Sandy Township Municipal Authority (PA) Sanitary Sewer System Evaluation

PennTec Conference

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Presented By:

Steve Gibson, PE & Matt Orner

Gwin, Dobson & Foreman, Inc.

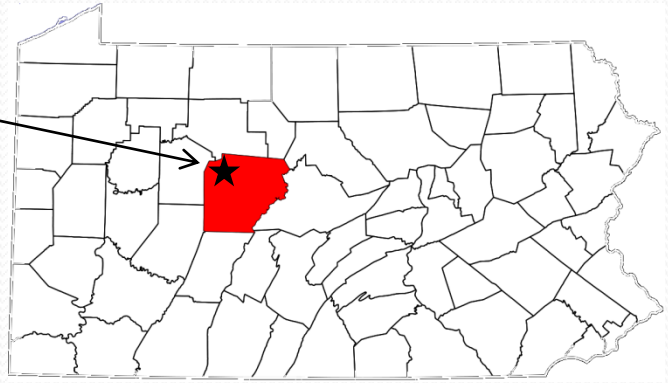
Outline

- Sandy Township Sewer System Evaluation
  - System Overview
  - Act 537 Planning and Corrective Action
  - Flow Monitoring
  - Sewer Cleaning/Televising Work
  - Manhole Inspections
  - Smoke & Dye Testing
  - Diagnostic Work Evaluation
  - System Options to Reduce I/I
- Final Compliance Plan
- Questions

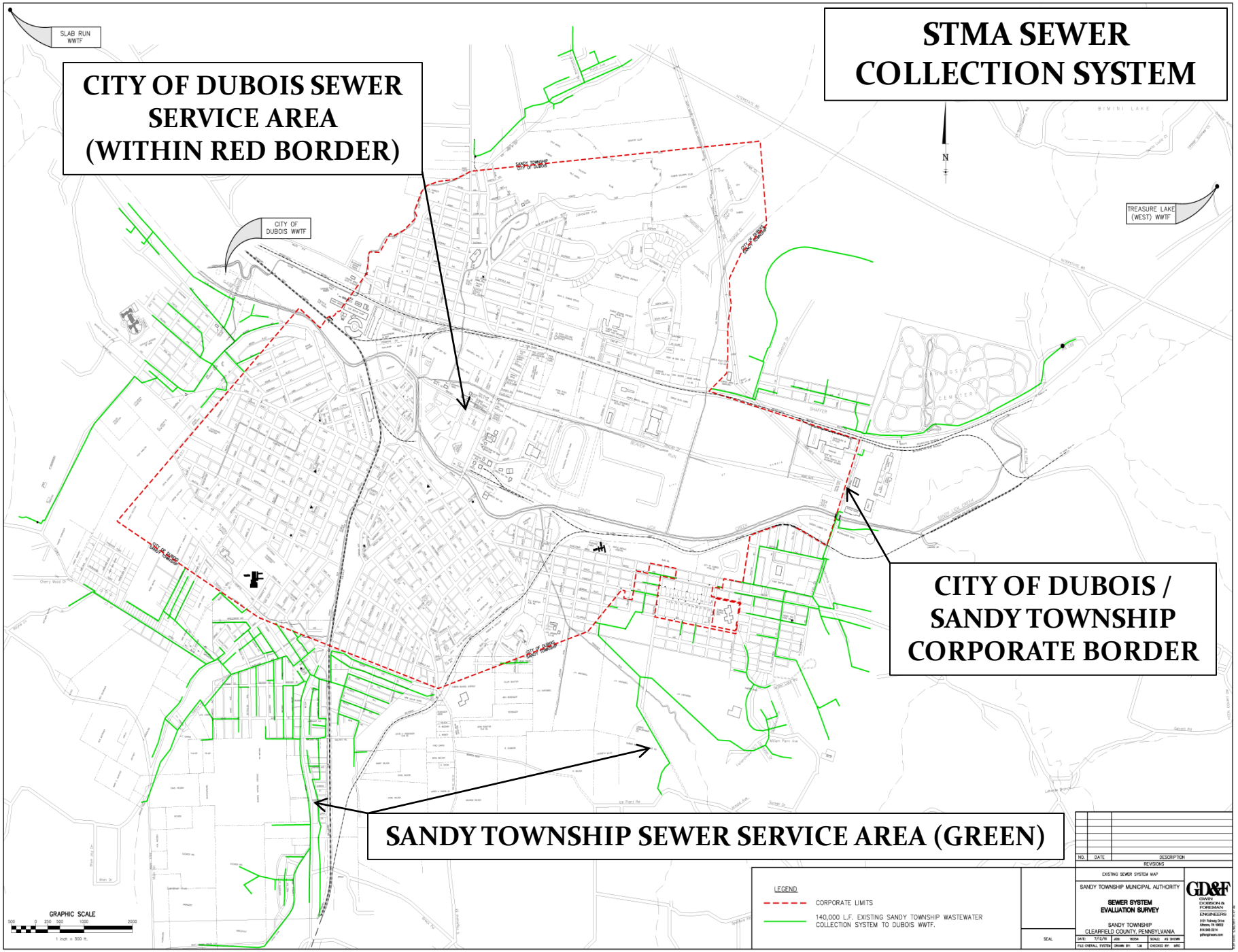
System Overview

- Sandy Township Municipal Authority (STMA) Wastewater System
  - Service Area – 1,500 customers (3,800 EDUs) in Sandy Township
  - STMA owns 27 miles of interceptor and collection sewers (separate sewer system) and 3 sewage lift stations
  - Sewage conveyed to City of DuBois interceptor sewer system / regional wastewater treatment plant
  - **STMA goal to reduce costly I/I**

Sandy Township, PA



STMA SEWER COLLECTION SYSTEM



System Description

- Sandy Township Municipal Authority System
  - 140,000 LF of 6”-15” pipe
  - 3 lift stations
  - Sewage collection system is 1 - 55 years old
  - Flow meter billing at all entry points to DuBois System

