

Sewershed 11 Corrective Action Plan

Consent Decree No. 2:11-cv-01011-EJM

Prepared for:

UNITED STATES
ENVIRONMENTAL
PROTECTION AGENCY,

UNITED STATES
DEPARTMENT OF JUSTICE

AND

IOWA
DEPARTMENT OF
NATURAL RESOURCES

Prepared by:

CITY OF DUBUQUE, IA
50 W 13th Street
Dubuque, IA 52001

December 8, 2011

Table of Contents

1.0	CERTIFICATION	1-1
2.0	INTRODUCTION	2-1
2.1	Background	2-1
2.2	Purpose	2-1
2.3	Corrective Actions	2-1
3.0	PRIVATE PROPERTY INSPECTIONS.....	3-1
3.1	Inspections	3-1
3.2	Corrective Actions	3-1
4.0	SMOKE TESTING	4-1
4.1	Investigation.....	4-1
4.2	Corrective Actions	4-1
4.2.1	Private Actions.....	4-1
4.2.2	Sanitary Sewer Improvements	4-1
4.2.3	Storm Sewer Improvements.....	4-2
5.0	BRICK MANHOLES.....	5-1
5.1	Investigation.....	5-1
5.2	Corrective Actions	5-1
6.0	SANITARY SEWER PRIORITY GRADING SYSTEM.....	6-1
6.1	Criticality Grade	6-1
6.2	Condition Grade	6-3
6.3	Priority Grade.....	6-3
6.4	Corrective Actions.....	6-4
7.0	CAMPUS INVESTIGATIONS.....	7-1
7.1	Sewershed 11 Campuses	7-1
7.2	Corrective Actions	7-1
7.2.1	Clarke University.....	7-1
7.2.2	St. Anthony’s Church and School	7-1
7.2.3	Senior High School.....	7-1

8.0	PLAN SUMMARY.....	8-1
8.1	Funding	8-1
8.2	Corrective Action Summary	8-1

TABLES

Table 3-1.	Failed private property inspections.	3-2
Table 4-1.	Private property defects identified by smoke testing.	4-2
Table 4-2.	Sanitary sewer defects identified by smoke testing.	4-3
Table 4-3.	Storm sewer defects identified by smoke testing.	4-3
Table 5-1.	Brick manholes identified for improvement or replacement.....	5-2
Table 6-1.	Weighted percent values for the Probability of Failure factors.	6-2
Table 6-2.	Weighted percent values for the Consequence of Failure factors.....	6-2
Table 6-3.	Guidelines for condition assessment and rehabilitation for Sowershed 11.....	6-4
Table 6-4.	Grade 4 pipes identified for improvement or replacement.	6-6
Table 6-5.	Grade 5 pipes identified for improvement or replacement.	6-6
Table 8-1.	Summary of corrective actions for Sowershed 11.....	8-2

FIGURES

Figure 2-1.	Map of priority sowersheds for I&I investigation.....	2-2
Figure 6-1.	Criticality Grade Color Matrix	6-3
Figure 6-2.	Priority grade color matrix.....	6-4
Figure 6-3.	Priority grades and brick manholes.	6-5

APPENDICES

Appendix A.	Inflow & Infiltration Program Financial Assistance Application
Appendix B.	City letter to Dubuque Community School District regarding Senior High School
Appendix C.	Response from Dubuque Community School District
Appendix D.	December letter to Dubuque Community School District

1.0 Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my directions and my inquiry of the person or person who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Michael C. Van Milligen
City Manager

2.0 Introduction

2.1 BACKGROUND

The City of Dubuque, Iowa is under a Consent Decree according to Case 2:11-cv-01001-EJM, United States of America and the State of Iowa v. the City of Dubuque, IA (N.D. Iowa), Civil Action Number 2008V00041, DOJ Case Number 90-5-1-1-09339 effective June 27, 2011.

2.2 PURPOSE

The purpose of this report is to satisfy Section V, Paragraph 12 of the Consent Decree. Paragraph 12 requires the City to submit a corrective action plan for Sewershed 11 by December 31, 2011.

Prior to June 27, 2011, the City experienced several discharges of untreated or partially treated wastewater. These events were caused by sharp increases in flow within the sanitary sewer system during and immediately after a rainstorm. To better locate the sources of this issue, the City placed flow meters throughout the city. Depending on location, the meters measured the flow of water from each sewershed over a one to eleven month period of time.

Five of the twelve sewersheds were identified as receiving elevated flows during and directly after a precipitation event. Under the Consent Decree, the City has agreed to investigate five sewersheds over the next five years (Figure 2-1).

2.3 CORRECTIVE ACTIONS

The City employed numerous methods to investigate sources of I&I: private property inspections; smoke testing the sanitary sewer collection system; brick manhole identification; sanitary sewer pipe prioritization; and “campus” inspections. Corrective actions specific to each investigation method are provided in subsequent sections of this plan.

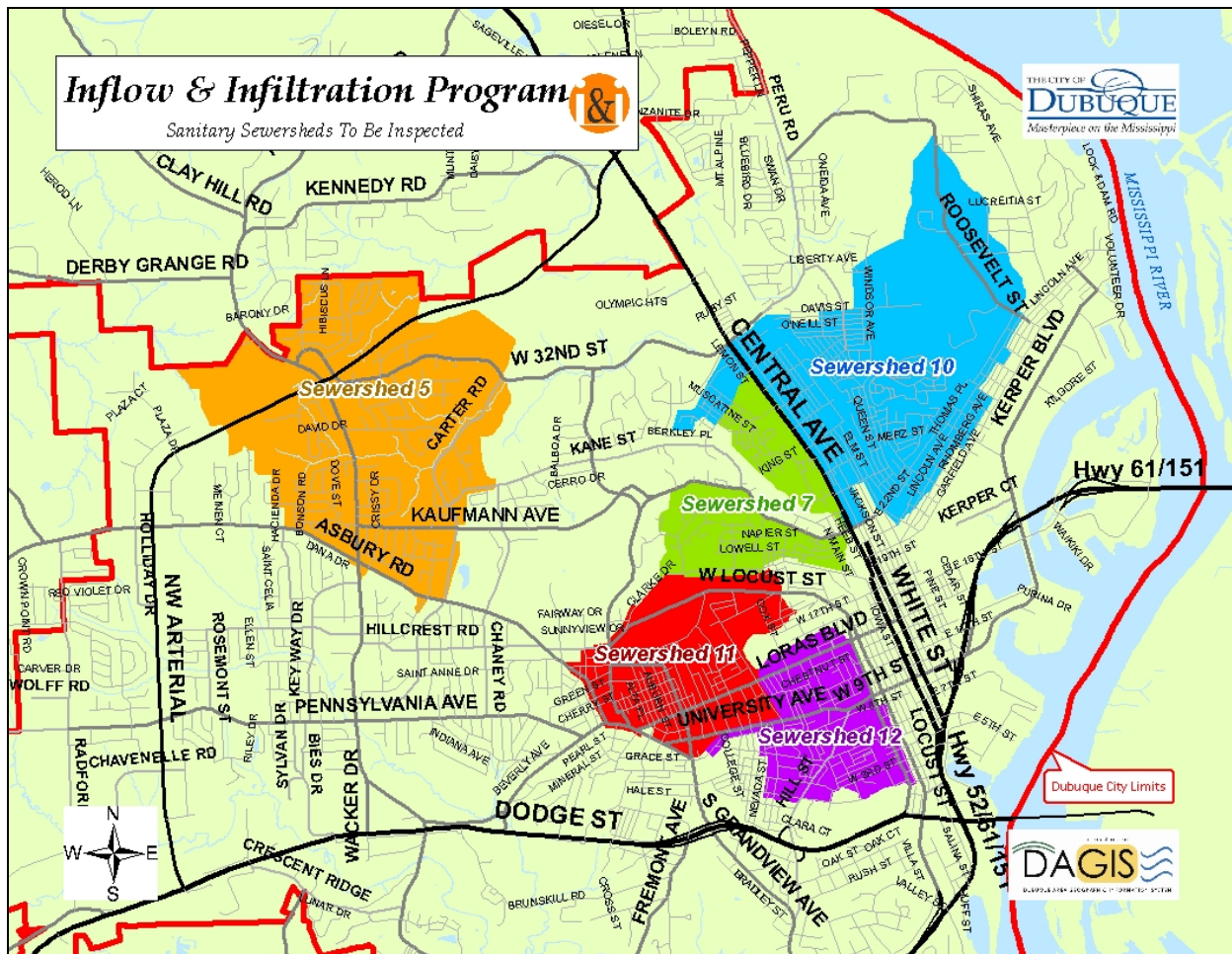


Figure 2-1. Map of priority sewersheds for I&I investigation.

3.0 Private Property Inspections

3.1 INSPECTIONS

City inspectors conducted 1,233 private property inspections to identify the roof drain discharge location, the presence of any stairwell or driveway drains, and the presence of a sump pit/pump on site. A passing inspection indicated no connections of clear water to the sanitary system. A failed inspection indicated an improper connection of clear water into the sanitary system, which could include roof drains connected to the sanitary sewer; a stairwell or driveway drain which is connected to the sanitary sewer; or a sump pump or floor drain plumbed directly to the sanitary sewer.

3.2 CORRECTIVE ACTIONS

Each improper connection observed during a private property inspection resulted in a failure notice. The property owner then had 30 days to correct the improper connection, at which point a re-inspection of the property was conducted to verify that the improper connection was eliminated. If the improper connection was not corrected, City inspectors reminded the property owner of the required work; requested a timeline to correct the improper connection; and offered suggestions on how to efficiently and economically correct the connection. If a property owner chooses not to correct an improper connection, the City may pursue legal action against the property owner.

The 79 failed private property inspections are listed in Table 3-1. (More than half have been corrected.) Some improper connections, such as driveway drains, can require complex and costly corrections for property owners. To better understand the cost to property owners, the City obtained three estimates ranging from \$4,800 to \$6,500 to correct improper driveway drain connections.

The City is sensitive to the economic hardship these corrections may cause and the need to eliminate these significant connections to the sanitary sewer. Therefore, a cost-share program has been established for the City to partner with property owners. The application form is provided in Appendix A. City staff will continue using the cost-share program to balance property owner costs and Consent Decree requirements. (The City retains the right to rescind cost-share program at any time for good cause including funding availability.)

The City has notified property owners of improper connections by mail, and City staff will continue to work with property owners to address the improper connections by June 30, 2016.

Table 3-1. Failed private property inspections.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
353620	1350	Nowata St	Exterior drain to sanitary sewer	Constructed enclosure around stairway	Yes
335523	1775	Alta Pl	Exterior drain to sanitary sewer	Constructed enclosure around stairway	Yes
358381	2010	Alta Vista St	Roof drain to sanitary sewer	Disconnected from sanitary sewer	Yes
340790	875	W Locust St	Sump pump discharges to sanitary sewer	New sump pit installed to separate storm and sanitary	Yes
335405	2340	Green St	Sump pump discharges to sanitary sewer	New sump pit installed to separate storm and sanitary	Yes
335404	2360	Green St	Sump pump discharges to sanitary sewer	New sump pit installed to separate storm and sanitary	Yes
353600	1340	Auburn St	Sump pit without pump	Pump installed in sump pit and plumbed properly	Yes
332904	1365	Loras Blvd	Sump pit without pump	Pump installed in sump pit and plumbed properly	Yes
324692	1818	Asbury Rd	Sump pit without pump	Pump installed in sump pit and plumbed properly	Yes
321778	1511	Adair St	Roof drain to sanitary sewer	Roof drain disconnected from sanitary sewer	Yes
332894	1586	Wood St	Roof drain to sanitary sewer	Roof drain disconnected from sanitary sewer	Yes
320500	1870	St Ambrose St	Roof drain to sanitary sewer	Roof drain disconnected from sanitary sewer	Yes
357918	1340	Wood St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
353587	1451	Atlantic St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
356767	1670	N Grandview Ave	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
335505	1845	Atlantic St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
331782	1885	Wood St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
341949	2386	University Ave	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
340944	770	Angella St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
358385	895	Kirkwood Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
318957	1050	Loras Blvd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
335432	1085	Wood St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
358325	1111	Rosedale Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
332384	1205	N Booth St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
357923	1212	Wood St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
356793	1458	Mt Pleasant St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
356803	1480	Glen Oak St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
342248	1490	N Grandview Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
343593	1580	Ashton Pl	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
356658	1610	Ashton Pl	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
332653	1645	Atlantic St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
333159	1665	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
353591	1693	Loras Blvd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
333157	1695	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
338756	1715	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
338763	1726	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
335515	1730	Avoca St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
331788	1755	Wood St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
315480	1800	Lawndale St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
331765	1810	Adair St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
320494	1845	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
324689	1850	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
324686	1855	Clarke Dr	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
324688	1860	St Ambrose St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
338791	1921	N Grandview Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
319187	1985	N Grandview Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
319182	2175	Rosedale Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
335384	2215	Green St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
358305	1049	W Locust St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
336589	1065	Auburn St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
357922	1222	Wood St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
331425	1275	Mt Pleasant St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
332906	1325	Loras Blvd	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
318969	1339	Alta Vista St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
353599	1380	Auburn St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
353606	1392	Atlantic St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
331365	1435	Mt Pleasant St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
335437	1475	University Ave	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
335436	1485	University Ave	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
331362	1491	Mt Pleasant St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
342277	1528	Mt Pleasant St	Roof drain to sanitary sewer; sump pump	Corrective action to be completed by property owner	
332667	1540	N Algona St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
345563	1640	Lawndale St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
356655	1660	Ashton Pl	Sump pit without pump	Corrective action to be completed by property owner	
338781	1671	Avoca St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
353592	1675	Loras Blvd	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
356643	1715	Atlantic St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
356763	1795	Adair St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
343914	1795	Auburn St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
357892	1815	Loras Blvd	Sump pit without pump	Corrective action to be completed by property owner	
325932	1885	St Ambrose St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
340687	1911	St Ambrose St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
340681	1983	St Ambrose St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
344813	1985	Alta Vista St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
335528	2025	Delaware St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
319171	2033	Clarke Dr	Sump pit without pump	Corrective action to be completed by property owner	
323944	2215	University Ave	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
324693	2275	Green St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
341948	2396	University Ave	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	

4.0 Smoke Testing

4.1 INVESTIGATION

The City conducted smoke testing in Sewershed 11 to identify improper clear water connections to the sanitary system and possible cracks, leaks or breaks in a property owner's sanitary lateral. Smoke testing has also been used for large commercial or educational buildings where dye testing would not be an efficient method of investigation.

