



CMOM – How to Develop Your Collection System Maintenance Program

NWOWEA Pre-Conference Utility Workshop
June 22, 2015
Kalahari Conference Center

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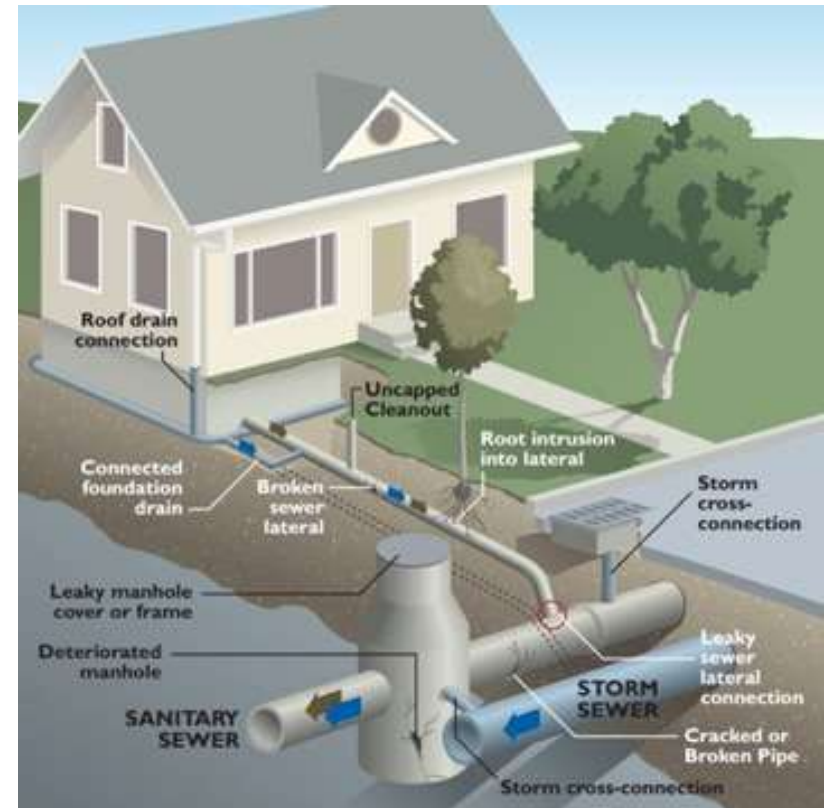


What is CMOM?

CMOM: Capacity, Management, Operation and Maintenance for sanitary sewer collection systems

CMOM provides a management framework to evaluate **information** on asset condition and system performance.

Information on collection system performance is useful when **optimizing capital investment.**



What is CMOM?

- CMOM Requires:

Provide collection system **capacity** to convey base and peak flow

.....**AND**.....

Proper **management, operation and maintenance**, at all times, of all parts of the collection system that you own or have operational control

.....**AND**.....

Take all feasible steps to stop and mitigate the impact of Sanitary Sewer Overflow events (**SSO's**)



Maintain Adequate Capacity

- Design Capacity
 - Plan vs. Install vs. Operation
- Current Capacity
 - Growth vs. Condition
 - Wet Weather vs. Dry Weather
- Capacity Upgrades

