

Consolidated Edison Company of New York

Steam Remote Monitoring System: Successes and Challenges

Presented by:

Frank A. Cuomo, PE, PMP

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Agenda

- Presenter introductions
- Brief history of the Con Ed Steam System
- Overview of the Con Ed Steam System
- Water hammer – types and impacts
- Remote Monitoring System
 - Hardware
 - Software
- System challenges and lessons learned

Presenter Introductions

Frank A. Cuomo, PE, PMP

- Project Manager – Steam Distribution
- Education
 - Manhattan College School of Engineering
 - Baruch Zicklin Graduate School of Business



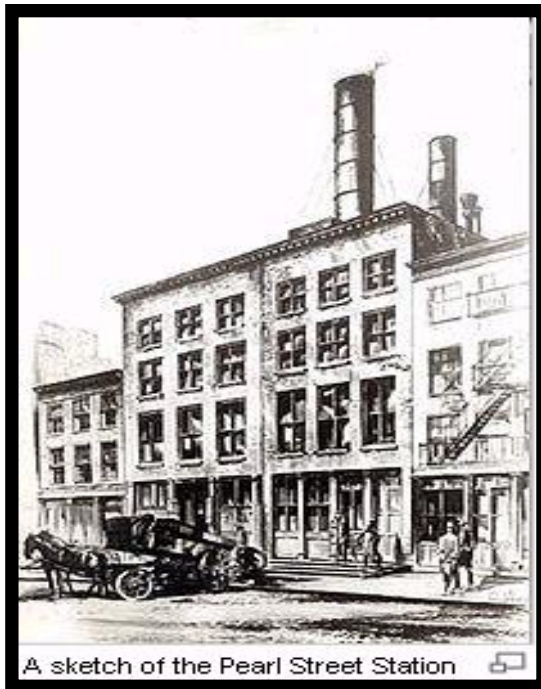
Dowlatram Somrah, PE

- Section Manager – Steam Distribution Engineering
- Education
 - Cooper Union College – Bachelor and Masters Engineering Program

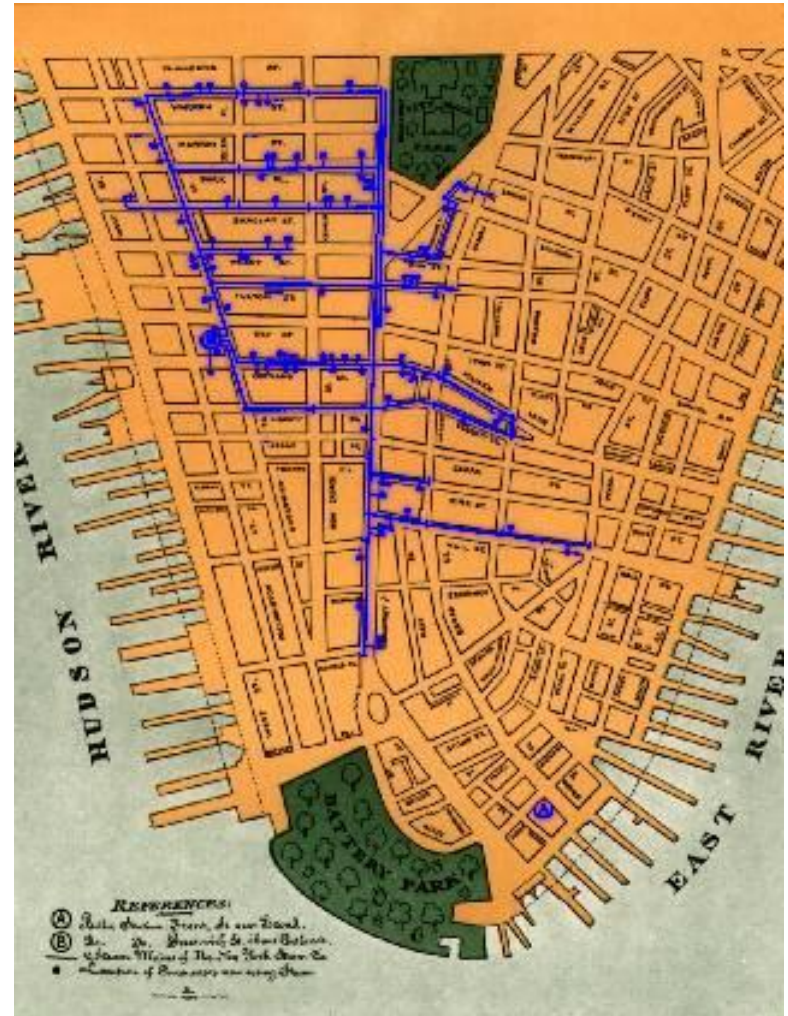


New York Steam System - 1882

- 62 steam customers
- 3 miles of steam mains
- System operated at 80 psig

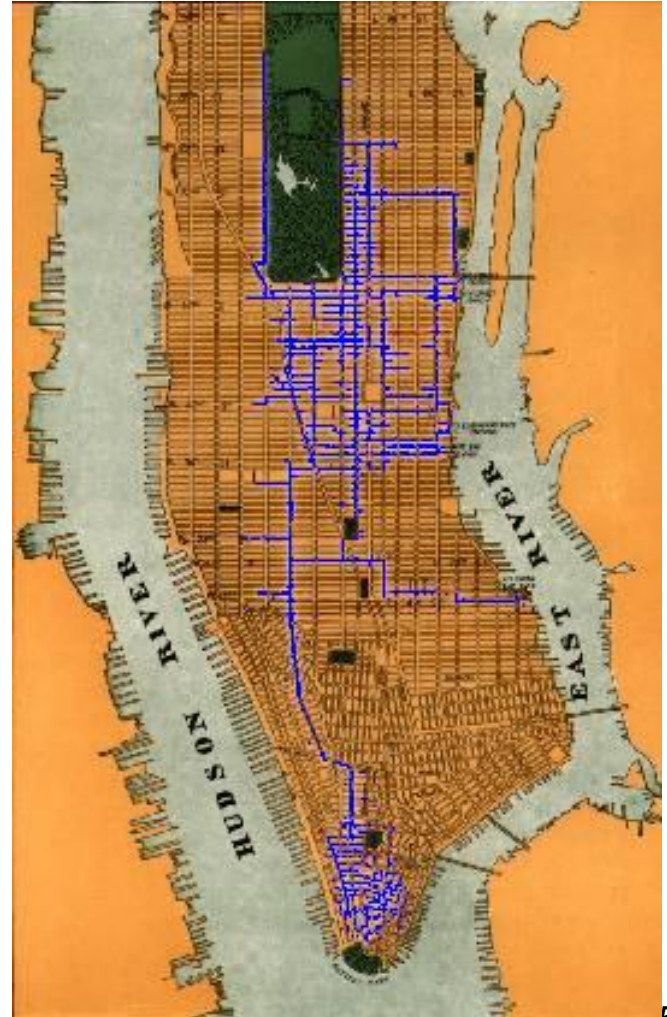


A sketch of the Pearl Street Station



New York Steam System - 1886

- Steam extended uptown
- 5 miles of steam mains and 350 customers added
- Served from Madison Ave to Fifth Ave between 53rd Street to 67th Street



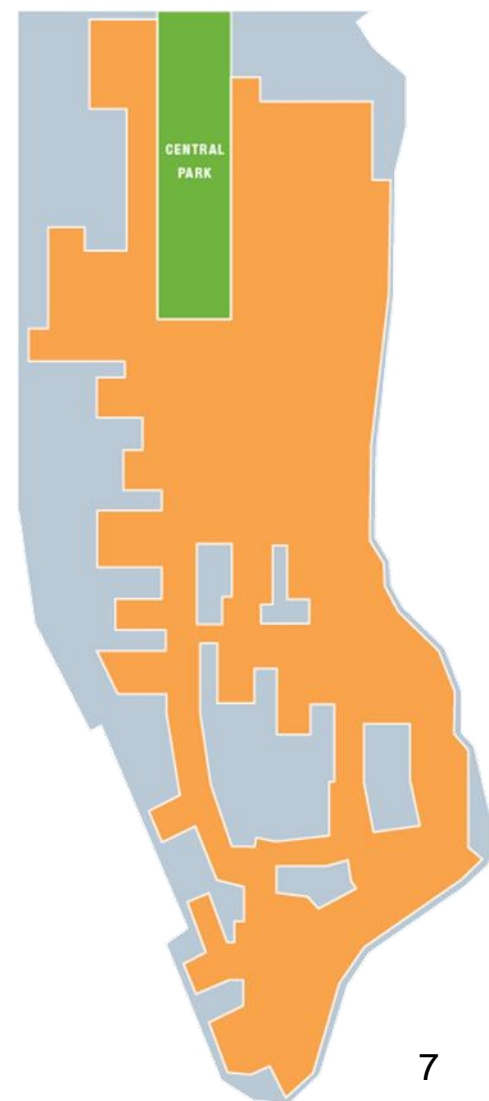
Con Edison Steam System - 1936

- Consolidated Edison of NY Purchased the New York Steam Corporation in 1936
- 65 miles of steam mains
- 6 generating stations
- Served approximately 2500 buildings