- City of DuBois System
  - Interceptor sewer system and the City’s original Treatment Plant (primary treatment via trickling filters) were constructed in early 1960’s
  - A major Plant expansion project completed in late 1980’s and 2.0 million gallon EQ basin added in 2007

Sanitary Sewer Billing Practices

- *Prior to June 2016:*
  - Historically the City has invoiced the Township monthly for sewage services based on the *metered volume of potable water consumed*
  - Recognized that this method does not accurately account for sewage conveyed and treated since there is a notable I&I influence

- *Since June 2016:*
  - City *installed master meters* at locations where the Authority's conveyance system lines transition into the City's
  - Currently used as billing meters
  - Authority pays for *all flow* entering the DuBois system, including *costly wet weather I&I flow*

Regulatory Action

- PADEP regulatory action mandated City to prepare an Update to Act 537 Plan
  - Upgrade its sewer system (I/I reduction) and..
  - Treatment Plant Improvements (permit compliance)

- Draft Act 537 Plan: "*significant infiltration and inflow (I/I) issues…require comprehensive examination and I/I reduction and plant improvements*"

- City and Authority faced with reducing I/I; expanding sewer system & treatment plant; or both to abate excessive I/I

- Tentative Plan submission in 2018

Act 537 Planning and Corrective Action

- As a result of the City's mandated planning study and the newly enforced billing:

- Authority undertook a system-wide diagnostic evaluation of the Township owned and maintained sewer system that drains to the City of DuBois wastewater treatment facility to identify system deficiencies.

- System study area: - 140,000 LF of sewer main
  - 1,231 laterals
  - 616 manholes

Act 537 Planning and Corrective Action

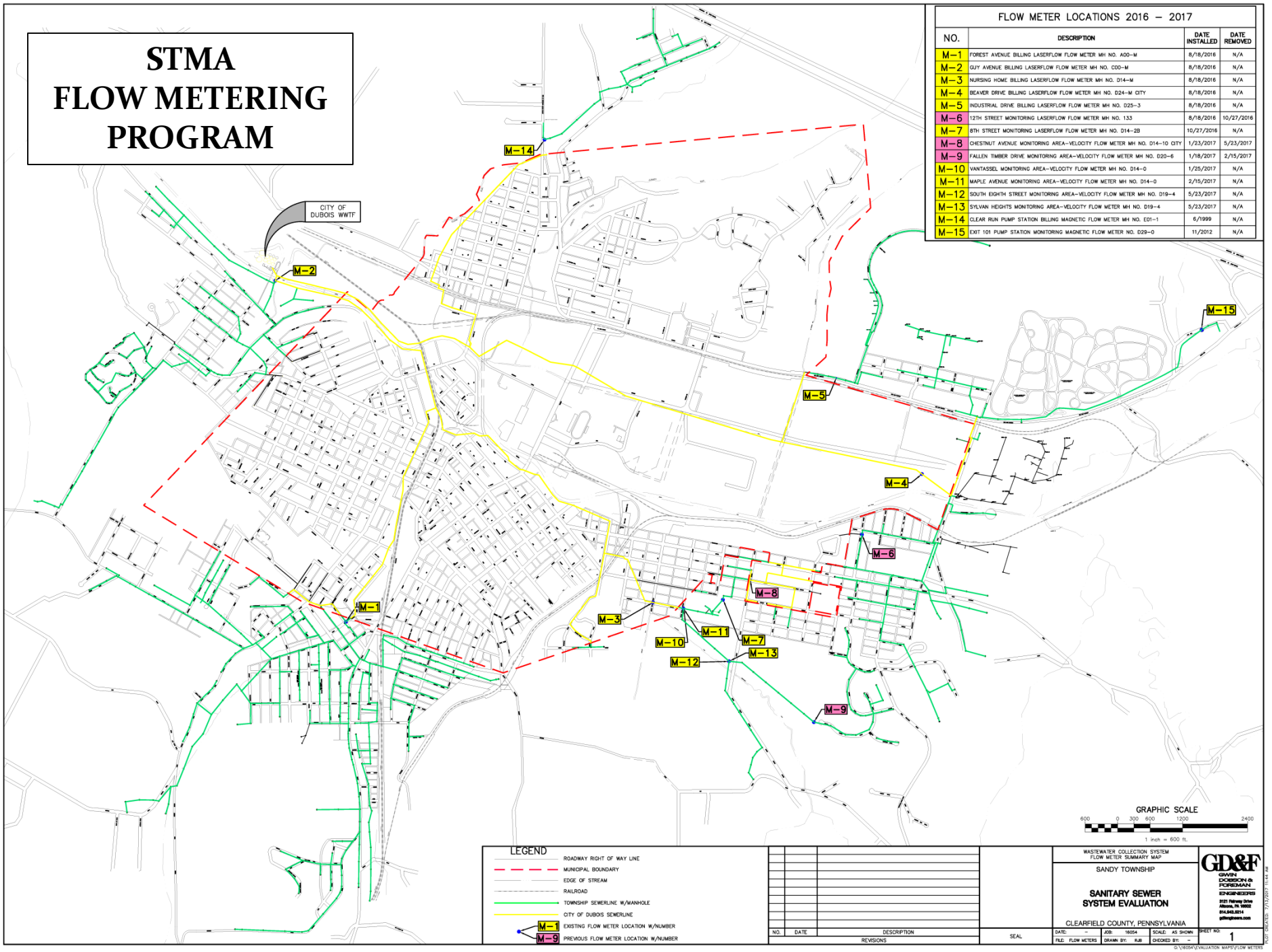
Comprehensive Compliance Plan

- Flow Monitoring
- Sewer Cleaning & Televising
- Manhole Inspections
- Dye and Smoke Testing
- Home Inspections
- Inflow and Infiltration Analysis
- Sewer System Evaluation
- Compliance Projects
- Compliance Schedule
- Update & Submit Act 537 Plan