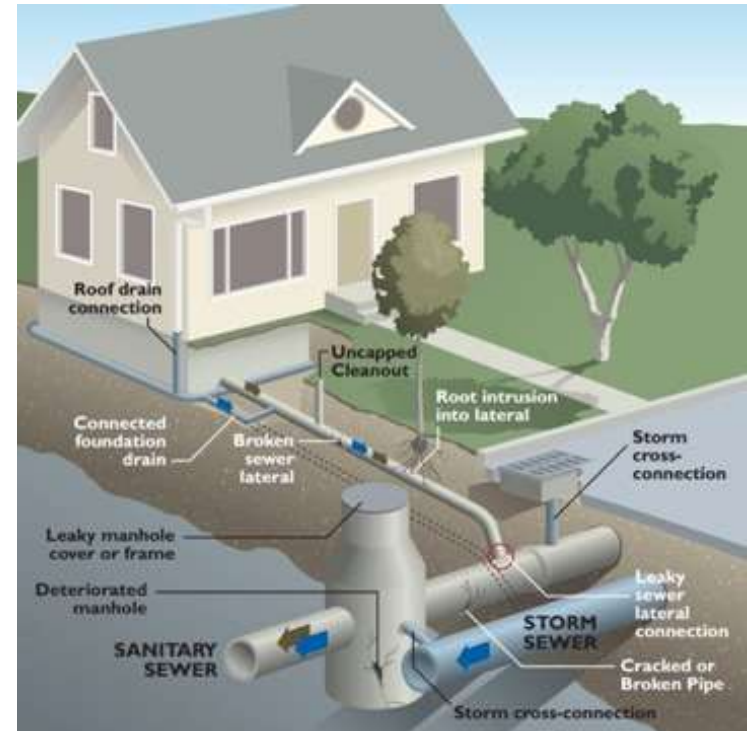
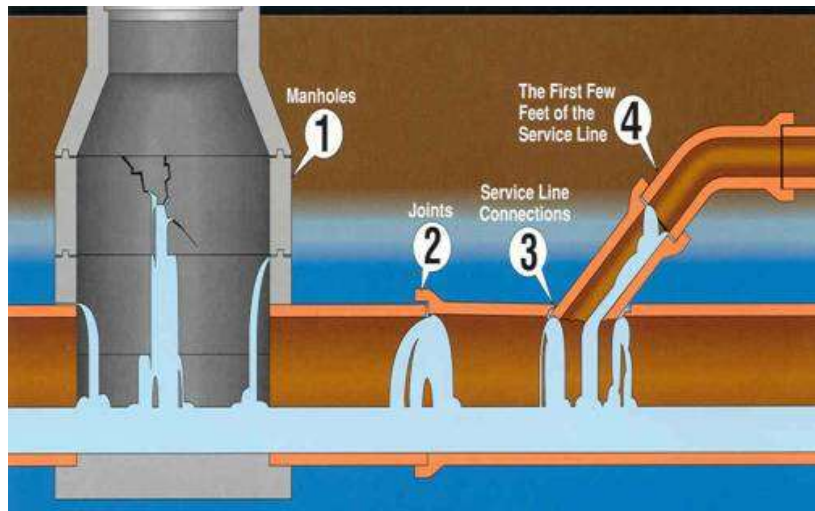


Credit: Alan Cressler

Why CMOM? (Defining the Problem!)

CMOM provides a management framework to evaluate **information** on asset condition and system performance.

This **information** is useful for optimizing operation, maintenance, performance monitoring and future capital investment practices.



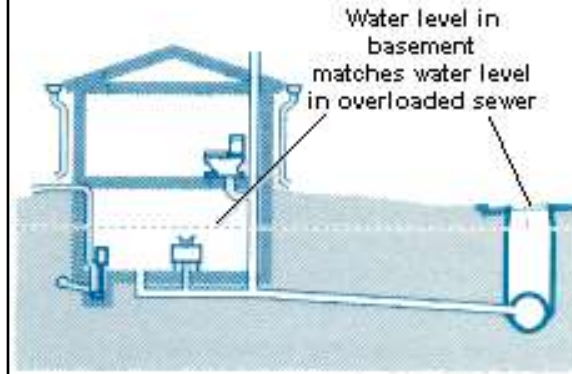
Sanitary Sewer Overflows (SSO)

- Sanitary sewer collection systems have a finite capacity to carry wastewater based on the size and condition of the components.
- Sanitary sewer overflows occur when effluent flows exceed the ability of the collection system to convey the wastewater to the treatment plant.



Basement Flooding

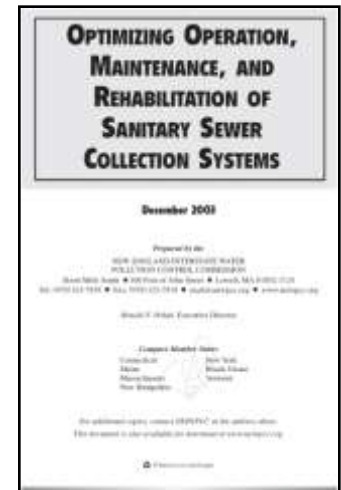
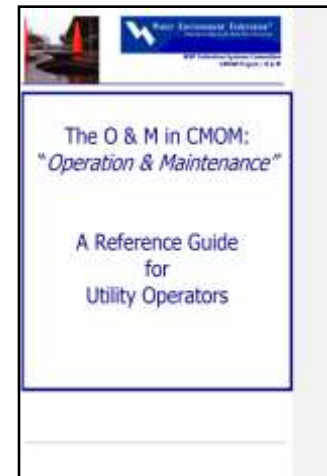
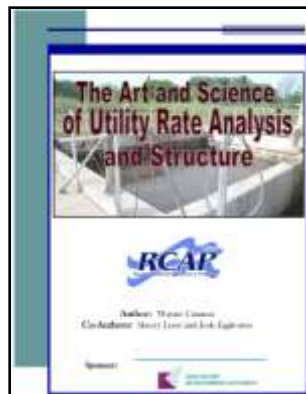
When the sanitary sewers were overloaded, the water level in the manholes and the sewers rises. When it rises above the level of the basement floor, the sewers can back up and flood the basement.



Sanitary Sewer Overflows are illegal!

