2017 Annual Conference

March 28-31

WWW.PRWA.COM/CONFERENCE

Penn Stater Hotel & Conference Center | State College, PA

PA Rural Water Association

Schedule at http://mobile.prwa.com

Welcome!

COLLECTION REHAB
AND MAINTENANCE

THURSDAY 3/30/17
1:30 PM TO 5 PM

We're Glad You're Here!

Please, put your cell phones on vibrate during sessions and, take calls to the hallway

COLLECTION REHAB AND MAINTENANCE

BRYON KILLIAN, PE

BKILLIAN@ENTECHENG.COM

ROBB KALBACH

RHK3@USGINC.NET

REMIND ME.. WHAT IS THE PRESENTATION ABOUT?

66. *Collection Rehab/Maintenance: Inspecting, identifying and repairing collection system problems before they become major problems are an important part of an operator's responsibilities. This class will cover common collection maintenance and rehabilitation techniques for system components. ***Earn up to 3 WW CH.**

COURSE OUTLINE

- PART 1 – WASTEWATER COLLECTION SYSTEM OVERVIEW
  - KILLIAN; APPROX. 50 MIN.
  - QUESTIONS; APPROX. 10 MIN.
  - QUIZ; APPROX. 10 MIN.
  - BREAK; APPROX. 15 MIN.

- PART 2 – COLLECTION REHABILITATION AND MAINTENANCE
  - KALBACH; APPROX. 50 MIN.
  - QUESTIONS; APPROX. 10 MIN.
  - QUIZ; APPROX. 10 MIN.
  - BREAK; APPROX. 15 MIN.

- PART 3 – RESOURCES AND BUDGETS
  - KILLIAN & KALBACH; APPROX. 20 MIN.
  - QUESTIONS; APPROX. 10 MIN.
  - QUIZ; APPROX. 10 MIN.

PART 1 - WASTEWATER COLLECTION SYSTEM OVERVIEW

2017
INFRASTRUCTURE
REPORT CARD
ASCE

Wastewater

D+

Demand on treatment plants will grow more than 23% by 2032

Source: www.infrastructurereportcard.org/

WASTEWATER

On the wastewater side, the report card graded the nation's clean water initiates a D+. The report notes that years of treatment plant upgrades and more stringent federal and state regulations have significantly reduced untreated releases and improved water quality nationwide.

It is expected that more than 56 million new users will be connected to centralized treatment systems over the next two decades, and an estimated $271 billion is needed to meet current and future demands, according to the EPA.

Through new methods and technologies that turn waste into energy, the nation's 1,269 biogas plants will also help communities better manage waste through reuse. The report card also notes that wastewater treatment demand will increase by 23 percent by 2032.

2014 REPORT CARD FOR PENNSYLVANIA'S INFRASTRUCTURE

D+	Bridges
C-	Dams
D	Drinking Water
C	Energy
B	Freight Rail
B-	Hazardous Waste
D+	Inland Waterways
C-	Levees
B-	Parks & Recreation
C+	Ports
D-	Roads
C-	Schools
C+	Solid Waste
D+	Stormwater
D	Transit
D-	Wastewater

Grades were assigned to each category based on the eight criteria. The grades break down as follows:

A
90–100%
Exceptional

B
80–89%
Good

C
70–79%
Mediocre

D
51–69%
Poor

F
50% or lower
Deteriorating

Source: www.infrastructurereportcard.org/


NO
PARKING
ANY
TIME

INSPECTION CHALLENGES: LACK OF ACCURATE SYSTEM DRAWINGS /AS-BUILT

INSPECTION CHALLENGES: LACK OF ACCESS (IN THE STREET)

Source: http://www.post-gazette.com/

INSPECTION CHALLENGES: LACK OF ACCESS (NOT ON THE STREET)

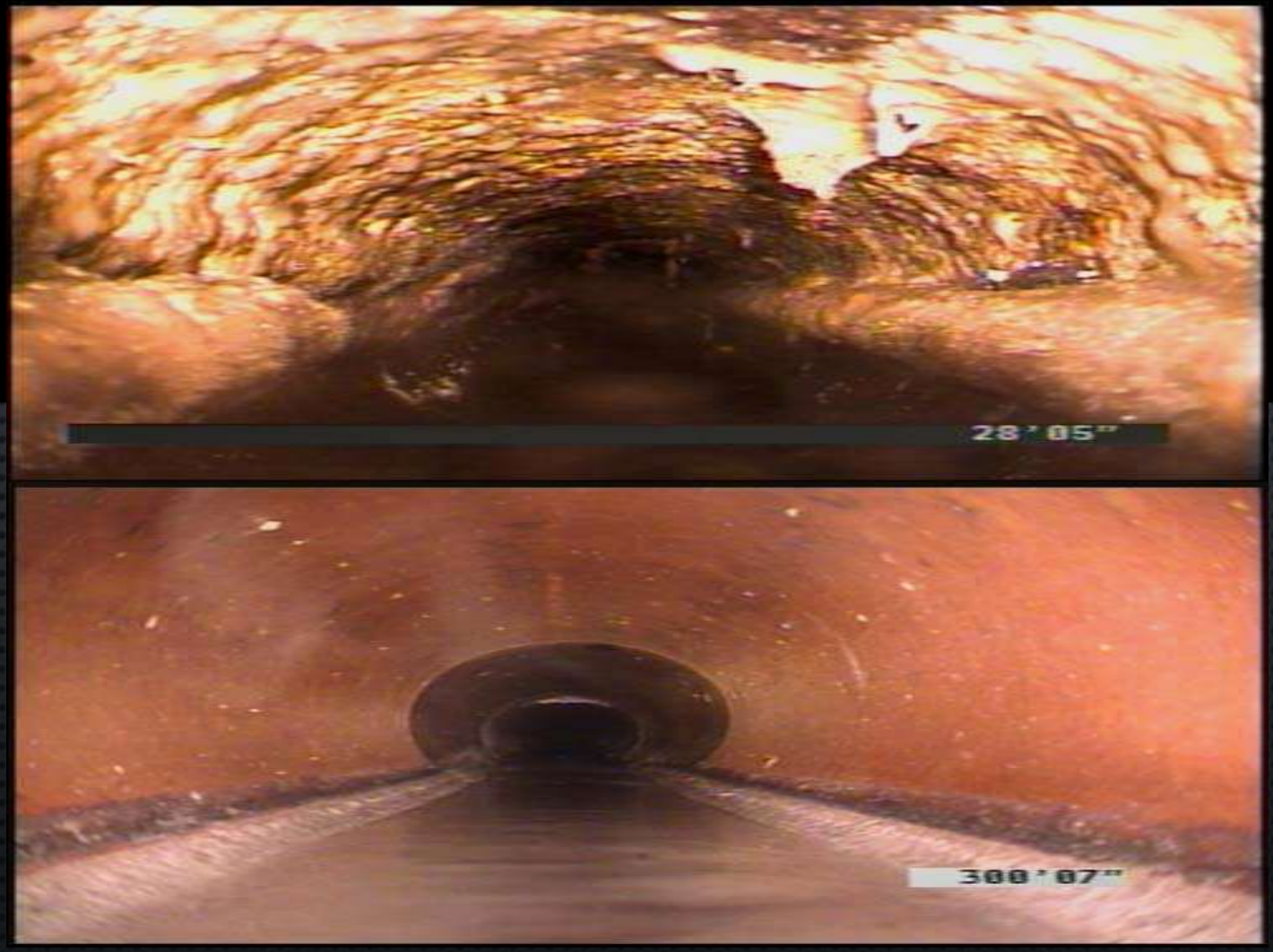
Source: http://www.treeremoval.com/

INSPECTION CHALLENGES: CONFINED SPACE / HAZARDOUS ENVIRONMENT

Source: http://www.cnn.com/

INSPECTION CHALLENGES: COST

INSPECTION CHALLENGES: CONDITIONS CHANGE



WHY INSPECT?

MAIN GOALS

- Prevent public health hazards
- Comply with regulations
- Minimize complaints
- Efficiently use funds (limited budgets)

Source: http://restorationeze.com

Source: http://www.abc.net.au

Source: http://www.abcnews.com


Source: http://www.animalsandenglish.com

HYDROGEN SULFIDE - ODOR

- HYDROGEN SULFIDE (H2S) IS A PRODUCT OF STALE SEWAGE AND HAS A ROTTEN EGG SMELL.
- ODORS OCCUR WHEN WASTE WATER PH ALLOWS HYDROGEN SULFIDE TO EVOLVE FROM LIQUID PHASE HYDROSULFIDE (HS-).
- STEAK, CHEESEBURGER, AND 3-DAY OLD NACHOS.
  - O2
  - NOX
  - SOX

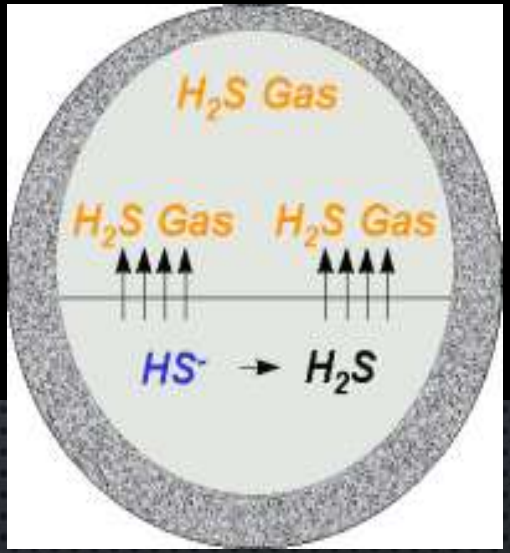


Chart from:
http://www.magnesiaspecialties.com/Thioguard/thio_direct.htm

HYDROGEN SULFIDE - CORROSION

- CERTAIN BACTERIA CONVERT HYDROGEN SULFIDE (H2S) TO SULFURIC ACID, WHICH IS VERY CORROSIVE TO ELECTRICAL EQUIPMENT AND TO CONCRETE, IRON, AND STEEL.

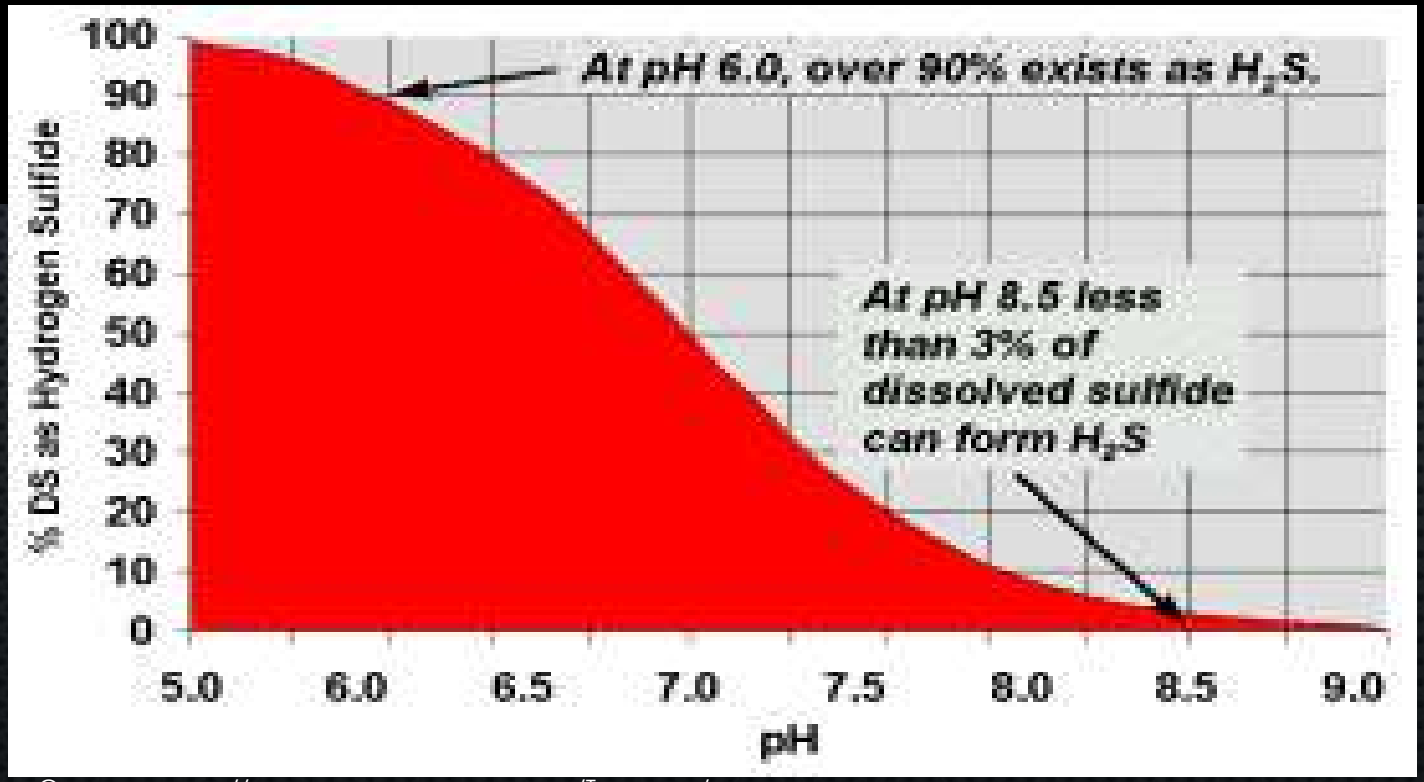


CHART FROM: HTTP://WWW.MAGNESIASPECIALTIES.COM/THIOGUARD/THIO_DIRECT.HTM


BUDGET

OK, ITS IMPORTANT – SO WHERE DO I START MY INSPECTIONS?

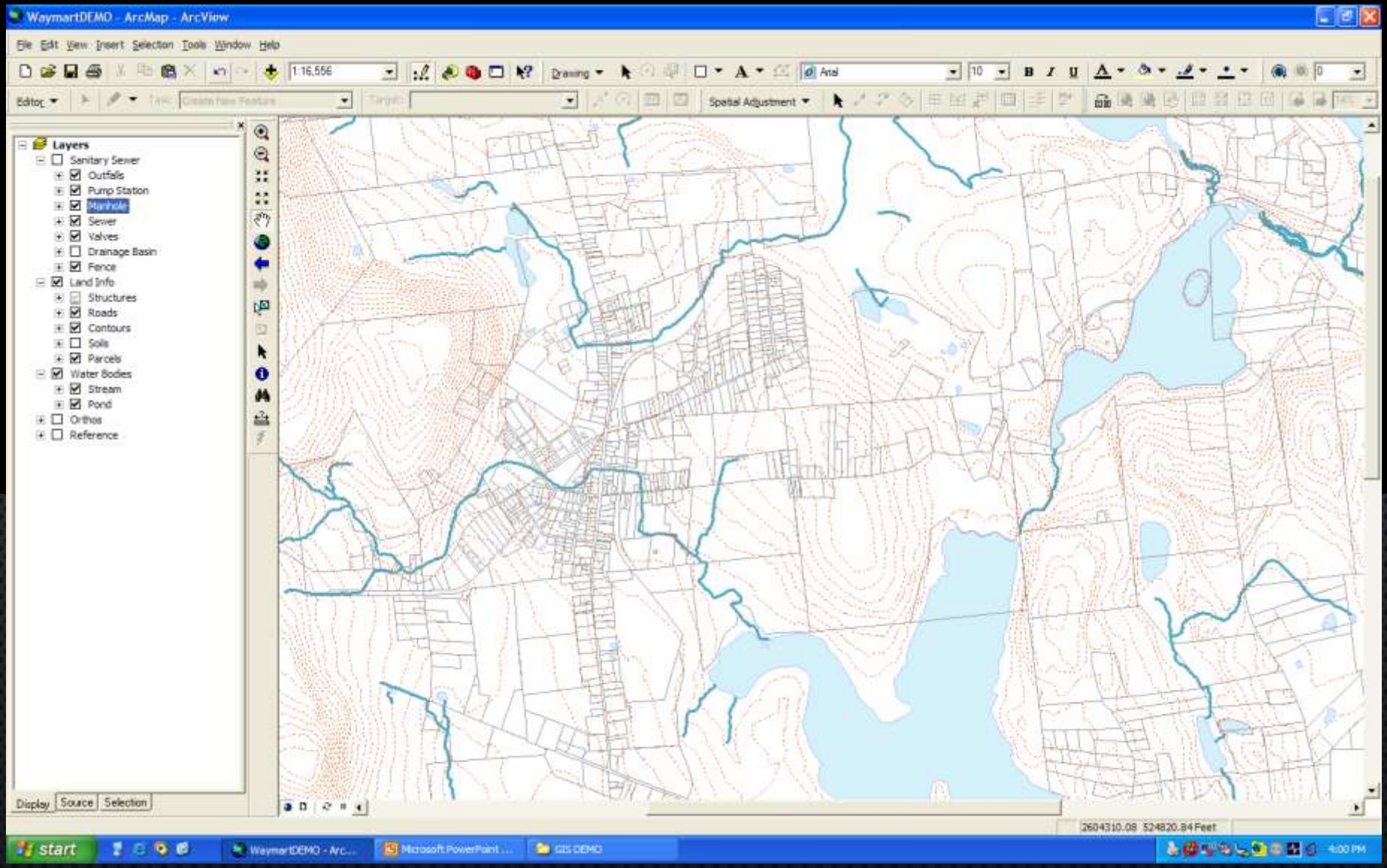
HOW ABOUT THIS MH?