Con Edison Steam System - 2016

- Largest steam distribution system in the country.
- 1665 customer accounts
- Six (6) generating stations
- System capacity – 11.7 million lbs per hr
- Total production – 26 billion lbs per yr
- System peak load – 9.6 million lbs per hr
- Approximately 670 employees



Con Edison Steam System – Customers

- Heat
- Hot water
- Air-conditioning
- Sterilization
- Cooking
- Humidification



157 W 57th Street



Time Warner Center



Guggenheim Museum



Grand Central Terminal



Beecher's Cheese

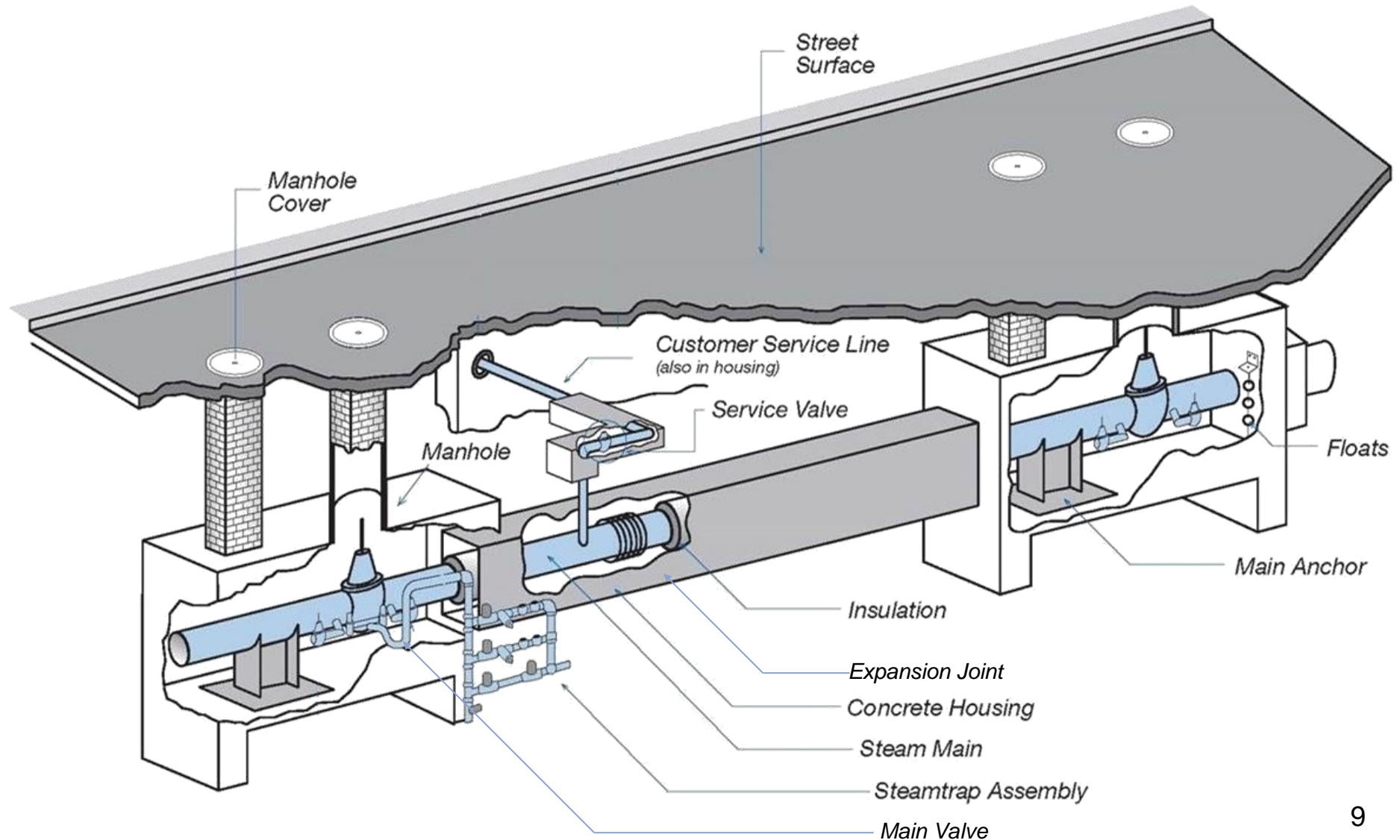


American Museum of
Natural History

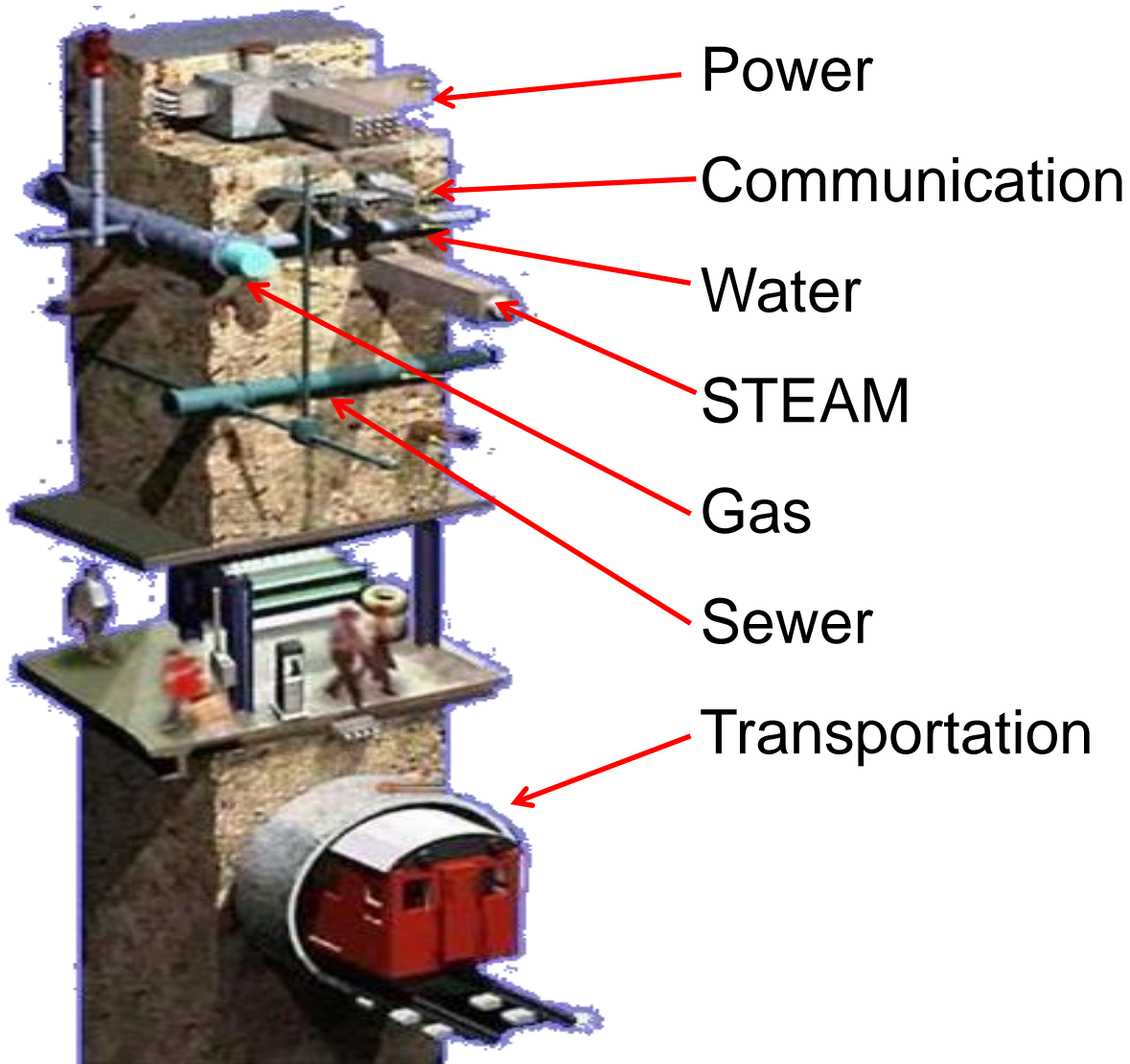
Segments

- Commercial 48%
- Residential 19%
- Hospitals 9%
- Hotels 6%
- Museums 2%
- Other 16%