What's Involved in CMOM?

- Understanding Collection System Capacity
- Administrative Review - “Management Factor”
- GIS Mapping (Ohio RCAP mapping program)
- Best Management Practices for O&M
- Asset Management – Check-Up Program for Small Systems
 - Asset Inventory / Condition Assessment / Identification of Critical Assets
 - O&M Strategy / Computerized Maintenance Management System
 - Capital Improvement Planning
 - Financial Management Strategy
- Utility Rate Analysis



Asset Management & CMOM Planning

Phase 1

1. Administrative Review of Utility Management
2. Develop an Asset Inventory (GPS Data Collection)
3. Construction and Maintenance History (Identify Problem Areas)
4. Operational Review (Historical vs. Best Practices) (Energy Audit)

Phase 2

5. Initial Condition Assessment (Reporting & Monitoring Standards)
6. GIS Mapping with Important Attributes (Permanent Electronic Record)
7. Identify Best Management Practices (Performance Benchmarks)
8. Set-up CMMS Software with Preventative Maintenance, Predictive Monitoring and Rehabilitation / Replacement Escrow

Phase 3

9. Capital Improvement Plan to address Deferred Maintenance
10. Asset Management Plan (Long term capital budgeting)
11. Rate Analysis (Affordable and Sustainable Rate)
12. Public Meeting to discuss Asset Management Plan results



Administrative Review

“The Management Factor”

- Legal Authority
- Rules and Regulations
- Organizational Structure
- Management Team
- Staffing / Job Descriptions
- Training & Safety Program
- Emergency Preparedness
- Customer Service & Public Relation Policy



Management is the
Key to Success

Rules, Regulations, Policies and Procedures

- Are written rules and regulations available? Are they legally enforceable? Can you locate the authorizing ordinances and by-laws?
- When were the rules and regulation last reviewed updated? Do they make sense? Are they compatible with current building standards and construction techniques?
- Do all utility employees understand the rules and regulations which they are responsible to enforce? Do they understand how enforcement of the rules and regulations are impacted by other departments?