MAPPING

- You must known what you have before you can inspect and assess its condition! At least an idea.
  - Existing Mapping / Available Data
  - Field locate MH / Pump Stations / Overflow Points (CSO & SSO) / Critical Monitoring Points / Etc.
    - Name each facility.
    - Operator Updates – they know more than what is on the map.

Mapping

- Existing Mapping versus Observed Conditions
- It's on my map but I can't find it!
  - Need reliable data
- Do you think it is there?
  - You know it is not there.
  - It is possible it is there.


WaymartDEMO - ArcMap - ArcView
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Sanitary Sewer
Outfalls
Pump Station
Manhole
Sewer
Valves
Drainage Basin
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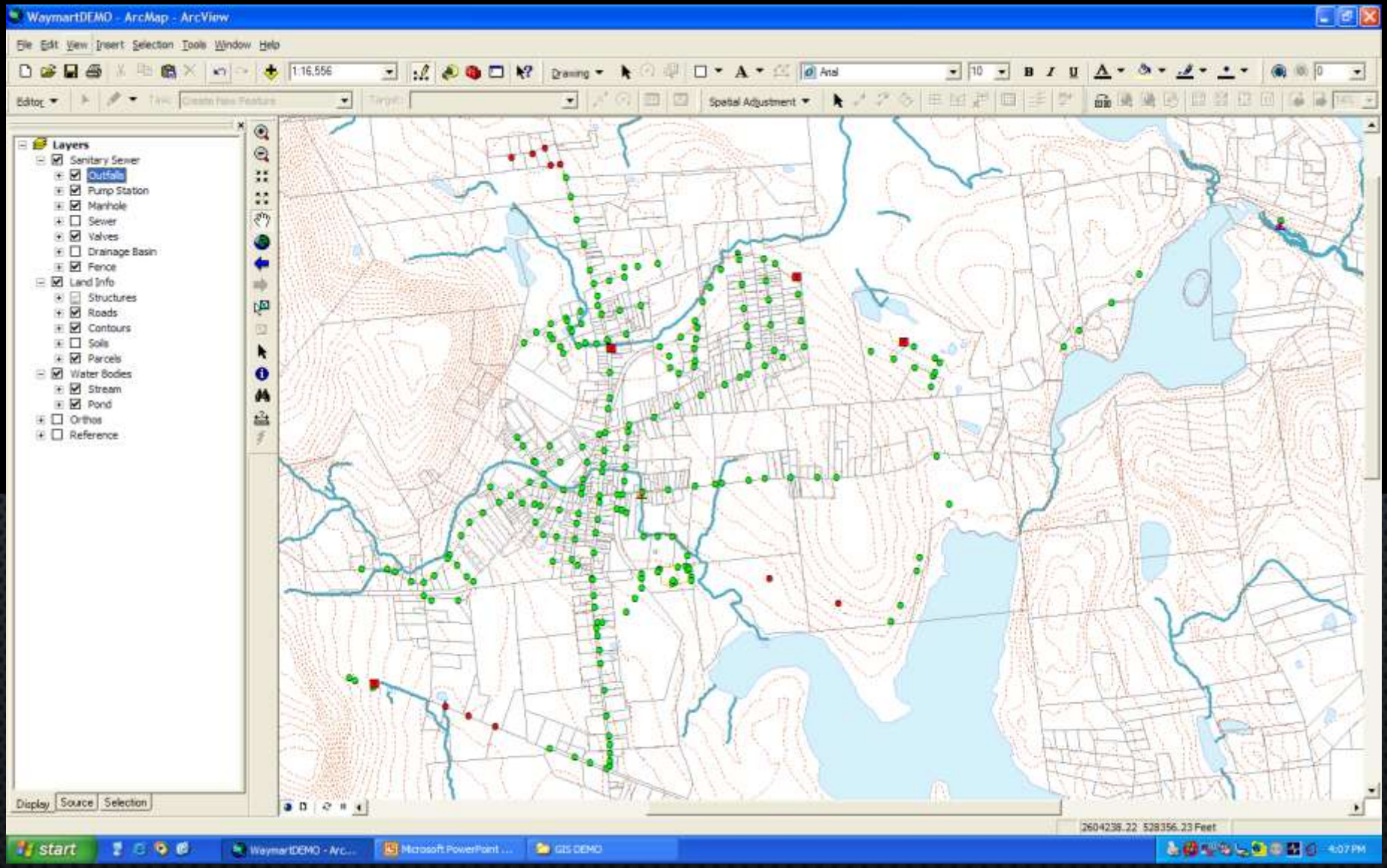
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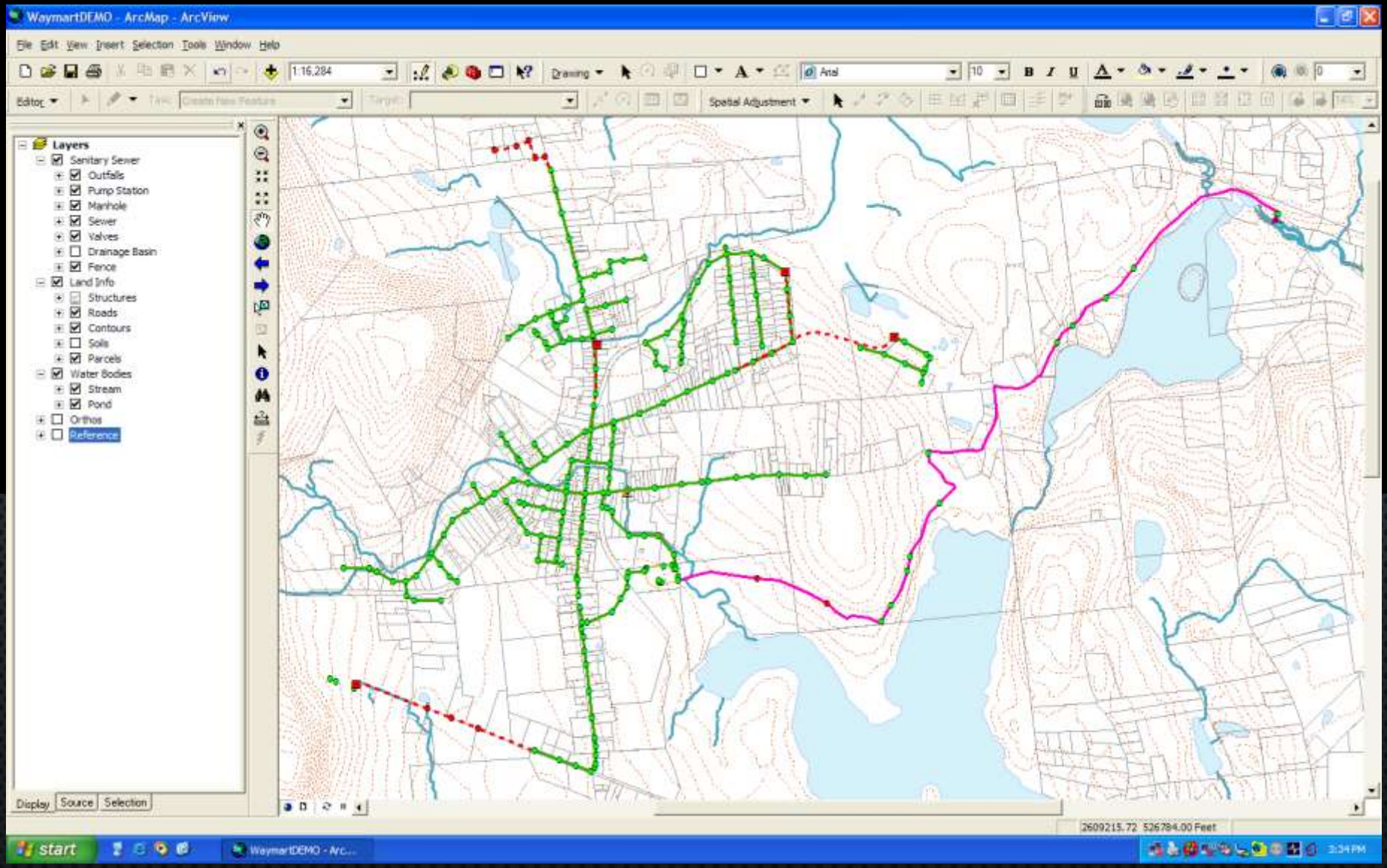
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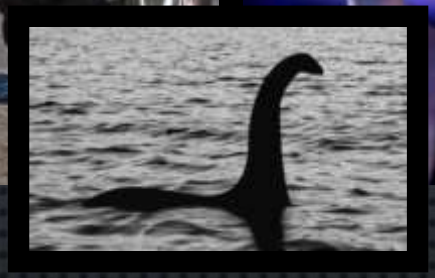
WHY NOT STICK WITH THE OLD WAY (USE THE AVAILABLE MAPPING)?

- Unfortunately, the wide variety of maps and the diversity of their scales and designs at our disposal make it extremely difficult to access, use, and maximize the value of information they contain.

- GIS is an integrating technology; it integrates all kinds of information and applications with a geographic component into one manageable system.

MAPPING



- 100% Complete Sewer Map
  - Loch Ness Monster, Big Foot, Aliens.
- Continually update and revise.

ENTECH

BOROUGH OF ORWIGSBURG

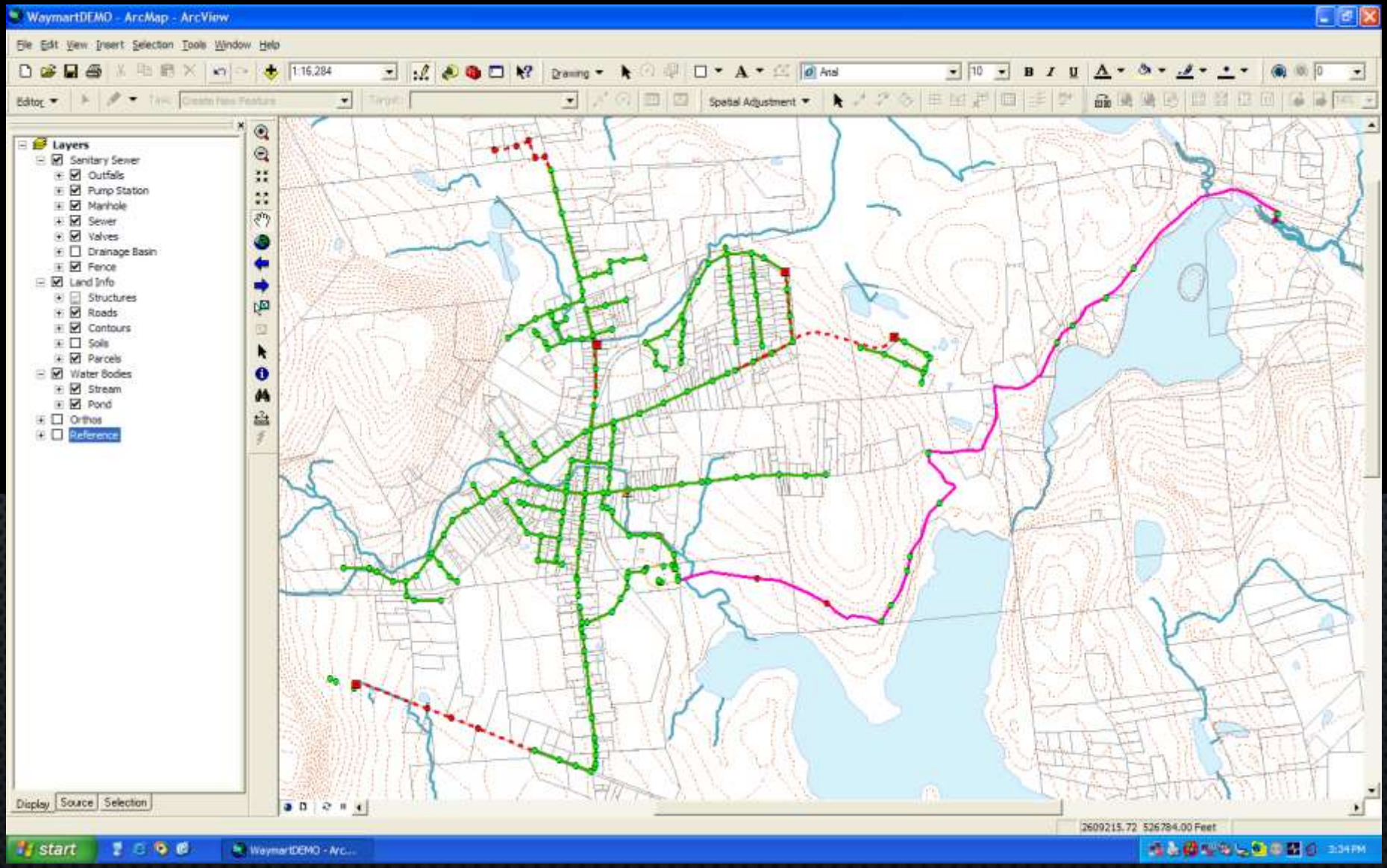
SANITARY SEWER SYSTEM MAP

PREPARED BY	CHECKED BY	PROJECT ENGINEER
MBB	KAM	KAM

DATE	PROJECT NO.	SCALE	DRAWING NO.
MAR 2009	4169.52	1" = 1,000'	EXH-1

I HAVE LOTS OF INFORMATION ON MY COLLECTION SYSTEM


Various
M2 Tetramer
Protein NMR
Manuscripts
SAMPLE PREP +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GIS DATABASE DEVELOPMENT