Conveyance System Flow Monitoring

- Initial program monitored flows at 5 strategic locations in the main conveyance system
- 15 flow monitoring locations from 2016 to 2018
- Combination of ultrasonic area-velocity, LaserFlow non-contact area-velocity & magnetic flow meters
- Authority maintained & serviced meters

STMA FLOW METERING PROGRAM



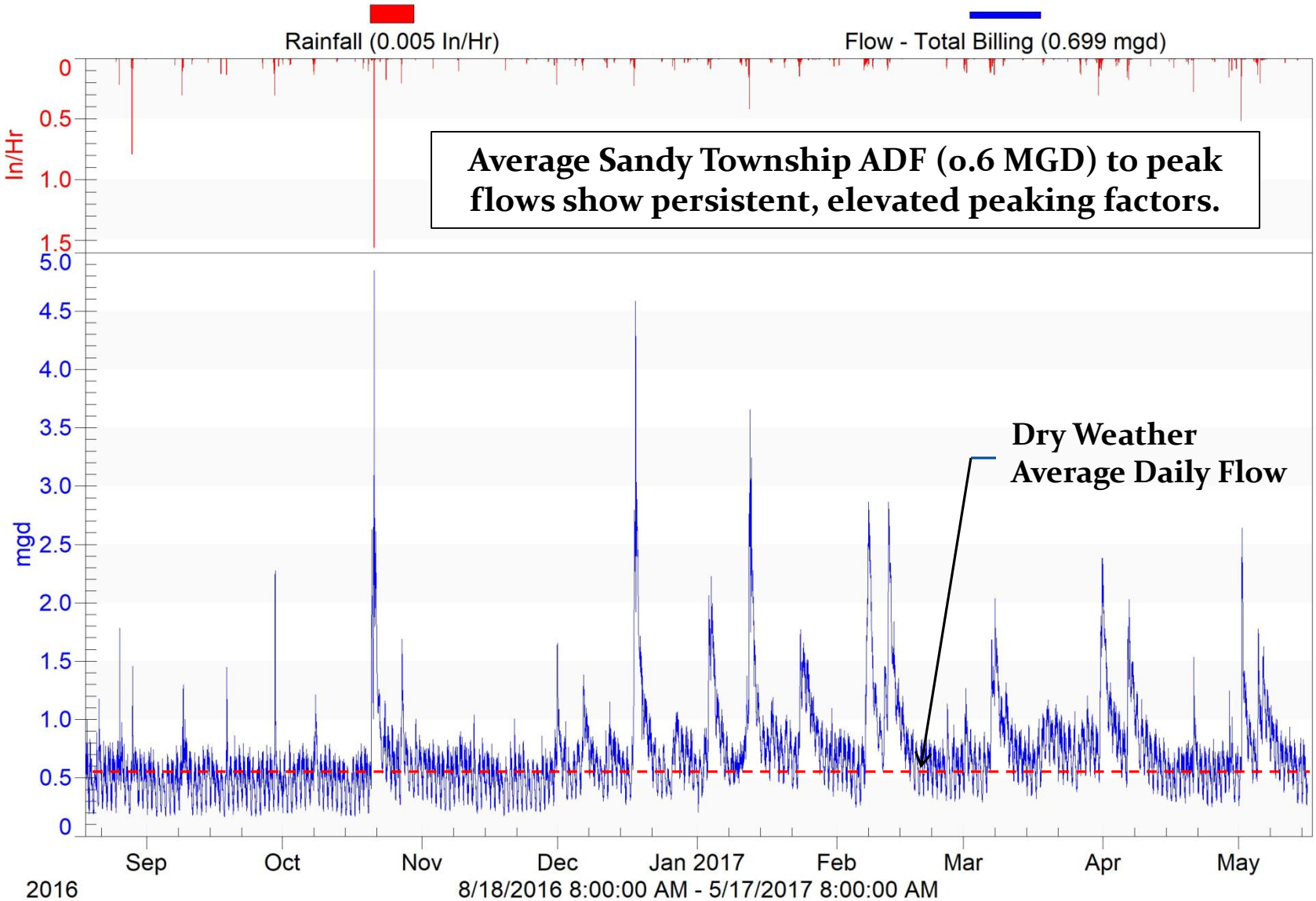
FLOW METER LOCATIONS 2016 – 2017			
NO.	DESCRIPTION	DATE INSTALLED	DATE REMOVED
M–1	FOREST AVENUE BILLING LASERFLOW FLOW METER MH NO. A00–M	8/18/2016	N/A
M–2	GUY AVENUE BILLING LASERFLOW FLOW METER MH NO. C00–M	8/18/2016	N/A
M–3	NURSING HOME BILLING LASERFLOW FLOW METER MH NO. D14–M	8/18/2016	N/A
M–4	BEAVER DRIVE BILLING LASERFLOW FLOW METER MH NO. D24–M CITY	8/18/2016	N/A
M–5	INDUSTRIAL DRIVE BILLING LASERFLOW FLOW METER MH NO. D25–3	8/18/2016	N/A
M–6	12TH STREET MONITORING LASERFLOW FLOW METER MH NO. 133	8/18/2016	10/27/2016
M–7	8TH STREET MONITORING LASERFLOW FLOW METER MH NO. D14–2B	10/27/2016	N/A
M–8	CHESTNUT AVENUE MONITORING AREA–VELOCITY FLOW METER MH NO. D14–10 CITY	1/23/2017	5/23/2017
M–9	FALLEN TIMBER DRIVE MONITORING AREA–VELOCITY FLOW METER MH NO. D20–6	1/18/2017	2/15/2017
M–10	VANTASSEL MONITORING AREA–VELOCITY FLOW METER MH NO. D14–0	1/25/2017	N/A
M–11	MAPLE AVENUE MONITORING AREA–VELOCITY FLOW METER MH NO. D14–0	2/15/2017	N/A
M–12	SOUTH EIGHTH STREET MONITORING AREA–VELOCITY FLOW METER MH NO. D19–4	5/23/2017	N/A
M–13	SYLVAN HEIGHTS MONITORING AREA–VELOCITY FLOW METER MH NO. D19–4	5/23/2017	N/A
M–14	CLEAR RUN PUMP STATION BILLING MAGNETIC FLOW METER MH NO. E01–1	6/1999	N/A
M–15	EXIT 101 PUMP STATION MONITORING MAGNETIC FLOW METER NO. D29–0	11/2012	N/A

