



Sean P. O'Rourke, PE
Senior Principal Engineer



Miamisburg: CMOM, Inspection, and Rehabilitation Program

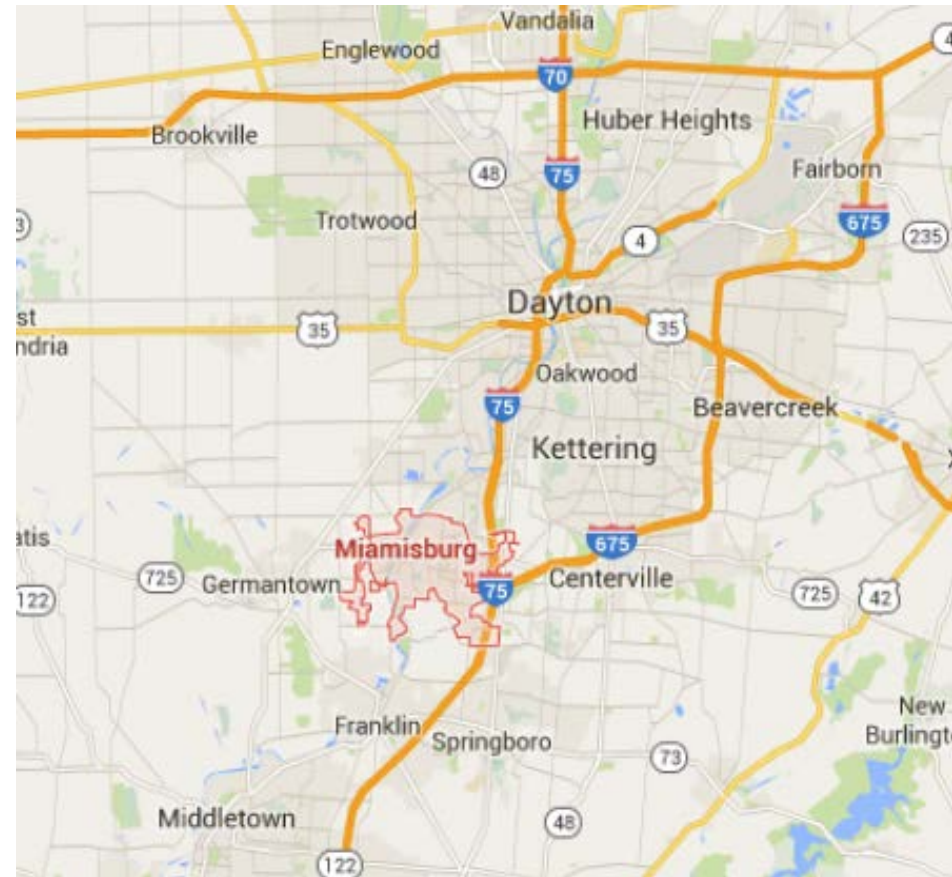
Hazen

Presentation Outline

- Who is the City of Miamisburg (Ohio)
- What is a CMOM Program
- Miamisburg's CMOM Program
- Inspection and Rehabilitation Program
- How the CMOM helped Miamisburg

The City of Miamisburg

- ~20,000 residents
- ~12.4 square miles
- 10 pump stations
- ~2,500 sanitary MHs
- ~100 miles of sewer
- 1 WRF (3 MGD ADF)



What is a CMOM Program?



GUIDE FOR EVALUATING CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE (CMOM) PROGRAMS AT SANITARY SEWER COLLECTION SYSTEMS

United States
Environmental Protection
Agency

Office of Enforcement and
Compliance Assurance (2224A)

EPA 305-B-05-002

www.epa.gov

January 2005

https://www.epa.gov/sites/production/files/2015-10/documents/cmom_guide_for_collection_systems.pdf

What is a CMOM Program?

Flexible / dynamic framework to identify and incorporate industry practices to:

- Better manage, operate, and maintain
- Investigate capacity constraints
- Respond to sanitary sewer overflows (SSO)
- Proactively prevent SSOs

Miamisburg CMOM Program

Major Goals:

- SSO prevention / reduction / communication
- Address O&M issues (FOG, roots, infiltration)
- Create electronic map of collection system (GIS)
- Establish design requirements, specification, and standards
- Review and develop internal SOPs
- **Conduct an Inspection and Rehabilitation Program**

Miamisburg CMOM Program

First step was the creation of a GIS map:

- Develop unique IDs for each asset
- Develop sewer shed basins
- Survey MHs
- Convert to GIS program and connect pipes