LENGTH	DIAMETER	MATERIAL	LENGTH	DIAMETER	MATERIAL
300.91484559007	8.00	Terra Cotta	316.00723316314	8.00	PVC
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211.22174587562	8.00	Terra Cotta	234.61219123264	8.00	PVC
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137.64338389120	8.00	Terra Cotta	399.69713854780	8.00	PVC
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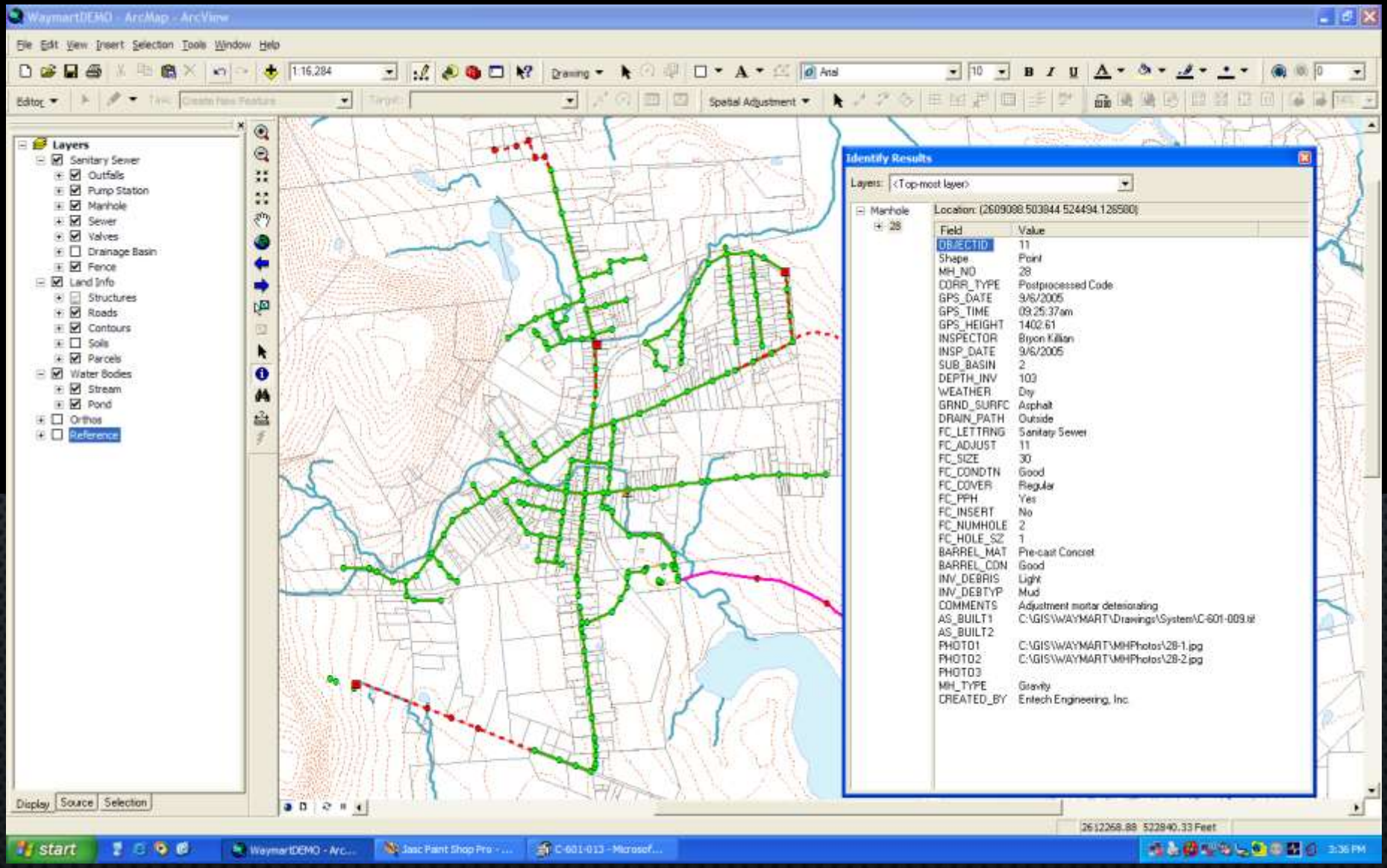
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Parcels
Water Bodies
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Pond
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Display Source Selection
Identify Results
Layers: <Top-most layer>
Manhole
28
Location: (2609088.503844 524494.126580)
Field Value
OBJECTID 11
Shape Point
MH_NO 28
CORR_TYPE Postprocessed Code
GPS_DATE 9/6/2005
GPS_TIME 09:25:37am
GPS_HEIGHT 1402.61
INSPECTOR Bryon Killian
INSP_DATE 9/6/2005
SUB_BASIN 2
DEPTH_INV 10.3
WEATHER Dry
GRND_SURFC Asphalt
DRAIN_PATH Outside
FC_LETTRNG Sanitary Sewer
FC_ADJUST 11
FC_SIZE 30
FC_CONDTN Good
FC_COVER Regular
FC_PPH Yes
FC_INSERT No
FC_NUMHOLE 2
FC_HOLE_SZ 1
BARREL_MAT Pre-cast Concret
BARREL_CON Good
INV_DEBRIS Light
INV_DEBTYP Mud
COMMENTS Adjustment mortar deteriorating
AS_BUILT1 C:\GIS\WAYMART\Drawings\System\C-601-009.tif
AS_BUILT2
PHOTO1 C:\GIS\WAYMART\MHPhotos\28-1.jpg
PHOTO2 C:\GIS\WAYMART\MHPhotos\28-2.jpg
PHOTO3
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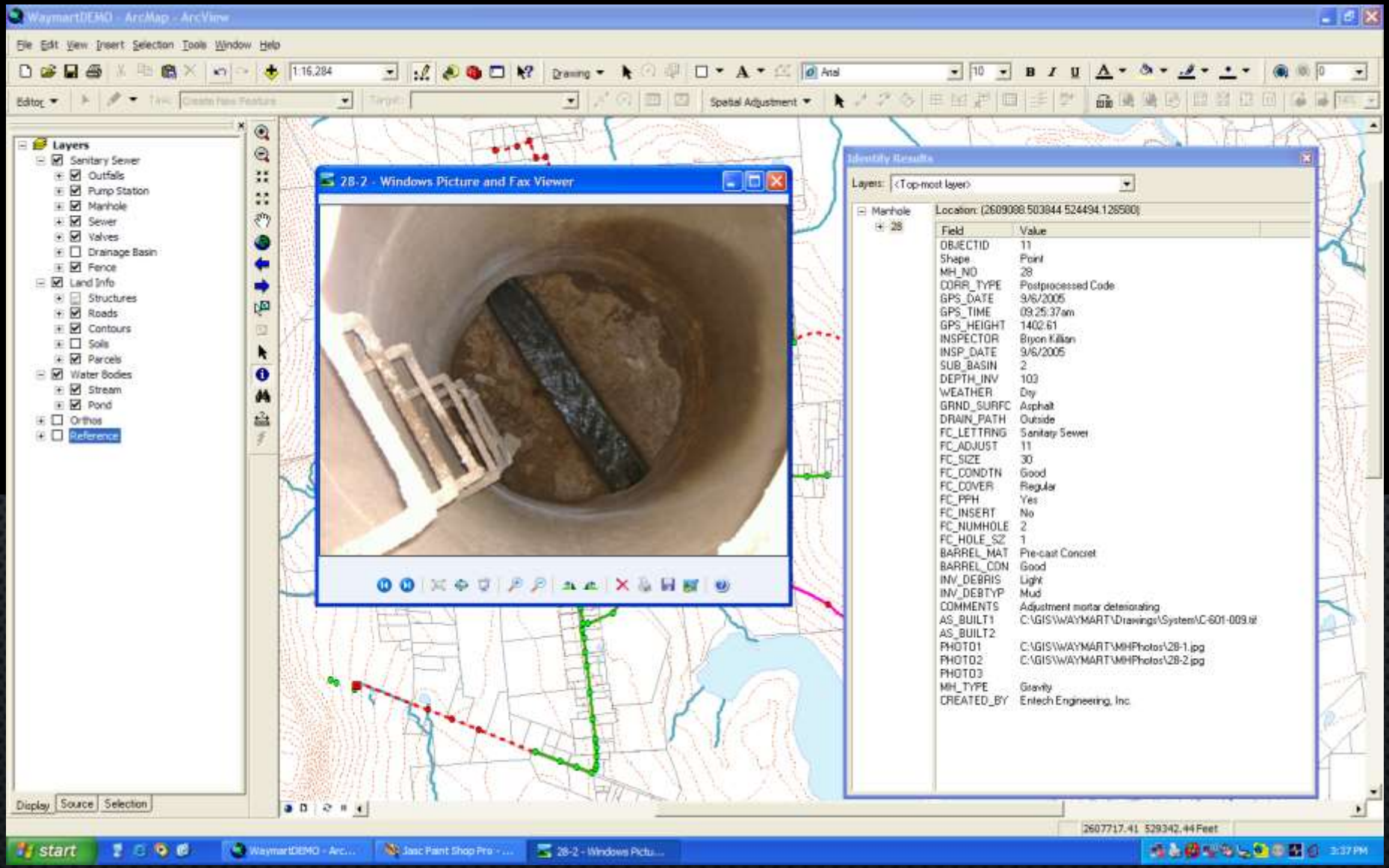
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28-2 - Windows Picture and Fax Viewer
Identify Results
Layers: <Top-most layer>
Manhole
28
Location: (2609088.503844 524494.126580)
Field Value
OBJECTID 11
Shape Point
MH_NO 28
CORR_TYPE Postprocessed Code
GPS_DATE 9/6/2005
GPS_TIME 09:25:37am
GPS_HEIGHT 1402.61
INSPECTOR Bryon Killian
INSP_DATE 9/6/2005
SUB_BASIN 2
DEPTH_INV 103
WEATHER Dry
GRND_SURFC Asphalt
DRAIN_PATH Outside
FC_LETTRNG Sanitary Sewer
FC_ADJUST 11
FC_SIZE 30
FC_CONDTN Good
FC_COVER Regular
FC_PPH Yes
FC_INSERT No
FC_NUMHOLE 2
FC_HOLE_SZ 1
BARREL_MAT Pre-cast Concret
BARREL_CON Good
INV_DEBRIS Light
INV_DEBTYP Mud
COMMENTS Adjustment mortar deteriorating
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PHOTO2 C:\GIS\WAYMART\MHPhotos\28-2.jpg
PHOTO3
MH_TYPE Gravity
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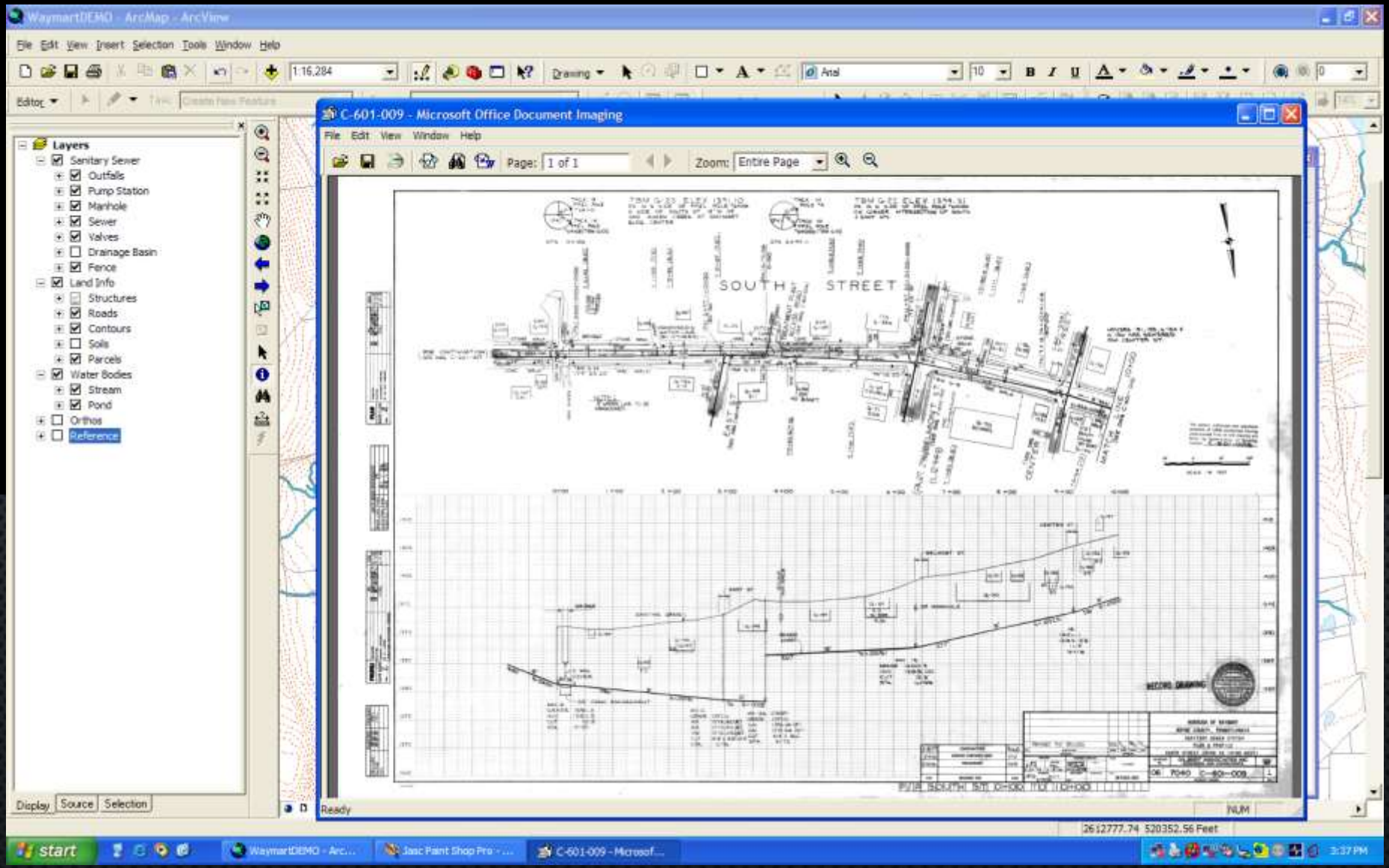
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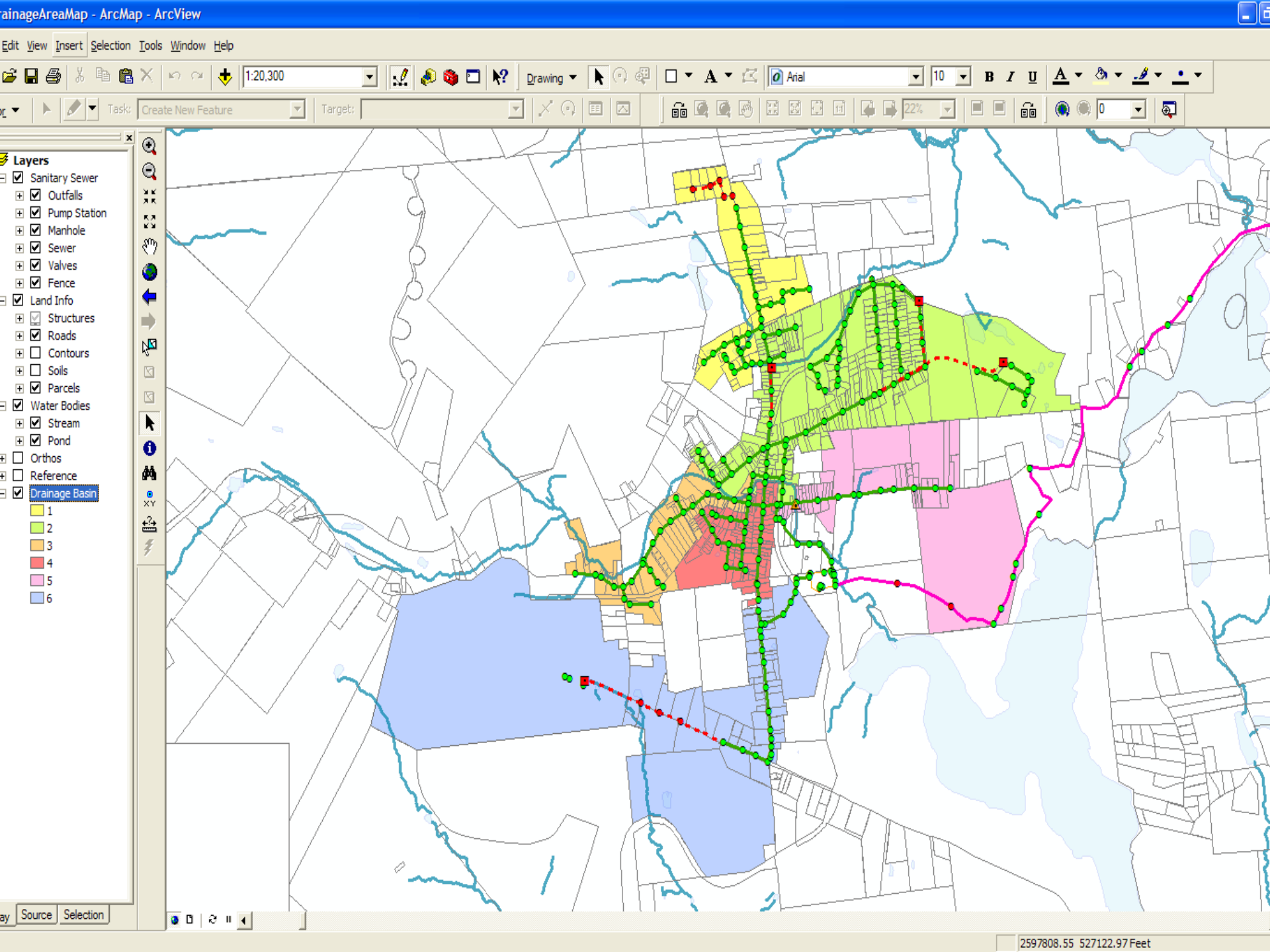
EASIER TO CHEW

- THE SANITARY SEWER SYSTEM SHOULD BE BROKEN DOWN INTO BASINS (MULTIPLE PUMP STATIONS) AND LATER POSSIBLY S
FOR FUTURE INVESTIGATION.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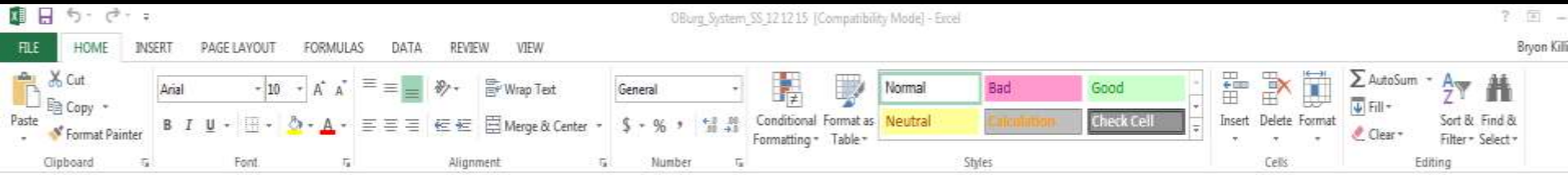
2597808.55 527122.97 Feet