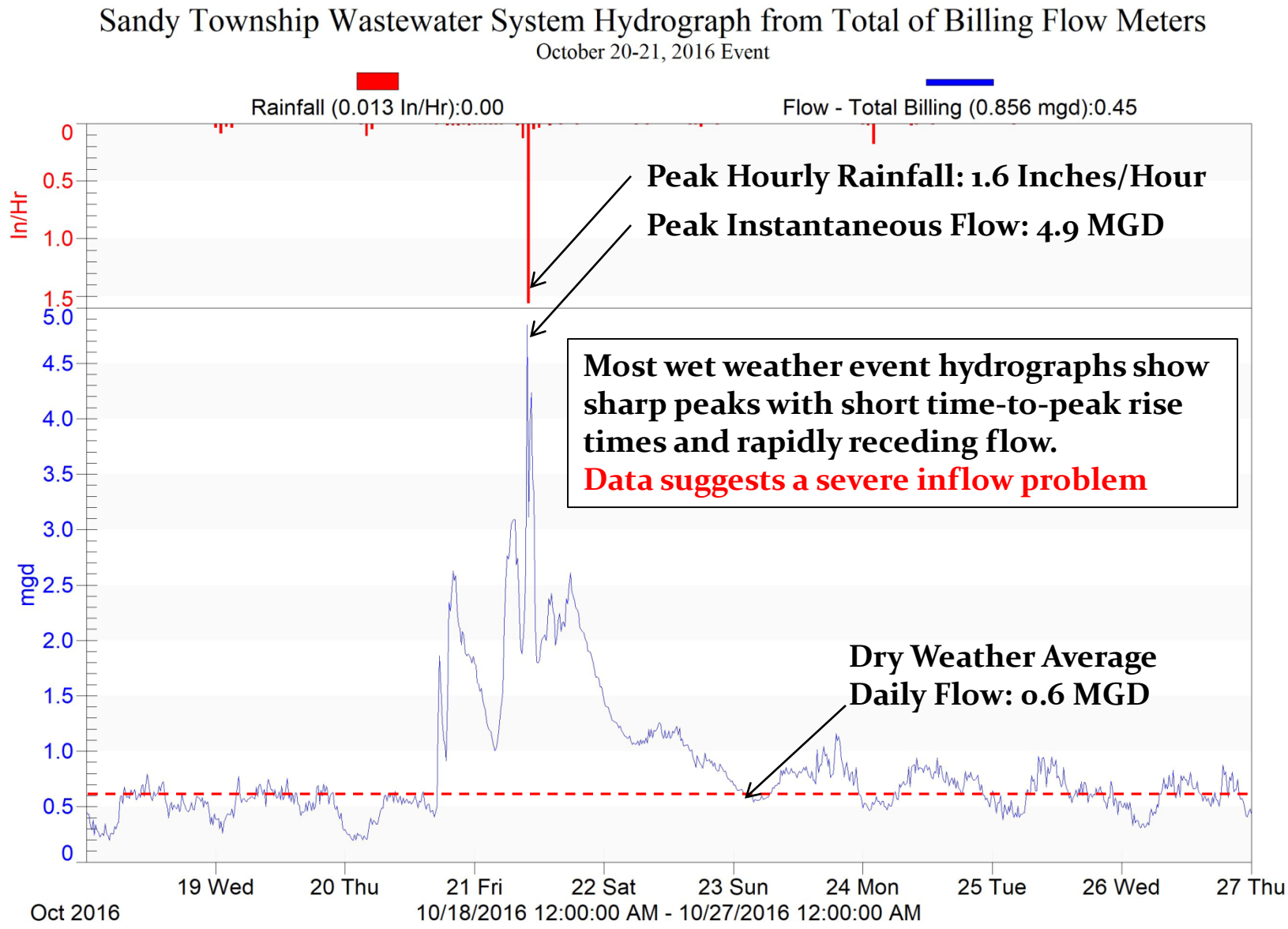
Flow Monitoring Devices

- Area-Velocity Meters (Sewer System)
  - Continuous wave Doppler technology measures average velocity
  - Primarily used in areas not prone to surcharge conditions
- Laser Flow Non-Contact Area-Velocity Meters (Sewer System)
  - Continuous laser Doppler technology accurately measures multiple velocity points below water surface
  - Installed in surcharge areas
- Magnetic Flow Meters (Pump Station Force Mains)
- Rain Gage
  - Integrated Tipping Bucket recorded hourly precipitation to develop flow-rainfall relationships