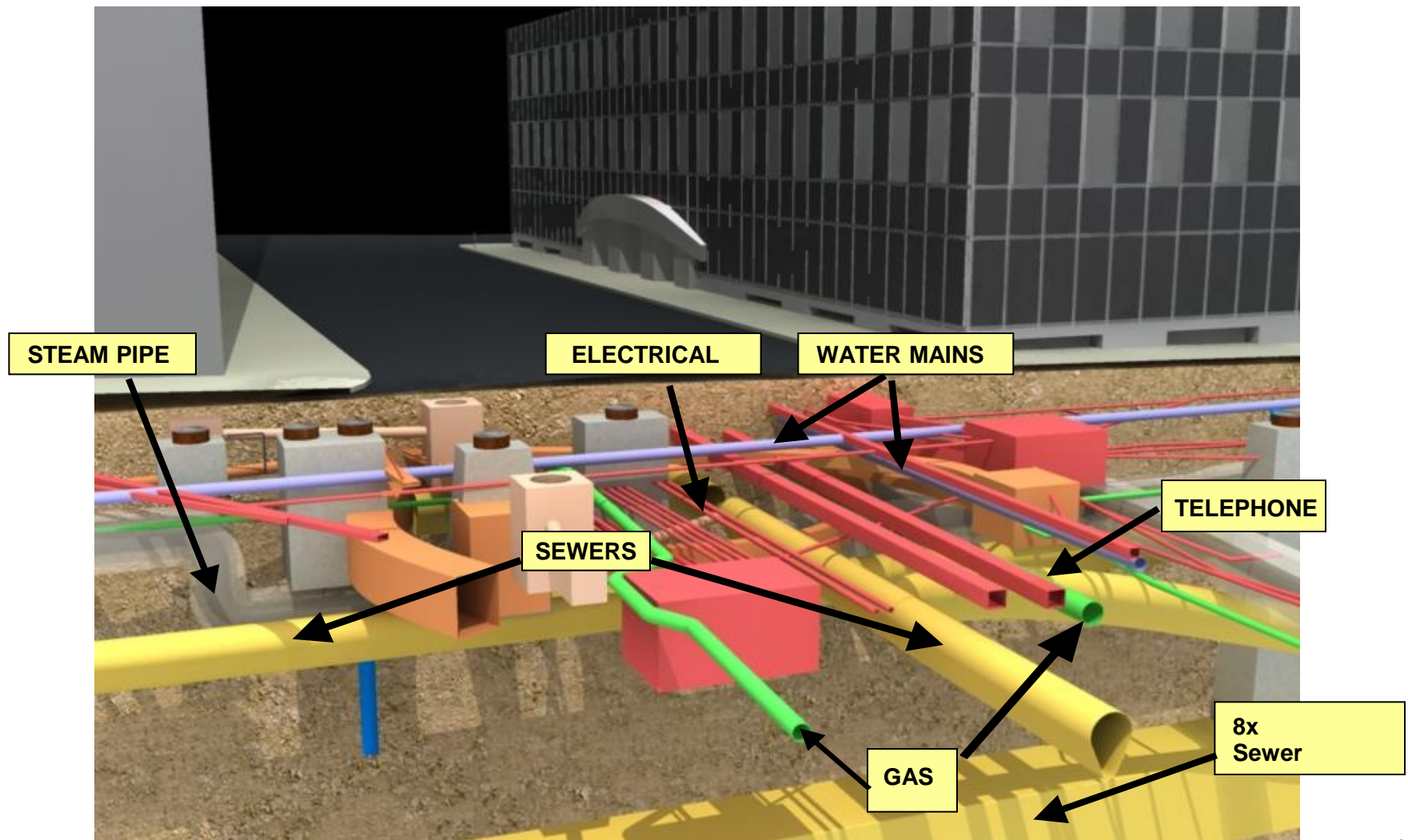
Con Edison Steam System - Components



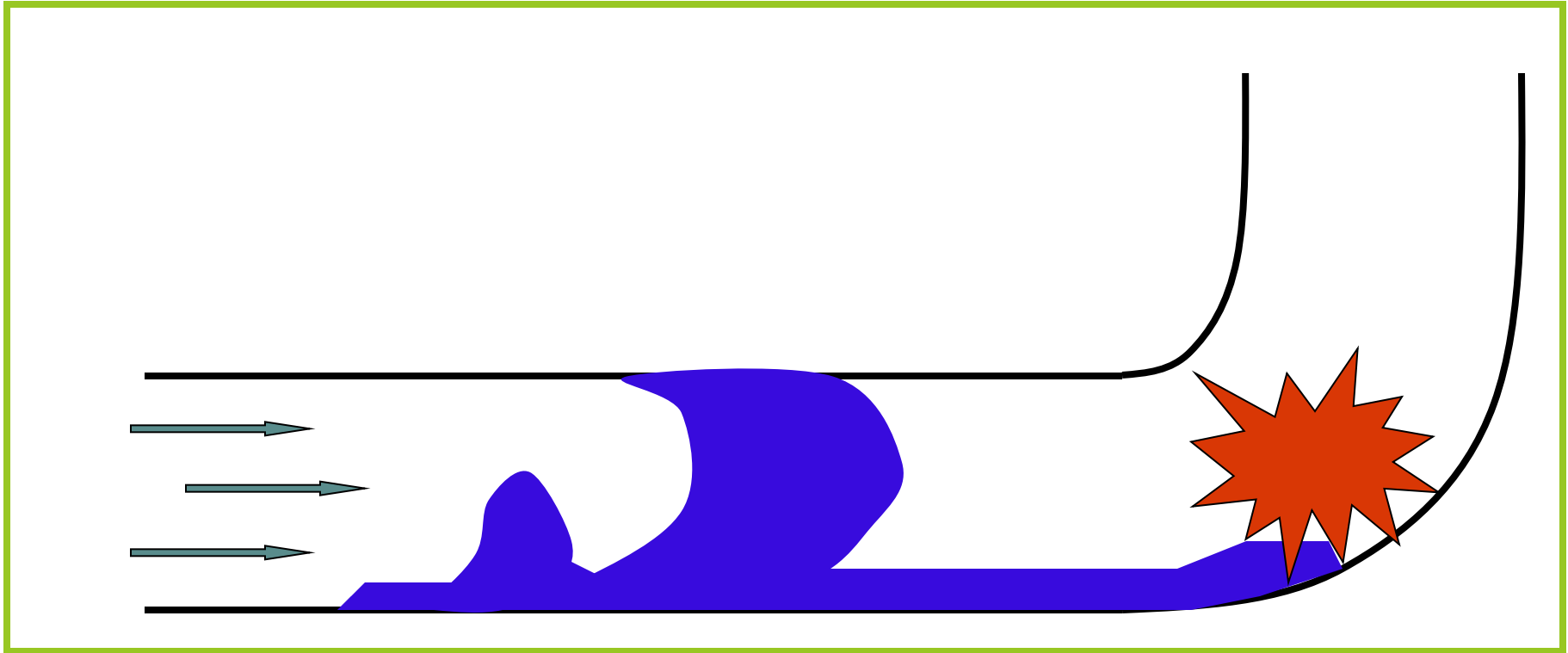
NYC Underground



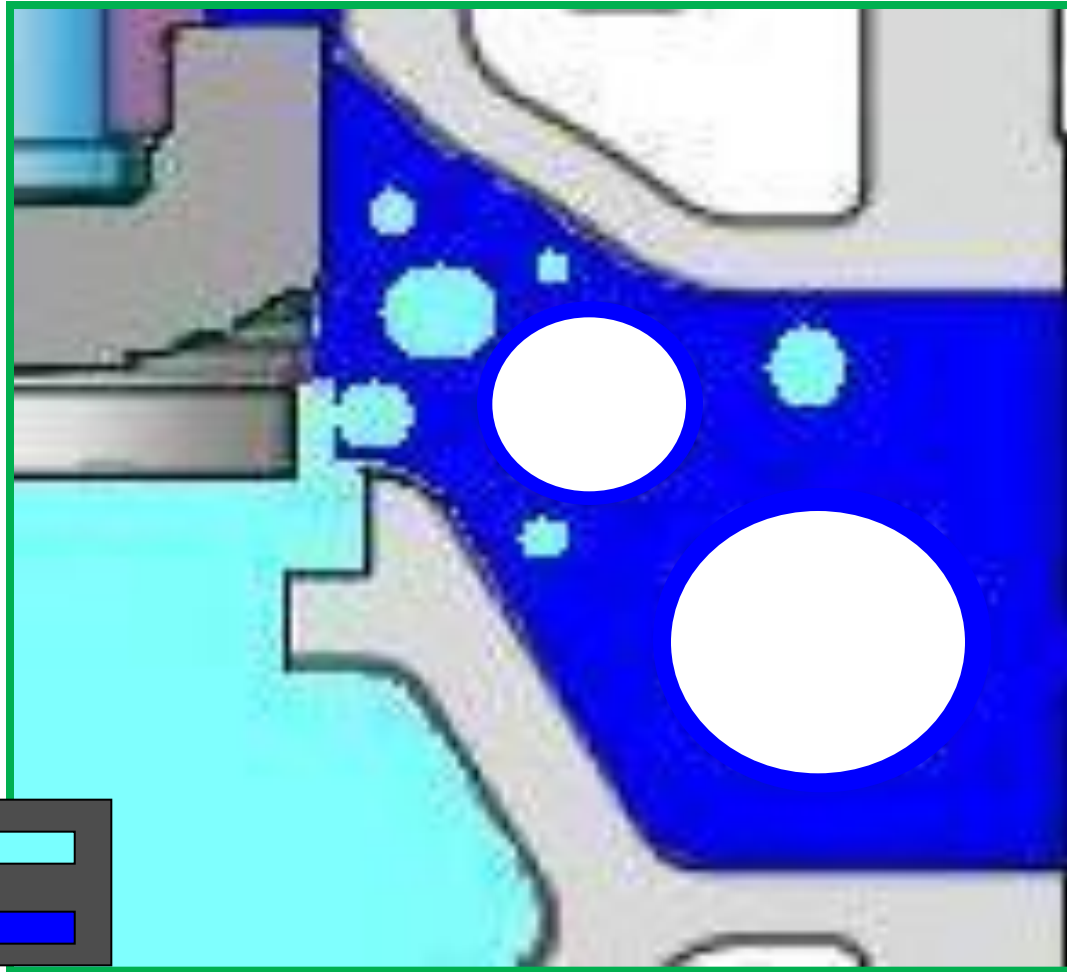
NYC Underground



Water Hammer – Slug Type



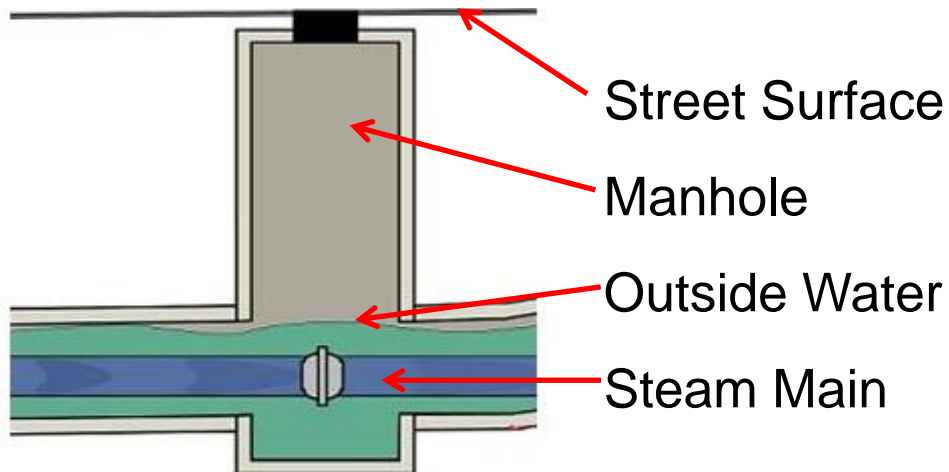
Water Hammer – Bubble Collapse Type



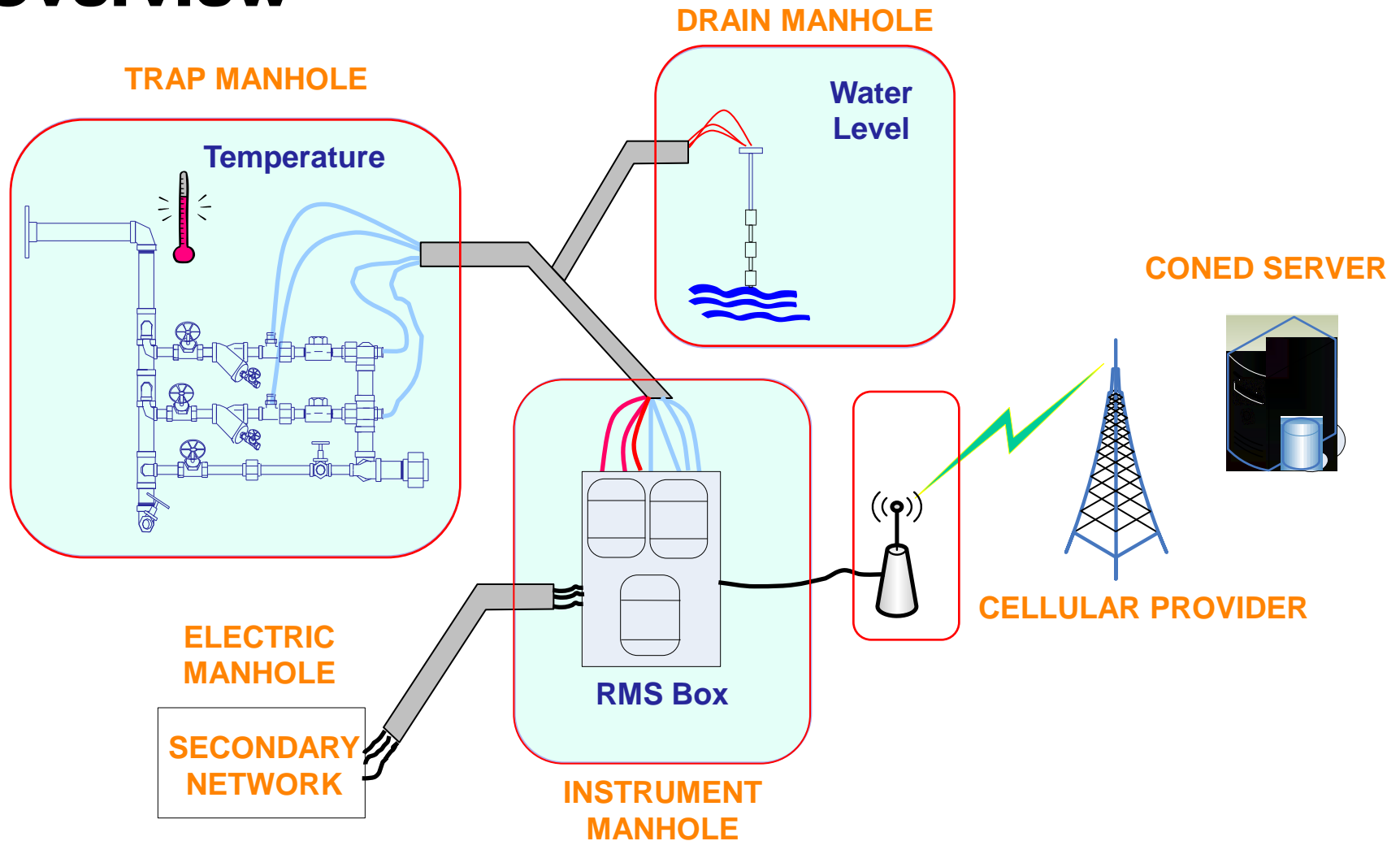