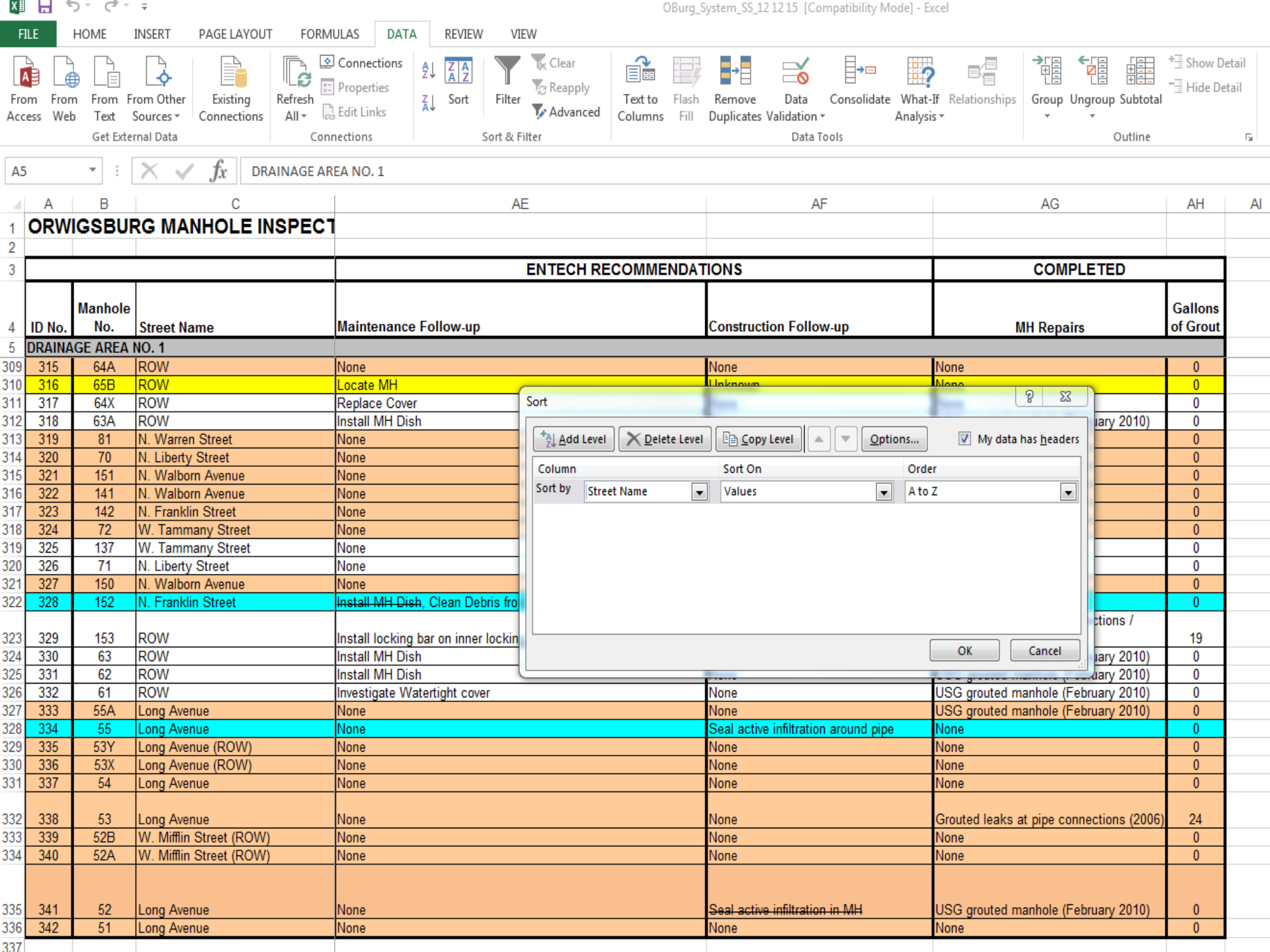
I DON'T HAVE GIS AND MY BOARD WONT PAY FOR IT



ORWIGSBURG MANHOLE INSPECTION SUMMARY

2/3/2015 BAK

				GENERAL						COVER								INSERT		FRAME	
ID No.	Manhole No.	Street Name	Basin	Inspector	Date Inspected	Weather	Depth to Invert (in)	Ground Surface		Type of Cover	Lettering	Cover Condition	Lid Size (in)	PPH	Holes #	Hole Size (in)	Drainage Path	Insert	Frame Condition	Adj
DRAINAGE AREA NO. 1																				
1	282A	Kings Court	1	T.Avenoso	10/30/08	Dry	67	Asphalt		Regular	Sanitary Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	None
2	282	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	74	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Cinder B
3	283	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	90	Asphalt		Regular	Sanitary Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Concret
4	284	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	57	Asphalt		Regular	Sanitary Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Concret
5	285	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	77	Asphalt		Regular	Sanitary Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	None
6	286	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	79	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Brick
7	287	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	104	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Brick
8	288	Ridge View Drive	1	DJ/Pat	3/16/09	Dry	37	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Brick
9	291A	Woodview Road	1	K.Killian	10/29/08	Dry	98	Asphalt		Regular	Sanitary	Good	26	No	0	0	Outside Drainage Path	No	Good	Cinder B
10	291	Woodview Road	1	K.Killian	10/29/08	Dry	98	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Cinder B
11	289A	Ridge View Drive	1	K.Killian	10/29/08	Dry	143	Grass		Regular	E.Quinn	Good	26	No	0	0	Possible Ponding	Recommend	Good	None
12	289	Ridge View Drive	1	K.Killian	10/29/08	Dry	110	Asphalt		Regular	Sewer	Good	23	No	0	0	Outside Drainage Path	No	Good	None
13	292	Ridge View Drive	1	K.Killian	10/29/08	Dry	194	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	None
14	281	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	61	Asphalt		Regular	Sanitary Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Concret
15	280	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	50	Asphalt		Regular	Septic Sewer	Good	22.5	No	0	0	Outside Drainage Path	No	Good	None
16	274	Ridge View Drive	1	T.Avenoso	10/30/08	Dry	52	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	None
17	273	Ridge View Drive	1	K.Killian	10/29/08	Dry	52	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	None
18	272	Country View Lane	1	T.Avenoso	10/30/08	Dry	68	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
19	271	Country View Lane	1	T.Avenoso	10/30/08	Dry	96	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
20	270	Ridge View Drive	1	K.Killian	10/29/08	Dry	185	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
21	269	Ridge View Drive	1	K.Killian	10/29/08	Dry	72	Asphalt		Regular	EA Quinn	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
22	268	Ridge View Drive	1	K.Killian	10/29/08	Dry	77	Asphalt		Regular	East Quinn Foundry	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
23	267	Ridge View Drive	1	K.Killian	10/29/08	Dry	63	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
24	266	Ridge View Drive	1	K.Killian	10/29/08	Dry	85	Asphalt		Regular	EA Quinn	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
25	265	Ridge View Drive	1	K.Killian	10/29/08	Dry	62	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	Yes	Good	Concret
26	260H	Ridge View Drive	1	K.Killian	10/29/08	Dry	77	Asphalt		Regular	Sewer	Good	26	No	0	0	Outside Drainage Path	No	Good	Concret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Get External Data
Refresh All
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Properties
Edit Links
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Sort
Filter
Clear
Reapply
Advanced
Sort & Filter
Text to Columns
Flash Fill
Remove Duplicates
Data Validation
Consolidate
What-If Analysis
Relationships
Data Tools
Group
Ungroup
Subtotal
Show Detail
Hide Detail
Outline
A5
DRAINAGE AREA NO. 1
ORWIGSBURG MANHOLE INSPECT
ENTECH RECOMMENDATIONS
COMPLETED
ID No.
Manhole No.
Street Name
Maintenance Follow-up
Construction Follow-up
MH Repairs
Gallons of Grout
DRAINAGE AREA NO. 1
315 64A ROW None None None 0
316 65B ROW Locate MH 0
317 64X ROW Replace Cover 0
318 63A ROW Install MH Dish 0
319 81 N. Warren Street None 0
320 70 N. Liberty Street None 0
321 151 N. Walborn Avenue None 0
322 141 N. Walborn Avenue None 0
323 142 N. Franklin Street None 0
324 72 W. Tammany Street None 0
325 137 W. Tammany Street None 0
326 71 N. Liberty Street None 0
327 150 N. Walborn Avenue None 0
328 152 N. Franklin Street ~~Install MH Dish~~, Clean Debris fro 0
329 153 ROW Install locking bar on inner lockin 19
330 63 ROW Install MH Dish 0
331 62 ROW Install MH Dish 0
332 61 ROW Investigate Watertight cover None USG grouted manhole (February 2010) 0
333 55A Long Avenue None None USG grouted manhole (February 2010) 0
334 55 Long Avenue None Seal active infiltration around pipe None 0
335 53Y Long Avenue (ROW) None None None 0
336 53X Long Avenue (ROW) None None None 0
337 54 Long Avenue None None None 0
338 53 Long Avenue None None Grouted leaks at pipe connections (2006) 24
339 52B W. Mifflin Street (ROW) None None None 0
340 52A W. Mifflin Street (ROW) None None None 0
341 52 Long Avenue None ~~Seal active infiltration in MH~~ USG grouted manhole (February 2010) 0
342 51 Long Avenue None None None 0
Sort
Add Level
Delete Level
Copy Level
Options...
My data has headers
Column
Sort On
Order
Sort by
Street Name
Values
A to Z
OK
Cancel

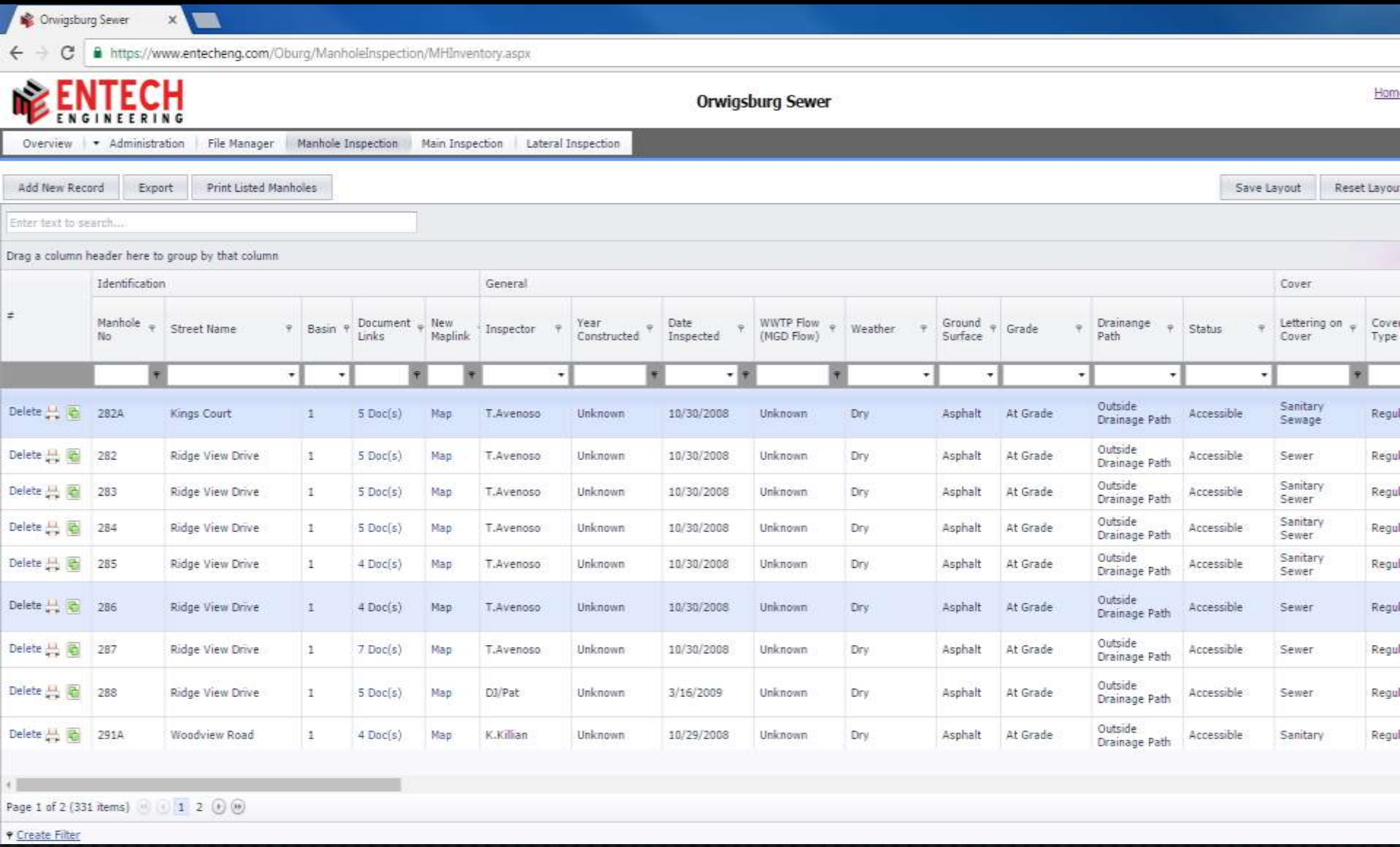
EXCEL LIMITATIONS

1. No system map associated with the database. Needed to use paper map in conjunction.

2. Had multiple versions of spreadsheet/database.

3. Could not link paper or electronic documents.

4. Could not easily have multiple users.


Orwigsburg Sewer
https://www.entecheng.com/Oburg/ManholeInspection/MHInventory.aspx
ENTECH ENGINEERING
Orwigsburg Sewer
Hom
Overview
Administration
File Manager
Manhole Inspection
Main Inspection
Lateral Inspection
Add New Record
Export
Print Listed Manholes
Save Layout
Reset Layou
Enter text to search...
Drag a column header here to group by that column
Identification
General
Cover
Manhole No
Street Name
Basin
Document Links
New Maplink
Inspector
Year Constructed
Date Inspected
WWTP Flow (MGD Flow)
Weather
Ground Surface
Grade
Drainange Path
Status
Lettering on Cover
Cover Type
Delete 282A Kings Court 1 5 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sanitary Sewage Regul
Delete 282 Ridge View Drive 1 5 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sewer Regul
Delete 283 Ridge View Drive 1 5 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sanitary Sewer Regul
Delete 284 Ridge View Drive 1 5 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sanitary Sewer Regul
Delete 285 Ridge View Drive 1 4 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sanitary Sewer Regul
Delete 286 Ridge View Drive 1 4 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sewer Regul
Delete 287 Ridge View Drive 1 7 Doc(s) Map T.Avenoso Unknown 10/30/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sewer Regul
Delete 288 Ridge View Drive 1 5 Doc(s) Map DJ/Pat Unknown 3/16/2009 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sewer Regul
Delete 291A Woodview Road 1 4 Doc(s) Map K.Killian Unknown 10/29/2008 Unknown Dry Asphalt At Grade Outside Drainage Path Accessible Sanitary Regul
Page 1 of 2 (331 items) 1 2
Create Filter

Overview | Administration | File Manager | Manhole Inspection | Main Inspection | Lateral Inspection

Add New Record | Export | Print Listed Manholes | Save Layout | Reset Layout | Show

Enter text to search...

Drag a column header here to group by t

Identification

Manhole No | Street Na | Ground Surface | Grade

Delete 282A Kings Cou Asphalt At Grade

Delete 282 Ridge Vie Asphalt At Grade

Delete 283 Ridge Vie Asphalt At Grade

Delete 284 Ridge Vie Asphalt At Grade

Delete 285 Ridge Vie Asphalt At Grade

Delete 286 Ridge Vie Asphalt At Grade

Delete 287 Ridge Vie Asphalt At Grade

Delete 288 Ridge Vie Asphalt At Grade

Delete 291A Woodview Asphalt At Grade

Page 1 of 2 (331 items) 1 2

Page size

Create Filter

Save changes Cancel

Add/View Attachments

Browse...

Upload

	Description	File Name	Default Report Image	Uploaded By	Uploaded
Edit Delete	MH 282.pdf	635942772953324884-MH 282.pdf	☐	bkillian	3/22/2016
Edit Delete	MH282_1.JPG	635944079024268684-MH282_1.JPG	☐	kkillian	3/24/2016
Edit Delete	MH282_2.JPG	635944079025204726-MH282_2.JPG	☐	kkillian	3/24/2016
Edit Delete	MH282_3.JPG	635944079026140768-MH282_3.JPG	☐	kkillian	3/24/2016
Edit Delete	MH282_4.JPG	635944079026920803-MH282_4.JPG	☐	kkillian	3/24/2016


Satellite
Ridgeview Dr
Ridgeview Dr
Kings Ct
Ridgeview Dr
Manhole No: 285
Basin: 1
General Comments: No mortar around frame
I&I Filtration Comments: Wet between Frame and Cone
View Inspection Report
Log Home Finding
Ridgeview Dr
Cedar Crest Ct
Ridgeview Dr
Ridgeview Dr
Ridgeview Dr

Manage Users

	User Name	Last Login	Email	Password Question	Password Answer
Edit Delete	bkillian	11/3/2016	bkillian@entecheng.com	Boss of FCA Group?	
Edit Delete	bwilliams	4/4/2016	robert@orwigsburg.net	Race Car #	
Edit Delete	channum	4/6/2016	channum@entecheng.com	Boss of FCA Group?	
Edit Delete	cseely	10/4/2016	cseely@entecheng.com	Who requested this password?	
Edit Delete	dteter	9/26/2016	dteter@orwigsburg.net	Kids Name	
Edit Delete	hedelman	7/11/2016	hedelman@entecheng.com	Dogs name	
Edit Delete	jbrensinger	5/3/2016	jake@orwigsburg.net	Dog Name	
Edit Delete	kkillian	7/28/2016	kkillian@entecheng.com	Boss of FCA Group?	
Edit Delete	kregan	4/29/2016	koregan@entecheng.com	Boss of FCA Group?	
Edit Delete	MHdave	11/3/2016	dtrommatter@Entecheng.com	City of Office	
Edit Delete	mquinn	3/30/2016	mquinn@entecheng.com	Who requested this password?	
Edit Delete	rdudek	4/13/2016	rdudek@entecheng.com	NFL Team	
Edit Delete	swagner	10/17/2016	swagner@entecheng.com	Favorite Sport	
Edit Delete	terrenceo	10/28/2016	toboyle@entecheng.com	Dog	

HOW ABOUT A BRIEF OVERVIEW ON I&I?