Miamisburg CMOM Program

Delineate sewer sheds from paper & CAD maps



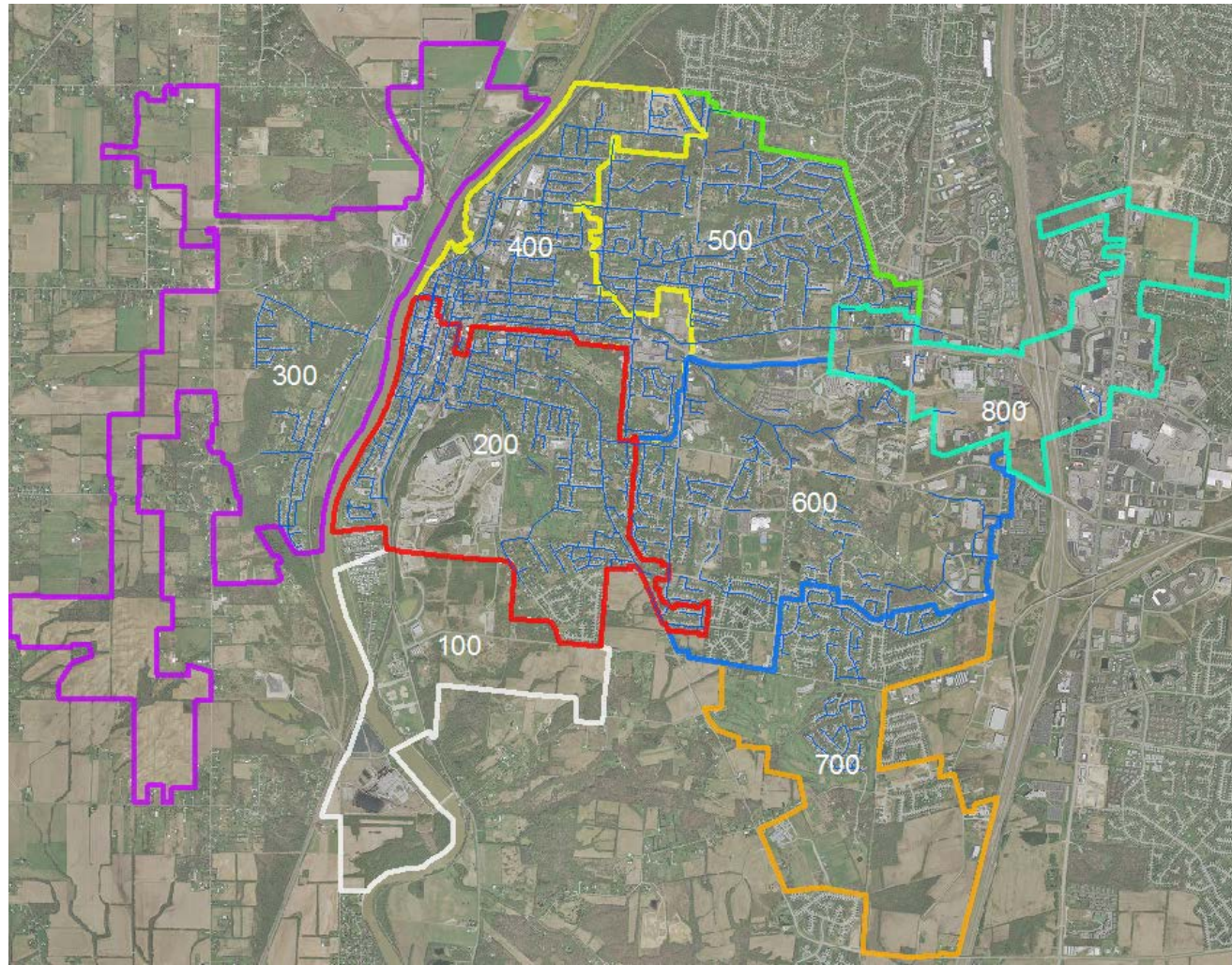
Miamisburg GIS Program

Sewer basins used for unique asset IDs

8 basins named:
100, 200, 300...

Ex: 155th MH in
Basin 100 =
SANMH100155

Ex: D/S sewer =
SANGS1001550



Miamisburg GIS Program

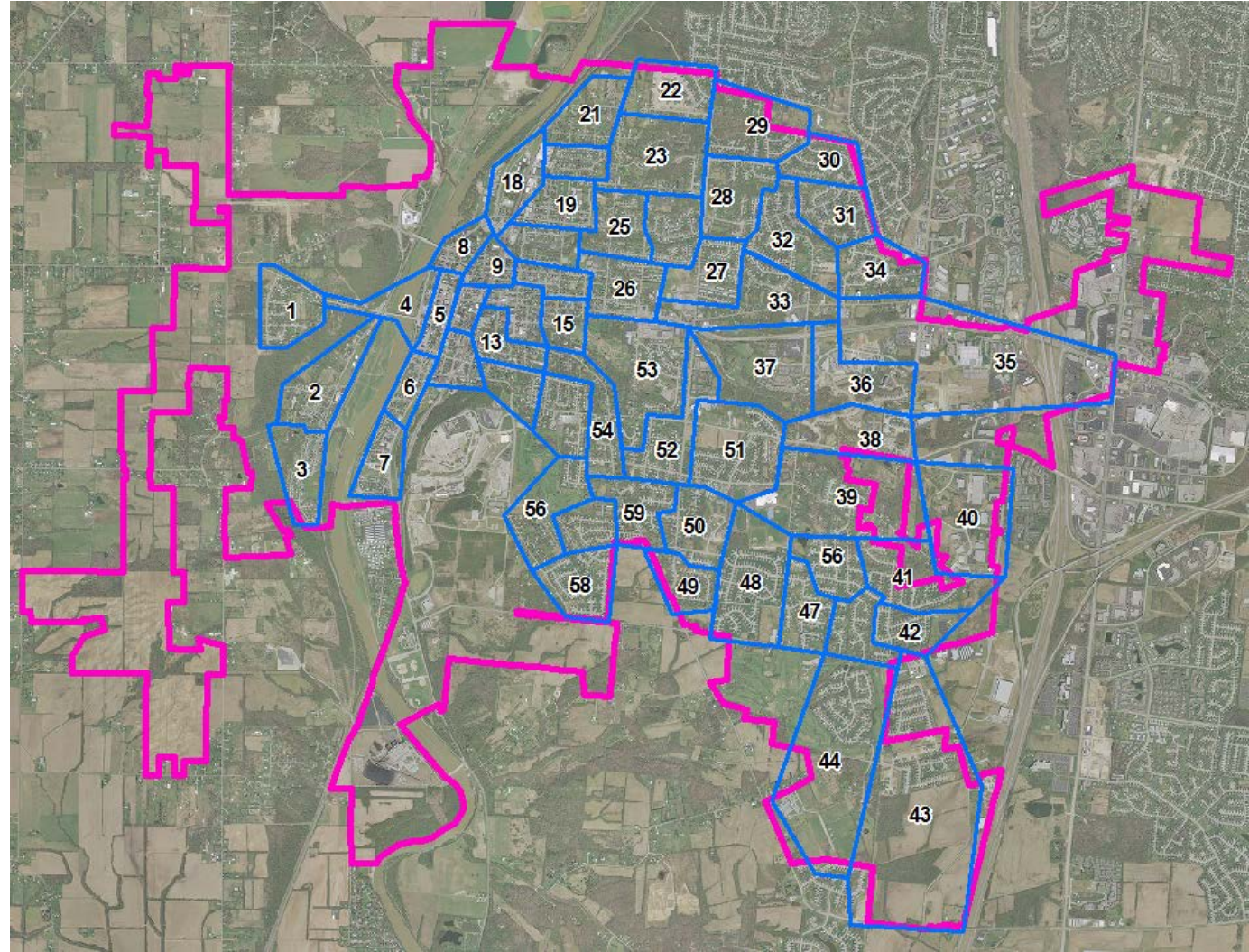
Benefits for City Staff:

- Each asset has a unique ID
- Asset inventory (size, depths, material, slope)
- Identify areas of low slopes
- Print out maps
- Develop maintenance plans
- Organize work orders



Miamisburg GIS Program

5-year sewer cleaning plan (i.e. 60 equal length areas)