Water Hammer – Impacts



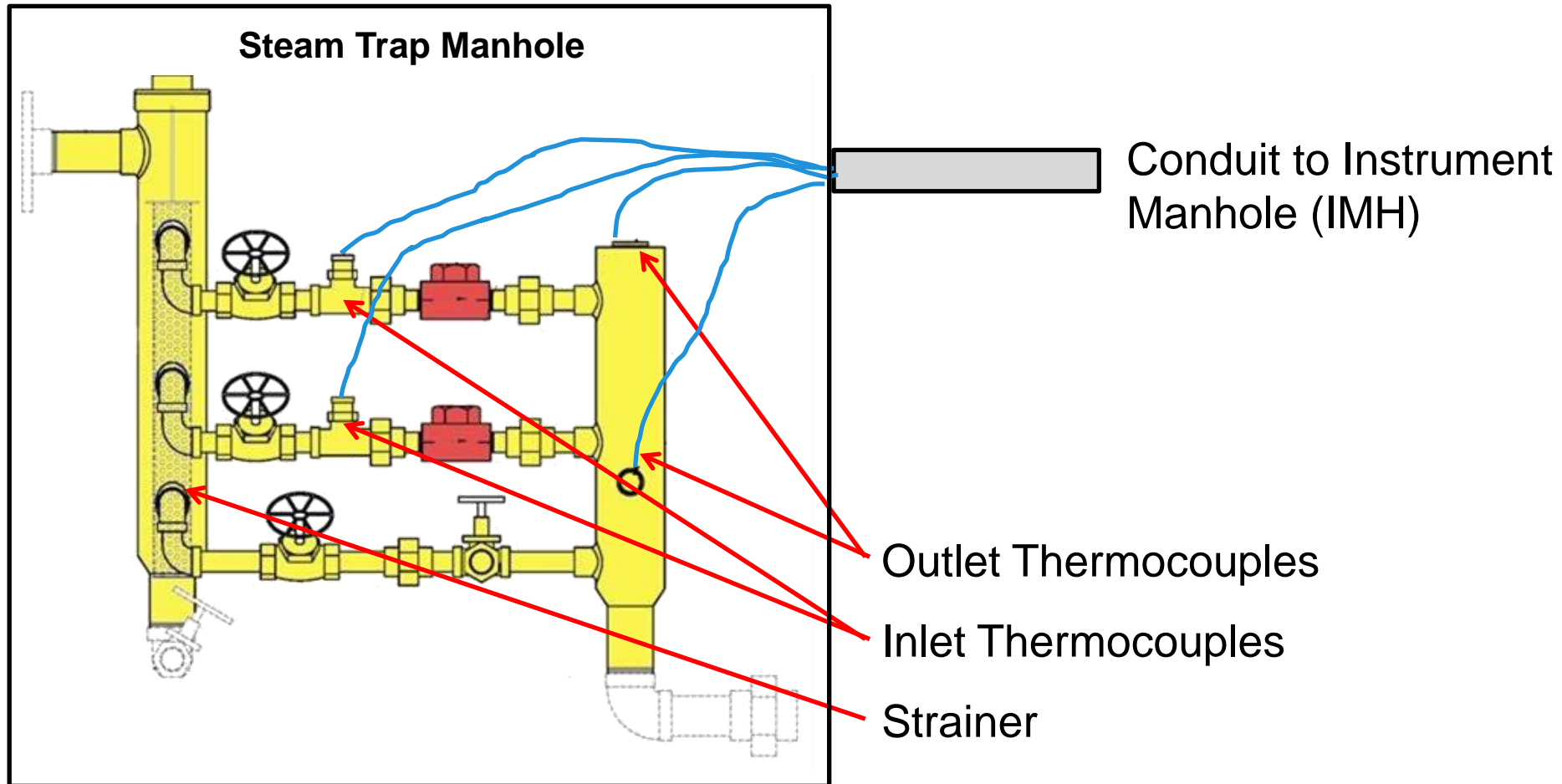
Water Hammer – Contributing Factors



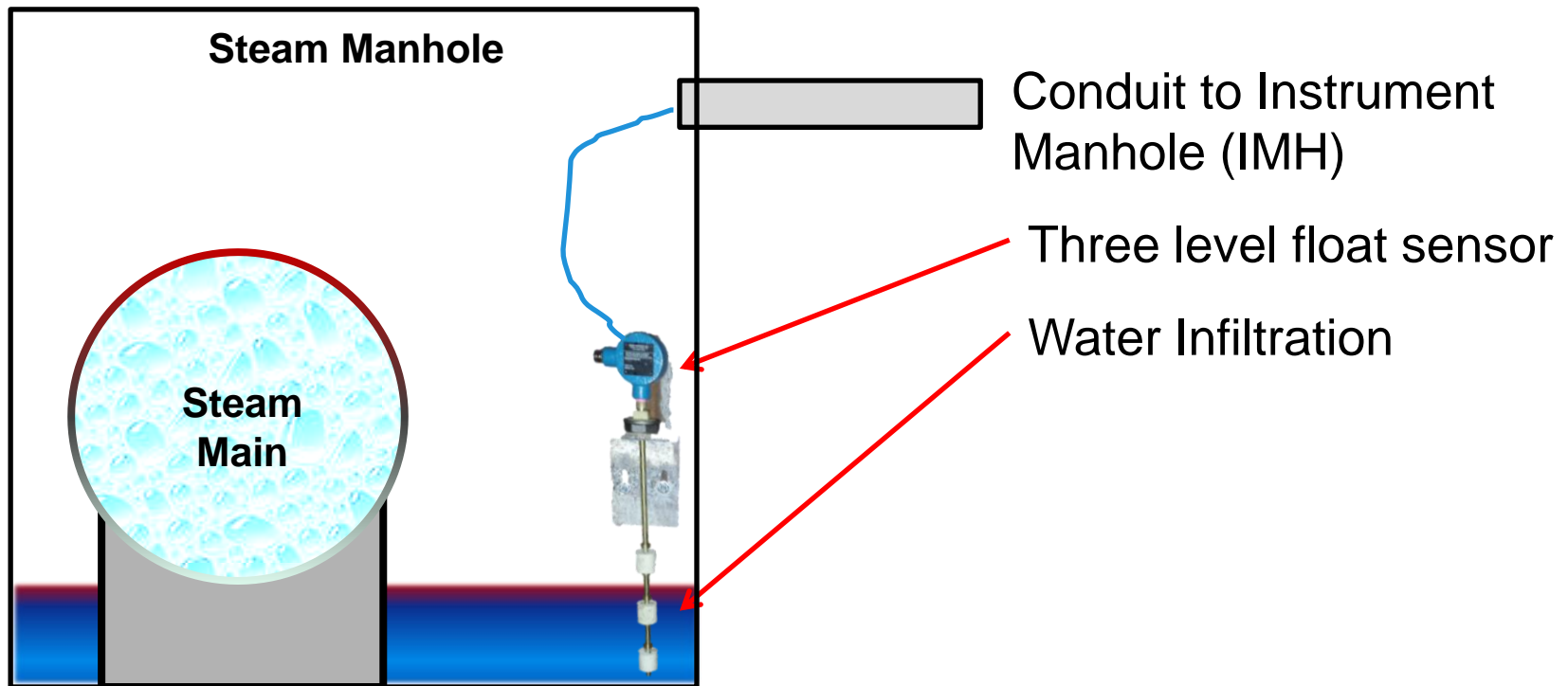
Remote Monitoring System: Overview



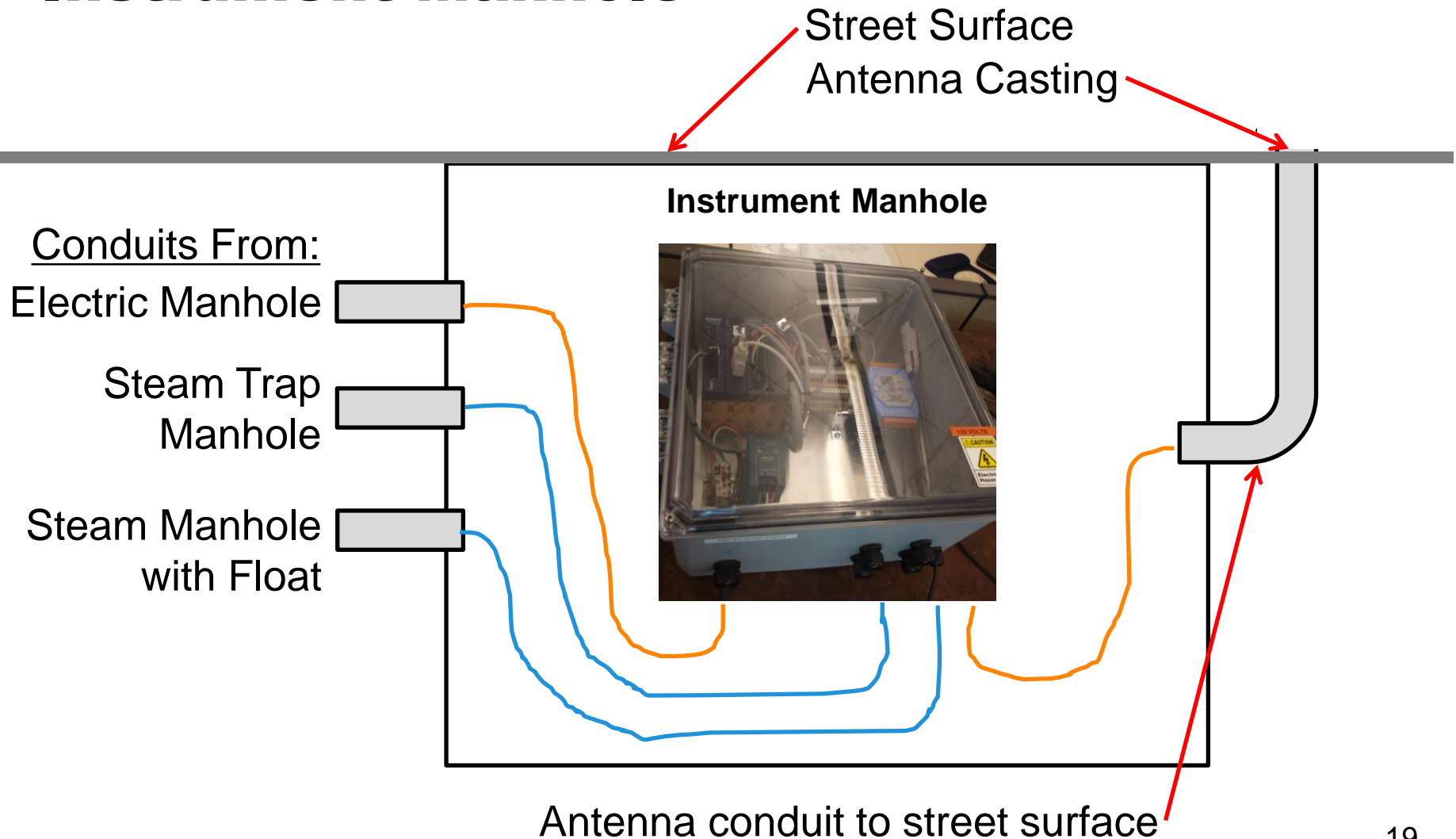
Remote Monitoring System: Trap Manhole



Remote Monitoring System: Steam Manhole



