4.9	0	4			X
kp4-17	5.0	0	4			X
kp4-18	6.7	0	4			X
kp4-19	8.9	0	4			X
kp4-20	11.5	0	4			X
kp4-21	11.4	20	4			X
kp4-22	7.5	32	3	X		X
ml-7	11.5	19	4			X
ml-8	9.5	25	4			X
ml-9	7.7	16	4			X
ml-10	7.9	0	4			X
ml-11	7.2	0	4	X		
ml-12	7.3	15	4			X
ml-13	6.3	0	4			X
ml-14	7.8	0	4			X
ml-15	7.1	13	4			X
ml-16	6.0	10	4			X
ml-17	8.0	13	4			X
ml-18	9.0	19	4			X
ml-19	6.1	0	4	X		X
ml-20	8.5	0	4			X
ml-21	10.5	15	4			X
ml-22	21.5	10	4			X
q-2	8.5	0	3	X		X
q-3	9.5	0	3	X		X
q-4	7.9	3	3	X		X
q-5	12.5	0	3	X		X
q-6	10.2	13	3			X
q-7	10.2	14	3	X		X
q-8	8.3	17	3	X		X
q-9	7.2	0	3	X		X
q-x	14.6	0	3			X
r-1	19.5	0	3	X		X
r-2	13.3	0	3	X		X
r-3	11.7	4	3	X		X
r-4	10.0	14	3			X
r-5	9.9	2	3	X		X
r-6	7.9	3	3			X
r-7	8.1	16	3	X		X
r-8	15.3	10	3			X
r-9	8.0	4	3			X
r-10	16.2	9	3			X
r-11	15.1	21	3			X
r-12	7.4	13	3			X
r-13	14.8	8	3	X		X
r-14	14.2	0	3	X		X
r-15	12.6	17	3			X
r-16	9.3	2	3	X		X
r-17	8.2	0	3	X		X
r-18	7.6	0	3	X		X
r-19	12.2	0	4	X		X
r-20	12.3	0	4			X
r-21	13.2	7	4	X		X
sdc-12	20.3	0	4	X		
t-2	15.0	0	3			X
t-3	8.3	0	3	X		X
t-4	8.8	3	3			X
t-5	15.1	0	3			X
t-6	8.9	0	3			X
t-7	7.7	6	3			X
t-16	14.7	0	3	X		
t-17	14.6	21	3			X
t-18	14.6	21	3			X
t-19	13.9	20	3	X		X
t-20	13.9	25	3	X		X
t-21	11.2	5	3			X
t-22	12.0	36	3	X		X
t-23	12.0	5	3	X		X
t-24	11.4	12	3			X
t-25	11.0	24	3	X		X
t-26	9.8	15	3			X
t-27	10.0	12	3	X	X	
t-28	8.7	11	3	X	X	
u-3	21.6	0	3	X		
u-5	20.4	10	3	X	X	
u-6	19.6	12	3			X
u-7	20.0	28	3		X	
u-8	13.9	28	3	X		X
u-9	13.1	11	3	X		X
u-10	11.7	13	3	X		X
u-11	11.6	0	3			X
u-22	17.8	0	3	X		X
u-23	17.8	3	3			X
u-24	9.3	13	3	X		X
u-25	8.4	10	3			X
u-27	17.5	10	3			X
u-28	18.1	19	3	X		X
u-32	12.6	11	3			X
u-32e	12.0	0	3	X		X
u-33	19.1	20	3	X		X
u-34	8.7	0	3	X		X
u-35	18.6	3	3			X
u-36	8.8	9	3	X		X
u-36s	7.8	0	3	X		X
u-37	16.3	0	3	X		X
u-38	16.0	16	4			X
u-46	11.3	0	4	X		X
u-47	15.5	18	4	X		X
u-48	14.8	6	4	X		X
u-49	13.0	11	4	X		X
u-50	9.5	20	4	X		X
w-4	3.0	8	3	X	X	

I:\Crystal Lake\WINNE\130269-SSES and Rehab\GIS\MapDocuments\SanitarySewerManholeRehabMap_wTable_ExhibitB.mxd
503jmj - 10/2/2014

Attachment 4
Mainline Sewer Repair Location Map

EXHIBIT C


VILLAGE OF WINNETKA, ILLINOIS
2013 SANITARY SEWER EVALUATION STUDY
RECOMMENDED MAINLINE SEWER REPAIRS
LEGEND
Recommended Repairs
CIPP LINER
CIPP LINER/EXCAVATE & REPLACE
GROUT HOLE IN PIPE
0 350 700 1,050 1,400 Feet
1 inch = 350 feet
BAXTER & WOODMAN
10/02/2014