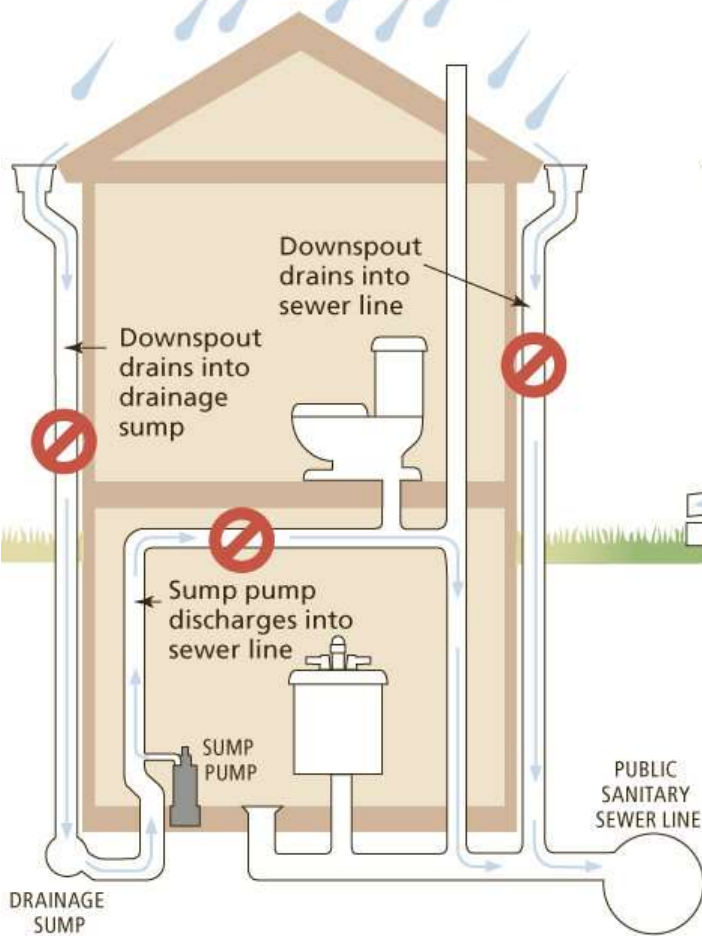


Rules & Regulations

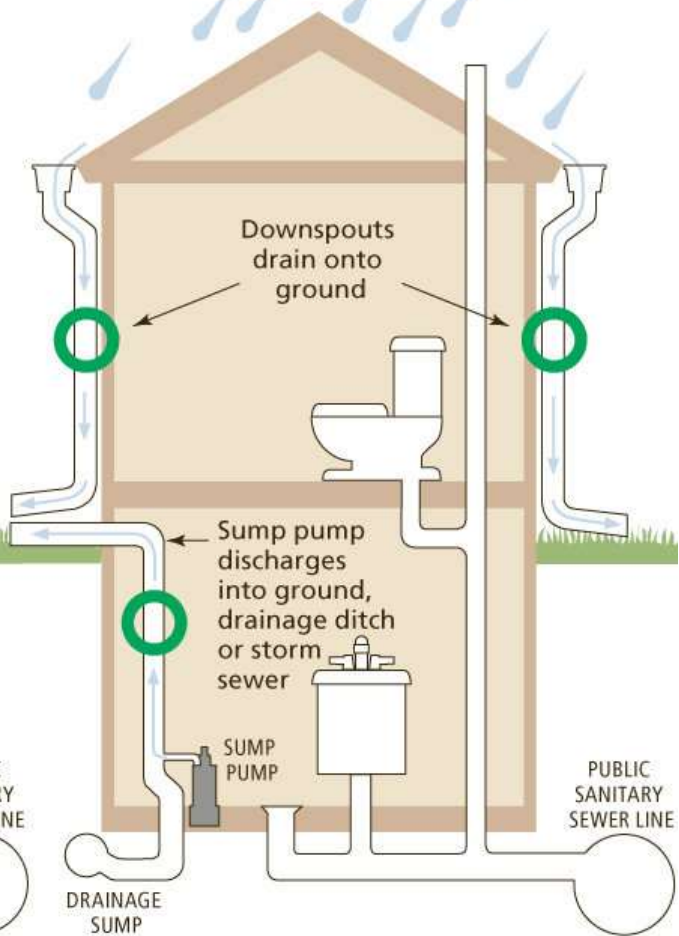


Illegal Plumbing Connections

IMPROPER
INSTALLATION



PROPER
INSTALLATION



The Post-Standard

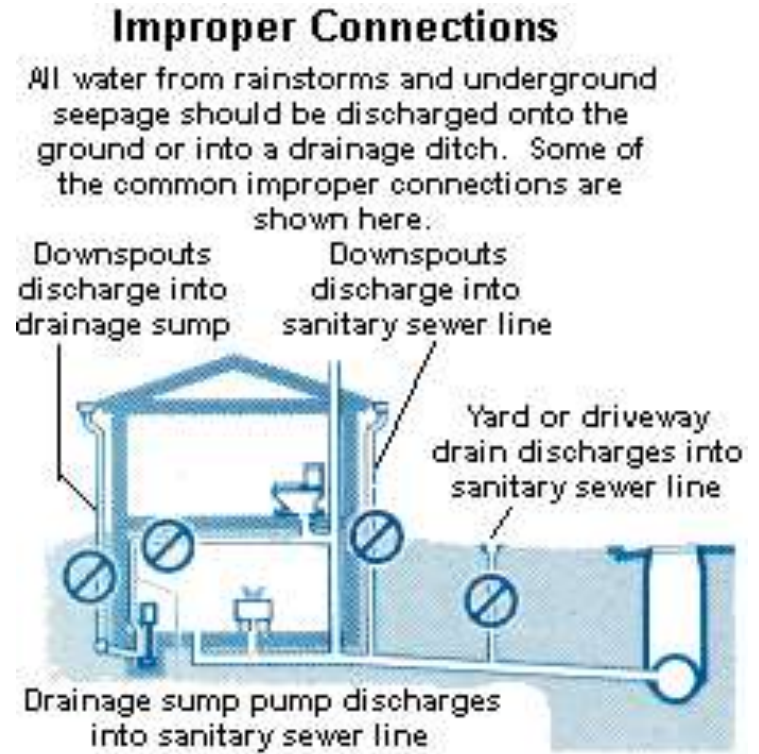
Illegal Sump Pumps

- A sanitary pump station rated at 500 GPM should be capable of serving 600 homes.
- A single ½ hp sump pump discharging with 10 feet of head would pump 60 GPM.
- Nine sump pumps representing only 1.5% of the customer base illegally discharging to the sanitary sewer system could overload the lift station possibility resulting in a sanitary sewer overflow (SSO).
- Education is a key component of private property I&I removal.



Private Property Inspection

- Illegal plumbing connections are most often identified by visual inspection.
- Private property inspections should be made by knowledgeable personnel in areas where flow monitoring and smoke testing indicates the likelihood of illegal connections.
- Knowledge of the building practices is helpful in deciding which areas merit building inspections.



This tool is seldom utilized by small communities who report private property inspection rate of only 0.3% per year according to the ASCE

Who is responsibility for Service Lateral Maintenance

- Responsibilities for sewer lateral ownership and maintenance should be specified in the sewer use rules and regulations.
- The ownership of service laterals must be clearly defined before a sewer line renovate or replace project can move forward.