QUICK REVIEW: INFILTRATION (GROUND WATER)

- INFILTRATION – "THE TOTAL EXTRANEOUS FLOW ENTERING A SEWER SYSTEM OR PORTIONS THEREOF, EXCLUDING SANITARY SEWAGE, BECAUSE OF POOR CONSTRUCTION, CORROSION OF THE PIPE FROM THE INSIDE OR OUTSIDE, GROUND MOVEMENT OR STRUCTURAL FAILURE THROUGH JOINTS, POROUS WALLS OR BREAKS."
- WPCF MOP NO. FD-5

QUICK REVIEW: INFLOW (SURFACE WATER)

- INFLOW – "THE EXTRANEOUS FLOW WHICH ENTERS A SANITARY SEWER FROM SOURCES OTHER THAN INFILTRATION, SUCH AS ROOF LEADERS, BASEMENT DRAINS, LAND DRAINS, AND MANHOLE COVERS. INFLOW, IN SHORT, IS USUALLY MAN MADE AND INTENTIONAL."
- WPCF MOP NO. FD-5

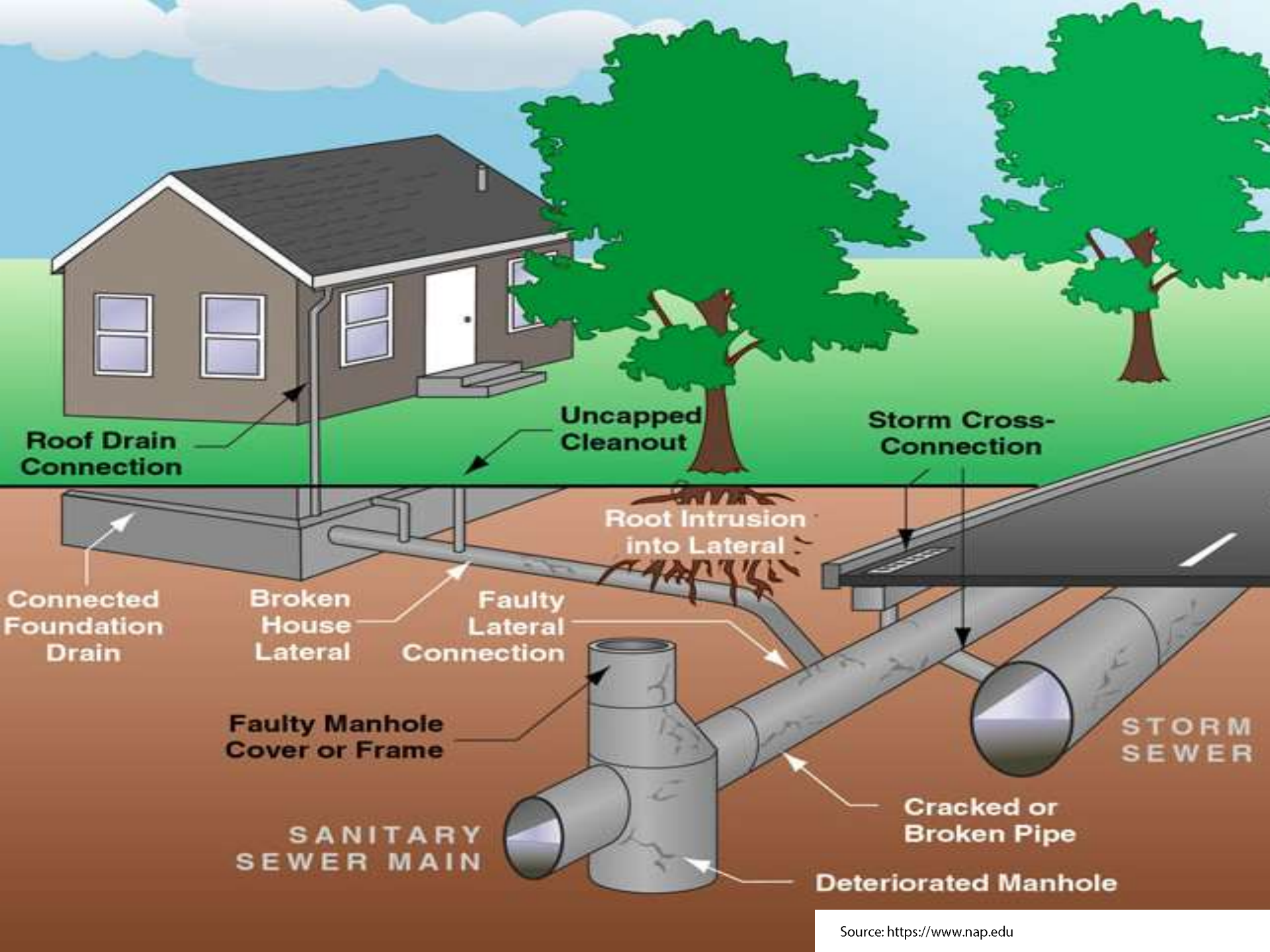
I DON'T HAVE I&I!

- EVERY SANITARY SEWER SYSTEM HAS SOME I&I EVEN NEWLY CONSTRUCTED SYSTEMS.
- FOR NEW CONSTRUCTION, THE LEAKAGE EXFILTRATION OR INFILTRATION SHALL NOT EXCEED 100 GALLONS PER INCH OF PIPE DIAMETER PER MILE PER DAY FOR ANY SECTION OF THE SYSTEM
- PADEP DOMESTIC WASTEWATER FACILITIES MANUAL (10/97), PAGE 20
- 3 MILE (15,840 FT) OF 8-INCH SEWER PIPE WOULD EQUATE TO 2,400 GPD OF INFILTRATION

Source: https://www.thinglink.com

A LITTLE WATER NEVER HURT ANYONE.

- Problems associated with excessive I&I:
  - Basement back-ups
    - $ - Result in litigation & potential liabilities
  - System deterioration
    - $ - System repairs / upgrades (quantity and quality)
    - CATASTROPHIC FAILURE
      - Undermining of piping/structures



Source: https://www.nap.edu

INFLOW & MH COVERS

Source: http://westchicago.org

- Tests made on manhole covers submerged in only 1-inch of water indicate that the leakage rate per manhole may be from 20 to 75 gpm depending on the number and size of holes in the cover.
  - Rawn, A.M., "What cost leaking manhole?" Waterworks and sewage, Vol, 84, 12, pg. 45, 1937.
- MH Penetrating Pick Holes are common holes in covers.
- Solid Watertight Covers are to be used whenever the manhole tops may be flooded by street runoff or high water.
  - PADEP Domestic Wastewater Facilities Manual (10/97), Page 20
- MH Dishes

HOW BAD IS MY I&I?

Do I have a problem with I&I?

- Quick & Dirty.
  - DMRs and Chapter 94 Report
    - Hydraulic Loading Chart
    - 3-month max. versus annual average flow
    - Review Flow per EDU

http://www.dep.pa.gov/Business/Water/CleanWater/WastewaterMgmt/Pages/Wasteload-Management.aspx. templates for annual wasteload mgmt. report.

- Pump Stations
  - Hour Meters
  - Drawdown Test
    - Are the pumps properly working?
- Known Overflows
  - Exceed Hydraulic Capacity / Blockages

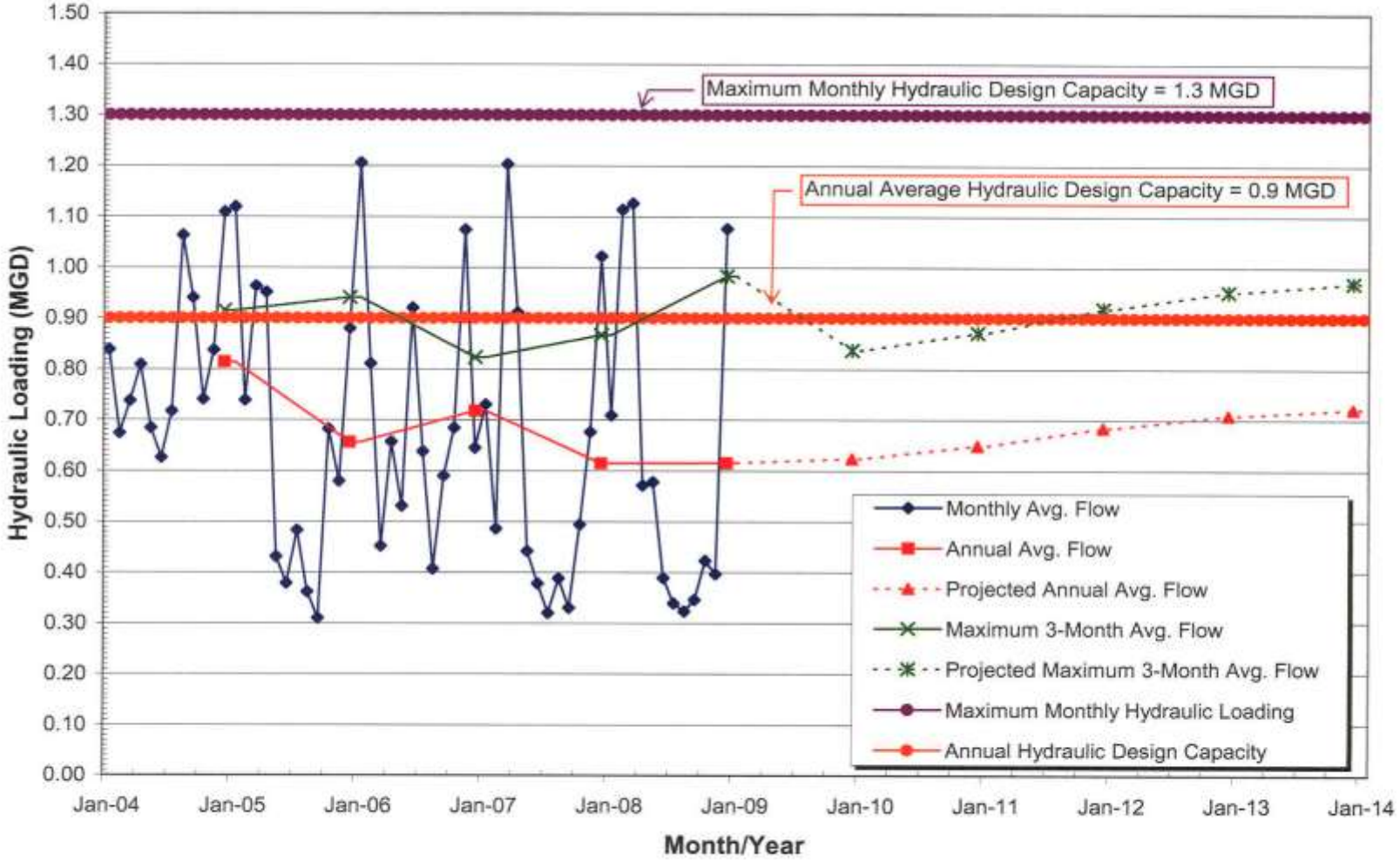
TABLE 2-1
Hydraulic Loading Data

Borough of Orwigsburg
Wastewater Treatment Plant

MONTH	MONTHLY AVERAGE WASTEWATER FLOWS (MGD)					PROJECTED WASTEWATER FLOWS (MGD)				
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
January	0.838	1.119 *	1.206 *	0.730	0.709 *					
February	0.674	0.739 *	0.811 *	0.486 *	1.114 *					
March	0.738	0.963 *	0.452 *	1.203 *	1.126 *					
April	0.809	0.951	0.657	0.911 *	0.571					
May	0.684	0.431	0.531	0.442	0.578					
June	0.626	0.379	0.920	0.378	0.389					
July	0.717	0.483	0.638	0.320	0.339					
August	1.063 *	0.362	0.407	0.388	0.323					
September	0.940 *	0.310	0.590	0.330	0.346					
October	0.741 *	0.682	0.684	0.494	0.423					
November	0.837	0.580	1.074	0.676	0.397					
December	1.109	0.880	0.645	1.022	1.076					
ANNUAL AVERAGE	0.815	0.657	0.718	0.615	0.616	0.624	0.650	0.684	0.709	0.722
NUMBER OF CONNECTIONS	1379	1392	1400	1410	1412	1450	1567	1723	1837	1896
FLOW per CONNECTION (GPD)	591	472	513	436	436	430	415	397	386	381
MAX 3-MONTH AVERAGE	0.915	0.940	0.823	0.867	0.983	0.837	0.871	0.918	0.951	0.968
RATIO (MAX 3-MONTH TO ANNUAL AVERAGE)	1.123	1.432	1.146	1.409	1.596					
AVERAGE OF 5-YEAR RATIOS					1.34					

* Indicates the maximum three consecutive months

FIGURE 2A
Hydraulic Loading



WHATS THE BEST WAY TO MINIMIZE MAINTENANCE AND MANAGE MY COLLECTION SYSTEM?

NEW CONSTRUCTION

- Pre-Construction Meeting:
  - Review of Contract Drawings
  - Review of Contract Specifications
  - Review Shop Drawing Requirements
  - Review Testing Requirements
  - Review Permits Requirements
- PA 1 Call Field Mark-ups
  - WALK THE JOB

Source: http://www.pa1call.org

Legal Authorities and Control

- Ordinances/Resolutions & Agreements
- How can paperwork help manage your collection system?
  - Design Review
  - Sewer Rules and Regulations / Ordinances (Up-to-date)
  - Control of improper (illegal) connections
  - Connection Permits.
  - Lateral and sewer extension inspection

PART 2 – COLLECTION REHABILITATION AND MAINTENANCE

Source: https://www.youtube.com

TERMS & DEFINITIONS

- Storm, Sanitary & Combined Sewers
- Inflow & Infiltration (I&I)
- Closed-Circuit TV (CCTV)
- Pipeline Assessment & Certification Program (PACP)
- Trenchless Pipe and Manhole Rehabilitation
- Cured-In-Place-Pipe (CIPP)
- NASSCO
  - Why so important?

SAFETY

- BEHIND THE SCENES
  - STATE CERTIFIED SAFETY COMMITTEE
  - FULL-TIME SAFETY PROFESSIONAL
  - DAILY JSA PER JOBSITE
  - CONFINED-SPACE CERTIFICATIONS
  - AIR MONITORS
  - RETRIEVAL TRIPODS
  - LOS
  - CERTIFIED FLAGGERS

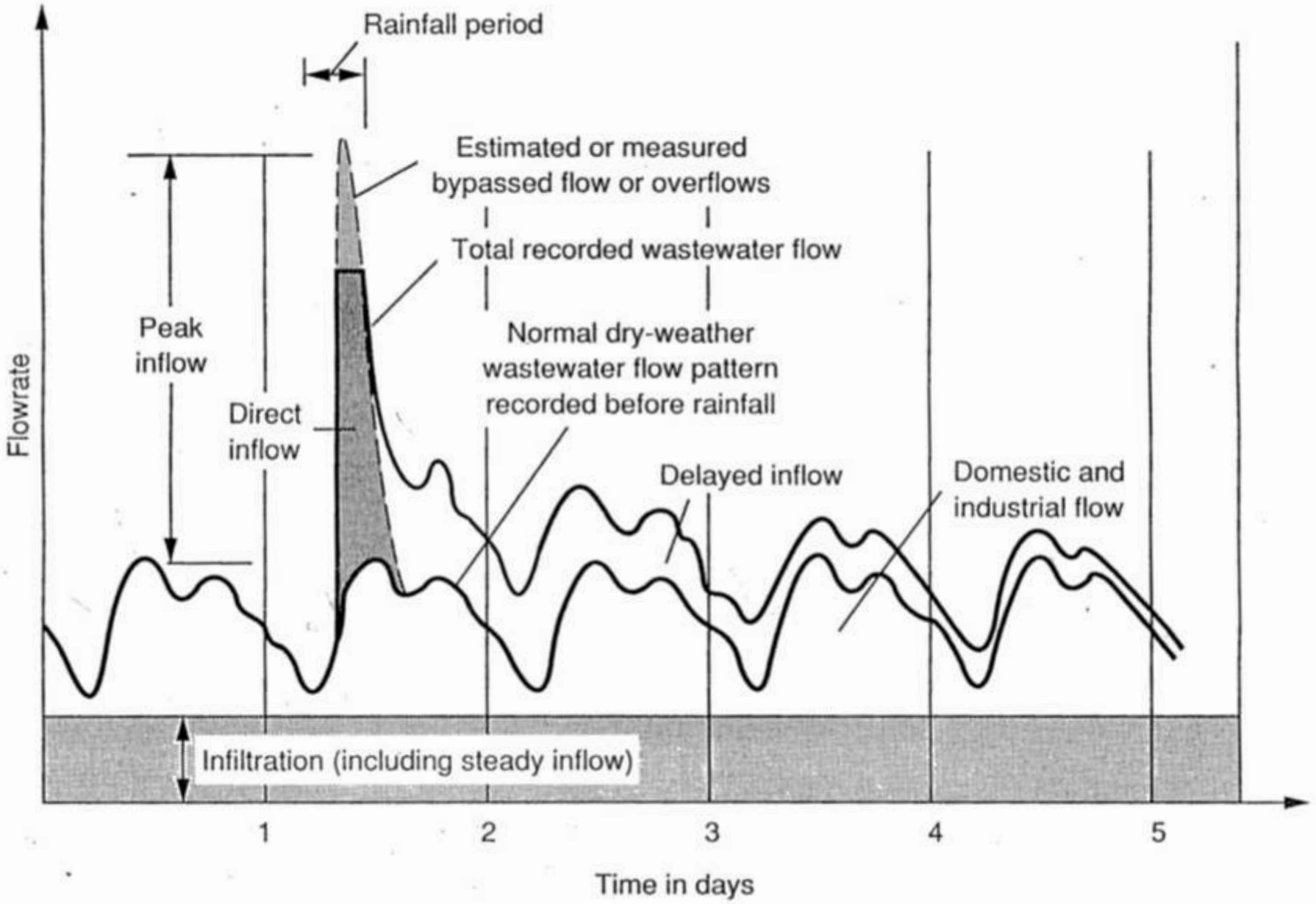

16:43:03
10-23-13
0.7FT
0 FPM

Inflow and Infiltration

- Four Primary Sewer Components:
  - Mainlines, Laterals, Lateral Connections & Manholes
- Underground Water Migration
  - French Drain Effect
- Wet-Weather and Spiked Flows

Flow and Rainfall Monitoring
Do I Mainly Have I or I?