Sandy Township Wastewater System Hydrograph from Total of Billing Flow Meters

August 2016 - May 2017





Typical Wet Weather Hydrograph Composite

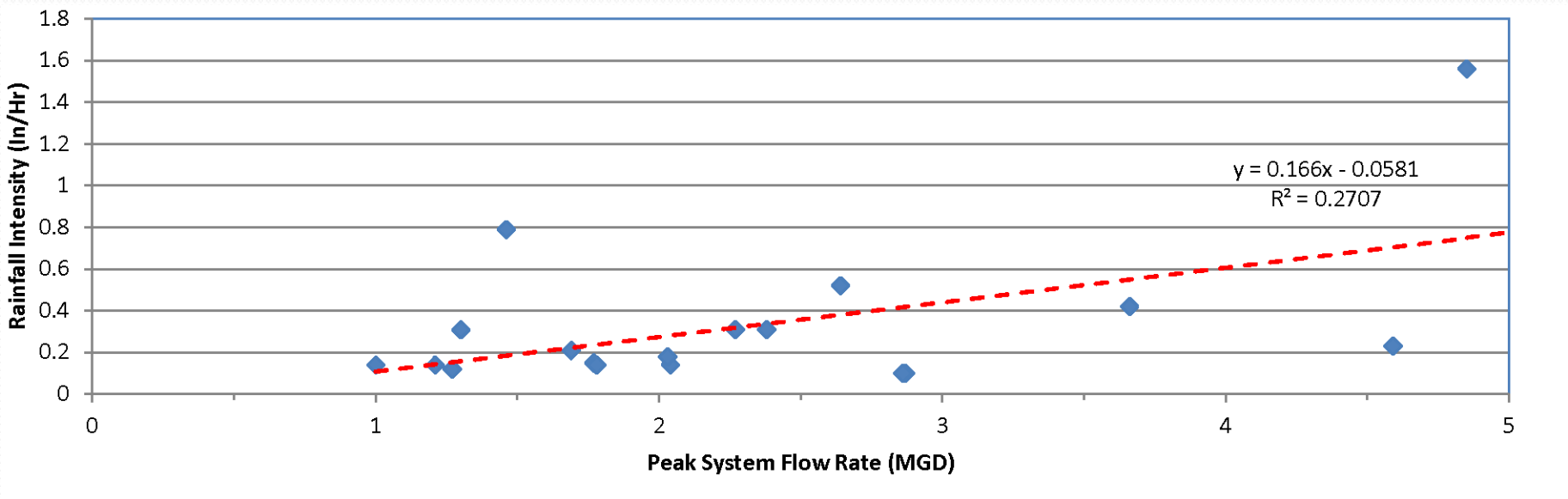
Flow Monitoring Results

Study Period from August 2016 to May 2017

- *City WWTP*
  - Plant Capacity: 4.4 MGD, Peak Capacity: 15.0 MGD
  - Plant Average Daily Flow: 3.0 MGD

- *Sandy Township Municipal Authority Subsystem*
  - Dry Weather Average Daily Flow: 0.6 MGD
  - Average Peak Wet Weather Event: 2.3 MGD
  - Peak Hourly Total Flow: 4.8 MGD (9 x DWAF)
- Peak Rainfall Event: 2.00 inches in 27 hours
  - *Maximum Rainfall Intensity: 1.6 inches/hour*
- 10 Events with Peak Hourly Flow 2 MGD or Greater
- 2 events with Peak Hourly Flow 4.5 MGD or Greater

Peak System Rates & Rainfall Intensity Relationship



- 0.8 inch per hour rainfall will produce ≈ 5 MGD system flow
- 0.5 inch per hour rainfall will produce ≈ 3.5 MGD system flow
- Most wet weather event hydrographs show sharp peaks with short time-to-peak rise times and rapidly receding flow
- **Data suggests a severe inflow problem**

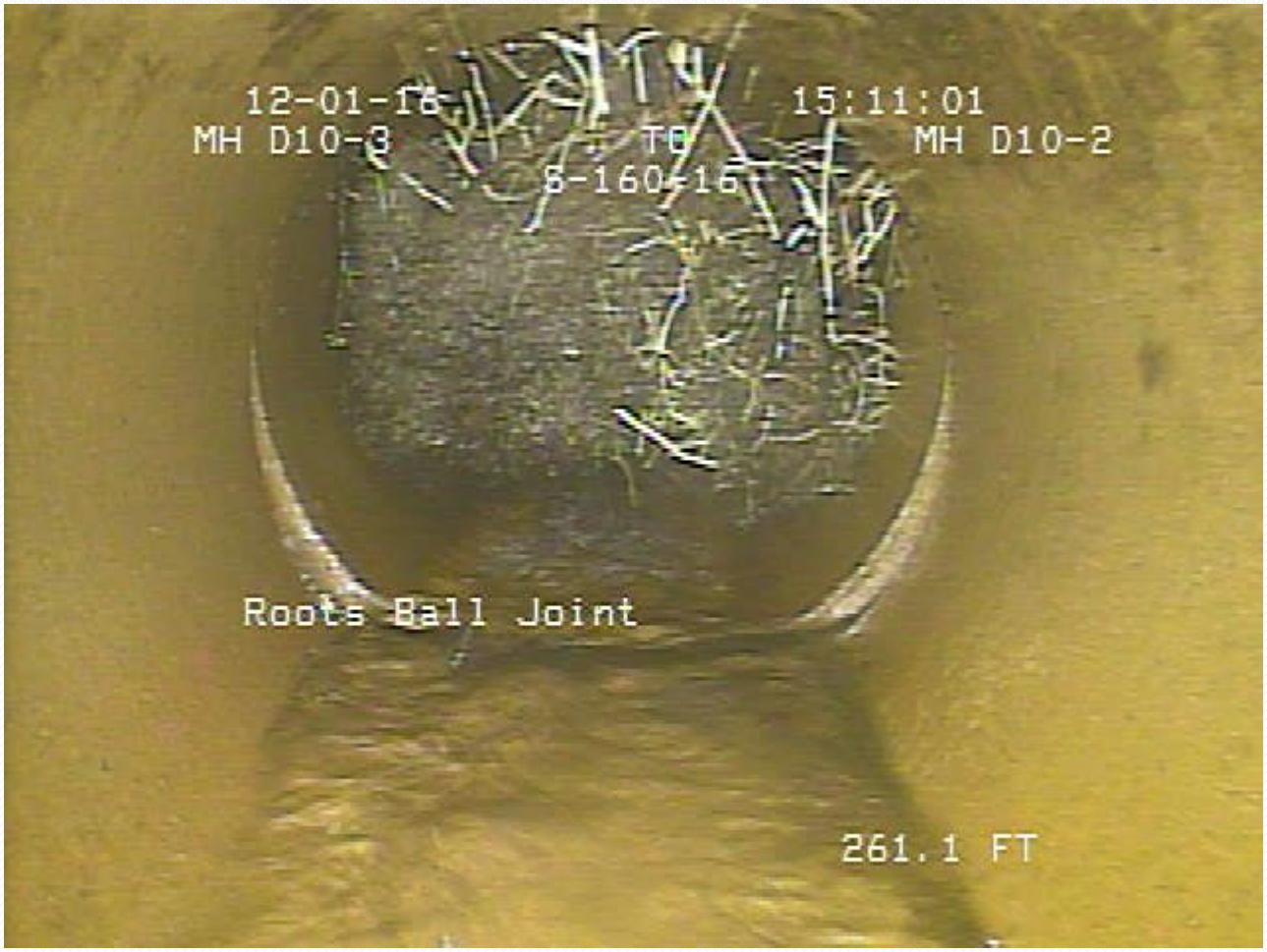
Diagnostic Work (System-Wide)