Studies show that more than 60% of storm water inflow and infiltration originates on private property



Customer Education

Politically private property enforcement is very difficult. However from a cost prospective private property improvements are the low hanging fruit.

Sewer laterals are closer to the surface and therefore easier to access. Repairs can be made without disrupting service to neighboring customers.

Service laterals represent over half of the wastewater collection system in most communities.

Communities sometimes accept responsibility for sewer laterals in the public right-of-way. Curb stops and clean-outs can be used to define the ownership boundaries.

Sewer renovations projects which ignore service laterals are doomed to failure!



The Delaware County Regional Water Quality Control Authority

Stop Throwing Money Down the Drain! (Brochure)

Private Lateral Inflow and Infiltration Elimination Project

Watch free video <http://youtu.be/827Xx-Cyt7A>

GIS Mapping

“Asset Inventory made EASY”

- Maps are effective visual tools for storing and communicating information.
- Poor mapping makes effective collection system maintenance and repairs very difficult.
- Each reference point should be assigned a distinct name or identifier.
- This identifier is used to manage asset attribute information such as location, capacity, condition, maintenance history, etc.



Asset Management Planning

- Asset Inventory / Condition Assessment
- Identification of Critical Assets
- Performance Monitoring
- Level of Service (SMART) Goals
- Operation and Maintenance Strategy
- Computerized Maintenance Management System (CMMS)
- Capital Improvement Planning
 - Deferred Maintenance
 - Predictive Maintenance Escrow
 - Asset Replacement Escrow
- Safeguarding Savings for Capital Improvements
- Funding Strategies



<http://www.epa.gov/cupss/>



What is Asset Management?

“A process for maintaining a desired level of customer service at the best appropriate cost.”



Focus: “Lowest Life of Asset Cost”

NOT “Lowest Next Year Cost!”

O&M “Best Practices”

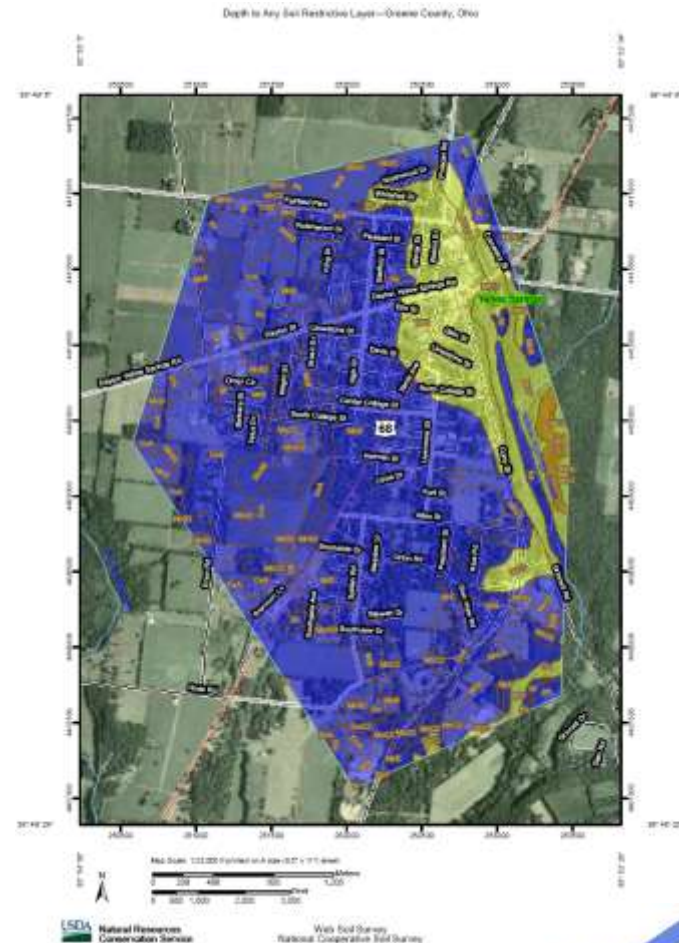
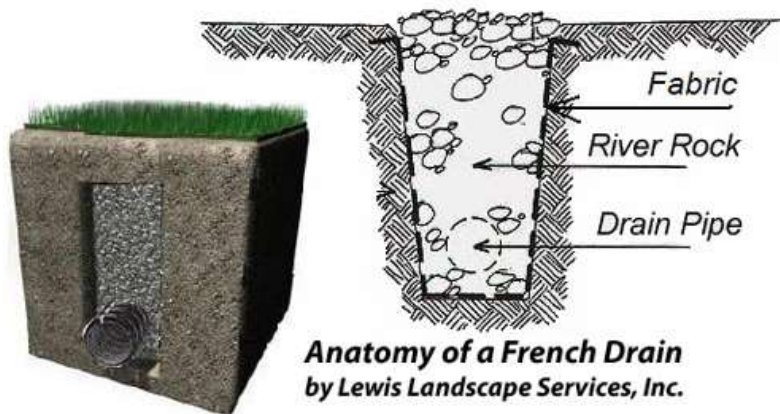
- Overall Sewer System Performance
- Lift Station Inspection & Performance
- Sewer Cleaning (Root & Debris Removal)
- Manhole Inspections
- Smoke & Dye Testing
- Hydrogen Sulfide Monitoring & Control
- Sewershed Flow Monitoring
- Private Property Inspections
- CCTV Inspections