4.2 CORRECTIVE ACTIONS

Fifty-three defects were identified within Sewershed 11. Photos were taken of each and mapped in the City's GIS. City staff has classified the results into three categories: private repairs; sanitary sewer repairs; and storm sewer repairs.

4.2.1 Private Actions

Table 4-1 lists 27 private property repairs identified by smoke testing and the corrective action required of the property owners by the City. Of the 27 repairs, sixteen are likely related to the sanitary sewer lateral. Identifying the source of I&I in a sanitary sewer lateral can be especially difficult and expensive for an individual property owner. Therefore, City staff has requested a new Capital Improvement Project (CIP) for Fiscal Year 2013 (July 2012 – June 2013) to televise private laterals. If this CIP is approved, the sixteen laterals will be televised to provide the property owner with more definitive information on how to repair the improper connection. If it is not approved, the City will require the property owners to investigate at their cost. According to State Law, the City Council must adopt and certify the budget by March 15, 2013.

The City will consider the private repairs listed in Table 4-1 similar to the failed private property inspections – property owners will be notified by letter in 2012, asked to correct the connection, and City staff will continue to work with property owners to address the improper connections by June 30, 2016. Reinspections will be conducted to ensure the repair was done correctly.

4.2.2 Sanitary Sewer Improvements

Smoke testing revealed 21 defects related to the sanitary sewer collection system. The defects consisted of vented manhole covers, brick manholes, and broken or cracked pipes (Table 4-2).

The vented manhole covers will be replaced by the City. As will be discussed in Section 5.2, the brick manholes will be improved or replaced. The pipes will be improved or replaced as will be discussed in Section 6.4. The sanitary sewer improvements identified by smoke testing will cost the City approximately \$34,000.

4.2.3 Storm Sewer Improvements

Smoke was observed from five storm sewer catchbasins during smoke testing (Table 4-3). City staff investigated each of these immediately, but no direct “cross-connections” to the sanitary sewer were found. Two of the five smoking catchbasins may be due to a nearby sanitary sewer lateral; as discussed above in Section 4.2.1, the City will televise these sanitary laterals if the CIP is approved.

The City will further investigate the other three smoking catchbasins in 2012. Public Works staff will flood the storm sewer with dyed water while simultaneously televising the sanitary sewer to locate any possible cross-connections. The storm sewer improvements identified by smoke testing will cost the City approximately \$15,000.

Table 4-1. Private property defects identified by smoke testing.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
NA	1744	N Grandview Ave	Smoke from Water Access	Televise lateral; notify property owner of any necessary repair	
NA	1669	Adair St	Smoke from Behind Curb	Televise lateral; notify property owner of any necessary repair	
NA	1450	Wood St	Severed Sanitary Cleanout	Property owner repair with water tight seal	
NA	1951	Loras Blvd	Smoke from ground near gas meter	Televise lateral; notify property owner of any necessary repair	
NA	1280	Glen Oak St	Smoke from ground and water access	Televise lateral; notify property owner of any necessary repair	
NA	800	W Locust St	Smoke from water valve at corner of stairs and sidewalk	Televise lateral; notify property owner of any necessary repair	
NA	1537	Irving St	Smoke from buffer strip between sidewalk and back of curb	Televise lateral; notify property owner of any necessary repair	
NA	1890	Audubon St	Smoke from retaining wall, steps and concrete in front of house	Televise lateral; notify property owner of any necessary repair	
NA	990	Booth St	Smoke from water valve across street	Televise lateral; notify property owner of any necessary repair	
NA	1871	Glen Oak St	Smoke from driveway	Property owner to disconnect driveway drain	
NA	1575	Irving St	Smoke from rocks near driveway	Televise lateral; notify property owner of any necessary repair	
NA	1671	Avoca St	Smoke from rear downspout	Property owner disconnect downspout from sanitary sewer	
NA	1660	Ashton Pl	Smoke from shut-off valve	Televise lateral; notify property owner of any necessary repair	
NA	1657	Ashton Pl	Smoke from sidewalk/valve	Televise lateral; notify property owner of any necessary repair	
NA	1905	Loras Blvd	Smoke from rear door	Televise lateral; notify property owner of any necessary repair	
NA	1065	Auburn St	Smoke from crack near driveway	Property owner to disconnect driveway drain	
NA	1339	Mt. Pleasant St	Smoke from valve	Property owner to install water tight cap	
NA	730	Kirkwood St	Smoke from ground behind curb	Televise lateral; notify property owner of any necessary repair	
NA	1985	Clarke Dr	Smoke from hole in ground by down spout	Property owner disconnect downspout from sanitary sewer	
NA	1550	Clarke Dr	Smoke from hole in ground	Property owner to install water tight cap	
NA	1570	Mt. Pleasant St	Smoke from uneven curb	Televise lateral; notify property owner of any necessary repair	
NA	1556	Mt. Pleasant St	Smoke from driveway drain	Property owner to disconnect driveway drain	
NA	1350	Nowata St	Smoke from stairway drain	Action complete; awning installed to prevent rain from entering drain	Yes
NA	1200	Glen Oak St	Smoke by water shut-off	Televise lateral; notify property owner of any necessary repair	
NA	615	Angella St	Smoke by water shut-off	Lateral was televised by licensed plumber; no corrective action needed	Yes
NA	1065	Auburn St	Smoke from MH/cistern in front yard	Property owner repair	
NA	1800	Clarke Dr (SHS softball field)	Smoke from ground near MH	Property owner repair	

Table 4-2. Sanitary sewer defects identified by smoke testing.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
SAN P 05590	1302	Atlantic Street	Smoke from Ground; longitudinal crack in pipe	Improve or replace pipe	
SAN S 05395	1537	Irving St	Vented MH Cover	Replace cover	
SAN S 05385	NA	Irving St & Decorah St	Smoke at MH Diamond	Improve or replace manhole	
SAN S 05381	NA	Loras Blvd & Nowata St	Vented MH Cover	Replace cover	
SAN S 06848	1419	Loras Blvd	Smoke from ground around MH, Vented Cover	Improve or replace manhole	
SAN S 05574	1871	Glen Oak St	Smoke from ground around MH	Improve or replace manhole	
SAN S 05580	NA	Woods N of Lawndale St	Smoke from ground around MH	Improve or replace manhole	
SAN S 05348	NA	St. Ambrose St & Rosedale Ave	Smoke around MH	Improve or replace manhole	
SAN S 05409	NA	Custer St & Atlantic St	Smoke around MH	Improve or replace manhole	
SAN S 05394	1324	N Grandview Ave	Smoke from MH, driveway and curb	Improve or replace manhole	
SAN S 05657	NA	Martha St and Nevada St	Smoke around MH and catch basin at SE Corner of Intersection	Improve or replace pipe to northeast (SAN P 05553)	
SAN S 06789	1881	Glen Oak St	Manhole in low spot in front yard	Improve or replace manhole	
SAN S 05578	1871	Glen Oak St	Smoke from Ground near MH	Improve or replace manhole	
SAN S 05436	NA	W Locust St & Clarke Dr	Smoke from crack in pavement	Improve or replace pipe (Grade 4 pipe, SAN P 06063)	
SAN S 04703	1234	Rosedale Ave	Smoke from MH in yard	Improve or replace manhole	
SAN S 05320 or 05395	2155	University	Vented MH Cover	Replace cover	
SAN P 05622	1340	Auburn St	Multiple fractures, hole, lateral intruding	Improve or replace pipe	
SAN P 05621	1880	Custer St	Multiple fractures, hole in pipe	Improve or replace pipe	
SAN P 05619	1790	Custer St	Multiple fractures, joint separated, circumferential crack	Improve or replace pipe	
SAN P 05615	1784	Custer St	Multiple fractures	Improve or replace pipe	
SAN P 05620	NA	Custer St	Multiple fractures, longitudinal crack, joint offset	Improve or replace pipe	

Table 4-3. Storm sewer defects identified by smoke testing.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
STO S 04272	1855	Wood St	Smoke from catch basin	Flood & dye storm sewer; televise sanitary; improve as needed	
STO S 04376	995	Nevada St	Smoke from catch basin	Protruding lateral tap; property owner to repair	
STO S 04340	1871	Glen Oak St	Smoke from catch basin	Possibly lateral from 1825 Glen Oak; property owner to repair	
STO S 04231	1795	Adair St	Smoke from catch basin	Flood & dye storm sewer; televise sanitary; improve as needed	
STO S 04310	NA	Delaware St & Grandview Ave	Smoke from catch basin	Flood & dye storm sewer; televise sanitary; improve as needed	

5.0 Brick Manholes

5.1 INVESTIGATION

Sanitary sewer manholes within Sewershed 11 were opened and recorded as concrete or brick. Brick manholes are of the greater I&I concern because they are typically older and deteriorated mortar can be a significant source of infiltration. Of the 278 manholes in Sewershed 11, one hundred and twenty-one are brick.

5.2 CORRECTIVE ACTIONS

The City will begin improvement or replacement of the 121 brick manholes (Table 5-1) during 2012 and will continue as needed until June 30, 2016. Sixty-one of the brick manholes are rated in either “poor” or “repair” condition by City staff and will be addressed first. The remaining brick manholes will be improved or repaired in subsequent years based on age (i.e. the older manholes will be replaced first). The expense of improving or replacing all brick manholes listed is approximately \$612,000.

Table 5-1. Brick manholes identified for improvement or replacement.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
SAN S 04710	1893	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05394	1321	N Grandview Ave	Brick manhole	Improve or replace manhole	
SAN S 05580	1800	Lawndale St	Brick manhole	Improve or replace manhole	
SAN S 05751	1939	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05610	1675	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05385	NA	Decorah St & Irving St	Brick manhole	Improve or replace manhole	
SAN S 05344	1911	N Grandview Ave	Brick manhole	Improve or replace manhole	
SAN S 05601	1700	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05331	NA	Atlantic St & Delaware St	Brick manhole	Improve or replace manhole	
SAN S 05585	1800	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05391	1445	Auburn St	Brick manhole	Improve or replace manhole	
SAN S 05383	NA	Fillmore St & Auburn St	Brick manhole	Improve or replace manhole	
SAN S 05341	1845	Avoca St	Brick manhole	Improve or replace manhole	
SAN S 05626	1045	Vernon St	Brick manhole	Improve or replace manhole	
SAN S 05653	1210	Loras Blvd	Brick manhole	Improve or replace manhole	
SAN S 05367	NA	Decorah St & Auburn St	Brick manhole	Improve or replace manhole	
SAN S 05357	NA	Delaware St & Auburn St	Brick manhole	Improve or replace manhole	
SAN S 05392	NA	Loras Blvd & Atlantic St	Brick manhole	Improve or replace manhole	
SAN S 05612	1686	Lawndale St	Brick manhole	Improve or replace manhole	
SAN S 05379	1633	Avoca St	Brick manhole	Improve or replace manhole	
SAN S 05730	950	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05628	1450	Alta Vista St	Brick manhole	Improve or replace manhole	
SAN S 05598	1760	Lawndale St	Brick manhole	Improve or replace manhole	
SAN S 05624	1608	Lawndale St	Brick manhole	Improve or replace manhole	
SAN S 07329	NA	Alley behind 1789 Univ Ave	Brick manhole	Improve or replace manhole	
SAN S 05605	1040	Edina St	Brick manhole	Improve or replace manhole	
SAN S 05615	1098	Edina St	Brick manhole	Improve or replace manhole	
SAN S 04720	NA	N Grandview Ave	Brick manhole	Improve or replace manhole	
SAN S 05574	1871	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05654	1430	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 06789	1881	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05405	1302	Atlantic St	Brick manhole	Improve or replace manhole	
SAN S 05345	1945	N Grandview St	Brick manhole	Improve or replace manhole	
SAN S 05384	1460	Atlantic St	Brick manhole	Improve or replace manhole	
SAN S 05368	NA	Delaware St & Ashton Pl	Brick manhole	Improve or replace manhole	
SAN S 01947	1795	Asbury Rd	Brick manhole	Improve or replace manhole	
SAN S 07012	NA	N Booth St & Martha St	Brick manhole	Improve or replace manhole	
SAN S 06848	1419	Loras Blvd	Brick manhole	Improve or replace manhole	
SAN S 05458	NA	Clarke Dr & N Grandview Ave	Brick manhole	Improve or replace manhole	
SAN S 05625	1576	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05752	1086	Wood St	Brick manhole	Improve or replace manhole	
SAN S 04703	1234	Rosedale Ave (on Glen Oak St)	Brick manhole	Improve or replace manhole	
SAN S 01939	1881	Asbury Rd	Brick manhole	Improve or replace manhole	
SAN S 05579	NA	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05647	NA	Mt Pleasant St & Loras Blvd	Brick manhole	Improve or replace manhole	
SAN S 05731	935	Nevada St	Brick manhole	Improve or replace manhole	
SAN S 05648	1050	Loras Blvd	Brick manhole	Improve or replace manhole	
SAN S 05833	1550	University Ave (behind building)	Brick manhole	Improve or replace manhole	
SAN S 05404	NA	Abandoned alley behind 1875 Custer St	Brick manhole	Improve or replace manhole	
SAN S 05622	1695	Mt Pleasant St	Brick manhole	Improve or replace manhole	
SAN S 05378	1555	N Algona St	Brick manhole	Improve or replace manhole	
SAN S 04715	1875	Audobon St	Brick manhole	Improve or replace manhole	
SAN S 05356	1709	N Algona St	Brick manhole	Improve or replace manhole	
SAN S 06803	1585	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05387	NA	Fillmore St & Algona St	Brick manhole	Improve or replace manhole	
SAN S 05355	NA	Dexter St (alley E of Algona St)	Brick manhole	Improve or replace manhole	
SAN S 04721	NA	N Grandview Ave & Auburn St	Brick manhole	Improve or replace manhole	
SAN S 05393	1421	N Algona St	Brick manhole	Improve or replace manhole	

Table 5-1 (continued). Brick manholes identified for improvement or replacement.