Remote Monitoring System: Instrument Manhole



Remote Monitoring System: Remote Telemetric Unit (RTU)

- Two design iterations
 - Smart Sync (2008-2011)
 - Bristol (2011-current)



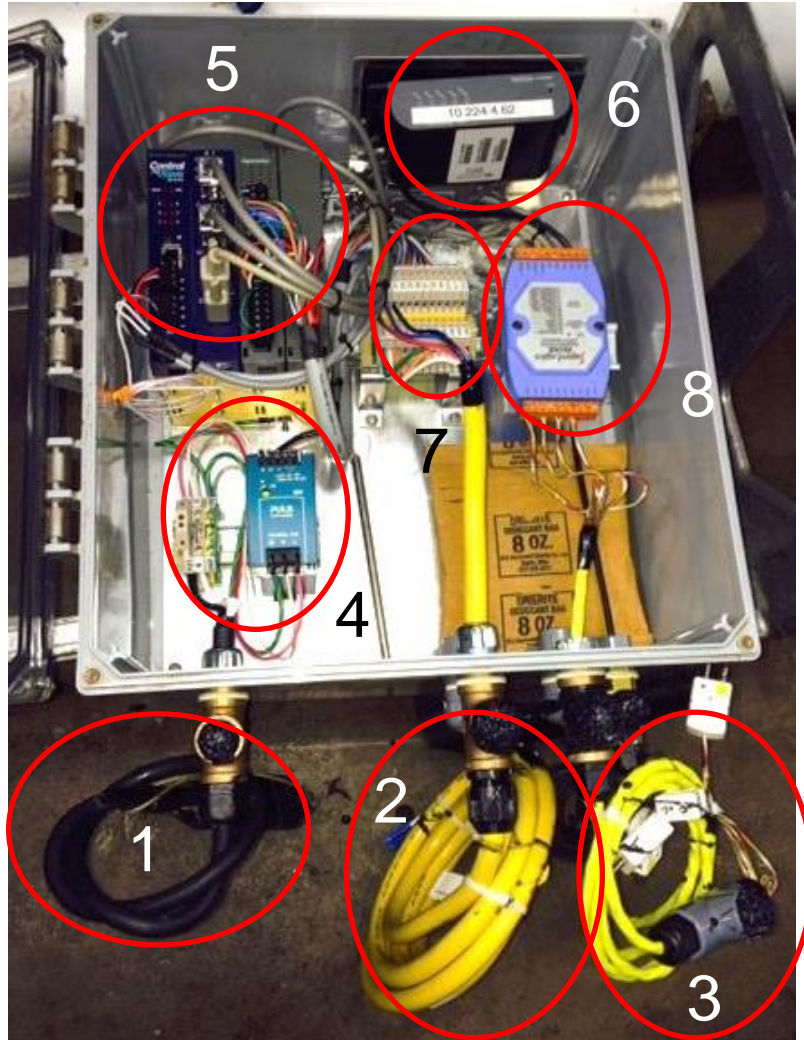
Remote Monitoring System: Remote Telemetric Unit (RTU)

External

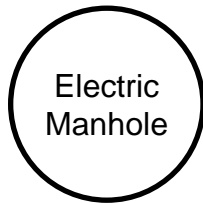