- Cleaning & Televising of Collection Conveyance System
  - Public Mains and Private Laterals
- Manhole Inspections (System-Wide)
- Smoke Testing (System-Wide)
- Dye Testing of Suspected Direct Cross Connections
- Home Inspections (Phase 2)

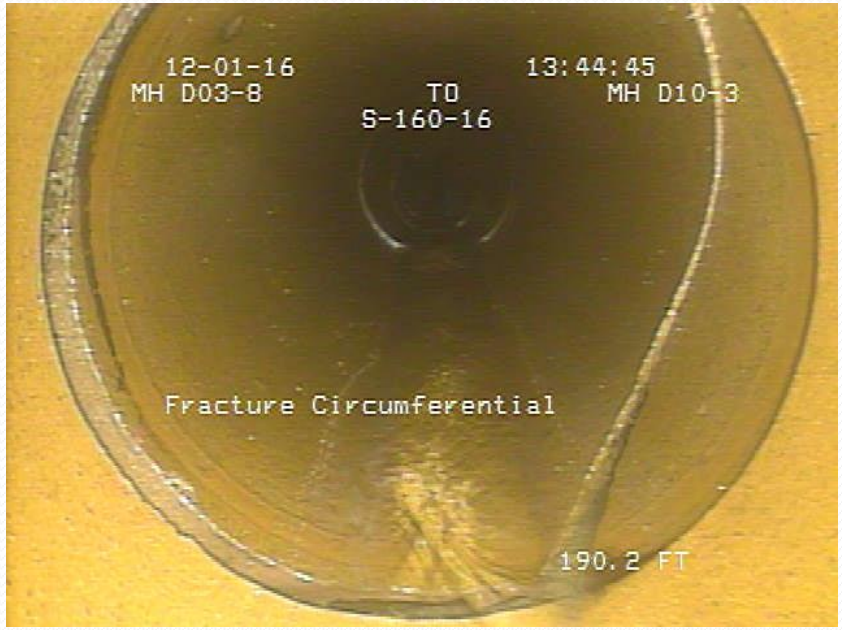
Sewer Cleaning/Televising Work

- 54,219 LF (10 Miles) of Sewer Main Cleaned/Inspected
- 1,231 Private Laterals Inspected
  - Main Line Launched Lateral Camera
  - Push camera via access from property and house cleanouts, when available
- Contracted with private firm to perform work

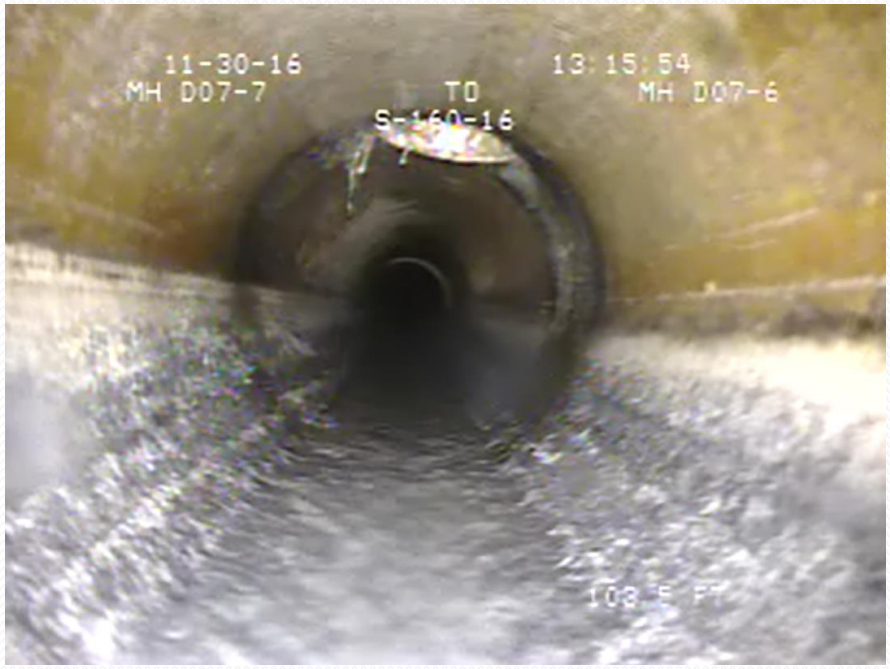
Main Interceptor Infiltration



Root Intrusion (90% Blockage)



Main Conveyance Sewer – Broken and Fractured Pipe



Deformed Pipe and Intruding/Leaking Lateral Connection

Summary of Public Lateral Televising Deficiencies

Reported Public Lateral Deficiency/Recommendation	Total No.
Replace public lateral	**55**
Spot repair	**42**
Inspection port cap to be replaced	13
Investigate/remove storm drain connections	**13**
Private lateral to be capped at mainline	11
Public lateral to be cleaned	8
Inspection port pipe structure to be repaired/replaced	7
Public lateral to be televised after spot repairs	5
Investigate unknown conduit	2
Investigate source of grease	1
Investigate illegal connection	1
TOTAL:	**158**