SAN S 05397	NA	Alley behind 1334 Atlantic St	Brick manhole	Improve or replace manhole	
SAN S 06939	1755	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05366	1650	N Algona St	Brick manhole	Improve or replace manhole	
SAN S 05350	2135	Green St	Brick manhole	Improve or replace manhole	
SAN S 05637	1195	Vernon St	Brick manhole	Improve or replace manhole	
SAN S 05327	2020	Green St	Brick manhole	Improve or replace manhole	
SAN S 05541	615	Angella St	Brick manhole	Improve or replace manhole	
SAN S 05544	1819	Pierce St	Brick manhole	Improve or replace manhole	
SAN S 05536	595	Angella St	Brick manhole	Improve or replace manhole	
SAN S 05464	1893	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05549	NA	Angella St & Pierce St	Brick manhole	Improve or replace manhole	
SAN S 05539	1903	Pierce St	Brick manhole	Improve or replace manhole	
SAN S 05560	NA	Loras property near Kirkwood & Blake Sts	Brick manhole	Improve or replace manhole	
SAN S 05640	NA	Vernon St & Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05559	NA	Cox St & Angella St	Brick manhole	Improve or replace manhole	
SAN S 05540	601	Angella St	Brick manhole	Improve or replace manhole	
SAN S 05642	1265	Vernon St	Brick manhole	Improve or replace manhole	
SAN S 05411	1790	Custer St	Brick manhole	Improve or replace manhole	
SAN S 05562	1037	Kirkwood St	Brick manhole	Improve or replace manhole	
SAN S 05553	NA	Kirkwood St	Brick manhole	Improve or replace manhole	
SAN S 05402	1375	Auburn St	Brick manhole	Improve or replace manhole	
SAN S 05415	NA	Auburn St (alley between Custer & Univ)	Brick manhole	Improve or replace manhole	
SAN S 05724	1081	N Booth St	Brick manhole	Improve or replace manhole	
SAN S 05364	NA	Decorah St & Atlantic St	Brick manhole	Improve or replace manhole	
SAN S 05413	NA	Atlantic St (alley between Custer & Univ)	Brick manhole	Improve or replace manhole	
SAN S 05359	1645	Atlantic St	Brick manhole	Improve or replace manhole	
SAN S 05543	890	Kirkwood St	Brick manhole	Improve or replace manhole	
SAN S 05652	1380	N Booth St	Brick manhole	Improve or replace manhole	
SAN S 05725	935	N Booth St	Brick manhole	Improve or replace manhole	
SAN S 05721	1319	Mt Pleasant St	Brick manhole	Improve or replace manhole	
SAN S 05722	1145	Mt Pleasant St	Brick manhole	Improve or replace manhole	
SAN S 01941	1850	N Grandview Ave	Brick manhole	Improve or replace manhole	
SAN S 05646	1435	Mt Pleasant St	Brick manhole	Improve or replace manhole	
SAN S 05723	940	Mt Pleasant St	Brick manhole	Improve or replace manhole	
SAN S 06961	1445	Wood St	Brick manhole	Improve or replace manhole	
SAN S 05335	1775	Wood St	Brick manhole	Improve or replace manhole	
SAN S 01782	1715	Asbury Rd	Brick manhole	Improve or replace manhole	
SAN S 05319	1655	Asbury Rd	Brick manhole	Improve or replace manhole	
SAN S 05636	1555	Mt Pleasant St	Brick manhole	Improve or replace manhole	
SAN S 05343	1937	St Ambrose St	Brick manhole	Improve or replace manhole	
SAN S 05336	1905	Asbury Rd	Brick manhole	Improve or replace manhole	
SAN S 07363	1925	Pierce St	Brick manhole	Improve or replace manhole	
SAN S 05320	1535	Irving St	Brick manhole	Improve or replace manhole	
SAN S 05395	1537	Irving St	Brick manhole	Improve or replace manhole	
SAN S 05534	1978	Cox St	Brick manhole	Improve or replace manhole	
SAN S 07013	1715	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 05732	995	Nevada St	Brick manhole	Improve or replace manhole	
SAN S 05412	1060	Auburn St (at Custer St)	Brick manhole	Improve or replace manhole	
SAN S 05589	1790	Glen Oak St	Brick manhole	Improve or replace manhole	
SAN S 07328	1760	Custer St	Brick manhole	Improve or replace manhole	
SAN S 05362	1735	Avoca St	Brick manhole	Improve or replace manhole	
SAN S 05634	1100	Vernon St	Brick manhole	Improve or replace manhole	
SAN S 05340	NA	Atlantic St & Dexter St	Brick manhole	Improve or replace manhole	
SAN S 05334	1795	Adair St	Brick manhole	Improve or replace manhole	
SAN S 05326	1669	Adair St	Brick manhole	Improve or replace manhole	
SAN S 05372	1475	Adair St	Brick manhole	Improve or replace manhole	
SAN S 05588	1799	Lawndale St	Brick manhole	Improve or replace manhole	
SAN S 05421	1420	Loras Blvd	Brick manhole	Improve or replace manhole	
SAN S 04711	1865	Adair St	Brick manhole	Improve or replace manhole	
SAN S 05349	1910	Asbury Rd	Brick manhole	Improve or replace manhole	
SAN S 05330	NA	Algona St & Dexter St	Brick manhole	Improve or replace manhole	
SAN S 05374	NA	Decorah St & N Algona St	Brick manhole	Improve or replace manhole	
SAN S 05380	1425	Adair St	Brick manhole	Improve or replace manhole	

6.0 Sanitary Sewer Priority Grading System

A sanitary sewer priority grading system offers the City a proactive approach to eliminating sanitary sewer overflows (SSOs). The system allows City staff to pinpoint areas within the gravity sanitary sewer pipes that need a more thorough investigation due to the critical nature of the location, physical attributes of a pipe section, the structural integrity of the pipe, and operation and maintenance needs of the pipe.

The general formulas in the priority grading system are listed below and explained further in this section:

- Priority Grade = Criticality Grade & Condition Grade
- Where,
 - Criticality Grade = Probability of Failure & Consequence of Failure and
 - Condition Grade = Structural Grade & Operations and Maintenance Grade

The EPA report “Rehabilitation of Wastewater Collection and Water Distribution Systems” (May 2009) states that the major issues leading to sanitary sewer blockages and overflows include, “cracks, internal corrosion, grease build-up (plus grit and debris), root intrusion, joint misalignment separation and leakage, excessive pipe deflection, lateral connection/leakage, grade and alignment.” Establishing priority grades ensures that the City’s resources are being used to maintain and/or rehabilitate the more critical areas within the system first and allow time to develop a schedule to investigate the less critical areas at a later date.

6.1 CRITICALITY GRADE

The criticality grade is split into two categories: “Probability of Failure” and “Consequence of Failure.” Specific analysis is performed on each category before they are combined into the criticality grade. Eleven factors are divided among the Probability and Consequence categories:

1. Material
2. Age
3. Pipe slope
4. Maintenance
5. Proximity of the pipe to a recorded SSO
6. Pre-defined road capacity levels
7. Priority locations within the City
8. Proximity of the pipe to rivers and water bodies
9. Proximity of the pipe to railroad tracks

10. Pipe diameter
11. Pipe is located under a building.

Probability of failure factors focus on the physical condition of the pipe while consequence of failure factors focus on the impact a pipe failure will have on the surrounding area. The probability of failure and consequence of failure grades were determined using a weighted percent of the factor grades. The weighted percent allows the City to determine the emphasis placed on each criticality factor. By separating the factors into two categories (Table 6-1 and Table 6-2), the weighted percent has a greater effect than if the factors were combined.

Table 6-1. Weighted percent values for the Probability of Failure factors.

Probability of Failure	
Criticality Factor	Weighted Percentage
Material	25
Age	26
Slope	10
Maintenance	20
Proximity to SSO	19
Sum	100

Table 6-2. Weighted percent values for the Consequence of Failure factors.

Consequence of Failure	
Criticality Factor	Weighted Percentage
Road Capacity Levels	18
Priority Location	16
Proximity to Water	15
Proximity to Railroad	10
Diameter	22
Pipe Under Building	19
Sum	100

City staff developed a color matrix to determine an overall criticality grade (Figure 6-1) for each pipe. The color matrix is based off of the color matrix from the Pierce County, Washington Sewer Utility Asset Management Implementation Criticality Model. Each pipe was assigned a grade for the eleven factors mentioned above ranging from 0 to 10 – the higher the grade, the more critical the pipe is to the system. Probability of failure was assigned a greater emphasis because the City wants to locate pipes with the greatest risk of failure due to the pipe’s physical features. The grades associated with the color matrix are as follows:

- Red = 5
- Orange = 4
- Yellow = 3
- Blue = 2
- Green = 1.

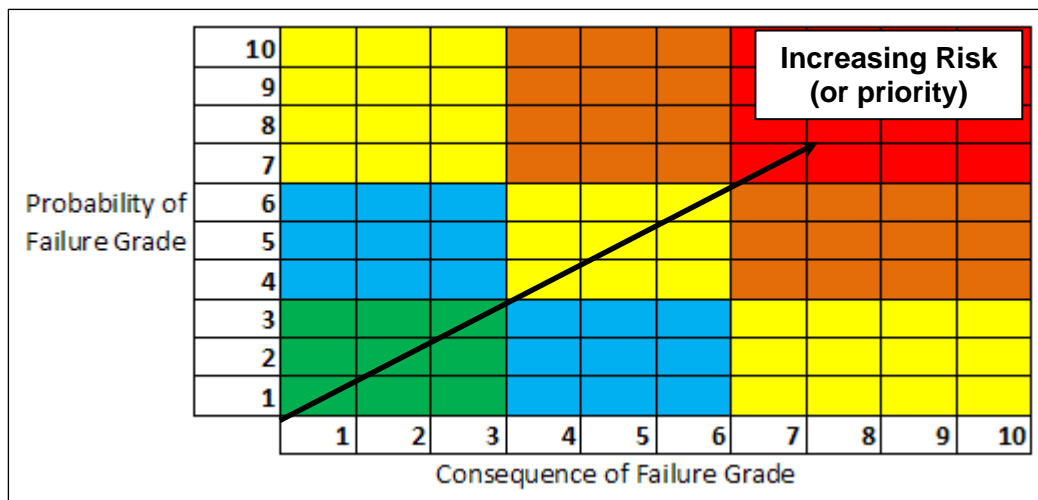


Figure 6-1. Criticality grade color matrix.

6.2 CONDITION GRADE

The condition grade of a pipe is determined using structural and operation and maintenance (O&M) grades acquired by closed circuit television (CCTV) evaluation of the pipe. As a pipe is televised, City staff uses the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) to code the pipe. Any structural and O&M deficiencies in the pipe are noted by certified PACP operators. Since 2010, the condition coding for any pipe recorded by CCTV is automatically done by PipeTech® software which uses the PACP condition grading system matrix. Any video completed prior to 2010 was coded manually using the PACP condition grading matrix.

The PACP grading system code matrix can be found in the NASSCO PACP manual and ranges from 0 to 5. A grade of 0 means there is no structural or O&M deficiency noted for the pipe. The condition grade is the maximum of the structural and O&M grades assigned to the pipe.

6.3 PRIORITY GRADE

The priority grade is the final grade for the pipe and determines the order in which the pipes should be investigated further. These investigations include but are not limited to further observation of the pipe, repairs, or replacement.