- 1. Power cable
- 2. Float connections
- 3. Trap connections

Internal

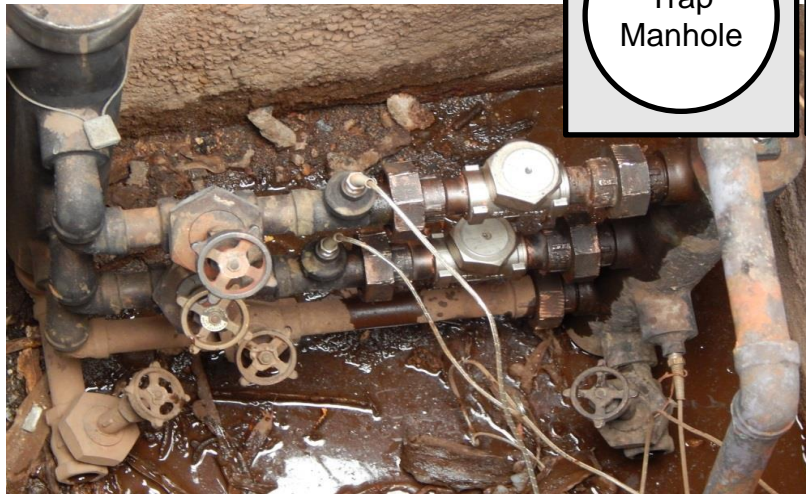
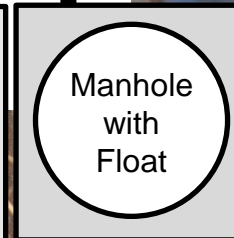
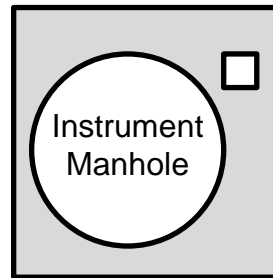
- 4. Fuse and Rectifier
- 5. Programmable Cards
- 6. Wireless modem
- 7. Digital input float block
- 8. Trap thermocouple reader