Miamisburg CMOM Program

Reviewed / developed / standardized requirements

- Standard specs and construction details

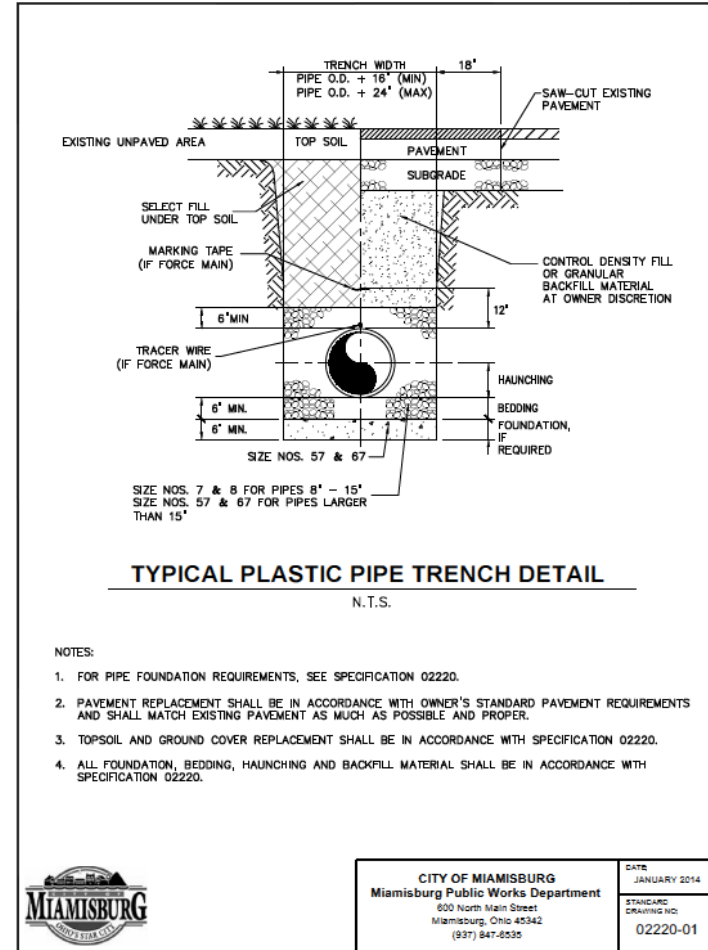
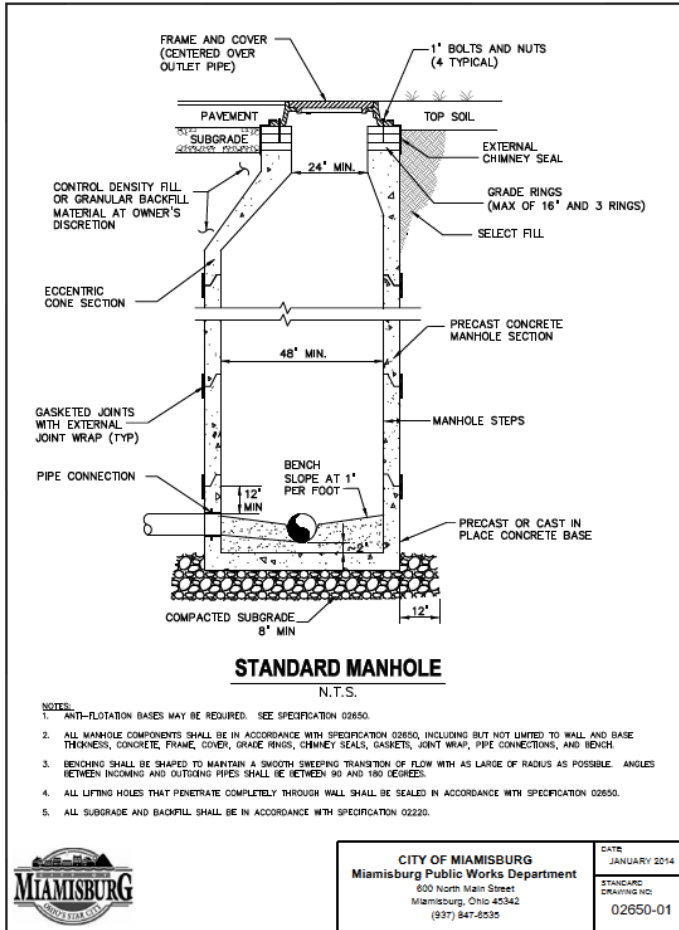
Reviewed codified ordinances:

- Grease traps
- Private laterals
- New construction

Reviewed / developed internal SOPs

Miamisburg CMOM Program

New Specifications / Details



Miamisburg CMOM Program

New Design Checklists

Sanitary Sewer System Design Review Checklist

Name of Development: _____
 Drainage Basin Number: _____ Receiving MH or PS Asset ID: _____
 Location: _____
 Developer: _____
 Design Engineer: _____
 Date Submitted: _____ Date Checked: _____
 Checked By: _____

Yes No N/A Element Reference Code

Yes	No	N/A	Element	Reference Code
ENGINEER'S NARRATIVE - PLANNING, CAPACITY AND INITIAL DESIGN				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Provisions for unique installations, including sewer separations and creek, aerial, railroad, and major road crossings?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	An average daily flow, using criteria 100 gal/(day-person), but not less than 270 gal/(residence-day)?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Peaking Factor using the equation, P.F. = $(18 + \sqrt{P}) / (4 + \sqrt{P})$, where P is population in thousands?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Population projection for 20 years?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sewer capacity calculation using Manning's "n" of 0.013 provided?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Capacity in downstream sewer?	
GRAVITY SEWER PIPING				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PVC SDR-26 at depths greater than 14 feet?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Class 350 DIP at depths greater than 25 feet?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prohibitive note about clean water connections (downspout, catch basin, driveway or foundation drain, sump pump, etc.)?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prohibitive note no building shall be connected to a sanitary sewer lateral until the building is under roof of as directed by City Engineer?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pipes maintain a uniform slope between manholes?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum pipe slopes per regulations?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum pipe velocity (flowing full) 2 ft./sec using Manning's "n" 0.013?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cleansing velocities (minimum 3 ft./sec) achieved with Peak Daily Flow?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sewers with velocities greater than 15 ft./sec secured and protected?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum mainline pipe cover is 32-inches (frost depth)?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum of 10-foot horizontal and 18-inch vertical separations between sewers, manholes, and water main?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	One full length of water main pipe centered at the point of crossing such that joints are equidistant and as far from the point of intersection as possible?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Where a water main passes under a sewer main, sewer main material of construction matches that of the water main for that span?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum 20-foot wide easements (if not in the public right-of-way) or $(2 \times \text{Depth}) + (5 \text{ feet})$ whichever is greater?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is there an inverted siphon?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does inverted siphon have dual lines? Does it have a means to isolate and clear either line?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum of 50-ft horizontal separation between sewers and streams excluding perpendicular crossings?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sewer crossings perpendicular to the flow of the stream and are free from changes in grade?	



Miamisburg CMOM Program

New Construction Inspection SOPs

2. Vacuum Testing Procedure and Checklist

Purpose

Vacuum testing demonstrates the integrity of the installed material, construction procedures, and the water-tightness of joint and penetration seals prior to backfilling activities.

Apparatus

1. Plugs for pipes entering manhole
2. Non-shrinkable grout for cover lifting holes
3. Vacuum Pump
4. Stopwatch/Timer

Pretesting Procedure

1. This test should be completed after the manhole has been constructed but before backfill activities occur around the manhole.
2. Prior to this test, the visual inspection procedure should be followed with the corresponding checklist finished.
3. Lifting Holes, if any, shall be plugged with an approved, non-shrinkable grout prior to testing.
4. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab or grade rings.

Testing Procedure

1. Plug all lift holes and pipes entering manhole in accordance with Contract Specifications or at least 8-inches into the sewer pipe. The plug must be inflated at a location past the manhole/pipe gasket.
2. Secure plugs to prevent withdrawal when vacuum is drawn.
3. Place test head at the top of manhole in accordance with manufacturer's recommendations.
4. Draw a vacuum pressure of 10 in. of mercury (Hg) using a vacuum pump.
5. Shut valve on vacuum line of the test head and shut off or disconnect pump.
6. Start a stopwatch precisely when the vacuum pump is shut off or disconnected and monitor the exact test time required for the internal pressure to drop to exactly to 9 in. Hg.
7. Record the time it takes for the vacuum pressure to reduce to 9 in. Hg.