- Methods for determining Quantity of Inflow
  - Graph wastewater flows and denote precipitation and spikes within the graph.
- Methods for determining Quantity of Infiltration
  - Nighttime flows during dry weather conditions.


Rainfall period
Estimated or measured
bypassed flow or overflows
Total recorded wastewater flow
Peak
inflow
Normal dry-weather
wastewater flow pattern
recorded before rainfall
Direct
inflow
Delayed inflow
Domestic and
industrial flow
Flowrate
Infiltration (including steady inflow)
1
2
3
4
5
Time in days

NO MAGIC BULLETS

Table 1. Gravity Sewer Systems: Percent Distribution by Pipe Material and Diameter Range (WERF, 2004)

Material	Diameter, inches				
	4 to 12	14 to 20	21 to 36	37 to 54	≥ 60
VCP	41	36	23	7.1	3
RCP	18	28	44	64	63
Lined RCP	1.4	3.9	6.2	17	20
PVC	27	15	6	1.6	0
HDPE	1.5	1.4	1	0.9	0
DI/CI	8.6	12	10	4.1	2.5
ACP	3.8	2.6	1.3	5.1	0.1
Brick	0.5	0.9	2.1	3.8	4.2
Other	0.9	1	3	0	6

Notes: VCP = vitrified clay pipe; RCP = reinforced concrete pipe; PVC = poly vinyl chloride; HDPE = high density polyethylene; DI = ductile iron (lined and unlined); CI = cast iron (lined and unlined); ACP = asbestos cement pipe.

I & I INVESTIGATION

- Mainline CCTV
- Lateral CCTV
- Manhole Inspection
- Smoke Testing
- Dye Testing
- Flow-Meters / Rain-Gauge
- Wet-Weather Investigation

WET WEATHER / NIGHT TIME INVESTIGATIONS

- WET WEATHER
  - SELECT MANHOLES
- NIGHT TIME
  - SELECT MANHOLES

SMOKE TESTING

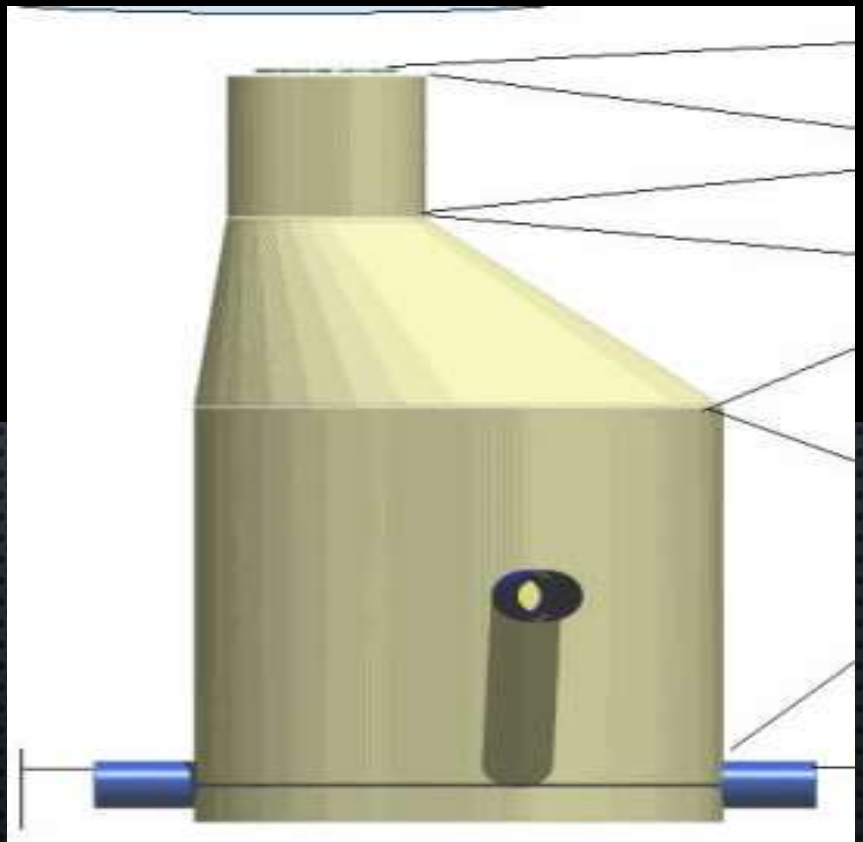
- An easy and cost effective method to identify I&I.
- Smoke testing can identify illegal connections, storm water cross connections, abandoned lines not properly plugged, cracked pipes, and bad service connections.
- Proper Trap does not allow smoke to enter.

Source: http://www.halifax.ca

Source: http://www.hydrostructures.com

MANHOLE COMPONENTS

- Frame / Cover
- Chimney
- Cone / Corbel
- Barrel Section
- Bench
- Channel / Invert
- Inlet / Outlet Pipe



Source: http://www.cartegraph.com

INSPECTION FORM

- Pictures
- Diagram
- Construction Method / Material
- Corrosion and pH Test
- Settlement / Washout of fines / VOIDS
- Structural Integrity
- Active / Inactive Leaks
- Watermarks
- Mineral Deposits
- Drops
- Flow
- Condition of Steps

TRICKS OF THE TRADE

- Daily catalog
- Digital everything
- Pictures, pictures and more pictures
- MACP
- Special attention to frame and cover
- Set a plug
- Crew Chief

MANHOLE VISUAL INSPECTIONS

ENTECH ENGINEERING, INC
MANHOLE INSPECTION REPORT

PROJECT: _____
MANHOLE: _____

I. GENERAL INFORMATION

Inspector: _____
Date: _____
Location: _____
Weather: ( ) Dry ( ) Rain
Ground Surface:
( ) Concrete ( ) Asphalt ( ) Gravel ( ) Grass
Drainage Path:
1. Outside of any visible drainage path ( )
2. Possible ponding over manhole ( )

MH Diameter: ( ) 4-feet ( ) Other _____
Depth to Invert (inches): _____
Insert: Insert Installed: ( )Yes ( ) No
If "No" - Recommend Insert: ( )Yes ( ) No

II. MANHOLE INFORMATION:

FRAME AND COVER
Type of Cover: ( ) Regular ( ) Watertight
Cover Condition:
( ) Poor ( ) Good ( ) Very Good ( ) Cracked
( ) Missing ( ) Needs immediate repair
Dimension: _____ **PPH**: ( ) Yes ( ) No
Holes in Cover: ( ) Number ( ) Size
Lettering: _____ **Adj**: _____
Type of Adj: _____
Frame Condition:
( ) Poor ( ) Good ( ) Very Good ( ) Cracked
( ) Missing ( ) Needs immediate repair

CONE / BARREL / BASE
Material:
( ) Brick ( ) Pre-cast Concrete
( ) Poured-in-place
Condition:
( ) Poor ( ) Good ( ) Very Good
Condition Comment:
( ) Cracked ( ) Major Breaks ( ) Severe Deterioration ( ) Holes ( ) Leaking Joints
( ) No Channel ( ) No Comment

Debris: ( ) None ( ) Light ( ) Medium ( ) Heavy
Type of Debris:
( ) None ( ) Mud ( ) Stone ( ) Sewage

III. VISIBLE INFILTRATION

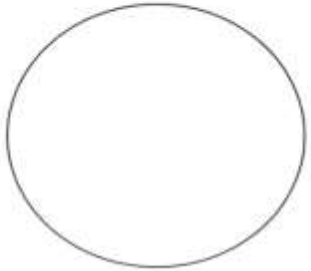
Frame & Cone:	____	GPM
Frame & Risers:	____	GPM
Cone & Risers:	____	GPM
Through Walls:	____	GPM
Through Wall Joints:	____	GPM
Around Pipe:	____	GPM
Through Inverts/Bench:	____	GPM

Pictures: _____

Remarks:
_____
_____
_____
_____

- **If None – Write "None"**

LOCATION SKETCH



Cleaning, Inspection and Assessment

- Cleaning
  - Sags
  - Trouble areas
  - Roots
  - Critical Service Areas
    - Hospitals
    - Schools
    - Prisons
- MH and Pipe Inspection / Assessment
- Staffing and Equipment

FLUSHING

- How to flush?
- Screen & Vacuum
- Pump Size & Spec
- "Flying Blind"
  - Value of competency
- Root Cutting
- Protruding-Tap Cutting

Source: http://www.thewatertreatments.com

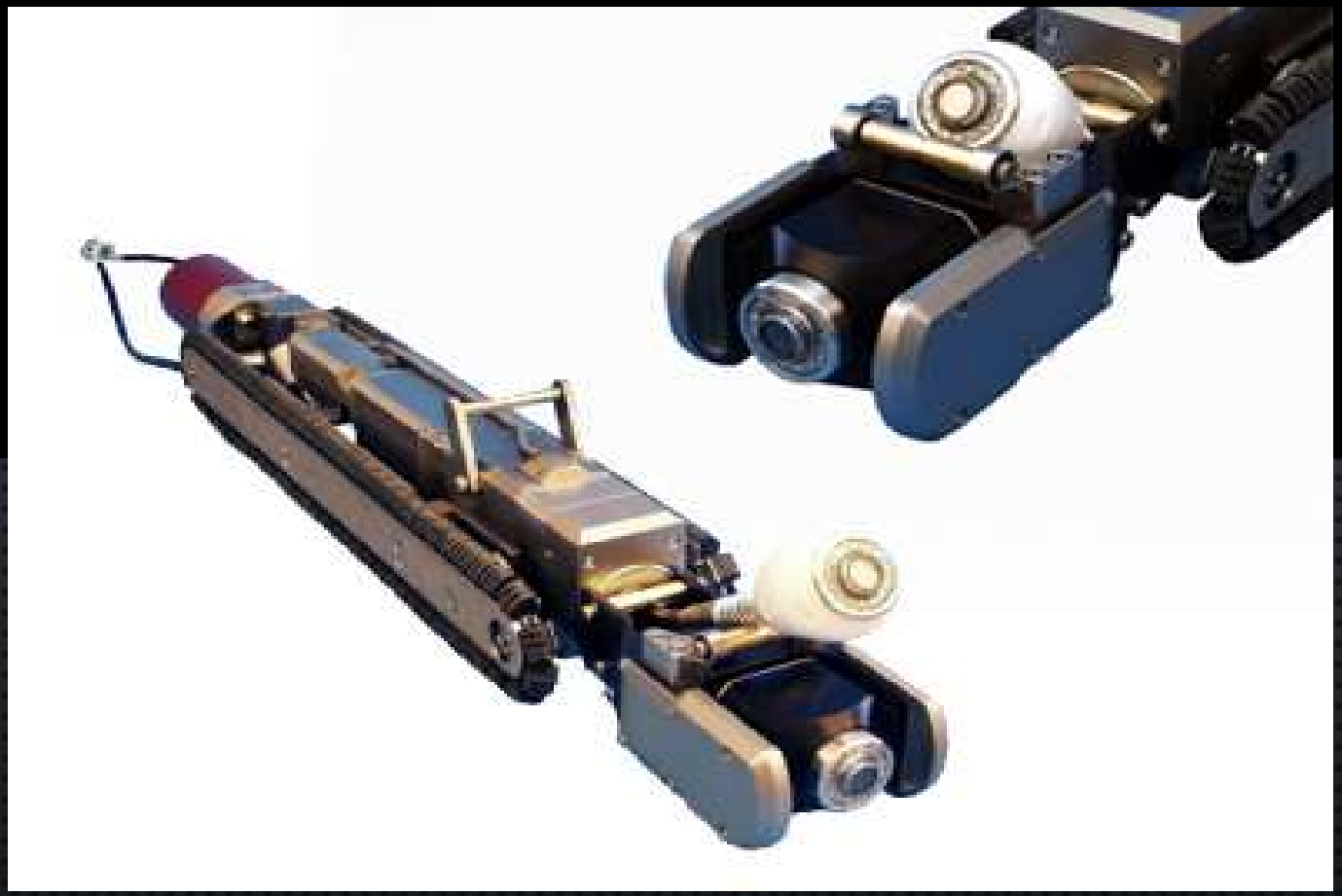
EASEMENT WORK

LIGHT & HEAVY CLEANING

CCTV INSPECTION

- Certified Operator - PACP
- Max Speed = 30 ft / min
- Tracked, Wheeled, Boat and Lateral Launching Systems
- Pan, Tilt & Zoom Camera
- DVD, Viewing Software, Report & Index

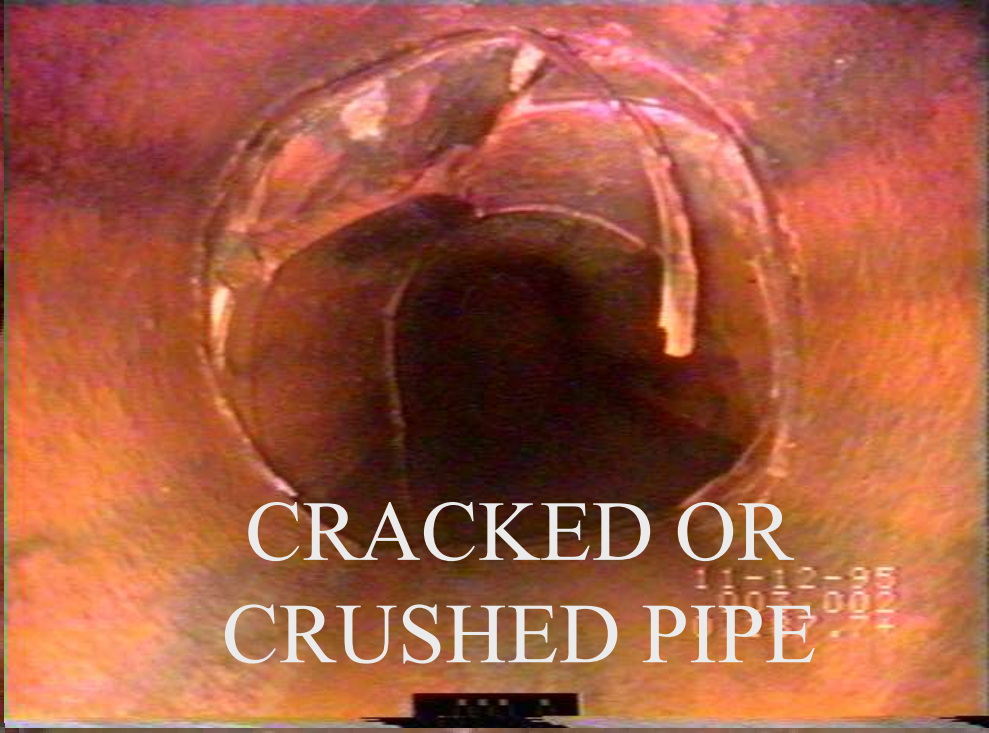
LATERAL LAUNCH

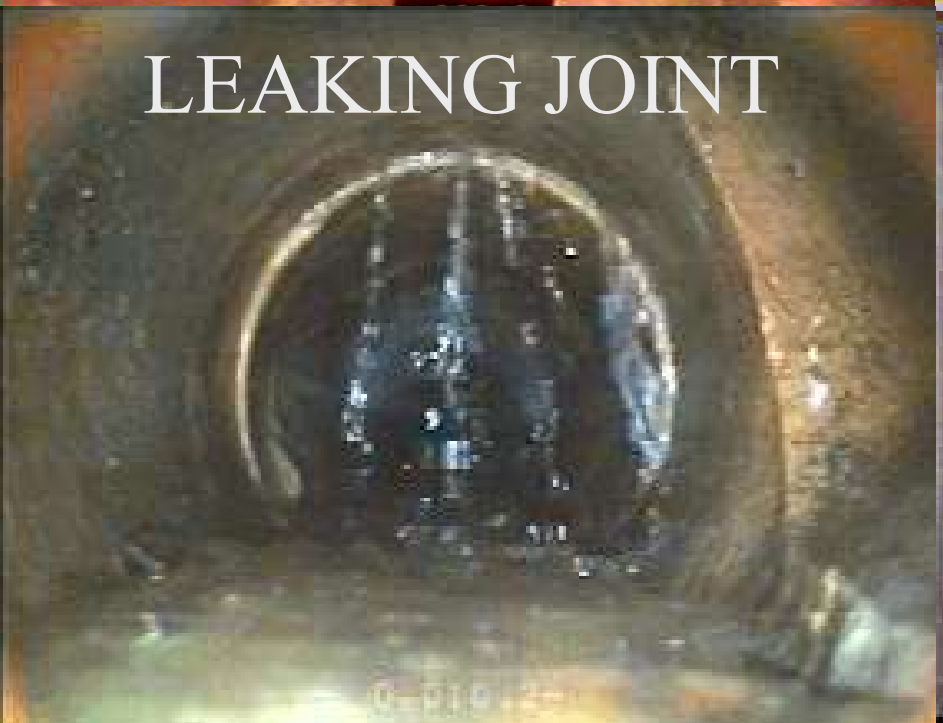


DECODING YOUR TV REPORTS

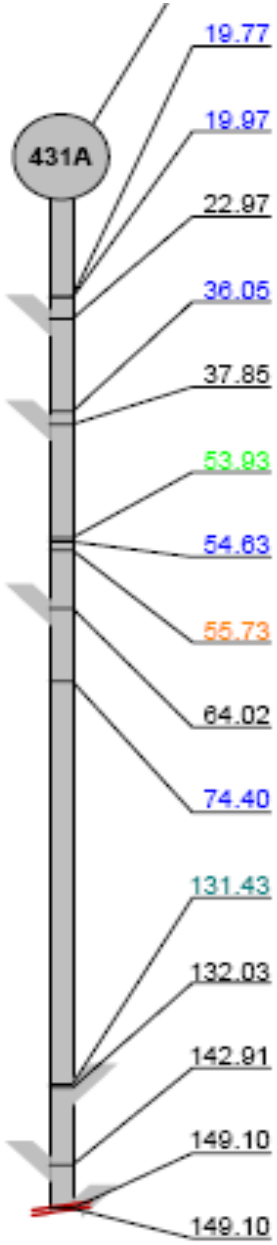
- UNDERSTAND THE DEFECT CODING METHOD USED.
- HOW TO PRIORITIZE REPAIRS?
  - IMMEDIATE STRUCTURAL REPAIRS (ASAP)
  - STRUCTURAL REPAIRS (PRIORITIZE / COST)
  - MAJOR SOURCES OF I&I (PRIORITIZE / COST)
  - MINOR SOURCES OF I&I (PRIORITIZE / COST)