The priority grade is dependent on both the condition grade and the criticality grade. The condition grade has been assigned greater emphasis than the criticality grade because the condition of the pipe provides more information on if the pipe is likely to fail due to structural issues. The pipe priority grade follows the recommendation in “Guidelines for Condition Assessment and Rehabilitation of Large Sewers” paper published in 2001 by the National Research Council of Canada and is shown in a color matrix (Figure 6-2). The colors in the color matrix indicate rehabilitation priority:

Red = Immediate
 Orange = High
 Yellow = Medium
 Blue = Low
 Green = Not Required

CONDITION GRADE	5					
	4					
	3					
	2					
	1					
	0					
		1	2	3	4	5
CRITICALITY GRADE						

Figure 6-2. Priority grade color matrix.

Figure 6-3 shows Sewershed 11 with manhole types and the priority grades identified.

6.4 CORRECTIVE ACTIONS

The City will improve or replace pipes with priority grades of four and five. This follows the recommendation set forth by the National Research Council of Canada in “Guidelines for Condition Assessment and Rehabilitation of Large Sewers” (2001, Table 6-3). Eleven of the 28 priority grade four pipes are ranked as such due to pipe sags or bends. Since these conditions do not necessarily cause I&I, these pipes are excluded from Table 6-4 as City staff investigates if these pipes warrant improvement or replacement.

Table 6-3. Guidelines for condition assessment and rehabilitation for Sewershed 11.

Rehabilitation and Maintenance Decisions						
Final Grade	Condition	Criticality	Count	Implication	Rehab Priority	Time of Next Inspection (yr)
1	0 or 1	5	0	Good or Excellent Condition	Not Required	10
1		1-4	141		Not Required	15-25
2	2	5	0	Fair Condition, Minimal Structural Risk	Low	5
2		1-4	57		Low	10-15
3	3	5	0	Poor Condition, Moderate Risk	Medium	3
2		1-4	41		Low	5-10
5	4	5	0	Very Poor Condition, High Structural Risk	Immediate	0
4		1-4	28		High	2-6
5	5	1-5	12	Failed or Imminent Failure	Immediate	0

Table 6-4 and Table 6-5 list the priority grade four and five pipes that have been identified for improvement or replacement. The City will begin improvement or replacement of the grade five pipes during 2012 and will continue with grade four pipes as needed until June 30, 2016. The cost to complete this work is approximately \$145,000.

Sanitary Sewershed 11

Priority Grades and Brick Manholes (Figure 6-3)

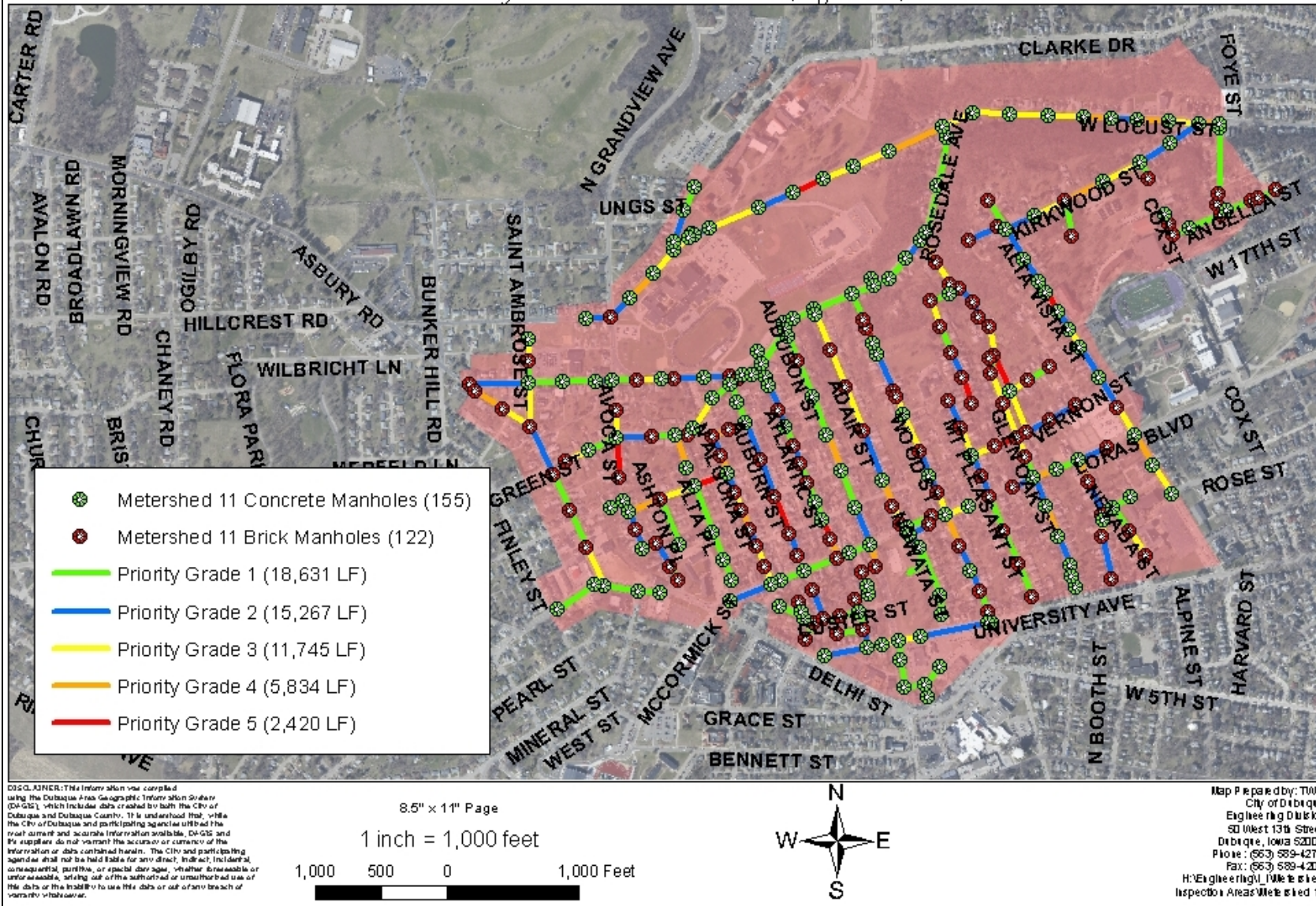


Figure 6-3. Priority grades and brick manholes.

Table 6-4. Grade 4 pipes identified for improvement or replacement.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
SAN P 04919	NA	W Locust St	Sag @ 191.3; long. crack @285.2; sag @295.6, 314.4; joint offset @343.4; sag @436.2	Install pipe liner or replace a portion of the pipe	
SAN P 05558	NA	N Booth St	Sag @15.5; circumferential crack @27.5; sag @39.8, 59.6, 82.0, 118.8	Install pipe liner or replace a portion of the pipe	
SAN P 05097	NA	W Locust St	Sag and joint offset in pipe @ 133.0	Install pipe liner or replace a portion of the pipe	
SAN P 05101	NA	W Locust St	Sag in pipe @ 28.9; 69.3(questionable); hole @173.8 (plugged, ok?)	Install pipe liner or replace a portion of the pipe	
SAN P 05112	NA	Glen Oak St	Circumferential crack @22.0, 37.0 (not id'd on TV); sag @45.9, 125.3	Install pipe liner or replace a portion of the pipe	
SAN P 05513	NA	Glen Oak St	Circumferential crack @32.8; sag @59.5; broken pipe @66.2-70.0; long. crack @124.6	Install pipe liner or replace a portion of the pipe	
SAN P 05319	NA	Adair St	Joint offset @13.4 (not id'd on TV); Heavy shale (15.5-23.9)	Install pipe liner or replace a portion of the pipe	
SAN P 05486	NA	Kirkwood St	Joints leaking with dye 220-223'; 232.4'; joint offset @310.2	Install pipe liner or replace a portion of the pipe	
SAN P 05546	NA	Glen Oak St	Circumferential crack @30.7; chuck out of top of pipe @105.3	Install pipe liner or replace a portion of the pipe	
SAN P 05587	NA	Alley behind 1324 Atlantic St	Longitudinal crack @45.9; sag in pipe @47.7; last 25' of pipe not televised	Install pipe liner or replace a portion of the pipe	
SAN P 05589	NA	N Grandview Ave	Cicumferential crack @13.2; sag @10.0-114.6; 157.9	Install pipe liner or replace a portion of the pipe	
SAN P 05600	NA	Wood St	Hole @43.1; joint gusher @160.3 (not id'd on TV); sag @161.3	Install pipe liner or replace a portion of the pipe	
SAN P 06113	NA	Decorah St	Broken pipe @4.0'; leaking joint @71.8	Install pipe liner or replace a portion of the pipe	
SAN P 06117	NA	Delaware St	Sag in pipe @151.3; holes in pipe @155.5 (3 to 5 and 7 to 9)	Install pipe liner or replace a portion of the pipe	
SAN P 06120	NA	Dexter St	Tap/break-in @9.8 (hole near tap); sag in pipe @29.1-62.0, 102.5 (not on TV report)	Install pipe liner or replace a portion of the pipe	
SAN P 06142	NA	Clarke Dr	Sag in pipe @36.4, 178.4, 211.9; leaking joint @234.1	Install pipe liner or replace a portion of the pipe	
SAN P 06127	NA	N Algona St	Cicumferential crack @65.2; shale buildup 70-88', 90-110'; sag @140-150	Install pipe liner or replace a portion of the pipe	

Table 6-5. Grade 5 pipes identified for improvement or replacement.

GIS ID	House Number	Street	Defect	Corrective Action	Completed?
SAN P 05571	NA	Wood St	Broken pipe @23.1; cracked pipe @40.2; broken pipe @58.5; broken pipe @62.2 (into brick MH)	Install pipe liner or replace a portion of the pipe	
SAN P 05516	NA	Glen Oak St	Broken pipe @ 75.0 (replace 16')	Install pipe liner or replace a portion of the pipe	
SAN P 05496	NA	Alta Vista St	Joints gushing @136.8, 139.5, 142.2, 143.1, 144.3,145.9,148.1	Install pipe liner or replace a portion of the pipe	
SAN P 05525	NA	Glen Oak St	Pipe located under 4 buildings; pipe broken @ 76.1 (north edge of house at 1191 Edina)	Install pipe liner or replace a portion of the pipe	
SAN P 05532	NA	Lawndale St	Hole in pipe @57.7; hole in pipe @ 60.5	Install pipe liner or replace a portion of the pipe	
SAN P 05572	NA	Wood St	Broken pipe @23.5	Install pipe liner or replace a portion of the pipe	
SAN P 06071	NA	W Locust St	Broken pipe @147.7	Install pipe liner or replace a portion of the pipe	
SAN P 06130	NA	Delaware St	Hole in pipe @84.4	Install pipe liner or replace a portion of the pipe	
SAN P 06136	NA	Atlantic St	Hole in pipe @17.9; hole in pipe @ 41.0	Install pipe liner or replace a portion of the pipe	
SAN P 06174	NA	Auburn St	Hole in pipe @63.8; shale & debris @ 107.6,135.4,146.8,165.8,185.1; shale obstruction @188.0	Install pipe liner or replace a portion of the pipe	
SAN P 06183	NA	Avon St	Broken pipe @8.0	Install pipe liner or replace a portion of the pipe	

7.0 Campus Investigations

7.1 SEWERSHED 11 CAMPUSES

City staff conducted detailed I&I investigations at five large campuses within Sewershed 11: Senior High School, Clarke University, Loras College, Nativity Church and School, and St. Anthony's Church and School. City staff met with campus staff, reviewed utility plans, and conducted dye and smoke testing on each campus. In the end, Senior High School, Clarke University, and St. Anthony's Church and School campuses were found to have improper connections.

7.2 CORRECTIVE ACTIONS

7.2.1 Clarke University

The improper connection at Clarke University was found during smoke testing and will be corrected by the university using the process explained for the private property inspections.

7.2.2 St. Anthony's Church and School

Two downspouts were connected to the sanitary sewer at St. Anthony Church and School. These have been corrected using the process explained for private property inspections.

7.2.3 Senior High School

During June 2011, City staff walked the Senior High School campus with school district staff and used dye and smoke testing to observe flow directions of the sanitary and storm sewer pipes. The inspectors observed:

- 1) Roof drains improperly connected to the City's sanitary sewer system;
- 2) Sanitary laterals in West Locust Street that are directed to the Senior campus but appear to be abandoned; and
- 3) Pavement and sidewalk cracks and joints that provide an indirect connection of rainfall into the sanitary system (infiltration).

The City requested the school district to submit a work plan further to investigate, identify, and recommend corrective actions for improper connections at Senior High School (Appendix B). The school district promptly responded by engaging an engineering consultant and conducting their own dye testing. As the school district located improper connections, they were immediately corrected. A summary letter from the school district's engineering consultant is provided in Appendix C.

The City conducted smoke testing on November 1, 2011 to verify all work had been properly completed. Unfortunately, City and school district staff continued to observe smoke from roof

drains and pavement cracks. The City issued a second letter (Appendix D) to request that the school district correct the defects observed on November 1, 2011.

8.0 Plan Summary

This plan fully addresses work to be conducted by the City and private property owners within Sewershed 11. The plan is subject to approval by the US EPA and Iowa DNR.

8.1 FUNDING

The Capital Improvement Program (CIP) Budget represents the City of Dubuque's five year physical development effort, attempts to address a variety of needs, which the City must meet if it is to maintain its physical facilities, meet its service commitments and provide for its future development. The CIP Budget reflects the City's comprehensive plan and the goals and priorities established by the City Council. The first year of the five-year CIP Budget goes into the budget for the next year and deserves the most attention. The CIP Budget is updated each year so that City Council has the opportunity to change the next four years and add a new year.