Interpreting the Test

1. Table 2 on Page 16 can be used to determine the minimum test time allowed for the required pressure drop based on manhole depth.
2. If the vacuum drops from 10 in. Hg to 9 in. Hg at or after the test time elapses, the manhole is acceptable and passes the test.
3. For intermediate depths of manholes, determine required holding time using following interpolation formula in conjunction with Table 2:

$$\text{Holding Time} = \text{Time}(A) + [\text{Time}(B) - \text{Time}(A)] \times \left[\frac{\text{Actual Depth} - \text{Depth}(A)}{\text{Depth}(B) - \text{Depth}(A)} \right]$$

Vacuum Testing of Manholes Checklist

Date: ____/____/____ Owner: City of Miamisburg, Ohio
 Contractor: _____ Inspector: _____
 Test Number: _____ Manhole Material: _____
 Depth: _____ feet Diameter: _____ inches
 No. of pipes entering manhole _____ Downstream MH Station No. _____
 Required holding time: ____ min ____ sec (Table 2) Initial Vacuum Pulled: _____ in Hg
 Time to reach 9 in. Hg: ____ min ____ sec Manhole Acceptable? (Y/N): _____

Complete the following checklist to ensure the manhole has been vacuum tested in compliance with the standard operating procedure:

Description	Y/N	Comments
Backfill not performed		
Drop connections installed		
Visual signs of water intrusion		
Lifting holes grouted flush		
Temporary plugs inflated 8-inches at a location past the pipe gasket.		
Plugs braced appropriately		
Test head installed in accordance with manufacturer recommendations.		
Approved pressure gauge for test head.		
Vacuum of 10 in. Hg achieved		
Overall procedure followed properly and completely		

Complete if pipe section failed:

Leak located: Yes / No (circle one)

If yes, describe: _____

Corrective action by Contractor: _____

Signature of Inspector: _____

Miamisburg CMOM Program

New Manhole Inspection & Basic Repair SOP

Manhole Inspection and Basic Repair SOP

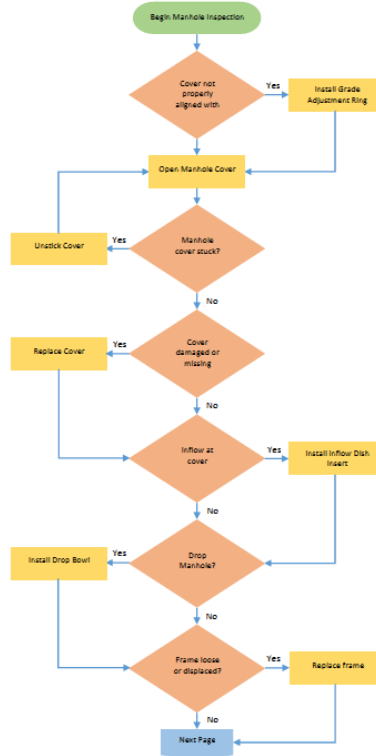


City of Miamisburg

Standard Operating Procedure
and Checklists

Manhole Inspection and Basic Repair

Manhole Inspection and Basic Repair SOP



stormwaterworks.com, LLC

48 Union Street, Suite M

Stamford, CT 06906-0905

Phone: 203-324-0045 / Fax: 203-324-0075

No Flow Inflow Manhole Seal

Prevent rainfall from entering collection systems easily and cost effectively with the no flow inflow manhole seal.

Manufactured from ultra high density polyethylene copolymer material known as Marlex HXM 50100, no flow inflow dishes are custom sized to provide enhanced fit and seal.

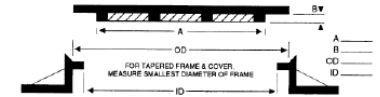
Each no flow inflow dish is outfitted with a 1" woven polypropylene strap for easy removal.

A small ventilation hole located on the side of the dish allows a maximum of 5 gallons of water per 24 hours to enter the system.

The no flow inflow dish can be inexpensively installed by your "in-house" maintenance personnel.



Take accurate measurements to order your custom fit no flow inflow dish



Remove the manhole cover

Clean the manhole rim or flange of any dirt or debris to insure accurate measurement

Locate the clear opening of the manhole diameter measurement (ID) as above.

Take two of three readings along the ID circumference and record the smallest measurement to the nearest 1/8 of an inch

Locate the outer edge of the manhole rim. This is the outside diameter measurement (OD).

Take two or three readings along the OD circumference and record the smallest measurement to the nearest 1/8"

Provide dimensions A&B on cover as above

Please indicate the specific type of manhole frame and cover that you have i.e. locking, bolt down, watertight, etc. along with the name of the foundry and drawing if possible

Inspection and Rehabilitation Programs

Three-Year Inspection Program

(\$250k / yr.)

Five-Year Rehabilitation Program

(\$300k / yr.)

Inspection Program

Sewer Inspection RFP

- Unit prices for sewer and MH inspection
- 4 Firms submitted
- Technical specs to supplement PACP and MACP for inspection, submittals, cleaning, etc.

BID PROPOSAL FORM CITY OF MIAMISBURG - SEWER AND MANHOLE ASSESSMENT YEAR ONE (REISSUED WITH ADDENDUM 1)					
Quantities listed are approximate for Year One work. Work will be directed by the Owner/Engineer in the field at the indicated unit prices. All indicated unit prices shall include all costs associated with the item as measured and described in the Technical Specifications including all materials, software, equipment, labor, fees, taxes, insurance, miscellaneous costs, overhead, and profit.					
ITEM NO.	ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION AND DEMOBILIZATION (NOT TO EXCEED 5% OF TOTAL BID)	LS	1	\$	\$
2 MANHOLE INSPECTION					
2.A	LEVEL 1	EA	300	\$	\$
2.B	LEVEL 2	EA	600	\$	\$
3 LIGHT CLEANING					
3.A	6-INCH THROUGH 10-INCH	LF	28,630	\$	\$
3.B	12-INCH THROUGH 15-INCH	LF	4,940	\$	\$
3.C	18-INCH THROUGH 24-INCH	LF	413	\$	\$
3.D	27-INCH THROUGH 33-INCH	LF	435	\$	\$
3.E	36-INCH AND ABOVE	LF	123	\$	\$
4 HEAVY CLEANING					
4.A	6-INCH THROUGH 10-INCH	LF	2,860	\$	\$
4.B	12-INCH THROUGH 15-INCH	LF	250	\$	\$
4.C	18-INCH THROUGH 24-INCH	LF	200	\$	\$
4.D	27-INCH THROUGH 33-INCH	LF	200	\$	\$
4.E	36-INCH AND ABOVE	LF	200	\$	\$
5	PROTRUDING TAP REMOVAL	EA	25	\$	\$
6	EXCESSIVE HEAVY CLEANING	HR	12	\$	\$
7	EXTERNAL MATERAIL DISPOSAL	TON	50	\$	\$
8	ALLOWANCE FOR BYPASS PUMPING	LS	1	\$ 15,000	15,000.00
9 SEWER CCTV INSPECTION					
9.A	6-INCH THROUGH 10-INCH	LF	143,150	\$	\$
9.B	12-INCH THROUGH 15-INCH	LF	24,700	\$	\$
9.C	18-INCH THROUGH 24-INCH	LF	8,250	\$	\$
9.D	27-INCH THROUGH 33-INCH	LF	8,700	\$	\$
9.E	36-INCH AND ABOVE	LF	2,450	\$	\$
GRAND TOTAL OF BID (ITEMS 1 THROUGH 9)					\$