Remote Monitoring System: Infrastructure

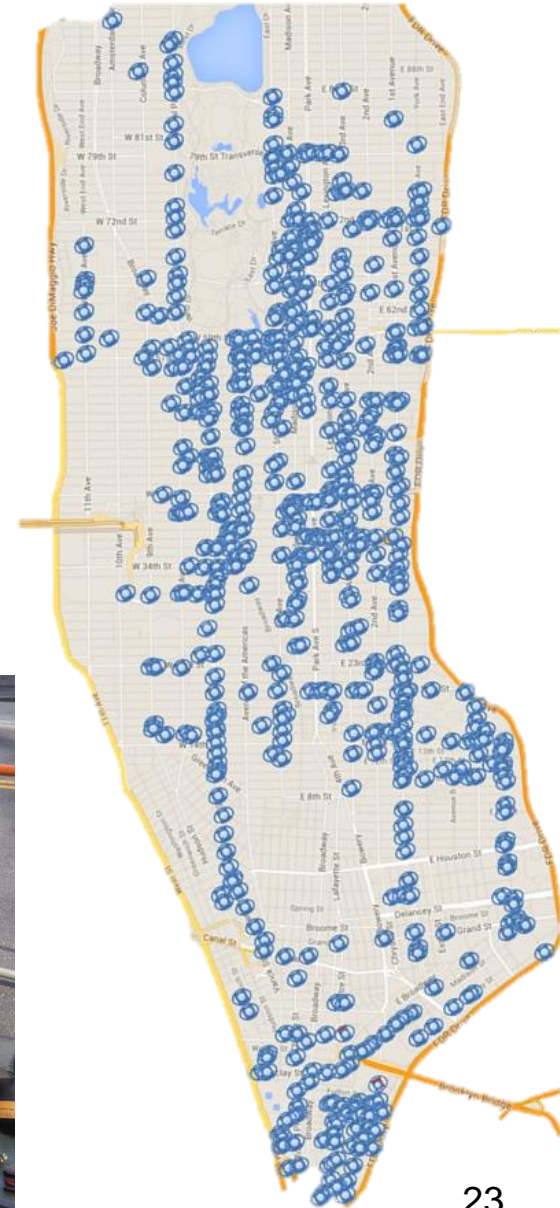


Secondary
Network

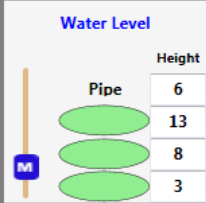


Remote Monitoring System: Progress as of 12/31/15

- System Expansion:
 - Total Locations: 871
 - Water Level: 757
 - Trap Monitors: 747
 - Planned Locations: 900



Remote Monitoring System: Alarm and Dispatch

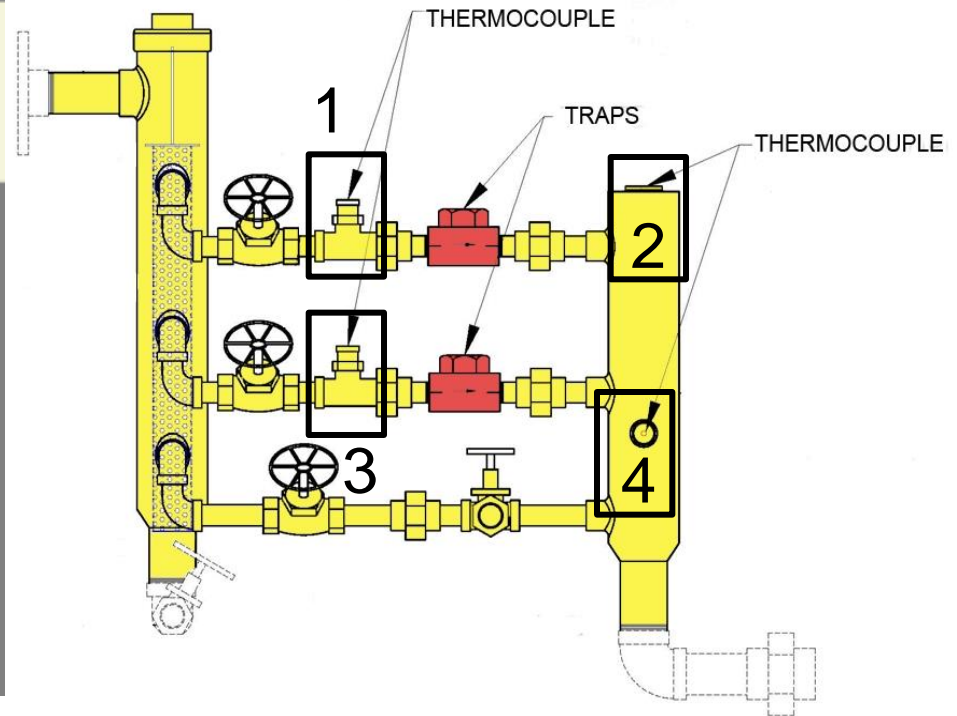
Location Details	Update Activities	Off Service	Trend	Activities	Response Procedure																		
Location Details: MVMH15179 Fifth Ave s/o 65th St																							
Field Data : Upto Date		Box Temperature : 101.53 F																					
Location Type: Street	Functional Priority:	Location Priority:	Response Group:																				
Crew Name:	WMS Job Number :																						
Remarks: <input type="text"/>																							
<div><div><p>Manhole Number: MVMH15179 Address: Fifth Ave s/o 65th St Location: Float Height : Actual</p><div><p>Water Level</p><table><thead><tr><th>Pipe</th><th>Height</th></tr></thead><tbody><tr><td>6</td><td>6</td></tr><tr><td>13</td><td>13</td></tr><tr><td>8</td><td>8</td></tr><tr><td>3</td><td>3</td></tr></tbody></table></div><p>Condition: Normal</p></div><div><p>Manhole Number: TMH15178 Trap ID:</p><p>Address: Fifth Ave s/o 65th St Location:</p><div><p>Trap Temperature</p><table><thead><tr><th>Upper Inlet</th><th>Upper Outlet</th></tr></thead><tbody><tr><td>369.14</td><td>213.08</td></tr><tr><th>Lower Inlet</th><th>Lower Outlet</th></tr><tr><td>364.64</td><td>213.44</td></tr></tbody></table></div><p>Condition: Normal</p></div></div>						Pipe	Height	6	6	13	13	8	8	3	3	Upper Inlet	Upper Outlet	369.14	213.08	Lower Inlet	Lower Outlet	364.64	213.44
Pipe	Height																						
6	6																						
13	13																						
8	8																						
3	3																						
Upper Inlet	Upper Outlet																						
369.14	213.08																						
Lower Inlet	Lower Outlet																						
364.64	213.44																						
Condition : Normal																							