At this time, the CIP Budget is sufficient to fund the corrective actions identified in this plan. However, the City reserves the right to adjust or remove corrective actions from this plan based upon funding, further investigation, and future I&I-related priorities in other sewersheds.

8.2 CORRECTIVE ACTION SUMMARY

The City employed numerous methods to investigate sources of I&I: private property inspections; smoke testing the sanitary sewer collection system; brick manhole identification; sanitary sewer pipe prioritization; and "campus" inspections. Sections 3 through 7 of this plan detailed the proposed corrective actions based upon each investigation method. Table 8-1 lists all of the corrective actions identified in this plan in one table. The total cost to the City for all proposed corrective actions is approximately \$806,000.

Table 8-1. Summary of corrective actions identified for Sewershed 11.

	GIS ID	House Number	Street	Defect	Corrective Action	Complete?
Private Property Inspections	353620	1350	Nowata St	Exterior drain to sanitary sewer	Constructed enclosure around stairway	Yes
	335523	1775	Alta Pl	Exterior drain to sanitary sewer	Constructed enclosure around stairway	Yes
	358381	2010	Alta Vista St	Roof drain to sanitary sewer	Disconnected from sanitary sewer	Yes
	340790	875	W Locust St	Sump pump discharges to sanitary sewer	New sump pit installed to separate storm and sanitary	Yes
	335405	2340	Green St	Sump pump discharges to sanitary sewer	New sump pit installed to separate storm and sanitary	Yes
	335404	2360	Green St	Sump pump discharges to sanitary sewer	New sump pit installed to separate storm and sanitary	Yes
	353600	1340	Auburn St	Sump pit without pump	Pump installed in sump pit and plumbed properly	Yes
	332904	1365	Loras Blvd	Sump pit without pump	Pump installed in sump pit and plumbed properly	Yes
	324692	1818	Asbury Rd	Sump pit without pump	Pump installed in sump pit and plumbed properly	Yes
	321778	1511	Adair St	Roof drain to sanitary sewer	Roof drain disconnected from sanitary sewer	Yes
	332894	1586	Wood St	Roof drain to sanitary sewer	Roof drain disconnected from sanitary sewer	Yes
	320500	1870	St Ambrose St	Roof drain to sanitary sewer	Roof drain disconnected from sanitary sewer	Yes
	357918	1340	Wood St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
	353587	1451	Atlantic St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
	356767	1670	N Grandview Ave	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
	335505	1845	Atlantic St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
	331782	1885	Wood St	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
	341949	2386	University Ave	Sump pump discharges to sanitary sewer	Sump pit disconnected from sanitary sewer	Yes
	340944	770	Angella St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	358385	895	Kirkwood Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	318957	1050	Loras Blvd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	335432	1085	Wood St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	358325	1111	Rosedale Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	332384	1205	N Booth St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	357923	1212	Wood St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	356793	1458	Mt Pleasant St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	356803	1480	Glen Oak St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	342248	1490	N Grandview Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	343593	1580	Ashton Pl	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	356658	1610	Ashton Pl	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	332653	1645	Atlantic St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	333159	1665	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	353591	1693	Loras Blvd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	333157	1695	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	338756	1715	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	338763	1726	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	335515	1730	Avoca St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	331788	1755	Wood St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	315480	1800	Lawndale St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	331765	1810	Adair St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	320494	1845	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	324689	1850	Asbury Rd	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	324686	1855	Clarke Dr	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	324688	1860	St Ambrose St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	338791	1921	N Grandview Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	319187	1985	N Grandview Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	319182	2175	Rosedale Ave	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	335384	2215	Green St	Sump pump discharges through flexible hose	Sump pump discharges through rigid pipe	Yes
	358305	1049	W Locust St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	336589	1065	Auburn St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	357922	1222	Wood St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	331425	1275	Mt Pleasant St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
	332906	1325	Loras Blvd	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
	318969	1339	Alta Vista St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
	353599	1380	Auburn St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	353606	1392	Atlantic St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
	331365	1435	Mt Pleasant St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	335437	1475	University Ave	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	335436	1485	University Ave	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	331362	1491	Mt Pleasant St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
	342277	1528	Mt Pleasant St	Roof drain to sanitary sewer; sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	332667	1540	N Algona St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	

	GIS ID	House Number	Street	Defect	Corrective Action	Complete?
	345563	1640	Lawndale St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
	356655	1660	Ashton Pl	Sump pit without pump	Corrective action to be completed by property owner	
	338781	1671	Avoca St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
	353592	1675	Loras Blvd	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	356643	1715	Atlantic St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	356763	1795	Adair St	Exterior drain to sanitary sewer	Corrective action to be completed by property owner	
	343914	1795	Auburn St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
	357892	1815	Loras Blvd	Sump pit without pump	Corrective action to be completed by property owner	
	325932	1885	St Ambrose St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	340687	1911	St Ambrose St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
	340681	1983	St Ambrose St	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
	344813	1985	Alta Vista St	Roof drain to sanitary sewer	Corrective action to be completed by property owner	
	335528	2025	Delaware St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	319171	2033	Clarke Dr	Sump pit without pump	Corrective action to be completed by property owner	
	323944	2215	University Ave	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	324693	2275	Green St	Sump pump discharges through flexible hose	Corrective action to be completed by property owner	
	341948	2396	University Ave	Sump pump discharges to sanitary sewer	Corrective action to be completed by property owner	
Smoke Testing - Private Property Defects	NA	1744	N Grandview Ave	Smoke from Water Access	Televise lateral; notify property owner of any necessary repair	
	NA	1669	Adair St	Smoke from Behind Curb	Televise lateral; notify property owner of any necessary repair	
	NA	1450	Wood St	Severed Sanitary Cleanout	Property owner repair with water tight seal	
	NA	1951	Loras Blvd	Smoke from ground near gas meter	Televise lateral; notify property owner of any necessary repair	
	NA	1280	Glen Oak St	Smoke from ground and water access	Televise lateral; notify property owner of any necessary repair	
	NA	800	W Locust St	Smoke from water valve at corner of stairs and sidewalk	Televise lateral; notify property owner of any necessary repair	
	NA	1537	Irving St	Smoke from buffer strip between sidewalk and back of curb	Televise lateral; notify property owner of any necessary repair	
	NA	1890	Audubon St	Smoke from retaining wall, steps and concrete in front of house	Televise lateral; notify property owner of any necessary repair	
	NA	990	Booth St	Smoke from water valve across street	Televise lateral; notify property owner of any necessary repair	
	NA	1871	Glen Oak St	Smoke from driveway	Property owner to disconnect driveway drain	
	NA	1575	Irving St	Smoke from rocks near driveway	Televise lateral; notify property owner of any necessary repair	
	NA	1671	Avoca St	Smoke from rear downspout	Property owner disconnect downspout from sanitary sewer	
	NA	1660	Ashton Pl	Smoke from shut-off valve	Televise lateral; notify property owner of any necessary repair	
	NA	1657	Ashton Pl	Smoke from sidewalk/valve	Televise lateral; notify property owner of any necessary repair	
	NA	1905	Loras Blvd	Smoke from rear door	Televise lateral; notify property owner of any necessary repair	
	NA	1065	Auburn St	Smoke from crack near driveway	Property owner to disconnect driveway drain	
	NA	1339	Mt. Pleasant St	Smoke from valve	Property owner to install water tight cap	
	NA	730	Kirkwood St	Smoke from ground behind curb	Televise lateral; notify property owner of any necessary repair	
	NA	1985	Clarke Dr	Smoke from hole in ground by down spout	Property owner disconnect downspout from sanitary sewer	
	NA	1550	Clarke Dr	Smoke from hole in ground	Property owner to install water tight cap	
	NA	1570	Mt. Pleasant St	Smoke from uneven curb	Televise lateral; notify property owner of any necessary repair	
	NA	1556	Mt. Pleasant St	Smoke from driveway drain	Property owner to disconnect driveway drain	
	NA	1350	Nowata St	Smoke from stairway drain	Action complete; awning installed to prevent rain from entering drain	Yes
	NA	1200	Glen Oak St	Smoke by water shut-off	Televise lateral; notify property owner of any necessary repair	
	NA	615	Angella St	Smoke by water shut-off	Lateral was televised by licensed plumber; no corrective action needed	Yes
	NA	1065	Auburn St	Smoke from MH/cistern in front yard	Property owner repair	
	NA	1800	Clarke Dr (SHS softball field)	Smoke from ground near MH	Property owner repair	
Smoke Testing - Sanitary Sewer Defects	SAN P 05590	1302	Atlantic Street	Smoke from Ground; longitudinal crack in pipe	Improve or replace pipe	
	SAN S 05395	1537	Irving St	Vented MH Cover	Replace cover	
	SAN S 05385	NA	Irving St & Decorah St	Smoke at MH Diamond	Improve or replace manhole	
	SAN S 05381	NA	Loras Blvd & Nowata St	Vented MH Cover	Replace cover	
	SAN S 06848	1419	Loras Blvd	Smoke from ground around MH, Vented Cover	Improve or replace manhole	
	SAN S 05574	1871	Glen Oak St	Smoke from ground around MH	Improve or replace manhole	
	SAN S 05580	NA	Woods N of Lawndale St	Smoke from ground around MH	Improve or replace manhole	
	SAN S 05348	NA	St. Ambrose St & Rosedale Ave	Smoke around MH	Improve or replace manhole	
	SAN S 05409	NA	Custer St & Atlantic St	Smoke around MH	Improve or replace manhole	
	SAN S 05394	1324	N Grandview Ave	Smoke from MH, driveway and curb	Improve or replace manhole	
	SAN S 05657	NA	Martha St and Nevada St	Smoke around MH and catch basin at SE Corner of Intersection	Improve or replace pipe to northeast (SAN P 05553)	
	SAN S 06789	1881	Glen Oak St	Manhole in low spot in front yard	Improve or replace manhole	
	SAN S 05578	1871	Glen Oak St	Smoke from Ground near MH	Improve or replace manhole	
	SAN S 05436	NA	W Locust St & Clarke Dr	Smoke from crack in pavement	Improve or replace pipe (Grade 4 pipe, SAN P 06063)	
	SAN S 04703	1234	Rosedale Ave	Smoke from MH in yard	Improve or replace manhole	
	SAN S 05320 or 05395	2155	University	Vented MH Cover	Replace cover	
	SAN P 05622	1340	Auburn St	Multiple fractures, hole, lateral intruding	Improve or replace pipe	
	SAN P 05621	1880	Custer St	Multiple fractures, hole in pipe	Improve or replace pipe	
	SAN P 05619	1790	Custer St	Multiple fractures, joint separated, circumferential crack	Improve or replace pipe	
	SAN P 05615	1784	Custer St	Multiple fractures	Improve or replace pipe	
	SAN P 05620	NA	Custer St	Multiple fractures, longitudinal crack, joint offset	Improve or replace pipe	