Inspection Program

Hydromax USA
11420 Watterson Ct. Suite 1100
Louisville KY 40299
(812) 925-3930

HYDROMAX USA



Defect Listing Plot with Images



Pipe Segment Refers...	City	Street	Material	Location C...	Bewer Use
SANGS4000020	Miamisburg, OH	1096 N 4th St.	RCP	D	SS
Upstream MH	Total Length	Year Laid	Shape	Location Details	
SANMH400002	273.5		C	paved asphalt	
DB Manhole	Length surveyed	Year Renewed	Height	Width	Pipe Joint...
SANMH400001	273.5		10	10	G



SPR	N/A	M/PR	4	PO Number	Customer
SPRI	N/A	M/PR	2	1696	Hazen & Sawyer
QBR	N/A	QMR	Z200	Work Order	Purpose
					G
QPR	4	Surveyed By	Direction	Date	Media label
		CLH	D	20150518	
QPR	2	Certificate Number	Pre-Cleaning	Time	Weather
		U-914-06013821	J	12:37	1



Additional Info



SANMH400002



0.0 ft. AMH-Access Point Manhole   SANMH400002



0.0 ft. MWL-Water Level  

110.7 ft. TB-Tap Break-In  

213.2 ft. TB-Tap Break-In  

227.3 ft. MWLS-Water Level Sag   2


235.2 ft. MWL-Water Level  


253.0 ft. MWLS-Water Level Sag   2


Miamisburg OH CCTV Page #: 3


MACP Survey Report SANMH300001 Report Date 2015/04/29

Sheet No. 24	Surveyor's name ALESUT	Certificate Number U-1211-13818	Date 2015/04/13
System Owner City of Miamisburg	Survey Customer Hazen & Sawyer	Location (No. & Name) 506 Schroeder St.	Time 14:11
Drainage Area P.O. No. 50071-004	Locality/City Name Miamisburg, OH		
Further Location Details In parking lot of city park.	Outgoing Rim to Invert 17.1 ft.	Outgoing Grade to Invert 17.1 ft.	Rim to Grade 0.0 ft.
Use of Sewer Sanitary	Year Laid	Year Rehabilitated	Tape/Media Number
Purpose Infiltration and inflow investigation	Date Cleaned	Weather Dry	Sewer Category
Pre-Cleaning	Location Code Parking Lot	Potential for Runoff	Evidence of Surcharge Yes
Access Point Type Manhole	Coordinate System NAD 1983	StatePlane Ohio	South FIPS 3402
	Feet		
Northing 598275.428	Easting 1461256.569	Elevation	Accuracy of GPS Sub-Meter
Inspection Status Remote Inspection	Image Reference		
Additional Information			
Manhole Surface Types			
Concrete Pavement <input type="checkbox"/>	Concrete Collar <input type="checkbox"/>	Asphalt <input checked="" type="checkbox"/>	Grass/Dirt <input type="checkbox"/>
Gravel <input type="checkbox"/>	Other <input type="checkbox"/>		

Survey  File Name Map_SANMH300001.jpg
File Date 2015/04/20 14:03

Survey  File Name SANMH300001_Picture_2.jpg
File Date 2015/04/21 09:47

Survey  File Name SANMH300001_Picture_1.jpg
File Date 2015/04/21 09:47

Cover  File Name SANMH300001_Picture_3.jpg
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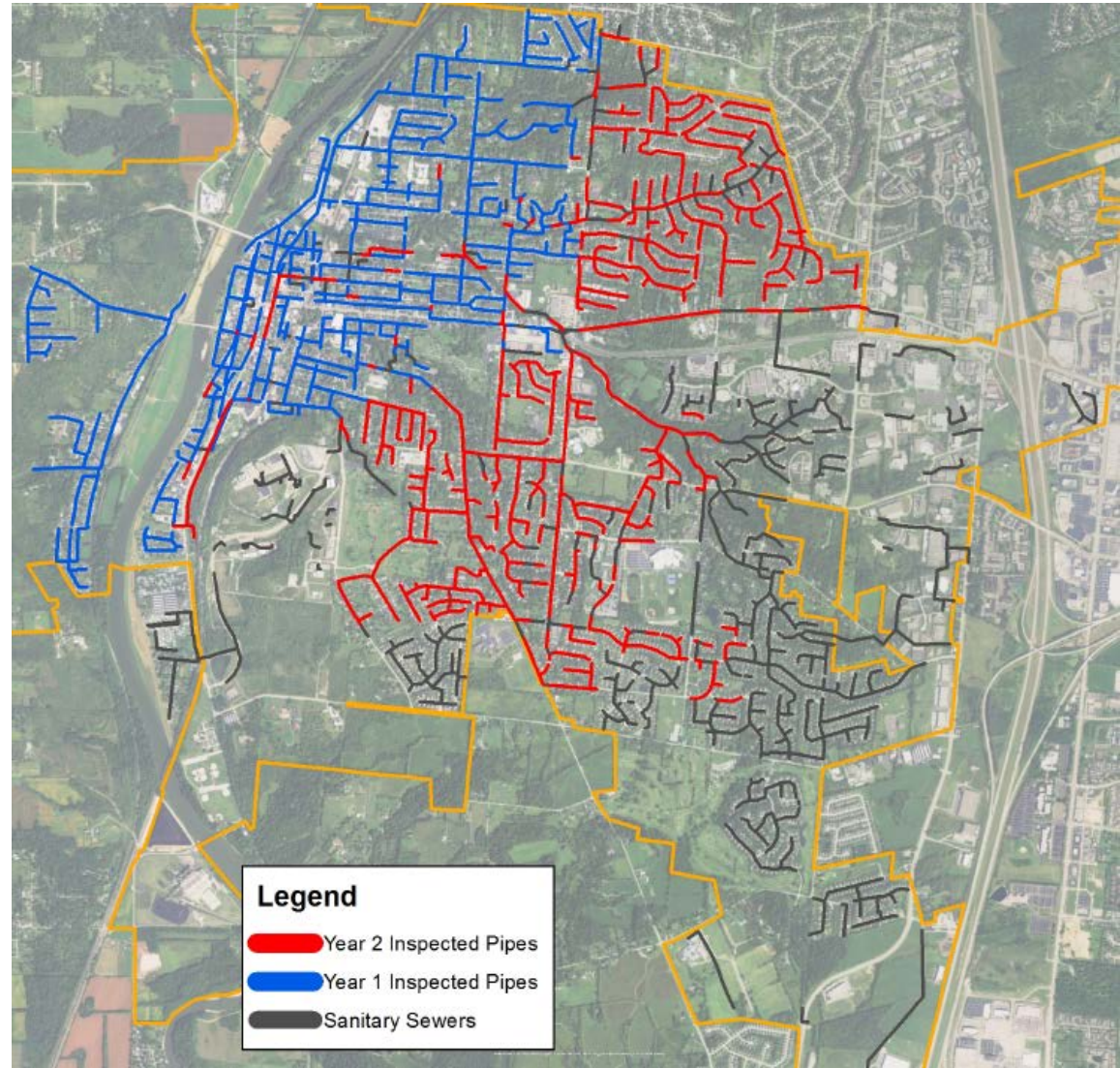
Hydromax USA Phone: 502-409-8109 Fax: 502-565-0239