Best management practices are particularly important for collection system maintenance since no owner’s manual exist for this type of infrastructure.

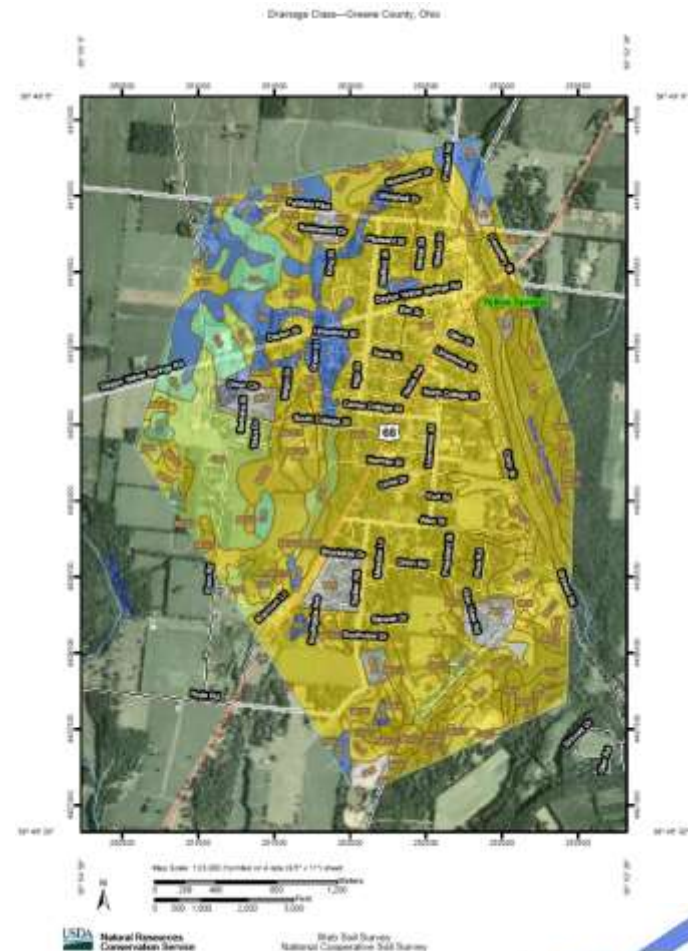
Sewershed Flow Monitoring (Site Geology)

- Sewer pipelines installed on bedrock are susceptible to infiltration.
- Deteriorating sanitary sewer lines which are bedded in gravel performs as a French drain removing trapped ground water



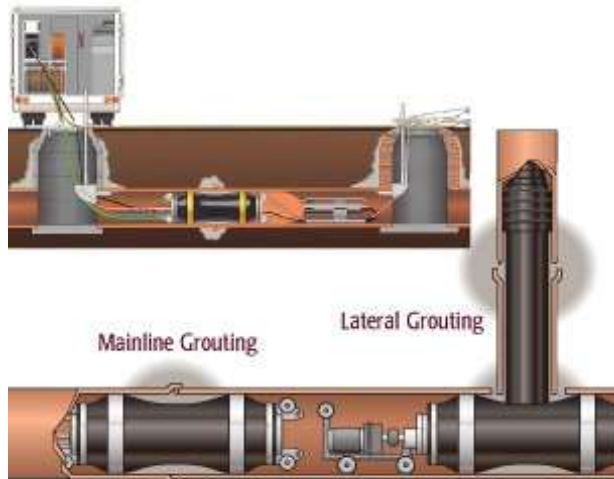
Sewershed Flow Monitoring (Site Geology)

- Very fine textured soils are resistant to the percolation of water.
- The longer water ponds at or near the surface the greater the likelihood it will find its way into the sanitary sewer system.
- Deteriorating sanitary sewer lines in these area co-function as agriculture drainage tile to lower the water table.



Capital Improvement Program

- A sewer rehabilitation program is necessary to defend the collection system against the effects of time.
- Rehabilitation activities should be scheduled based upon information obtained from your performance monitoring program.