MISSING PIPE


CRACKED OR
CRUSHED PIPE


LEAKING JOINT


MULTIPLE CRACKS,
PIECES MISSING



19.77	Roots Fine Joint, from 06 to 09 o'clock, within 8 inches of joint: YES	00:02:01	
19.97	Crack Longitudinal, at 12 o'clock, within 8 inches of joint: YES	00:02:36	2_3A
22.97	Tap Factory Made Capped, at 03 o'clock, 6", within 8 inches of joint: YES	00:03:23	
36.05	Fracture Circumferential, from 12 to 12 o'clock, within 8 inches of joint: NO	00:04:31	2_5A
37.85	Tap Factory Made, at 03 o'clock, 6", within 8 inches of joint: YES	00:05:10	
53.93	Joint Offset Medium	00:05:58	2_7A
54.63	Fracture Circumferential, from 12 to 12 o'clock, within 8 inches of joint: YES	00:06:24	2_8A
55.73	Infiltration Dripper, at 03 o'clock, within 8 inches of joint: YES, REMARK: Evidence of infiltration	00:06:48	2_9A
64.02	Tap Factory Made Capped, at 03 o'clock, 6", within 8 inches of joint: YES	00:07:31	
74.40	Crack Longitudinal, at 12 o'clock, within 8 inches of joint: YES	00:08:26	2_11A
131.43	Hole, from 12 to 06 o'clock, within 8 inches of joint: YES	00:13:33	2_12A
132.03	Tap Factory Made Capped, at 09 o'clock, 6", within 8 inches of joint: YES	00:13:56	
142.91	Tap Factory Made Capped, at 03 o'clock, 6", within 8 inches of joint: YES	00:14:39	
149.10	Tap Break-In Active, at 11 o'clock, 6", within 8 inches of joint: YES	00:15:20	
149.10	Survey Abandoned, REMARK:	00:15:20	2_16A

TYPICAL SEWER MAIN DEFECTS

- PROTRUDING LATERAL CONNECTIONS
- BROKEN PIPE
- SAGS
- MISALIGNMENT
- SEPARATED JOINTS

DYE TESTING

- VERIFICATION OF SUSPECT SOURCES
  - ROOF LEADERS
  - STORM INLETS
  - UNKNOWN PIPES

Source: Tool Experts | https://www.toolexperts.com/

Source: Drains IOM| http://www.drainsiom.com/

BUILDING SEWER INSPECTION PROGRAM - rev. 10.5.09

(7)

- **Roof Drains/Leader**
  Roof drains and leaders direct storm water from roof gutters to the ground through pipes and downspouts. Roof drains should not be connected to the sanitary sewer but should discharge to the ground outside of a building. If your roof drains are connected to the sanitary sewer, disconnect them, plug any open connections to the sanitary sewer using a non-shrink permanent material, and redirect the roof drains onto the ground outside the building.

N/A

- **Foundation Drains**
  Foundation drains are underground pipes that collect storm water from around the base of a building and into a sump basket, where it is then pumped outside of the building. Foundation drains should not be connected to the sanitary sewer. The process could involve excavation to disconnect the foundation drain from the sanitary sewer and installation of a sump pump system. The new sump system must pump directly to the ground outside of the building or be connected to the storm sewer system.

N/A

- **Floor Drains**
  Floor drains are designed to capture surface or ground water that enters basements or crawl spaces. Floor drains should not be connected to the sanitary sewer. The process could involve excavation to disconnect the floor drain from the sanitary sewer and redirect to the storm system or installation of a sump pump system. The new sump system must pump directly to the ground outside of the building or be connected to the storm sewer system.

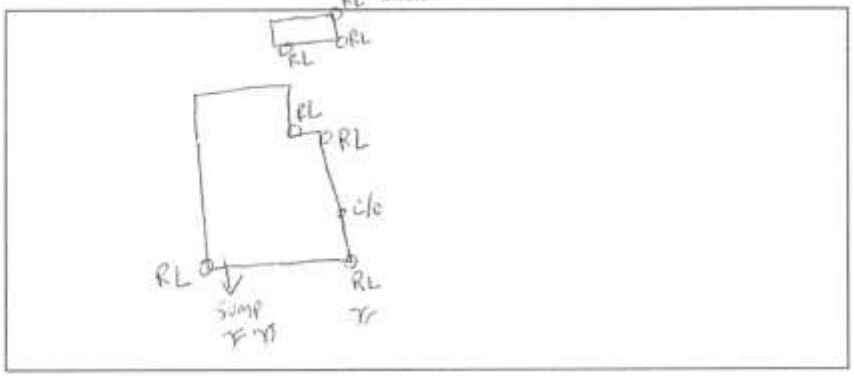
(1)

- **Sump Pump Systems**
  Sump pumps are designed to capture surface or ground water that enters basements or crawl spaces and pump it away from the house. The basic sump system includes drain tile, a sump pit, a sump pump, a float or switch, and a drain line. The sump pit extends below the slab and collects surface water that enters the basement/crawl space or groundwater that rises to the slab. Sump pumps should not be connected to the sanitary sewer. Sump pumps should drain into the storm sewer system through one of two methods: a direct connection (a pipe from the house to the main storm sewer line), if available, or directly onto the ground (preferably 20 feet from the house and not into a neighbor's yard).

NOT LOCATED

- **Vents and Cleanouts**
  Vents and cleanouts are designed to vent sewer gases and provide lateral access for maintenance. Low lying and/or broken vents and cleanouts can be responsible for extraneous flow entering the sanitary sewer system. Inspections to be made on existence, location, and structural condition of vents/cleanouts.

Sketch



INITIAL INSPECTION

Inspector Name: BRYON KILLIAN

Inspector Signature:

Home Owner Name: N/A - FOR SALE

Home Owner Signature: N/A

House Address: 13 BIRCH STREET

Date: 11/27/09

Problems Identified: NONE

Solutions Identified: N/A

FOLLOW-UP INSPECTION (IF NECESSARY) – WITHIN 30 DAYS FROM INITIAL INSPECTION

Follow-up Inspection Date: N/A

Have all issues been corrected: N/A

Now that we've found the problem….

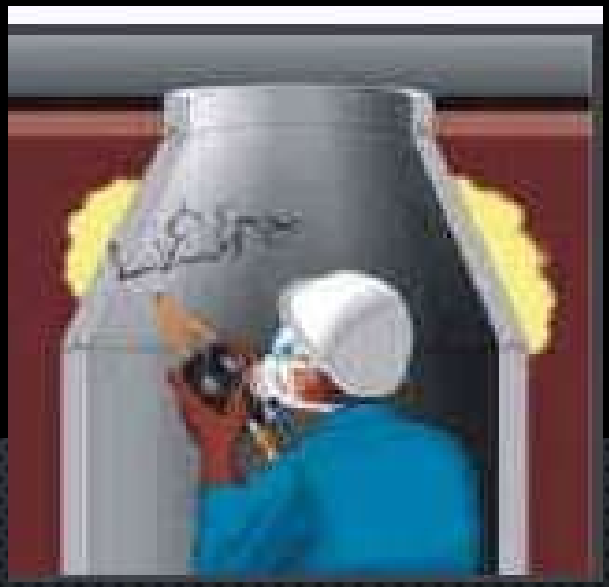
- How do we fix it?
- Dig and Replace
  - Costly, inconvenient, but sometimes necessary
- Trenchless Rehabilitation
  - "No-dig" Option
  - Temporary or Permanent Fix?

Main Line Replacement Versus Rehabilitation

- Condition of existing pipe / manholes / lateral piping
- Constructability of new pipe
- Number of laterals
- Restoration / Permitting Requirements
- Job Size and Number of Contractors

MANHOLE GROUTING 101

- 100 Types of Grout
  - "Chemical Manhole Grouting"
  - Hydrophobic vs. Hyrophilic
  - Product Selection based on:
    - Leak flow-rate
    - Soil / Backfill Condition
    - Is Grout sole Rehab?
    - Budget



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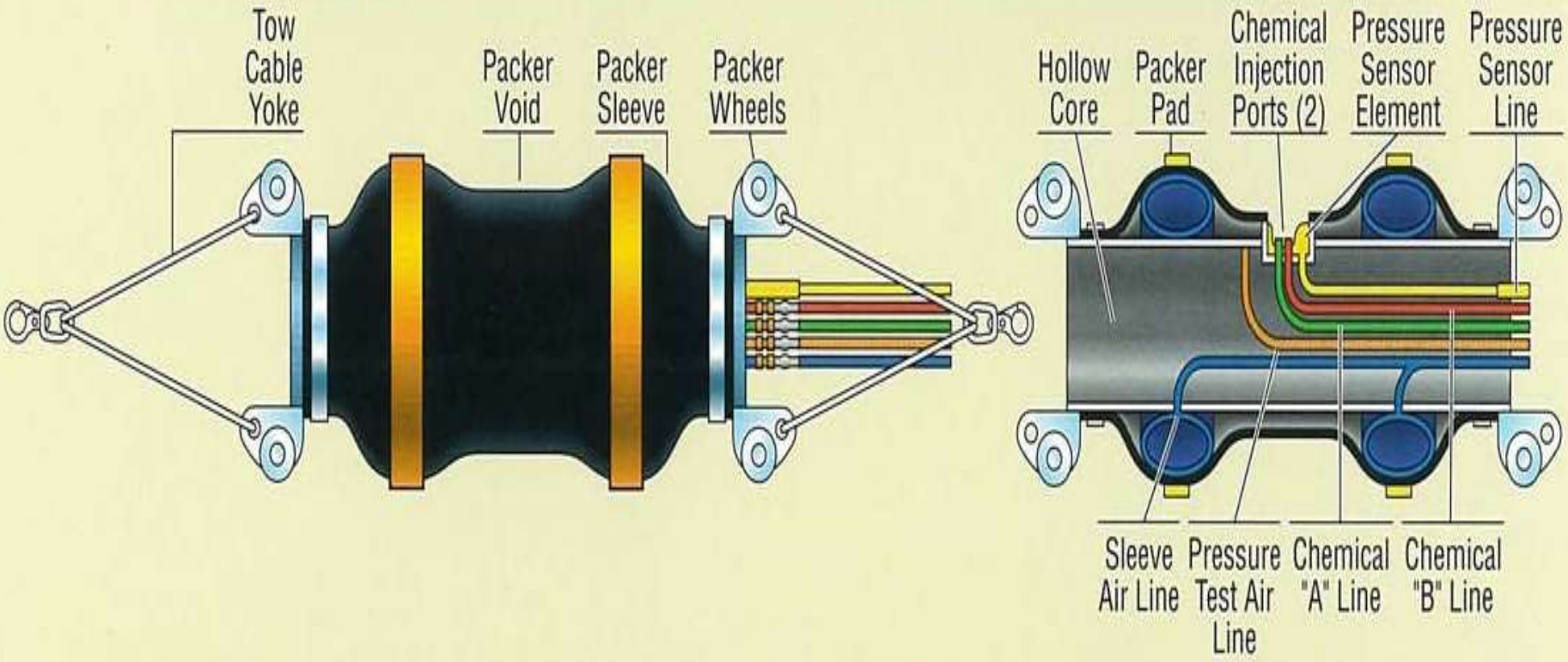
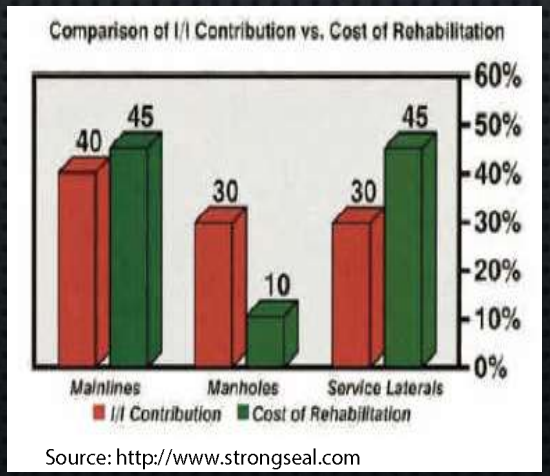
ANATOMY OF A MAINLINE TEST/SEAL PACKER

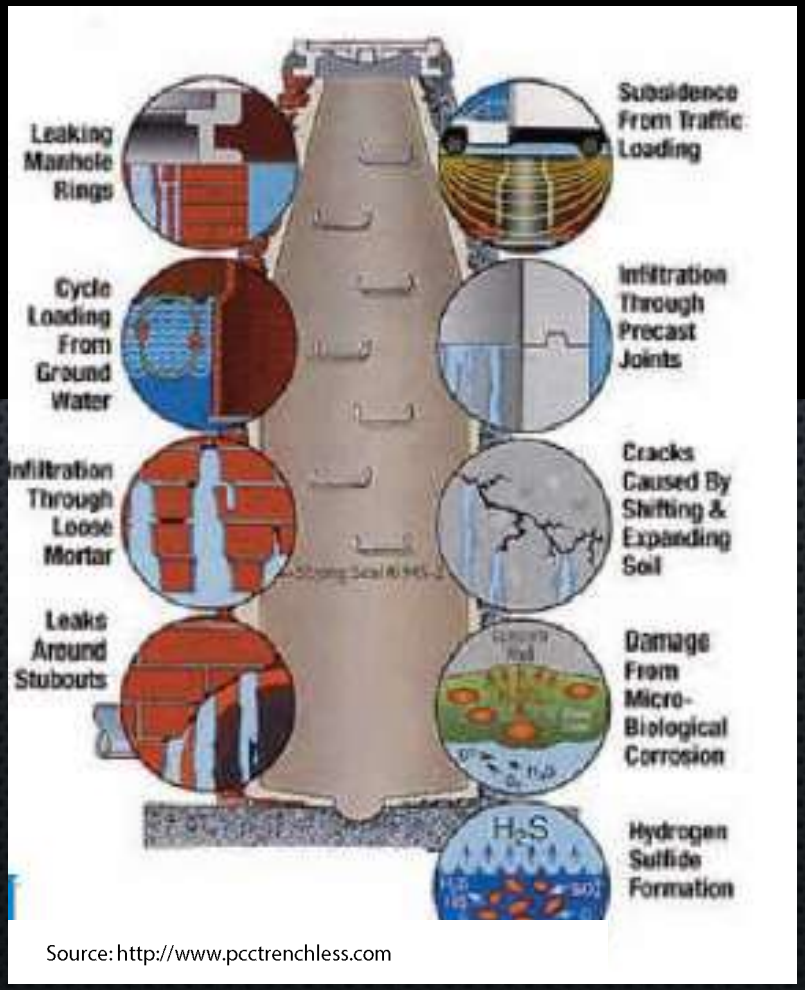


MANHOLE REHABILITATION

- "Low-Lying Fruit"
- Cost-Effective
- Grouting
- Cementitious vs Epoxy Sprays
  - Selection Criteria
- Chimney Seal



Source: http://www.strongseal.com



Source: http://www.pcctrenchless.com

MONOLITHIC CEMENTITIOUS COATING

- PRESSURE WASH
- STOP LEAKS
- PROFILE HOLES
- SPIN-CAST
- BENCH / CHANNEL
- HARD WITHIN HOURS

EXETER SUPPLY CO., INC.

USG Utility Services Group

WHAT IS HYDROGEN SULFIDE (H2S)?

- ACIDIC GAS
  - POISONOUS, FLAMMABLE, COLORLESS, ROTTEN EGGS
- COMES FROM ANEROBIC DIGESTION (NO OXYGEN)
  - CREATED IN FORCEMAINS

USG Utility Services Group

HYDROGEN SULFIDE - CORROSION

- CERTAIN BACTERIA CONVERT HYDROGEN SULFIDE (H2S) TO SULFURIC ACID, WHICH IS VERY CORROSIVE TO ELECTRICAL EQUIPMENT AND TO CONCRETE, IRON, AND STEEL.