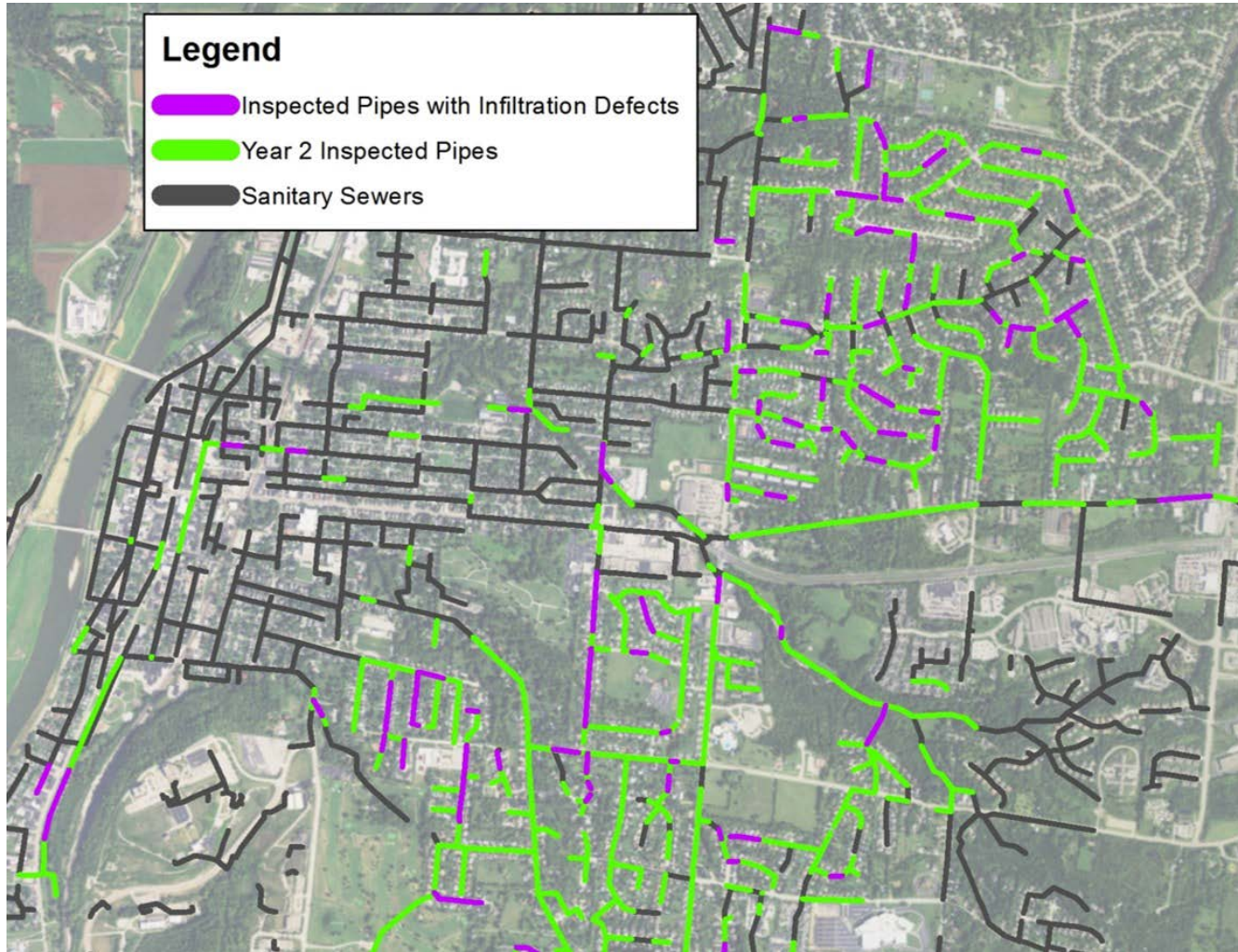
Inspection Program

Inspection Years 1 and 2 (2015 and 2016)

- 61 mi of sewers
- 790 MHs
- \$~236k (Year 1)
- \$~245k (Year 2)

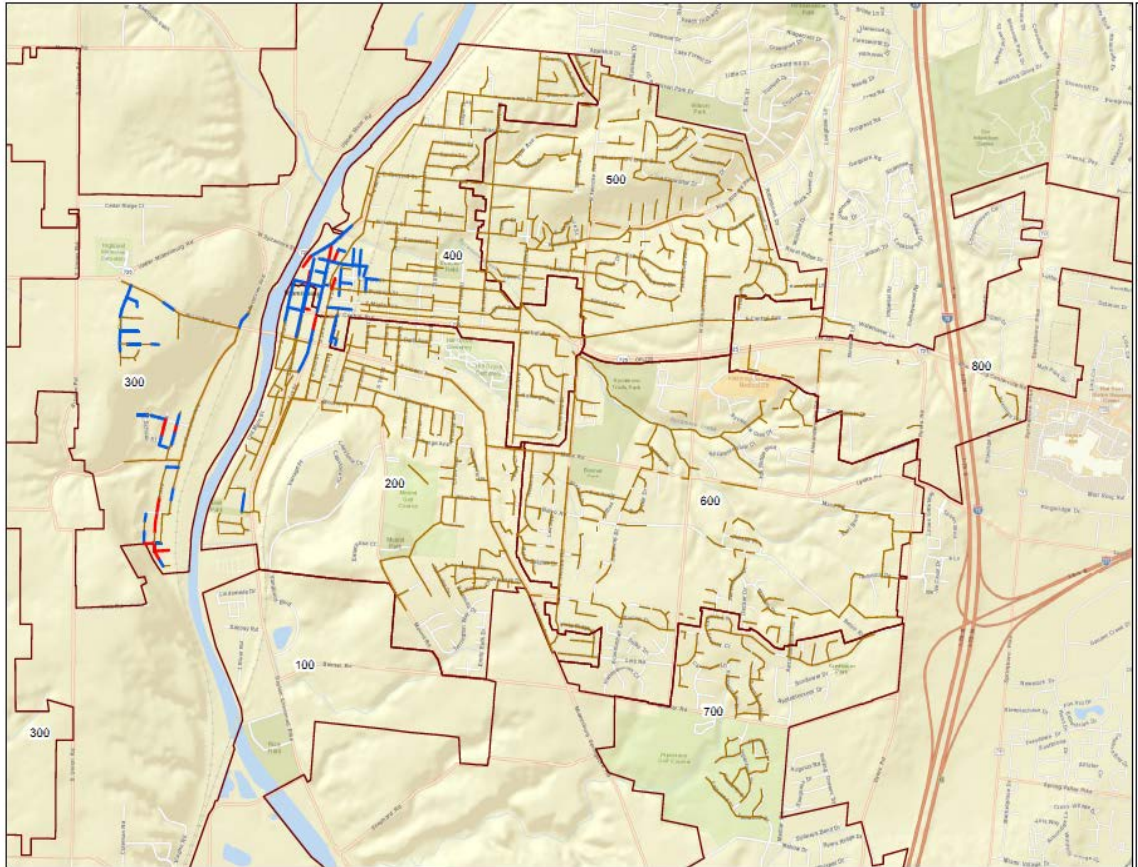


Inspection Program



Inspection Program

Structural Defects (Grades 4 & 5)