Chemical Grouting



BEFORE



AFTER

Manhole Rehabilitation

Capital Improvement Planning (Deferred Maintenance)

- Deferred maintenance discovered by asset condition assessments should be corrected as soon as practical to mitigate further damages.
- Costs of overcoming deferred maintenance is the greatest barrier to the implementation of Asset Management and CMOM principles.



Even with an asserted effort, it may require several years to overcome past management practices.

Capital Improvement Planning (Deferred Maintenance)

- Capital upgrades to correct deferred maintenance should address the underlying management problems responsible for asset failure.
- CMMS and GIS mapping should be a component of any capital improvement project made necessary by deferred maintenance.

Computerized
Maintenance
Management
System -CMMS-



GIS Mapping

“Those who fail to learn from the mistakes of their predecessors
are destined to repeat them.”

George Santayana

Budgeting, Rates, and Funding

Improved Preventive Maintenance

- Expense reductions are more difficult when consequences are understood.
- CUPSS Table 5-1 shows preventive maintenance and performance monitoring work orders and associated cost.
- By presenting the maintenance budget in this manner decision makers must recognize the cost and consequences of individual maintenance tasks.

Goal: Maintain infrastructure and equipment for maximum economical life.

Table 5-1. Yellow Springs Sewer Preventive Maintenance Schedule for 2013

Task Name	Cost(\$)	Frequency	Estimate Annual Cost	Deferred Maintenance
Aeration Diffusers Annual Maintenance - Aeration Diffusers	0	The 4th Tuesday of June	0	0
Aeration Diffusers Monthly Maintenance - Aeration Diffusers	0	The 4th Tuesday every 1 month(s)	0	0
Aeration Tank Annual Maintenance - Aeration Tank	0	The 4th Tuesday of June	0	0
Aeration Tank Quarterly Maintenance - Aeration Tank	0	The 3rd Tuesday every 3 month(s)	0	0
Anaerobic Tank Maintenance - Anaerobic Tanks	0	The 1st Thursday of November	0	0
Anaerobic Tank Quarterly Maintenance - Anaerobic Tanks	0	The 1st Thursday every 3 month(s)	0	0
Anoxic Tank Annual Maintenance - Anoxic Tank	0	The 2nd Thursday of September	0	0
Anoxic Tank Diffuser Annual Maintenance - Anoxic Tank	0	The 2nd Thursday of September	0	0
Anoxic Tank Diffuser Monthly Maintenance - Anoxic Tank	0	The 2nd Thursday every 1 month(s)	0	0
Anoxic Tank Monthly Maintenance - Anoxic Tank	0	The 2nd Thursday every 3 month(s)	0	0
Anoxic Tank Quarterly Maintenance - Anoxic Tank	0	The 2nd Thursday every 3 month(s)	0	0
Auto Effluent Sampler Monthly Maintenance - Auto Effluent Sampler	0	The 3rd Monday every 1 month(s)	0	0
Auto Effluent Sampler Semi-Annual Maintenance - Auto Effluent Sampler	0	The 3rd Monday every 6 month(s)	0	0
Automated Slide Gate Quarterly Maintenance - Automated Slide Gate	0	The 3rd Thursday every 3 month(s)	0	0
Automated Slide Gate Semi-Annual Maintenance - Automated Slide Gate	0	The 3rd Thursday every 6 month(s)	0	0
Automatic Slide Gate Annual Maintenance - Automated Slide Gate	0	The 3rd Thursday of September	0	0
CCTV Sewer Line Inspection - Collection (Overall) System	25000	Every June 1	0	25000

Budgeting, Rates, and Funding

Predictive Maintenance Escrow

- Predictive maintenance involves the renovation and replacement of short-lived components of long-term asset.
- The long-term asset management goal should be to save 100% of predictive maintenance cost.
- An intermediate goal is to fund predictive maintenance from savings within 10-years.

Table 7-2. Predictive Maintenance Escrow

Capital Improvement Project	Total Cost	Annual Savings	Type of Capital Improvement Project	Year to Conduct
Rehabilitation of Sewer Collection Pipes	\$1,608,000	\$134,000	Support of Preventive Maintenance	2013 - 2024
Rehabilitation of Manholes	\$480,000	\$40,000	Support of Preventive Maintenance	2013 - 2024
Rehabilitation of Service Laterals	\$408,000	\$51,000	Support of Preventive Maintenance	2013 - 2020
WWTP & Lift Station	\$1,300,000 (Estimated by RCAP)	\$85,000 (Estimated by RCAP)	Support of Preventive Maintenance	2013 - 2033
Total	\$3,796,000	\$290,000		

Small capital projects should be funded from savings. Preserve credit capacity for large projects.