	GIS ID	House Number	Street	Defect	Corrective Action	Complete?
Smoke Testing Storm Sewer Defects	STO S 04272	1855	Wood St	Smoke from catch basin	Flood & dye storm sewer; televise sanitary; improve as needed	
	STO S 04376	995	Nevada St	Smoke from catch basin	Protruding lateral tap; property owner to repair	
	STO S 04340	1871	Glen Oak St	Smoke from catch basin	Possibly lateral from 1825 Glen Oak; property owner to repair	
	STO S 04231	1795	Adair St	Smoke from catch basin	Flood & dye storm sewer; televise sanitary; improve as needed	
	STO S 04310	NA	Delaware St & Grandview Ave	Smoke from catch basin	Flood & dye storm sewer; televise sanitary; improve as needed	
Brick Manholes	SAN S 04710	1893	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05394	1321	N Grandview Ave	Brick manhole	Improve or replace manhole	
	SAN S 05580	1800	Lawndale St	Brick manhole	Improve or replace manhole	
	SAN S 05751	1939	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05610	1675	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05385	NA	Decorah St & Irving St	Brick manhole	Improve or replace manhole	
	SAN S 05344	1911	N Grandview Ave	Brick manhole	Improve or replace manhole	
	SAN S 05601	1700	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05331	NA	Atlantic St & Delaware St	Brick manhole	Improve or replace manhole	
	SAN S 05585	1800	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05391	1445	Auburn St	Brick manhole	Improve or replace manhole	
	SAN S 05383	NA	Fillmore St & Auburn St	Brick manhole	Improve or replace manhole	
	SAN S 05341	1845	Avoca St	Brick manhole	Improve or replace manhole	
	SAN S 05626	1045	Vernon St	Brick manhole	Improve or replace manhole	
	SAN S 05653	1210	Loras Blvd	Brick manhole	Improve or replace manhole	
	SAN S 05367	NA	Decorah St & Auburn St	Brick manhole	Improve or replace manhole	
	SAN S 05357	NA	Delaware St & Auburn St	Brick manhole	Improve or replace manhole	
	SAN S 05392	NA	Loras Blvd & Atlantic St	Brick manhole	Improve or replace manhole	
	SAN S 05612	1686	Lawndale St	Brick manhole	Improve or replace manhole	
	SAN S 05379	1633	Avoca St	Brick manhole	Improve or replace manhole	
	SAN S 05730	950	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05628	1450	Alta Vista St	Brick manhole	Improve or replace manhole	
	SAN S 05598	1760	Lawndale St	Brick manhole	Improve or replace manhole	
	SAN S 05624	1608	Lawndale St	Brick manhole	Improve or replace manhole	
	SAN S 07329	NA	Alley behind 1789 Univ Ave	Brick manhole	Improve or replace manhole	
	SAN S 05605	1040	Edina St	Brick manhole	Improve or replace manhole	
	SAN S 05615	1098	Edina St	Brick manhole	Improve or replace manhole	
	SAN S 04720	NA	N Grandview Ave	Brick manhole	Improve or replace manhole	
	SAN S 05574	1871	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05654	1430	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 06789	1881	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05405	1302	Atlantic St	Brick manhole	Improve or replace manhole	
	SAN S 05345	1945	N Grandview St	Brick manhole	Improve or replace manhole	
	SAN S 05384	1460	Atlantic St	Brick manhole	Improve or replace manhole	
	SAN S 05368	NA	Delaware St & Ashton Pl	Brick manhole	Improve or replace manhole	
	SAN S 01947	1795	Asbury Rd	Brick manhole	Improve or replace manhole	
	SAN S 07012	NA	N Booth St & Martha St	Brick manhole	Improve or replace manhole	
	SAN S 06848	1419	Loras Blvd	Brick manhole	Improve or replace manhole	
	SAN S 05458	NA	Clarke Dr & N Grandview Ave	Brick manhole	Improve or replace manhole	
	SAN S 05625	1576	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05752	1086	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 04703	1234	Rosedale Ave (on Glen Oak St)	Brick manhole	Improve or replace manhole	
	SAN S 01939	1881	Asbury Rd	Brick manhole	Improve or replace manhole	
	SAN S 05579	NA	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05647	NA	Mt Pleasant St & Loras Blvd	Brick manhole	Improve or replace manhole	
	SAN S 05731	935	Nevada St	Brick manhole	Improve or replace manhole	
	SAN S 05648	1050	Loras Blvd	Brick manhole	Improve or replace manhole	
	SAN S 05833	1550	University Ave (behind building)	Brick manhole	Improve or replace manhole	
	SAN S 05404	NA	Abandoned alley behind 1875 Custer St	Brick manhole	Improve or replace manhole	
	SAN S 05622	1695	Mt Pleasant St	Brick manhole	Improve or replace manhole	
	SAN S 05378	1555	N Algona St	Brick manhole	Improve or replace manhole	
	SAN S 04715	1875	Audobon St	Brick manhole	Improve or replace manhole	
	SAN S 05356	1709	N Algona St	Brick manhole	Improve or replace manhole	
	SAN S 06803	1585	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05387	NA	Fillmore St & Algona St	Brick manhole	Improve or replace manhole	
	SAN S 05355	NA	Dexter St (alley E of Algona St)	Brick manhole	Improve or replace manhole	
	SAN S 04721	NA	N Grandview Ave & Auburn St	Brick manhole	Improve or replace manhole	
	SAN S 05393	1421	N Algona St	Brick manhole	Improve or replace manhole	
	SAN S 05397	NA	Alley behind 1334 Atlantic St	Brick manhole	Improve or replace manhole	
	SAN S 06939	1755	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05366	1650	N Algona St	Brick manhole	Improve or replace manhole	

	GIS ID	House Number	Street	Defect	Corrective Action	Complete?
Brick Manholes	SAN S 05350	2135	Green St	Brick manhole	Improve or replace manhole	
	SAN S 05637	1195	Vernon St	Brick manhole	Improve or replace manhole	
	SAN S 05327	2020	Green St	Brick manhole	Improve or replace manhole	
	SAN S 05541	615	Angella St	Brick manhole	Improve or replace manhole	
	SAN S 05544	1819	Pierce St	Brick manhole	Improve or replace manhole	
	SAN S 05536	595	Angella St	Brick manhole	Improve or replace manhole	
	SAN S 05464	1893	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05549	NA	Angella St & Pierce St	Brick manhole	Improve or replace manhole	
	SAN S 05539	1903	Pierce St	Brick manhole	Improve or replace manhole	
	SAN S 05560	NA	Loras property near Kirkwood & Blake Sts	Brick manhole	Improve or replace manhole	
	SAN S 05640	NA	Vernon St & Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05559	NA	Cox St & Angella St	Brick manhole	Improve or replace manhole	
	SAN S 05540	601	Angella St	Brick manhole	Improve or replace manhole	
	SAN S 05642	1265	Vernon St	Brick manhole	Improve or replace manhole	
	SAN S 05411	1790	Custer St	Brick manhole	Improve or replace manhole	
	SAN S 05562	1037	Kirkwood St	Brick manhole	Improve or replace manhole	
	SAN S 05553	NA	Kirkwood St	Brick manhole	Improve or replace manhole	
	SAN S 05402	1375	Auburn St	Brick manhole	Improve or replace manhole	
	SAN S 05415	NA	Auburn St (alley between Custer & Univ)	Brick manhole	Improve or replace manhole	
	SAN S 05724	1081	N Booth St	Brick manhole	Improve or replace manhole	
	SAN S 05364	NA	Decorah St & Atlantic St	Brick manhole	Improve or replace manhole	
	SAN S 05413	NA	Atlantic St (alley between Custer & Univ)	Brick manhole	Improve or replace manhole	
	SAN S 05359	1645	Atlantic St	Brick manhole	Improve or replace manhole	
	SAN S 05543	890	Kirkwood St	Brick manhole	Improve or replace manhole	
	SAN S 05652	1380	N Booth St	Brick manhole	Improve or replace manhole	
	SAN S 05725	935	N Booth St	Brick manhole	Improve or replace manhole	
	SAN S 05721	1319	Mt Pleasant St	Brick manhole	Improve or replace manhole	
	SAN S 05722	1145	Mt Pleasant St	Brick manhole	Improve or replace manhole	
	SAN S 01941	1850	N Grandview Ave	Brick manhole	Improve or replace manhole	
	SAN S 05646	1435	Mt Pleasant St	Brick manhole	Improve or replace manhole	
	SAN S 05723	940	Mt Pleasant St	Brick manhole	Improve or replace manhole	
	SAN S 06961	1445	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 05335	1775	Wood St	Brick manhole	Improve or replace manhole	
	SAN S 01782	1715	Asbury Rd	Brick manhole	Improve or replace manhole	
	SAN S 05319	1655	Asbury Rd	Brick manhole	Improve or replace manhole	
	SAN S 05636	1555	Mt Pleasant St	Brick manhole	Improve or replace manhole	
	SAN S 05343	1937	St Ambrose St	Brick manhole	Improve or replace manhole	
	SAN S 05336	1905	Asbury Rd	Brick manhole	Improve or replace manhole	
	SAN S 07363	1925	Pierce St	Brick manhole	Improve or replace manhole	
	SAN S 05320	1535	Irving St	Brick manhole	Improve or replace manhole	
	SAN S 05395	1537	Irving St	Brick manhole	Improve or replace manhole	
	SAN S 05534	1978	Cox St	Brick manhole	Improve or replace manhole	
	SAN S 07013	1715	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 05732	995	Nevada St	Brick manhole	Improve or replace manhole	
	SAN S 05412	1060	Auburn St (at Custer St)	Brick manhole	Improve or replace manhole	
	SAN S 05589	1790	Glen Oak St	Brick manhole	Improve or replace manhole	
	SAN S 07328	1760	Custer St	Brick manhole	Improve or replace manhole	
	SAN S 05362	1735	Avoca St	Brick manhole	Improve or replace manhole	
	SAN S 05634	1100	Vernon St	Brick manhole	Improve or replace manhole	
	SAN S 05340	NA	Atlantic St & Dexter St	Brick manhole	Improve or replace manhole	
	SAN S 05334	1795	Adair St	Brick manhole	Improve or replace manhole	
	SAN S 05326	1669	Adair St	Brick manhole	Improve or replace manhole	
	SAN S 05372	1475	Adair St	Brick manhole	Improve or replace manhole	
	SAN S 05588	1799	Lawndale St	Brick manhole	Improve or replace manhole	
	SAN S 05421	1420	Loras Blvd	Brick manhole	Improve or replace manhole	
	SAN S 04711	1865	Adair St	Brick manhole	Improve or replace manhole	
	SAN S 05349	1910	Asbury Rd	Brick manhole	Improve or replace manhole	
	SAN S 05330	NA	Algona St & Dexter St	Brick manhole	Improve or replace manhole	
	SAN S 05374	NA	Decorah St & N Algona St	Brick manhole	Improve or replace manhole	
	SAN S 05380	1425	Adair St	Brick manhole	Improve or replace manhole	

	GIS ID	House Number	Street	Defect	Corrective Action	Complete?
Sanitary Sewer Priority System - Grade 4 Pipes	SAN P 04919	NA	W Locust St	Sag @ 191.3; long. crack @285.2; sag @295.6, 314.4; joint offset @343.4; sag @436.2	Improve or replace a portion of the pipe	
	SAN P 05558	NA	N Booth St	Sag @15.5; circumferential crack @27.5; sag @39.8, 59.6, 82.0, 118.8	Improve or replace a portion of the pipe	
	SAN P 05097	NA	W Locust St	Sag and joint offset in pipe @ 133.0	Improve or replace a portion of the pipe	
	SAN P 05101	NA	W Locust St	Sag in pipe @ 28.9; 69.3(questionable); hole @173.8 (plugged, ok?)	Improve or replace a portion of the pipe	
	SAN P 05112	NA	Glen Oak St	Circumferential crack @22.0, 37.0 (not id'd on TV); sag @45.9, 125.3	Improve or replace a portion of the pipe	
	SAN P 05513	NA	Glen Oak St	Circumferential crack @32.8; sag @59.5; broken pipe @66.2-70.0; long. crack @124.6	Improve or replace a portion of the pipe	
	SAN P 05319	NA	Adair St	Joint offset @13.4 (not id'd on TV); Heavy shale (15.5-23.9)	Improve or replace a portion of the pipe	
	SAN P 05486	NA	Kirkwood St	Joints leaking with dye 220-223', 232.4'; joint offset @310.2	Improve or replace a portion of the pipe	
	SAN P 05546	NA	Glen Oak St	Circumferential crack @30.7; chuck out of top of pipe @105.3	Improve or replace a portion of the pipe	
	SAN P 05587	NA	Alley behind 1324 Atlantic St	Longitudinal crack @45.9; sag in pipe @47.7; last 25' of pipe not televised	Improve or replace a portion of the pipe	
	SAN P 05589	NA	N Grandview Ave	Cicumferential crack @13.2; sag @10.0-114.6; 157.9	Improve or replace a portion of the pipe	
	SAN P 05600	NA	Wood St	Hole @43.1; joint gusher @160.3 (not id'd on TV); sag @161.3	Improve or replace a portion of the pipe	
	SAN P 06113	NA	Decorah St	Broken pipe @4.0'; leaking joint @71.8	Improve or replace a portion of the pipe	
	SAN P 06117	NA	Delaware St	Sag in pipe @151.3; holes in pipe @155.5 (3 to 5 and 7 to 9)	Improve or replace a portion of the pipe	
	SAN P 06120	NA	Dexter St	Tap/break-in @9.8 (hole near tap); sag in pipe @29.1-62.0, 102.5 (not on TV report)	Improve or replace a portion of the pipe	
Sanitary Sewer Priority System - Grade 5 Pipes	SAN P 06142	NA	Clarke Dr	Sag in pipe @36.4, 178.4, 211.9; leaking joint @234.1	Improve or replace a portion of the pipe	
	SAN P 06127	NA	N Algona St	Cicumferential crack @65.2; shale buildup 70-88', 90-110'; sag @140-150	Improve or replace a portion of the pipe	
	SAN P 05571	NA	Wood St	Broken pipe @23.1; cracked pipe @40.2; broken pipe @58.5; broken pipe @62.2 (into brick MH)	Improve or replace a portion of the pipe	
	SAN P 05516	NA	Glen Oak St	Broken pipe @ 75.0 (replace 16')	Improve or replace a portion of the pipe	
	SAN P 05496	NA	Alta Vista St	Joints gushing @136.8, 139.5, 142.2, 143.1, 144.3,145.9,148.1	Improve or replace a portion of the pipe	
	SAN P 05525	NA	Glen Oak St	Pipe located under 4 buildings; pipe broken @ 76.1 (north edge of house at 1191 Edina)	Improve or replace a portion of the pipe	
	SAN P 05532	NA	Lawndale St	Hole in pipe @57.7; hole in pipe @ 60.5	Improve or replace a portion of the pipe	
	SAN P 05572	NA	Wood St	Broken pipe @23.5	Improve or replace a portion of the pipe	
	SAN P 06071	NA	W Locust St	Broken pipe @147.7	Improve or replace a portion of the pipe	
	SAN P 06130	NA	Delaware St	Hole in pipe @84.4	Improve or replace a portion of the pipe	
	SAN P 06136	NA	Atlantic St	Hole in pipe @17.9; hole in pipe @ 41.0	Improve or replace a portion of the pipe	
	SAN P 06174	NA	Auburn St	Hole in pipe @63.8; shale & debris @ 107.6,135.4,146.8,165.8,185.1; shale obstruction @188.0	Improve or replace a portion of the pipe	
	SAN P 06183	NA	Avon St	Broken pipe @8.0	Improve or replace a portion of the pipe	