Inspection Program

Value of Program:

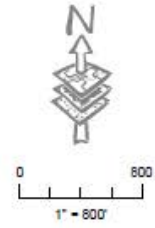
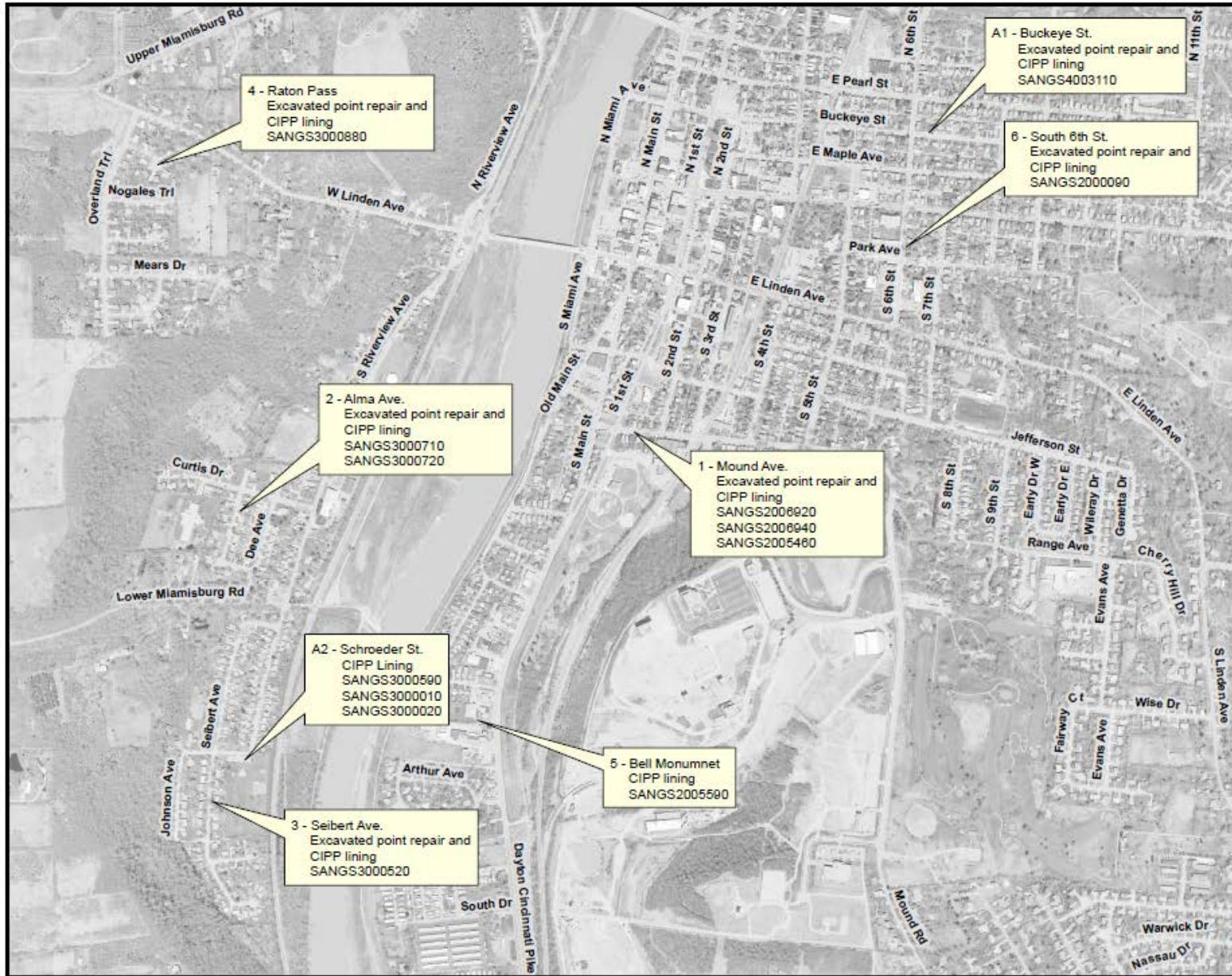
- Physical record of buried assets
(videos, photos, lengths, diameters, materials, laterals, etc.)
- GIS updated with more accurate information
- O&M resources can be allocated based on areas with roots, FOG, debris, etc.

Inspection Program

Value of Program (cont'd):

- Areas of infiltration
- Areas with structural defects
- Resources for rehabilitation and repairs can be allocated based on the bigger picture