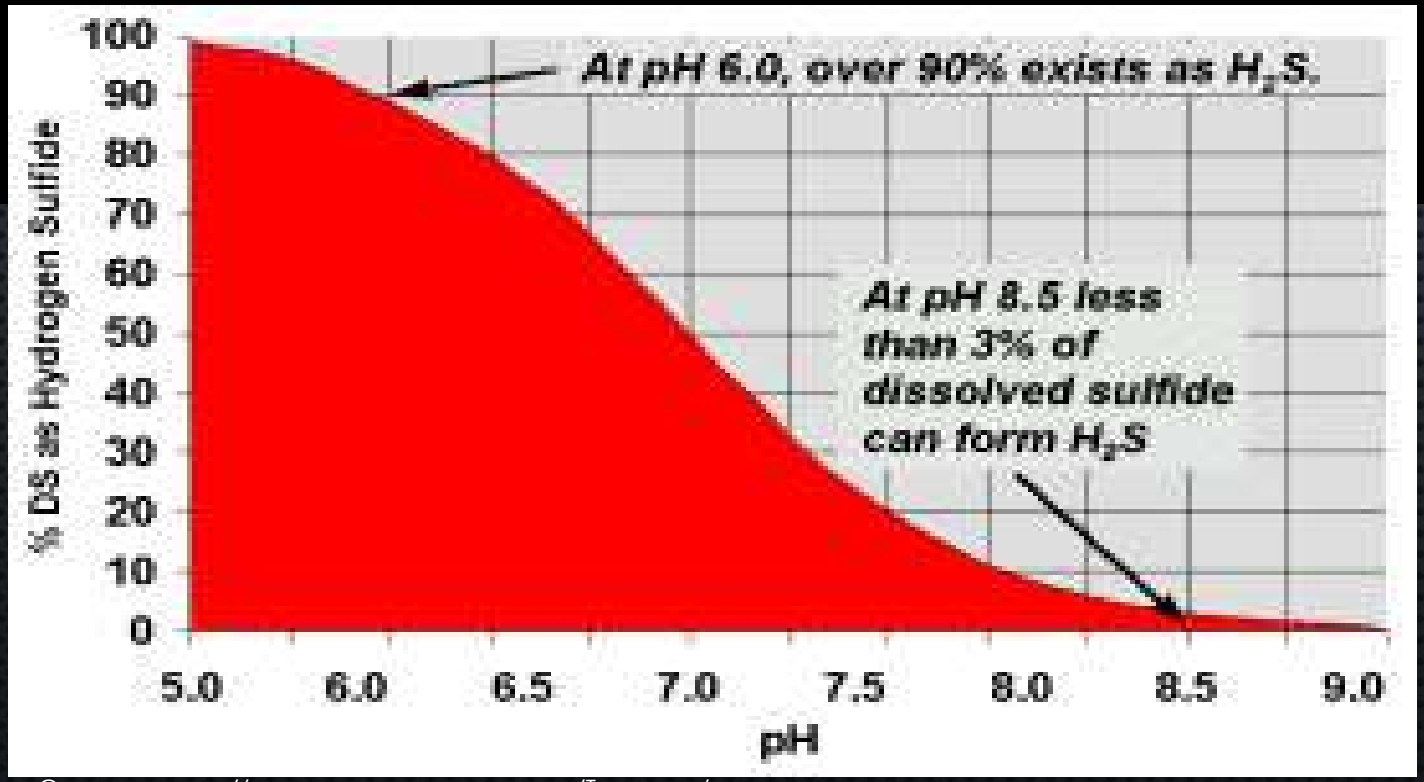


CHART FROM: HTTP://WWW.MAGNESIASPECIALTIES.COM/THIOGUARD/THIO_DIRECT.HTM

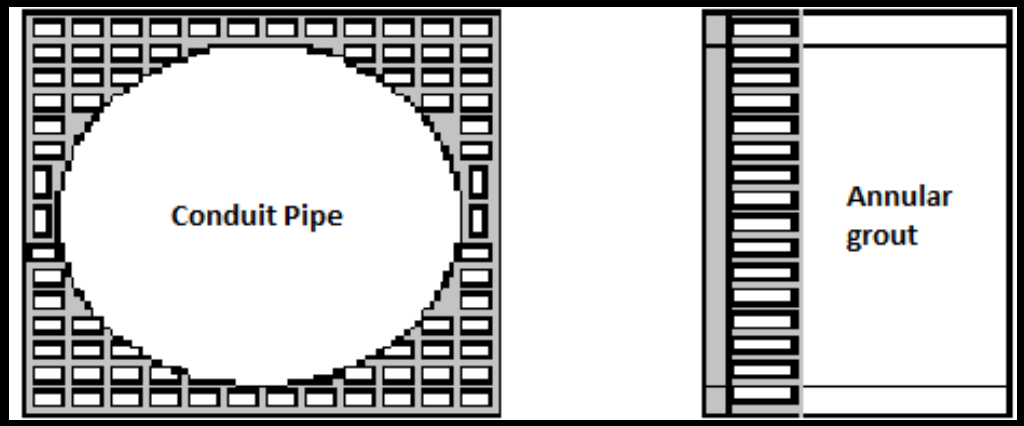
CORROSION PROBLEM

2ND MANHOLE FROM FORCEMAIN

H2S DAMAGE

- USUALLY LOCALIZED NEAR FORCE MAIN DISCHARGE POINTS
- REHABILITATION OF H2S PRONE STRUCTURES IS EXPENSIVE

CONCEPT OF SLIP LINING




BEFORE
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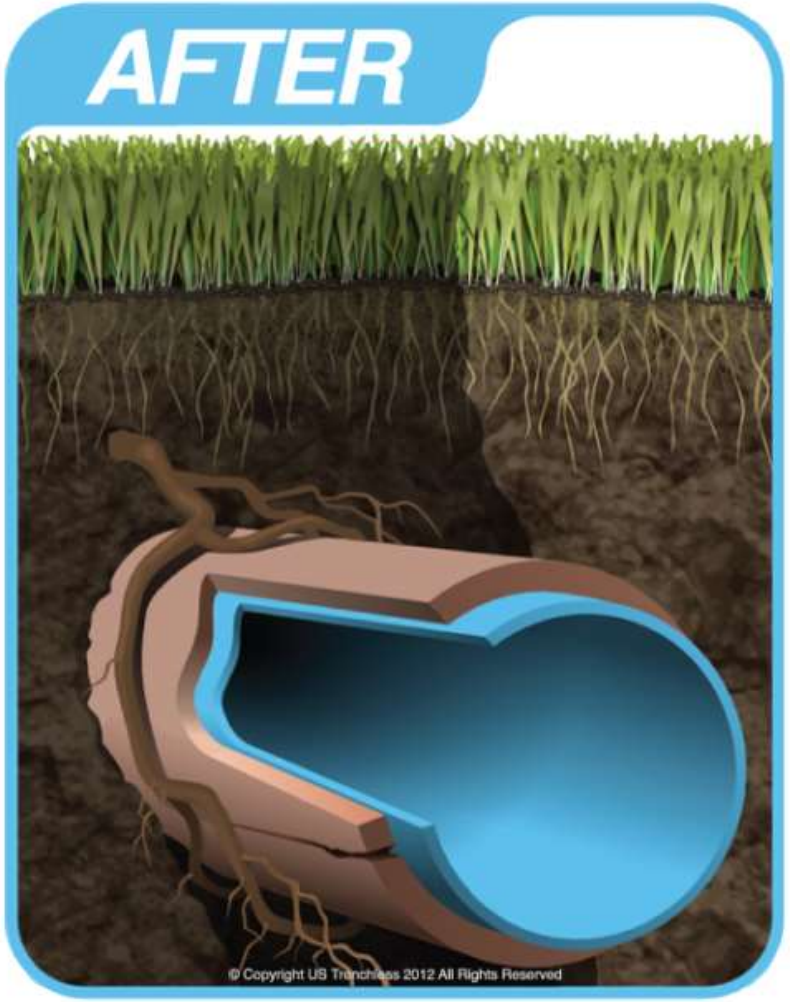
AFTER
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IMPORTANCE OF POST-CCTV

- INSTALLATION INSPECTION
- POST-CCTV VERIFICATION


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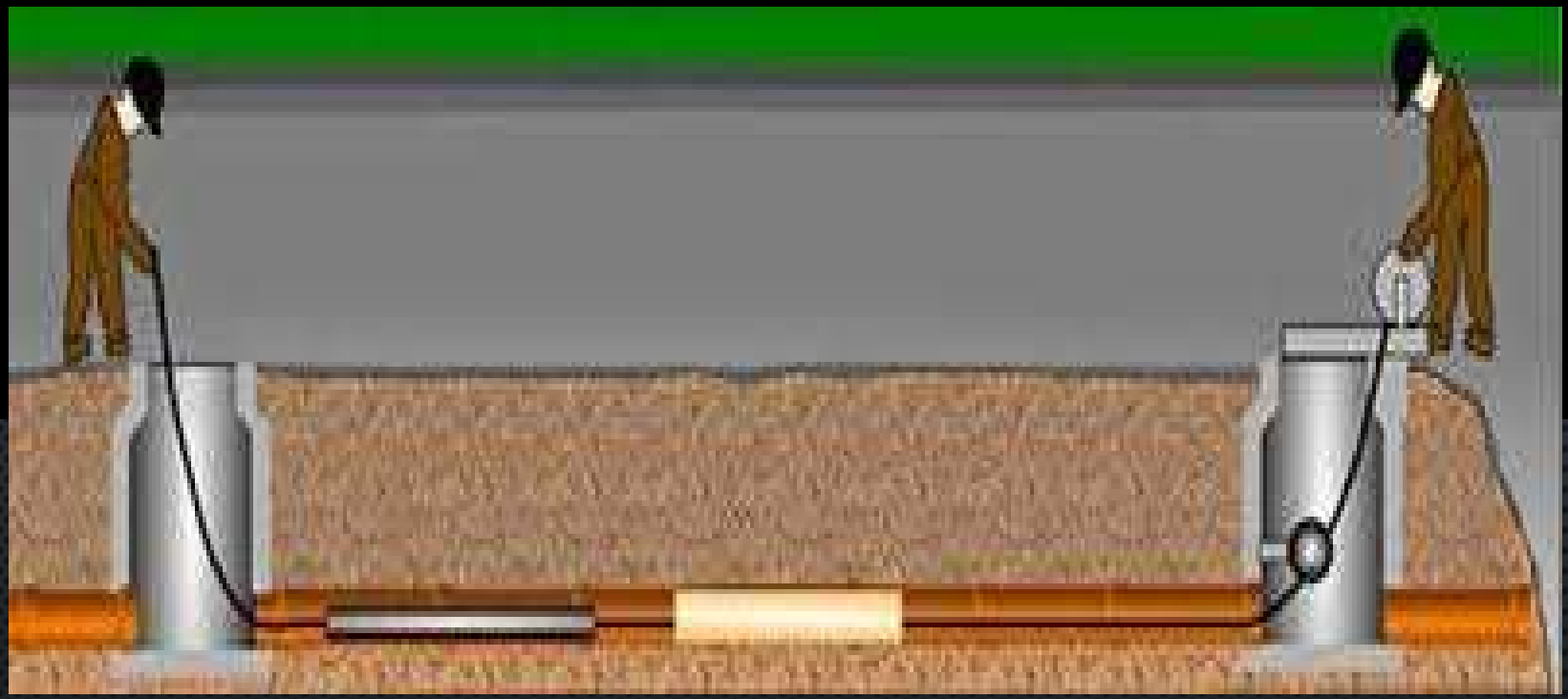
CURED-IN-PLACE SECTIONAL REPAIR

- "SURGICAL APPROACH"
- COST-EFFECTIVE
- 2'-20' REPAIRS



Source: http://www.expresssewer.com

CURED-IN-PLACE SECTIONAL REPAIR

LARGE DIAMETER PIPE REPAIR

Lateral Rehabilitation

- Laterals rehabilitation have been given less attention in the past due to:
  - Lack of adequate inspection for small diameter lines
  - Lack of adequate rehabilitation methods for small diameter lines
  - Complex issues of ownership and maintenance
  - Transitions from 4 to 6-inchs
  - Bends
    - Usually up to 45 degree with liners.

Other Solutions

- Pipe Bursting
  - Need to re-connect laterals
- Slip-Lining
  - Grout the annular space
- Lateral Lining

CONTRACTING

- IDENTIFY BUDGET – SELECT REHABILITATION
- CLARIFY SCOPE
  - ACCESS, TRAFFIC CONTROL, BYPASS PUMPING, DUMP SITE, LIGHT / HEAVY CLEANING, WATER SOURCE, COMPLETION TIMEFRAME, WET WEATHER, CERTIFIED OPERATOR, DELIVERABLES
- AVOID "SOLE-SOURCING"
- ECONOMIES OF SCALE

3RD PARTY NEW CONSTRUCTION TESTING

- FLUSH AND CCTV NEW PIPES
- MANDRILL / LASER PROFILE
- PRESSURE TESTING
- VACUUM TEST MANHOLES

GOOD PRACTICES

- Public notification of flushing / smoke test
  - Document laterals with issues, for future notifications
- Identify sags, severe offsets, roots
- CCTV New Construction Pipes
- Pump Station Grit Removal / Vacuuming

PART 3 - RESOURCES AND BUDGETS

Resources and Budget

- Budget Process
- Rate Setting, Budgetary Policies and Financial History
- Historical Rate Review
- Operating and Maintenance Expense
- Capital Improvement Program Overview
- Capital Improvement Plan

Selecting the Right Method

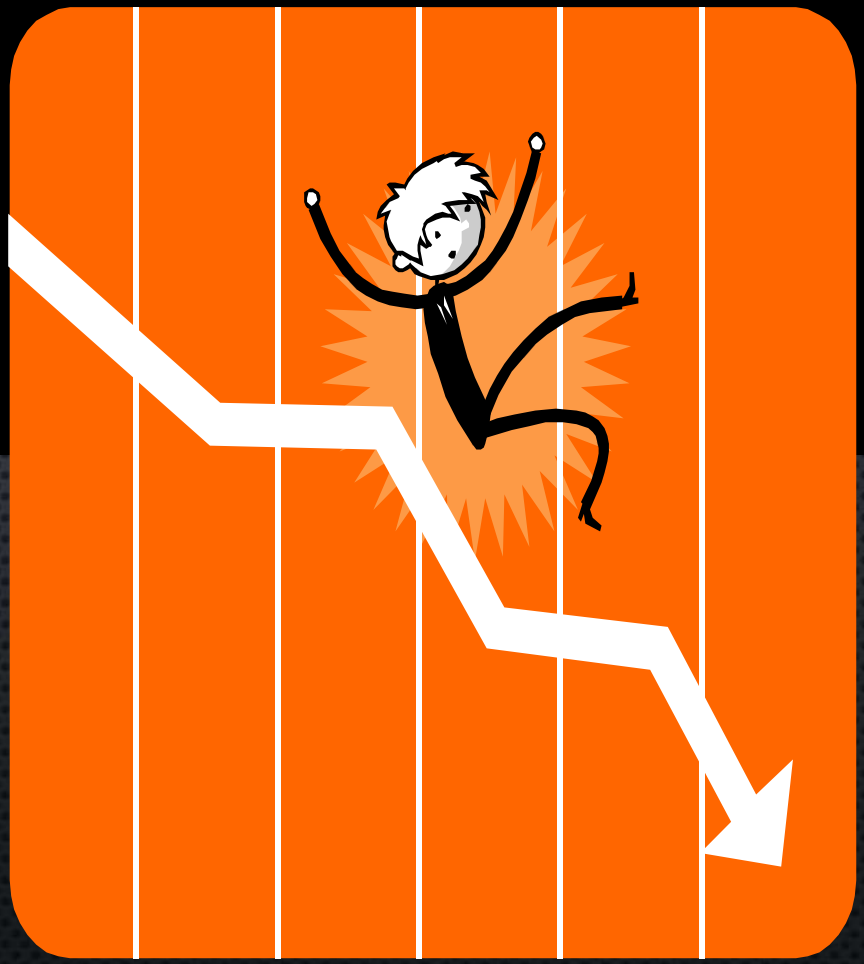
- What are the problems to be addressed?
- What methods can remedy the problems identified?
- Does the method provide a short or long term solution?
- Does the method go beyond just solving the problem identified and is there an added benefit?

NO MORE I&I PROBLEM?

- "I DID I&I WORK FIVE YEARS AGO AND I STILL HAVE A PROBLEM!"
- THE REDUCTION AND CONTROL OF I&I SHOULD BE CONSIDERED A PART OF YOUR DISCIPLINED, LONG-TERM MONITORING AND MAINTENANCE PROGRAM.
  - NOT A ONE TIME FIX. IT'S A PROGRAM NOT A PROJECT.

POST-REHAB FLOW DATA

- DID IT WORK?
  - PRE- AND POST REHAB EVALUATION
  - ARE THE FLOWS DOWN?
    - MONITOR PEAKS
    - MONITOR DURATION



Meaningful Conversation with your Board

- What is needed now versus what can be budgeted in the future?
- Proactive versus Reactive; the cost of waiting

QUESTIONS

BRYON KILLIAN, PE
BKILLIAN@ENTECHENG.COM

ROBB KALBACH
RHK3@USGINC.NET

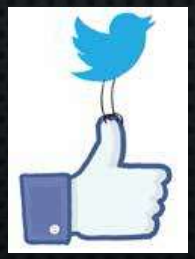
REVIEW / QUIZ

Thank You!

COLLECTION REHAB AND MAINTENANCE

Please, leave feedback on this session
Complete the online form at: www.prwa.com/training-survey

Schedule at http://mobile.prwa.com



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