Appendix A



FINANCIAL ASSISTANCE APPLICATION

(Rev. 12/6/11)

Program Eligibility and Requirements:

1. Applicant must be the owner and resident of the property where code violation occurred.
2. All applicants are eligible for 50% assistance on repairs greater than \$500. The maximum amount of City assistance is \$3,000 unless the applicant qualifies for income-based assistance described below.
3. City assistance amounts greater than \$1,000 will be 3-year forgivable loans. The City assistance amount shall be due upon the sale of the property if the owner-occupant sells the property within 3 years of financial assistance application approval. The assistance amount will not be prorated.
4. Applicant must obtain cost estimates from three licensed contractors, and all three estimates must be greater than \$500. (Applicant is responsible for paying the first \$500.)
5. The City retains the right to solicit additional cost estimates if it deems the cost estimates obtained by the property owner excessive.
6. The three cost estimates must be itemized and accompany this application form. Work not related to the code violation is not applicable. The City may exclude work if it is not related to code repairs.
7. Applicant may choose any of the three contractors but will be reimbursed based on the lowest of the three cost estimates.
8. Reimbursement will occur after:
 - a. Work is completed per City Code,
 - b. Work is re-inspected and deemed satisfactory by the City of Dubuque. (We suggest having the re-inspection done by the City prior to final payment to the contractor.)
9. Additional assistance is available based on U.S. Department of Housing and Community Development income guidelines. The assistance percentage (75%, 50%, or 25%) is in addition to the 50% assistance amount offered to all applicants. See attached "Participant Income Verification Form."
10. Funding examples:

Lowest Cost Estimate*	Amount Not Subject to Cost Share	Amount Subject to Cost Share	50% City Cost Share	Income-Based Assistance Percentage	Income-Based City Cost Share Amount	Total Cost to Applicant
\$4,500	\$500	\$4,000	\$2,000	0%	\$0	\$4,500 - \$2,000 \$2,500
\$4,500	\$500	\$4,000	\$2,000	25%	\$500	\$4,500 - \$2,000 - \$500 \$2,000
\$4,500	\$500	\$4,000	\$2,000	50%	\$1,000	\$4,500 - \$2,000 - \$1,000 \$1,500
\$4,500	\$500	\$4,000	\$2,000	75%	\$1,500	\$4,500 - \$2,000 - \$1,500 \$1,000

* For all eligible costs, as determined by the City

11. If the City finds the work was not done correctly and a violation remains, the City of Dubuque assumes no responsibility.
12. The City retains the right to review each application thoroughly. Improper connections or connections to the sanitary sewer system made without a City permit may not be eligible for financial assistance.
13. The City retains the right to rescind this assistance at any time for good cause including funding availability.

Applicant – Please Complete This Page

Please complete fully and accurately, attach a copies of all income verification information and cost estimates and submit to:

Office of City Engineering
ATTN: Todd Shoemaker, Environmental Engineer
50 W. 13th Street
Dubuque, Iowa 52001-4864
Phone (563) 589-4270.

Name of Property Owner: _____ Phone #: _____

Property Address: _____

City: _____ State: _____ Zip: _____

Today's Date: _____ Signature: _____

Cost Estimates to Correct Violation:

	Amount (\$)	Plumber or Company	License Number
Cost Estimate #1			
Cost Estimate #2			
Cost Estimate #3			

Are you applying for income-based assistance: YES NO

- If you checked "YES" above, please complete this section and the "Participant Income Verification Form".
- Attach a complete copy of the latest Federal income tax statement as submitted to the IRS. Include a copy of W-2 forms.
- If no income tax filing is required, please attach note stating so and show all sources of income you receive such as SOCIAL SECURITY, PENSION, INTEREST, CHILD SUPPORT, etc. attaching a copy of a statement from the source of income for verification.
- If any of your income is through Social Security, the attached release form must be completed and submitted along with this application OR a copy of the SSA-1099.
- Residence Description (check one): Single Family _____ Rental: ____ (# of units) ____
- Number in Household: Under Age 18 ____ Between 18 & 65 __ Over 65 ____
- If unemployed, state source of income: _____

I authorize the City of Dubuque to contact my employer, or source of income, in order to verify my income for purposes of my qualifying for the financial assistance for the Inflow and Infiltration Reduction Program. I hereby certify that the above information is true and correct, and that I reside at the location indicated, and understand that false statements or information are grounds for denial of the assistance.

Signature of Property Owner _____ Home Phone _____ Social Security # _____ Work Phone _____

Signature of Property Owner _____ Home Phone _____ Social Security # _____ Work Phone _____

Unusual circumstance information: _____

PARTICIPANT INCOME VERIFICATION FORM

CITY OF DUBUQUE, IOWA

The U.S. Department of Housing and Community Development (HUD) requires the following information be collected for using this service. This information is confidential and for reporting purposes only. If you have any questions regarding this form, please contact the Housing and Community Development Department at (563) 589-4239.

1. Please **CIRCLE BELOW THE NUMBER OF RELATED PEOPLE LIVING IN YOUR HOUSEHOLD, UNDER FAMILY SIZE.** **On that same line,** to the right of the number you circled, **CIRCLE ONE** of the four ranges that includes the **AMOUNT OF YOUR COMBINED GROSS HOUSEHOLD INCOME (including yourself),** as of the date signed below.

Family Size	Extremely Low Income – 75% Assistance	Very Low Income – 50% Assistance	Low Income – 25% Assistance	Over Income
1	\$0 - \$13,400	\$13,401- \$22,300	\$22,301-\$35,700	Above \$35,700
2	\$0 - \$15,300	\$15,301 - \$25,500	\$25,501-\$40,800	Above \$40,800
3	\$0 - \$17,200	\$17,201 - \$28,700	\$28,701-\$45,900	Above \$45,900
4	\$0 - \$19,100	\$19,101 - \$31,850	\$31,851-\$50,950	Above \$50,950
5	\$0 - \$20,650	\$20,651 - \$34,400	\$34,401-\$55,050	Above \$55,050
6	\$0 - \$22,200	\$22,201 - \$36,950	\$36,951-\$59,150	Above \$59,150
7	\$0 - \$23,700	\$23,701 - \$39,500	\$39,501-\$63,200	Above \$63,200
8 or more	\$0 - \$25,250	\$25,250 - \$42,050	\$42,050-\$67,300	Above \$67,300

2. Are you Hispanic ? Yes ☐ No ☐

3. What is the race of the person you are applying for (*please check one*)?

- | | |
|---|--|
| <input type="checkbox"/> White | <input type="checkbox"/> Asian & White |
| <input type="checkbox"/> Black/African American | <input type="checkbox"/> Black/African American & White |
| <input type="checkbox"/> Asian | <input type="checkbox"/> American Indian/Alaskan Native & Black/African American |
| <input type="checkbox"/> American Indian/Alaskan native | <input type="checkbox"/> Other Multi-Racial |
| <input type="checkbox"/> Native Hawaiian/Other Pacific Islander | <input type="checkbox"/> Asian/Pacific Islander |
| <input type="checkbox"/> American Indian/Alaskan Native & White | <input type="checkbox"/> Hispanic |

4. Is the participant from a home where there is a female head of household?

☐ Yes ☐ No

I certify that the information above is, to the best of my knowledge and belief, true, correct and complete as stated herein. I am aware that the information being provided is subject to verification by the local or Federal government.

Print Name _____ Signature _____

Street Address _____ City, State, Zip Code _____ Telephone Number _____ Date _____

Warning: Whoever knowingly and willingly makes or uses a document or writing containing any false, fictitious or fraudulent statement or entry may be subject to federal prosecution.

This Page For City Use Only

Date of Inspection: _____

Reason for Violation:

- ☐ Roof drain discharges to sanitary sewer.
- ☐ Yard / area drain discharges to sanitary sewer.
- ☐ Exterior stairway or driveway drain discharges to sanitary sewer.
- ☐ Sump pit without pump.
- ☐ Sump pump discharges to sanitary sewer.
- ☐ Sump pump discharges to floor drain.
- ☐ Sump pump discharges through flexible hose to exterior.
- ☐ Seepage collection system (foundation drain) discharges to sanitary sewer.
- ☐ Seepage collection system discharges to floor drain.

Total Repair Cost: _____

50% Assistance: _____

Income-based assistance: _____

Total Assistance Amount: _____

Application Approved: Yes _____ No _____ Amount Approved: \$_____ Date Approved:_____

Appendix B



Engineering Department, I&I Program
City Hall
50 W. 13th Street
Dubuque, Iowa 52001
563.690.6113
www.cityofdubuque.org/i&i



July 15, 2011

Mr. Jim Brimmer
Dubuque Community Schools
2300 Chaney Road
Dubuque, IA 52001-3095

Dear Mr. Brimmer:

The City of Dubuque is conducting an Inflow and Infiltration (I&I) Program to eliminate storm water inflow and groundwater infiltration into Dubuque's sanitary sewer collector system. Excessive I&I can cause sanitary sewer back-ups into basements, overflows into creeks and wetlands, and increased operating costs to process the water at the Dubuque Water Pollution Control Plant. The area surrounding and including Senior High School has been identified as a source of high sanitary sewer flows during rainfall events, which indicates excessive I&I.

Over the past month, City inspectors have walked the Senior campus with your staff and used dye and smoke testing to observe flow directions of the sanitary and storm sewer pipes. The inspectors have observed:

- 1) Numerous roof drains that are improperly connected to the City's sanitary sewer system;
- 2) Numerous sanitary laterals in West Locust Street that are directed to the Senior campus but appear to be abandoned; and
- 3) Pavement and sidewalk cracks and joints that provide an indirect connection of rainfall into the sanitary system (infiltration).

A work plan must be submitted to the City within 30 days of the date of this letter to investigate, identify, and recommend corrective actions for improper connections at the Senior High School and Transportation Center campuses. The investigation and identification tasks of the work plan shall be completed within 60 days of the date of this letter. The recommended corrective actions shall include an estimated completion date. The work plan shall be certified by a licensed engineer in the State of Iowa.

Your help and cooperation in addressing these improper connections is greatly appreciated. If you have any questions regarding the work plan, please call me at (563) 690-6034.

Sincerely,

Todd Shoemaker, PE, CFM
Environmental Engineer

Cc: Gus Psihoyos, City Engineer

Appendix C

October 7, 2011

www.iiwengr.com

Mr. James C. Brimmer
 Manager of Buildings & Grounds
 Dubuque Community Schools
 2300 Chaney Rd.
 Dubuque, IA 52001-3095

**Re: Report of Testing Results, Corrective Improvements and Future Recommendations
 I & I Evaluation at Senior High School
 IIW Project No: 11156-01**

ARCHITECTURE
 CIVIL ENGINEERING
 CONSTRUCTION SERVICES
 ENVIRONMENTAL ENGINEERING
 LAND SURVEYING
 MUNICIPAL ENGINEERING
 STRUCTURAL ENGINEERING
 TRANSPORTATION ENGINEERING

INTRODUCTION

The City of Dubuque Engineering Department is conducting an Inflow and Infiltration (I & I) Program to eliminate storm water inflow and groundwater infiltration into Dubuque's sanitary sewer system. City officials were concerned that the Senior High School campus was the source of excessive inflow and infiltration present in the City's sanitary sewer collection system during rainfall events.

At the request of the Dubuque Community School District, IIW formulated a plan to evaluate the impacts of inflow through cross-connections and infiltration through aged and/or broken sewers or manhole structures that originate on the Senior High School campus and contribute flow to the City of Dubuque's sanitary sewer system.

The City of Dubuque had performed a limited amount of smoke and dye testing at the Senior High School campus initially to determine that there likely was some I & I issues that needed to be corrected. As a result of the City's preliminary evaluation, the City Engineering Department instructed the Dubuque Community School District to investigate, identify and recommend corrective actions for improper connections.

TESTING PROCEDURE

First, IIW conducted interviews of existing Dubuque Community School employees and City employees to obtain additional first hand observation information. Next, available Dubuque Community School and City of Dubuque documentation regarding plumbing as-builts, storm sewer system and sanitary sewer collection system plans and maps were reviewed to formulate a specific plan to investigate, dye test and monitor the existing sewer systems.

The testing and investigation procedure began with three consecutive days of dye testing the roof drains of the buildings that comprise the Senior High School campus. The testing involved a coordinated effort between IIW, P.C., Dubuque Community School District's Building and Grounds staff and the City of Dubuque Engineering Department staff to monitor and report results of the testing. After analyzing the results of the dye testing, recommendations for televising and exploratory excavation were made to the Dubuque Community School District to specifically locate and delineate the corrective improvements that needed to be performed.

Dennis F. Waugh, PE/SE*
 Charles A. Cate, PE **
 Gary D. Sejkora, PE
 Michael A. Jansen, PE/SE
 Ronald A. Balmer, PE/SE/AIA
 John M. Tranmer, PLS
 Timothy J. Tranel, PE*
 John F. Wandsnider, PE
 Julie P. Neebel, PE
 James P. Kaune, PE
 Thomas J. Oster, PLS **
 Wray A. Childers, PLS
 Geoffry T. Blandin, PE
 Mark C. Jobgen, PE
 Lauren N. Ray, PE/SE*
 Bradley J. Mootz, PE/SE
 Cody T. Austin, PE*
 Marc D. Ruden, PE
 Mark R. Fassbinder, AIA*
 Michael A. Ruden, NCARB/AIA*
 Alice M. Ohrtmann, PE
 Craig J. Elskamp, AIA
 Robert W. Blok, PE
 Eric J. Helminiak, PE/SE*
 Steven J. Hunn, PE
 Jeff J. Brandt, PLS

* LEED AP

** Retired

The Dubuque Community School District was very proactive in their approach to correcting the deficiencies discovered over the course of the investigation. The televising recommended was immediately performed by a combination of School District and City resources. The televising was promptly reviewed and recommendations for exploratory excavation were provided to further determine the corrective actions that were suggested.