Miamisburg Year 1 – Rehabilitation



Sewer Rehabilitation Year 1
OVERALL MAP





APPENDIX A

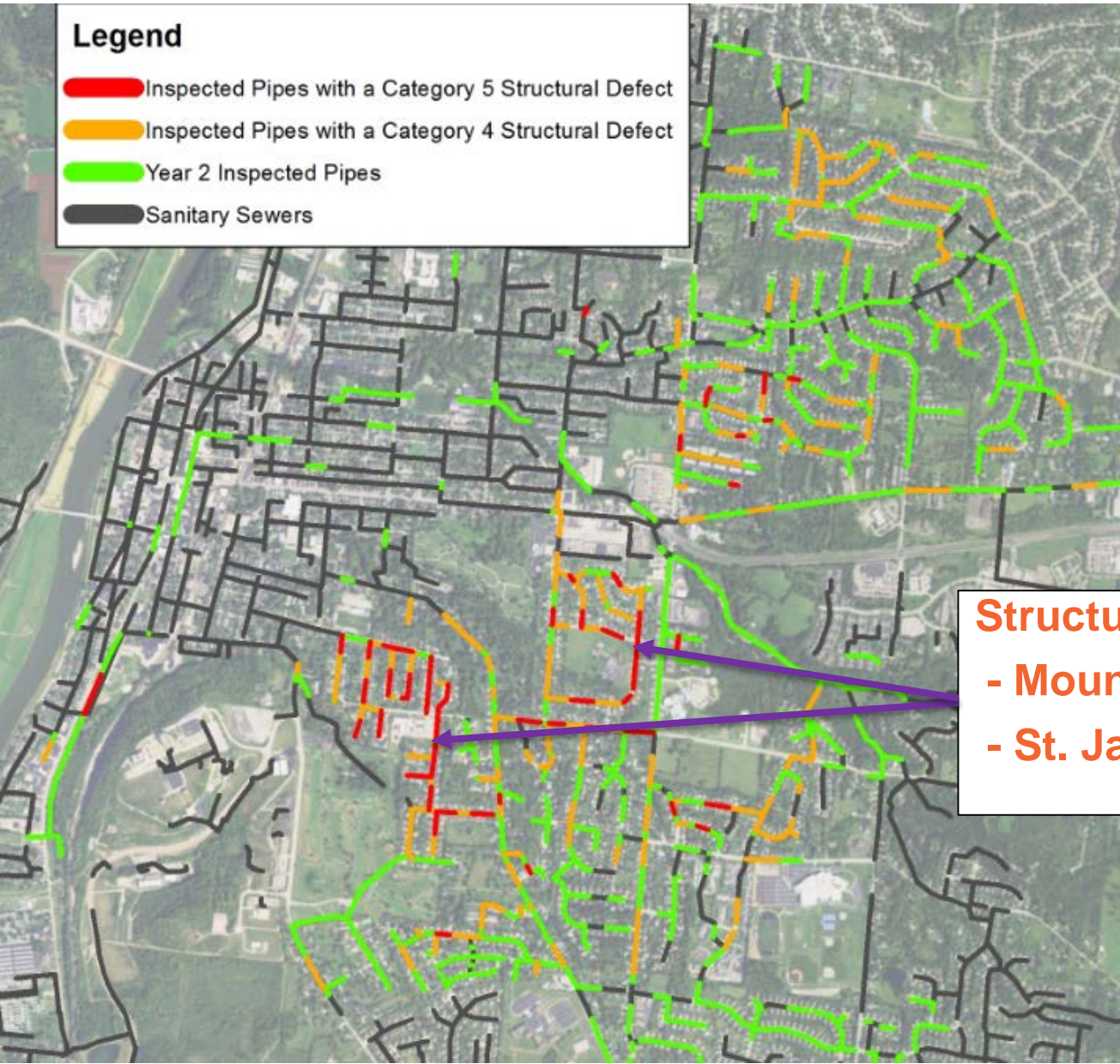
Miamisburg Year 1 – Rehabilitation



Miamisburg Year 2 – Rehabilitation

Legend

-  Inspected Pipes with a Category 5 Structural Defect
-  Inspected Pipes with a Category 4 Structural Defect
-  Year 2 Inspected Pipes
-  Sanitary Sewers



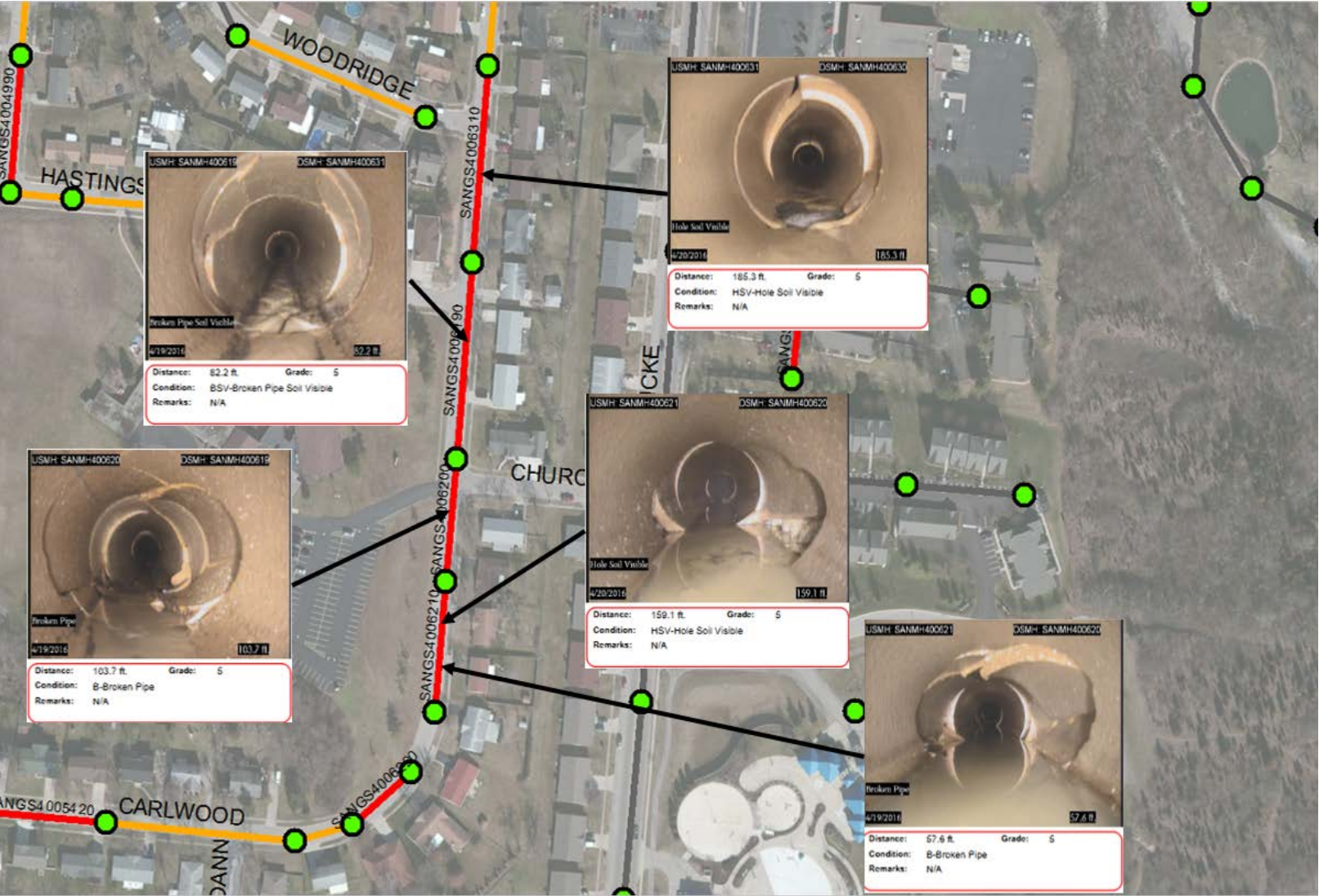
Structural defects around:

- Mound Grade School
- St. James Church

Miamisburg Year 2 – Rehabilitation



Miamisburg Year 2 – Rehabilitation



Miamisburg In-House Repairs

SANGS2000790, SANGS2000800, SANGS2000810, and SANGS2000820
S 9th Street, Range Avenue, and Rosetta Avenue



Notes:

1. SANGS2000790: 192-ft., 8-in., VCP pipe
2. SANGS2000800: 215-ft., 8-in., VCP pipe
3. SANGS2000810: 247-ft., 8-in., VCP pipe
4. SANGS2000820: 328-ft., 8-in., VCP pipe

Paving:

- None



Not to Scale

Legend

- Manhole
- Sanitary Sewers
- Street Name

Hazen



Conclusion and Lasting Benefits

- Badly needed repairs made and prioritization of future repairs
- Identified several MHs with urgent issues
- CMOM forced the City to develop a GIS and start thinking in terms of asset IDs
- Chance to review City specs, notes, details, and ordinances
- Chance to review / develop internal SOPs



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