Budgeting, Rates, and Funding

Asset Replacement

- An asset management plan is used to document the current year reserve deposits necessary to provide long-term sustainability of the utility system.
- Remaining useful life of sewer assets was adjusted to reflect the proposed improvements to the preventive and predictive maintenance.

Table 7-3. Asset Replacement Cost

Capital Improvement Project	Total Cost	Annual Savings	Type of Capital Improvement Project	Year to Conduct
Manhole S106-3	\$5,000	\$27	Rehabi/Replace	2136
Manhole S107	\$5,000	\$27	Rehabi/Replace	2136
Pipeline S107/S107-1	\$11,127	\$56	Rehabi/Replace	2150
Pipeline S107/S107-3	\$16,451	\$82	Rehabi/Replace	2150
Manhole S107-1	\$5,000	\$23	Rehabi/Replace	2163
Pipeline S107-1/S107-2	\$22,824	\$113	Rehabi/Replace	2150
Manhole S107-2	\$5,000	\$25	Rehabi/Replace	2150
Manhole S107-3	\$5,000	\$25	Rehabi/Replace	2150
Pipeline S107-3/S107-4	\$16,869	\$83	Rehabi/Replace	2150
Manhole S107-4	\$5,000	\$26	Rehabi/Replace	2143
Pipeline S107-4/S107-5	\$18,555	\$93	Rehabi/Replace	2150
Manhole S107-5	\$5,000	\$27	Rehabi/Replace	2136
South Service Laterals	\$738,000	\$5,387	Rehabi/Replace	2150
North Service Laterals	\$738,000	\$5,387	Rehabi/Replace	2150
Total	\$24,263,931	\$226,402		

Self funding 100% of capital replacement cost is not a realistic goal.

**Nothing lasts forever. Everything will wear out eventually.
Plan for asset replacement!**



Budgeting, Rates, and Funding

Asset Replacement

- Grant and low interest loan providers want to finance projects which are ready to proceed! (**Shovel Ready!**)
- Shovel ready projects have a greater probability of securing low interest loans and grants thereby reducing asset replacement cost.
- By paying for preliminary engineering and design from savings the project can be shovel ready.



Escrow deposits equal to 15% of total asset replacement over the remaining useful life of the infrastructure is a reasonable asset replacement goal for many utilities.

Capital Improvement Project	Total Cost	Annual Savings
Total	\$24,263,931	\$226,402
20% Target	\$4,852,786	\$45,280
15% Target	\$3,639,590	\$33,960
10% Target	\$2,426,393	\$22,640

Safeguarding Capital Reserves

- Specific escrow accounts should be established to help future decision makers understand the necessity of large escrow balances.
- Capital improvement escrow must withstand the political storms which will occur during the asset's lifecycle.
- Future decision makers must be trained to understand and respect the asset management and CMOM accomplishment of their predecessors.



Your CMOM Action Plan

Recommended Initial CMOM Goals:

- Improve regulatory compliance
- Improve preventive maintenance
- Establish predictive maintenance program
- Develop long-range asset replacement strategy
- Sustainable utility rate.



Your CMOM Action Plan

Table 9-1 Action Plan Table

Urgency	Service (All, W, WW)	Issue	Corrective Action Plan	Performance Target No.	Target Date for Completion	Status	Final Completion Date
High	WW	<p>Improve regulatory compliance by eliminating SSO events at the North Lift Station. Over the past five years, thirteen wet weather SSO events have occurred.</p>	<p>Install LJB recommended manhole actions for reduction in storm water Inflow/Infiltration in the northern collection system.</p> <p>Remove storm sewer cross connections documented by ORWA / RCAP smoke test results system wide. Storm water will either be rerouted to an approved outfall, or will be address through decentralized (on-site) measures as approved by the village.</p> <p>Establish sump pump inspection and removal program. This new policy will emphasize shared public / private responsibility to encourage voluntary participation of sewer customers.</p> <p>Enact stronger Sewer Code Ordinances to better define village / customer responsibilities. Ownership of sewer laterals should be uniformly defined and landowners made aware of their responsibility for sewer line maintenance and repair.</p>	<p>Reduce storm water impact upon wet weather flows (November through April) measured at the wastewater treatment plant influent and effluent meters by 3% annually.</p> <p>Achieve a 50% reduce the number of wet weather SSO at the north lift station by FYE 2015. Eliminate wet weather SSO at the north lift station by FYE 2018.</p> <p>Reduce the daily peaking factor from ____ to 6.0x by <u>2023 (10 Yr Goal)</u>.</p> <p>Reduce monthly peaking factor from ____ to 3.0x by <u>2023 (10 Yr Goal)</u>.</p> <p>(These ratios cannot yet been calculated due to water metering issues.) National average peaking factor is 2.24X.</p>	12/31/2013	In Progress	



Your CMOM Action Plan