The School District immediately hired a local contractor to make the recommended corrections as the evaluation was progressing. A more specific discussion of the investigation and testing results coupled with the corrective improvements performed are summarized in the following section. The Dubuque Community School District will provide a map to the City of Dubuque Engineering Department that indicates the locations of sanitary and storm sewers on the campus that were able to be determined through a combination of archived plan research and field investigation. The map also highlights the locations of the improper connections and subsequent corrective improvements.

INVESTIGATION / TESTING RESULTS AND CORRECTIVE IMPROVEMENTS

A. 1921 Main Building

Dye testing was first conducted on roof drains of the Main Building of Senior High School that was constructed around 1921. This was chosen as a starting point due to the fact that the City found evidence through smoke testing that there was some sort of connection between the sanitary and the storm sewers that serve this building.

The results of dye testing revealed that there was some minor cross-connection occurring in the vicinity of storm and sanitary manholes in the southwest quadrant of the Main Building courtyard. It was recommended to the School District that televising in conjunction with dye testing be conducted to determine if there was a direct cross-connection between the separate sanitary and storm sewer systems or if there was damaged pipes or separated joints causing the cross-connection by exfiltration from the storm sewer and infiltration into the sanitary sewer. The televising indicated that the cross-connection was through exfiltration and infiltration occurring between the storm and sanitary sewers due to broken and/or separated joints.

The School District immediately hired a contractor to excavate the area around the storm and sanitary structures to further investigate the extent of corrective improvements needed. Upon investigation, IIW reported findings to the I & I Program staff from the City Engineering Department and recommended the replacement of damaged storm and sanitary sewer sections in the courtyard. The work was completed immediately while the trench remained open from the exploratory excavation.

B. 1964 Addition to Main Building

Dye testing was also conducted on roof drains of the 1964 Addition to the Main Building of Senior High School. The City found no evidence through smoke testing that there was connection between the sanitary and the storm sewers that serve this building but, in an effort to investigate thoroughly, testing of the roof drains was performed.

The results of dye testing revealed that there was no cross-connection occurring between the sanitary and the storm sewers that serve this building. It was recommended to the School District that televising be conducted on the storm and sanitary sewers that cross beneath this building to determine their condition and better understand the piping configuration that serves the school. A review of the televising reports indicated that the plans for this building that the School District has on file generally agree with the actual configuration of the piping that was able to be confirmed in the field. Minor alterations to the schools under floor plans concerning the piping have been conveyed to school staff.

C. 1952 Nora Gymnasium

The next area where dye testing was conducted was the roof drains at the Nora Gymnasium. The building was constructed around 1952. The City found evidence through smoke testing that there was some sort of cross-connection between the sanitary and the storm sewers that serve this building.

The results of dye testing revealed that there was some direct cross-connection between the storm and sanitary sewers that run parallel to each other outside the northwest wall of the gymnasium. More specifically, the roof drain located above the western most entrance to the gymnasium was directly connected to the sanitary sewer.

It was recommended to the School District that televising in conjunction with further dye testing be conducted in the storm and sanitary sewers that serve the gymnasium to determine if there are more direct connections and to assess the condition of the sewers. A comparative analysis of the televising report to the original site plan for the gymnasium indicated that it was possible that the sanitary service connections serving the northwest restrooms, concession and drinking fountain facilities in the gymnasium were possibly directly connected to the storm sewer. Dye testing of the facilities confirmed the televising reports.

The School District immediately closed all facilities that were improperly connected to the storm sewer until repairs could be made and instructed the contractor they hired to excavate the area along the northwest wall of the gymnasium to further investigate the extents of corrective improvements needed. Upon investigation of the excavated service laterals and main sewers, IIW determined that corrective improvements could be made through reconfiguration of the sanitary service laterals to be routed directly into the sanitary sewer and the cross connected roof drain could also be rerouted to the storm sewer manhole adjacent to the cross-connection location. Additionally, all wye connections in the storm sewer that accepted sanitary flow were removed and repaired. All work was completed immediately while the trench remained open from the exploratory excavation.

Subsequent to the findings along the northwest wall of the Nora Gymnasium, further investigation through dye testing of the locker room, restroom, laundry and drinking fountain facilities along the southeast side of the gymnasium were conducted. One apparent cross-connection was found to be occurring between the storm and sanitary sewer systems when the restroom facilities in the Nora Gym lobby were flushed with dye. Corrective improvements that were performed and the correlation of this issue to one discovered beneath the 1988 Addition to Senior High School is described in the following section.

D. 1988 Addition Between Nora Gym and Tech Buildings

Dye testing was conducted on roof drains of the 1988 Addition between Nora Gym and the Technical Buildings. The City had reportedly found some evidence through smoke testing that the western most roof drain may be connected to the sanitary sewer that serves the 1921 main building and the 1964 addition to the main building.

The results of roof drain dye testing revealed that there was no cross-connection occurring between the sanitary and the storm sewers that serve this building.

As the School District was conducting televising on the accessible main sanitary and storm sewers near the Nora Gym lobby restroom that was determined through dye testing to have a cross-connection occurring, the televising personnel conducted testing of the storm and sanitary sewers accessible that pass beneath the 1988 Addition. Televising reports indicated that the main VCP storm sewer that channels all of the storm flow that is collected from the Nora Gymnasium roof drains appeared to be 75% obstructed with a mass of concrete. The pipe was also broken at this location. The televising crew was able to provide a distance to the obstruction. The distance indicated that the mass of concrete was very near the location of a drilled concrete pier foundation for a structural column of the 1988 addition.

The construction plans for the 1988 Addition had called for the clay storm sewer to be abandoned and rerouted away from the location of the drilled piers. The School District scheduled their Contractor to come perform exploratory excavation near the column after verifying with IIW's structural engineers that excavation adjacent to the drilled pier would not jeopardize the structural integrity of the supporting column. The exploratory excavation confirmed a suspicion that during the construction of the 1988 Addition the concrete piers were drilled through the storm sewer and the abandonment and relocation of the storm sewer was never performed.

Once the exploratory trench was opened in the mechanical room of the 1988 Addition, the televising of the remainder of the storm sewer was conducted and it was determined that the remaining sewer was in good shape. IIW worked with the School District and the Contractor to develop a corrective improvement plan to construct a concrete structure at the pier that would allow storm water to flow unobstructed around the drilled concrete pier. The concrete structure was subsequently constructed.

We believe that the obstruction that was created in the storm sewer at this location was a major cause of infiltration of storm water into the sanitary sewer in an upstream location near the south side of the Nora Gym lobby restroom. This realization came after performing exploratory excavation on the areas of the storm and sanitary sewer immediately upstream of the obstruction that were excavated to further delineate corrective improvements necessary to remedy the cross-connection occurring from the Nora Gym lobby restroom and to fix separated and cracked joints witnessed in reviewing the televising reports.

Upon excavation we discovered multiple issues:

1. The sanitary service lateral from the restroom in the Nora Gym lobby was not connected to either the sanitary or storm sewer, the lateral discharged in the soil above the storm sewer.
2. The storm sewer had severe joint separation and some cracked joints.
3. The sanitary sewer had two open wyes adjacent to the location where the storm sewer had the joint separation. (The sanitary sewer and the storm sewer run parallel and in opposite directions to each other approximately 5 feet apart at this location.)

The obstruction under the 1988 Addition coupled with the above issues immediately upstream of the obstruction combine to be a very likely source of extensive storm sewer inflow into the sanitary system during substantial rainfall events that likely would cause surcharging in the storm sewer to exfiltrate from the separated joints and inflow into the open wyes of the sanitary sewer located adjacent to the storm sewer.

The School District eliminated the separated joints in the storm sewer through replacement of the sewer in the affected areas, eliminated the open wyes in the sanitary sewer, and replaced the sanitary service lateral from the Nora Gym lobby restroom from the building to the sanitary main and properly connected the lateral to the sanitary sewer.

E. 1952 Technical Building

Dye testing was conducted on roof drains of the 1952 Technical Building of Senior High School. The City found no evidence through smoke testing that there was connection between the sanitary and the storm sewers that serve this building but to investigate thoroughly testing of the roof drains was performed.

The results of dye testing revealed that there was no cross-connection occurring between the sanitary and the storm sewers that serve this building. It was recommended to the School District that televising be conducted on the accessible main storm sewer that crosses beneath this building to determine its condition and better understand the piping configuration that serves the school. A review of the televising reports indicated that the plans for this building that the School District has on file generally agree with the actual configuration of the piping that was able to be confirmed in the field.

F. 1921 Technical Building

Finally, dye testing was also conducted on roof drains of the 1921 Technical Building of Senior High School. The City found no evidence through smoke testing that there was connection between the sanitary and the storm sewers that serve this building but to investigate thoroughly, testing of the roof drains and the restroom facilities in the basement was performed.

The results of the dye testing revealed that there was no cross-connection occurring between the sanitary and the storm sewers that serve this building.

G. Storm and Sanitary Structures on Campus Outside of Buildings

The storm and sanitary sewer structures south of the campus generally serve to convey storm and sanitary sewer flow from the campus to the respective storm and sanitary sewer systems of the City of Dubuque. Visual inspection of manholes and inlets coupled with televising was performed on accessible storm and sanitary sewer structures that are located to the south of the buildings that comprise the Senior High School campus. The campus manhole and inlet structures were also monitored during the dye testing operations performed in order to help determine the presence of cross-connections and to confirm the understanding of how the system is connected.

The investigative testing procedures conducted did not reveal any cross-connections between the sanitary and storm sewers that convey wastewater and storm water from the buildings that comprise the Senior High School campus to the City of Dubuque sewer systems.

TOTAL COST OF CORRECTIVE IMPROVEMENTS

The total cost of the corrective improvements to date including the engineering investigation, televising and corrective repair work performed by the Dubuque Community School District's contractor is approximately \$90,000.

RECOMMENDATIONS FOR FUTURE IMPROVEMENTS

The Dubuque Community School District was very proactive in terms of immediately addressing and fixing identified issues with inflow and infiltration occurring between the storm and sanitary sewer systems that serve the Dubuque Senior High School campus.

During the investigation that took place as a part of this evaluation it was revealed that the storm sewers and structures that convey storm water from the 1921 Main Building and the 1964 Addition are in very bad condition and are also likely undersized. We do not believe this situation contributes to any cross-connection of the sanitary and storm sewer systems, but it is an issue that should be corrected as the School District has historically had issues with soil erosion on the hillside adjacent to the right field fence of the softball diamond likely associated with storm structures surcharging during heavy rain events.


The School District is currently in the process of designing improvements to Dalzell field. It is our understanding that some of these improvements will extend into the area to the west of Dalzell field adjacent to and including a portion of the softball field. It is our recommendation that the School District takes this opportunity to include upgrades to the storm sewer system that conveys flow through this area as part of the Dalzell field project.

IIW, P.C. would be pleased to provide engineering services to perform hydraulic analysis and design services in regard to the recommended improvements.

ATTACHMENTS

Attached are hard copies of the televising reports from the Dubuque Community School District's contracted televising company and also the reports from the City of Dubuque's televising crew.

Also attached is a map prepared by the Dubuque Community School District that highlights the corrective improvements described in this report and shows how the storm and sanitary sewers are configured on the campus to the extent that we were able to discover through the investigations of this evaluation.

 <p>SEAL</p>	<p>I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.</p> <p>FOR IIW, P.C.</p> <p><i>Marc D. Ruden</i> <i>10/7/11</i></p>
	<p>Marc D. Ruden, P.E. Date License Number 19249 My license renewal date is December 31, 2012 Pages or sheets covered by this seal: Entire Report</p>

Appendix D



Engineering Department, I&I Program
City Hall
50 W. 13th Street
Dubuque, Iowa 52001
563.690.6113
www.cityofdubuque.org/i&i



December 8, 2011

Mr. Bill Burkhart
Dubuque Community Schools
2300 Chaney Road
Dubuque, IA 52001-3095

Dear Mr. Burkhart:

The purpose of this letter is to follow-up on the smoke testing conducted at Senior High School on November 1, 2011. The City conducted smoke testing to verify that all improper connections of stormwater into the sanitary sewer system had been completed correctly. Unfortunately, City and school district staff continued to observe smoke from roof drains, around two manholes, and from pavement cracks.

Please submit a work plan to the City within 30 days of the date of this letter to investigate, identify, and recommend corrective actions for improper connections to the sanitary sewer at Senior High School. If additional investigation and identification tasks are necessary, they shall be completed by April 30, 2012. The corrective actions shall be completed by June 30, 2012. The work plan shall be certified by an engineer licensed in the State of Iowa.

Your help and cooperation in addressing these improper connections is greatly appreciated. If you have any questions regarding the work plan, please call me at (563) 690-6034.

Sincerely,

Todd Shoemaker, PE, CFM
Environmental Engineer

Cc: Gus Psihoyos, City Engineer