Summary of Private Lateral Televising Deficiencies

Reported Private Lateral Deficiency/Recommendation	Total No.
Spot repair	**278**
Private lateral to be replaced	**278**
Private lateral to be cleaned	142
Televise remaining private lateral after spot repair work	84
Replace broken cleanout cap	80
Cleanout pipe structure to be repaired/replaced	38
Remove illegal floor drain	**35**
Remove illegal foundation/French drain	**26**
Sump pump/illegal connection to be removed	**10**
Manhole cover/frame to be repaired/replaced	7
Downspout to be removed	6
Investigate steady clear flow in lateral	5
Missing cleanout cap to be added	4
Remove illegal parking lot/drive way drains	3
Gain access to lateral to televise or clean	2
Investigate miscellaneous deficiencies	13
TOTAL:	**1,011**

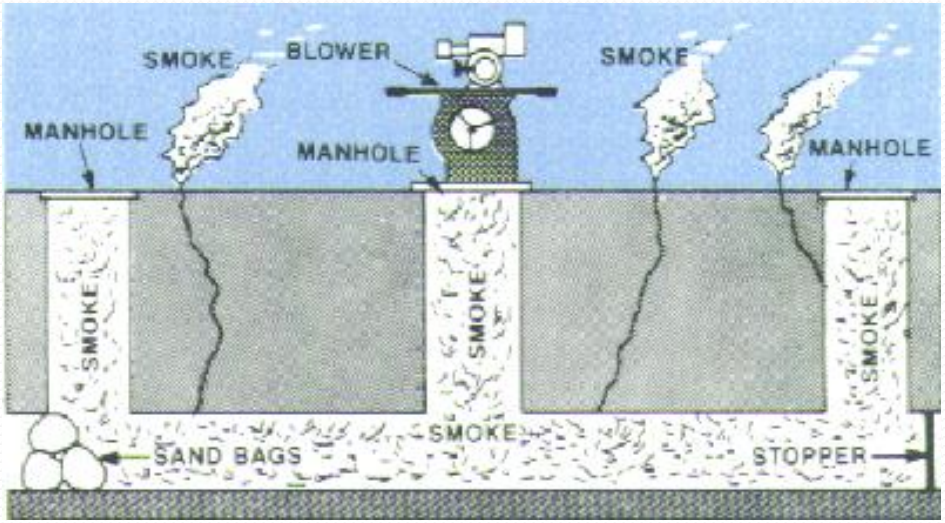
Manhole Inspections

Brick Manhole Subject to Infiltration

Manhole Subject to Infiltration and Deficient Flow Channel

Smoke & Dye Testing

- Goal is to identify possible cross connections and inflow to the sewer system
- Introduction of non-toxic smoke into sewer system for interconnection of:
  - Roof leaders
  - Area drains
  - Broken main lines
  - Leaking manholes
  - Storm sewer cross connections



- Follow-up dye testing
- STMA enforcement of illegal connections removal

Defective Private Lateral

Building Lateral Defects

Broken Cleanout Cap
at Property Line

Swimming Pool Filter Drain Connection to Sewer Cleanout

Illegal Parking Lot Area Drain Connection

Diagnostic Work Evaluation

- Internal inspections via CCTV were performed on 1,231 laterals
- Over 1,000 deficiencies were reported within 642 private laterals and 135 public laterals
- 278 private laterals require replacement along with 278 private laterals that require repairs
- 55 public laterals require replacement and 42 public laterals require repairs.

Summary of Diagnostic Work Deficiencies

Item	Quantity Inspected	Spot Repair	Complete Replacement	Other - Recommended Follow-up Maintenance Items	Total No. of Deficiencies Found
Public Mainline (LF)	46,453	400	15,809	6,469	**22,678**
Private Mainline (LF)	7,766	0	2,016	1,327	**3,343**
Public Laterals (EA)	1,231	42	55	61	**158**
Private Laterals (EA)	1,231	278	278	455	**1,011**
Manholes (EA)	616	84	18	163	**348**

Sewer System Options to Reduce I/I

- A fair portion of the deficiencies lie within the public sewer system; however, it is evident from the diagnostic work that a **greater source of I/I stems from private laterals**.

- To reduce I/I, the Township is encouraged to complete public sewer system repairs and replacements and implement and enforce a Private Lateral Rehabilitation program.

- This type of program can be established and enforced through existing Township Codes, Rules/Regulations and new Ordinances.

Sewer System Analysis to Reduce I/I

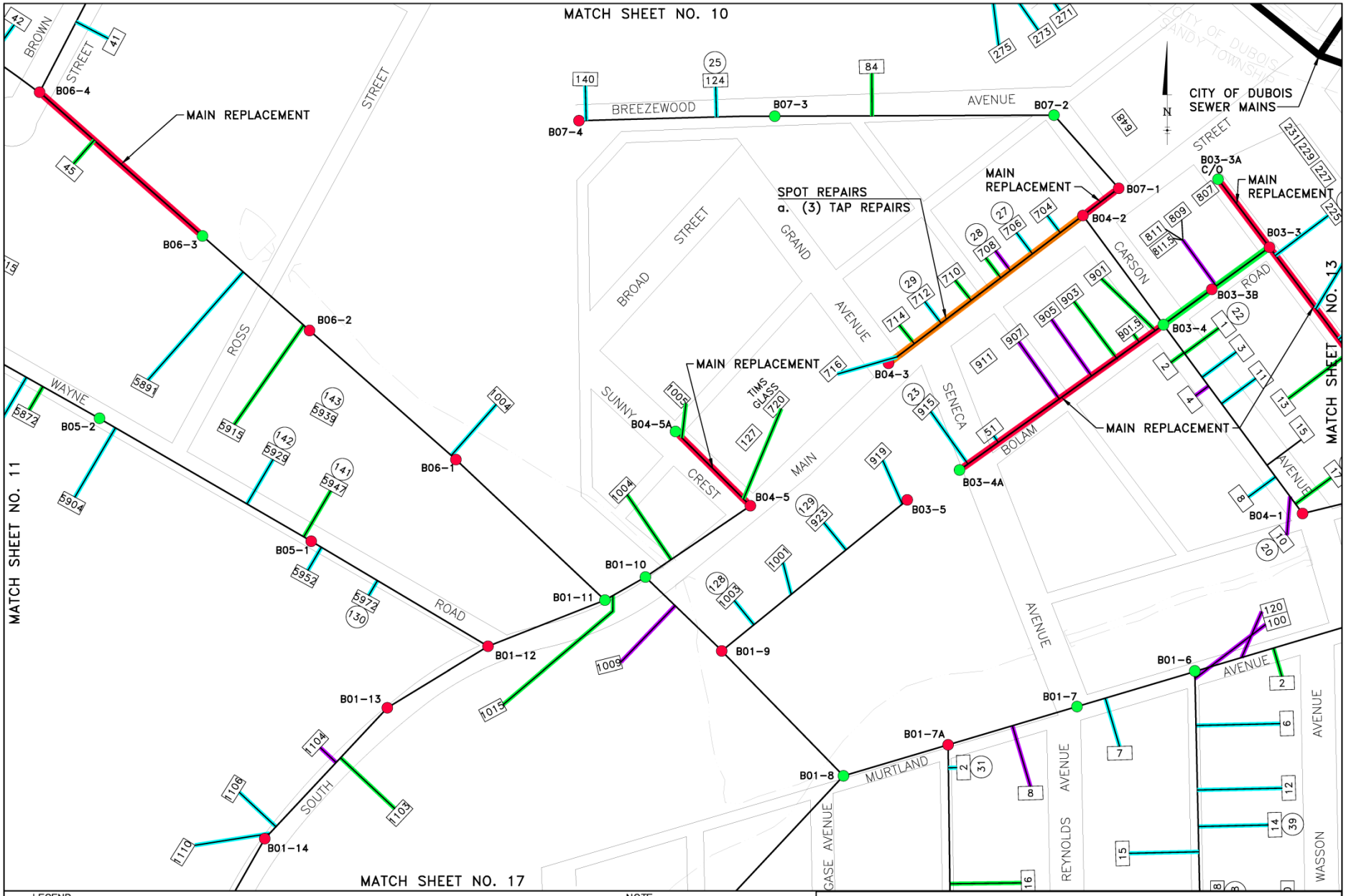
- An analysis estimated the potential I/I flow reduction from recommended public and private sewer system improvement projects.
  - The **estimated total potential infiltration and inflow reduction** is 5,748,068 gallons per month, or **approximately 25%** of current monthly billed and treated sewage from the Township service area
- The Township could anticipate a reduction of billed sewer flows from **20 million gallons per month to about 14 million gallons per month** with completion of system improvements
- Flow (I/I) reduction could potentially yield a payback period of **less than seven (7) years** based on estimated system improvement costs, system flows and treatment charges

Final Compliance Plan

- Authority stated it has sufficient resources and personnel needed for an annual I/I removal, maintenance & enforcement program
  - Major commitment of annual Authority personnel and resources
  - **Permanent, ongoing inspection and enforcement program a necessity**

- Phase 2: Follow-up home inspections to identify and document system cross connections such as floor drains, foundation perimeter drains, roof leaders, sump pumps, etc.

- Compliance Plan
  - Perform Targeted Inflow Removal to Reduce System Peak Flow
  - Reduction of I/I = Direct Reduction of Costs to Customers
  - Public rehabilitation project: Mainline, Lateral, Manholes
  - Private rehabilitation project: Mainline, Lateral
  - Incorporated into City's Act 537 Sewage Planning Update



LEGEND

- ROADWAY RIGHT OF WAY LINE
- MUNICIPAL BOUNDARY
- EDGE OF STREAM
- RAILROAD
- B03-5 SANITARY SEWER LINE w/LATERAL, MANHOLE AND NUMBER (CCTV INSPECTION NOT PERFORMED)
- 101 BILLING/PROPERTY ADDRESS NUMBER
- MAINLINE/LATERAL NO DEFICIENCIES
- MAINLINE REPLACEMENT RECOMMENDED AND PUBLIC LATERAL WITH DEFICIENCIES
- MAINLINE SPOT REPAIRS RECOMMENDED
- MAINLINE MAINTENANCE RECOMMENDED
- PRIVATE LATERAL WITH DEFICIENCIES
- PUBLIC AND PRIVATE LATERAL WITH DEFICIENCIES
- MANHOLE NO DEFICIENCIES
- MANHOLE MAINTENANCE, REPAIR OR REPLACEMENT RECOMMENDED
- 40 SMOKE TESTING REPORT NUMBER
- CCTV CLOSED CIRCUIT TELEVISION INSPECTION

NOTE:

REFERENCE THE SANITARY SEWER SYSTEM EVALUATION AND REMEDIATION REPORT, EVALUATION DRAWINGS AND RECOMMENDATIONS TABLES FOR DETAILED INFORMATION.

GRAPHIC SCALE

50 0 25 50 100 200

1 inch = 50 ft.

Excerpt Map of STMA Sewer System Compliance Projects

Compliance Projects and Goals

- Projects
  - Estimated project cost for the public rehabilitation project - $2,500,000
  - Estimated project cost for the private rehabilitation project - $1,650,000
  - Total Project Cost: $4.2 million
  - Targeted Inflow Reduction: Ongoing STMA televising, smoke testing, home inspections
  - Implementation of System Improvements 2018-2020

- Anticipated Results
  - Replacement of deficient and deteriorated system components
  - System capacity for future growth and development
  - City's Plant will have treatment capacity for all wet weather flow
  - Reduce burden of Township customers from paying high I/I surcharge rate

Questions