Remote Monitoring System: Trap Alarm

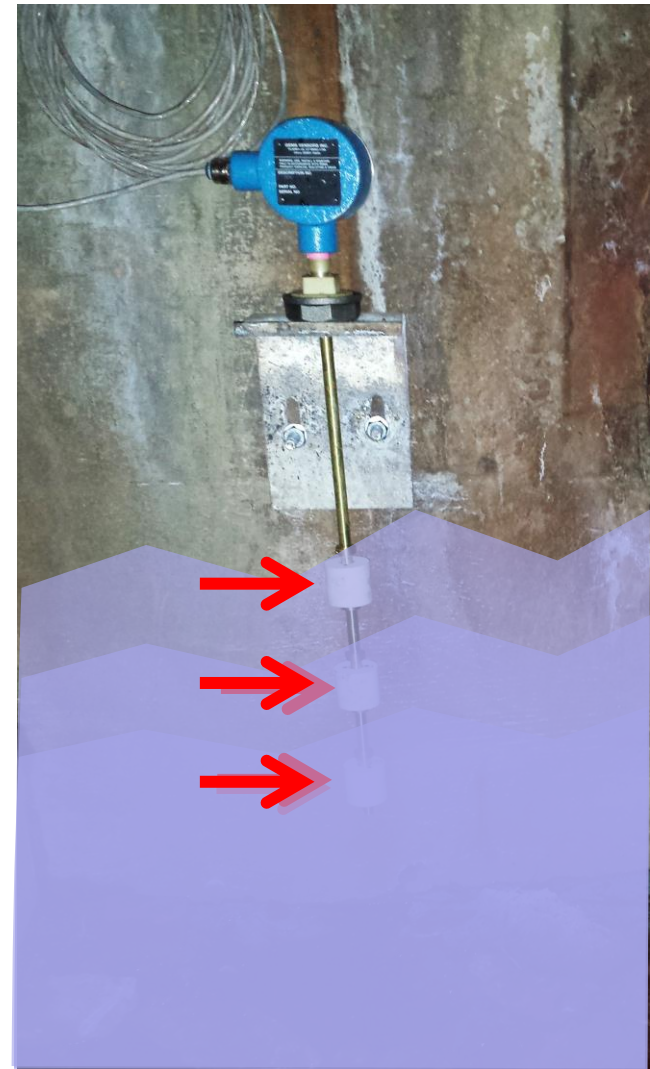
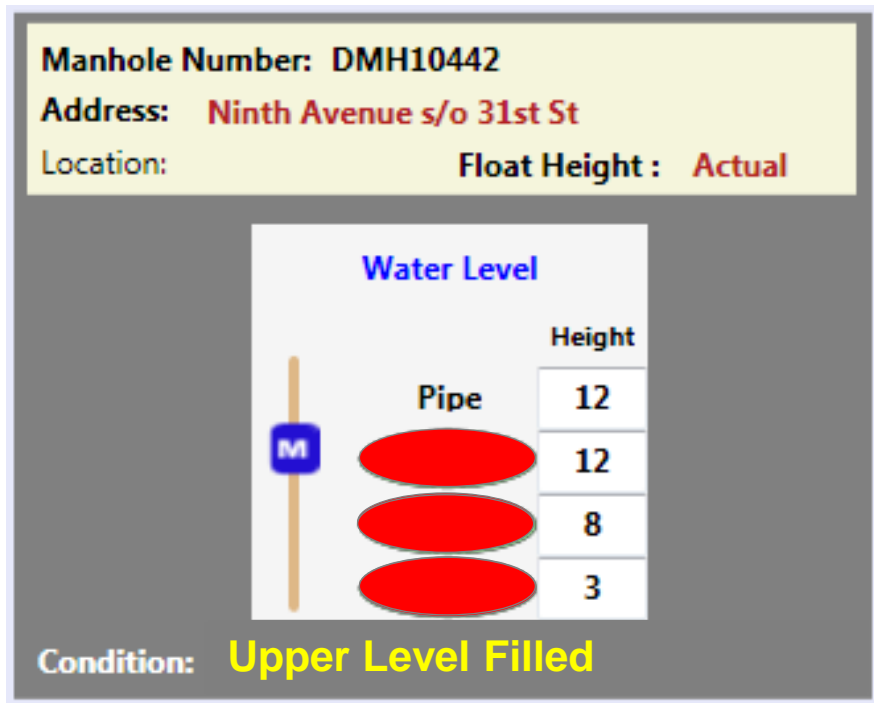
Manhole Number: TMH15178
Address: Fifth Ave s/o 65th St

Trap Temperature	
Upper Inlet	Upper Outlet
369.14	213.08
Lower Inlet	Lower Outlet
18031.82	213.44

Condition: **Values out of range**



Remote Monitoring System: Float Alarm



Remote Monitoring System: Dispatch

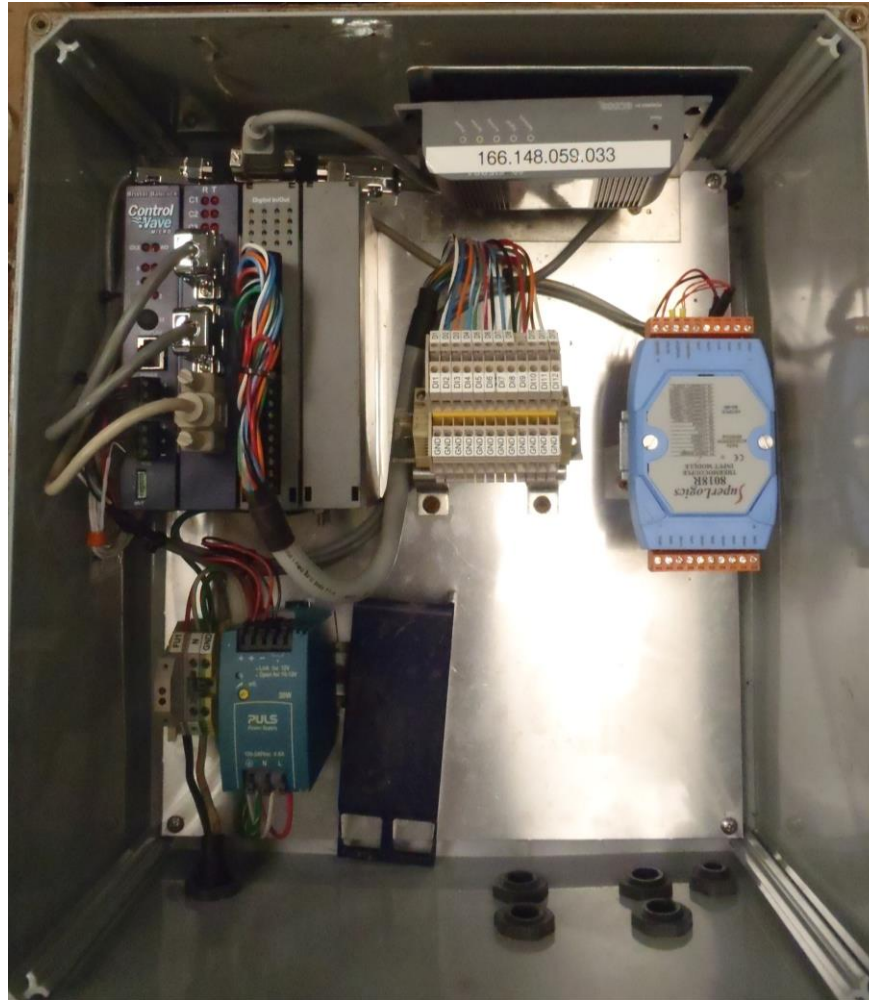


Remote Monitoring System: Maintenance

- Equipment Failure
 - Steam Leaks
 - High Ambient Temperature
 - Water Infiltration
 - Debris Collection



Remote Monitoring System: Maintenance



Remote Monitoring System: Maintenance Challenges - RTU



Remote Monitoring System: Maintenance Challenges - RTU



Remote Monitoring System: Communication Challenges



Remote Monitoring System: Communication Challenges

Antenna Casting



Conduits From:
Electric Manhole
Steam Trap
Manhole
Steam Manhole
with Float

Instrument Manhole



Antenna conduit to street surface

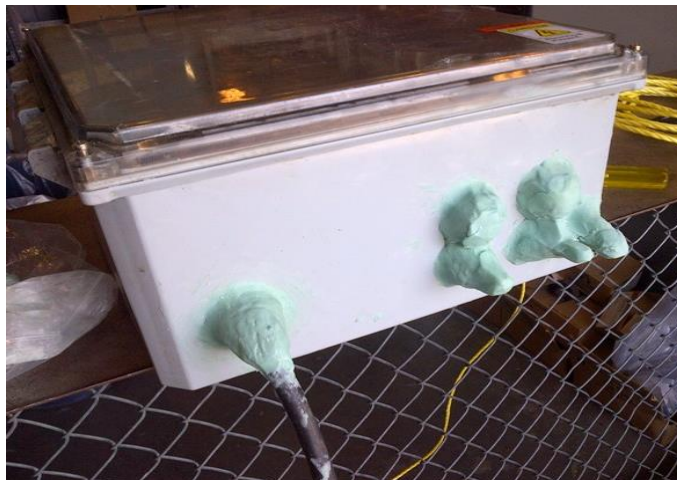
Remote Monitoring System: Lessons Learned

- Two design iterations
 - Smart Sync (2008-2011)
 - Bristol (2011-current)
- Proprietary design for RTU
- Vendor bidding issues
- Product life cycle

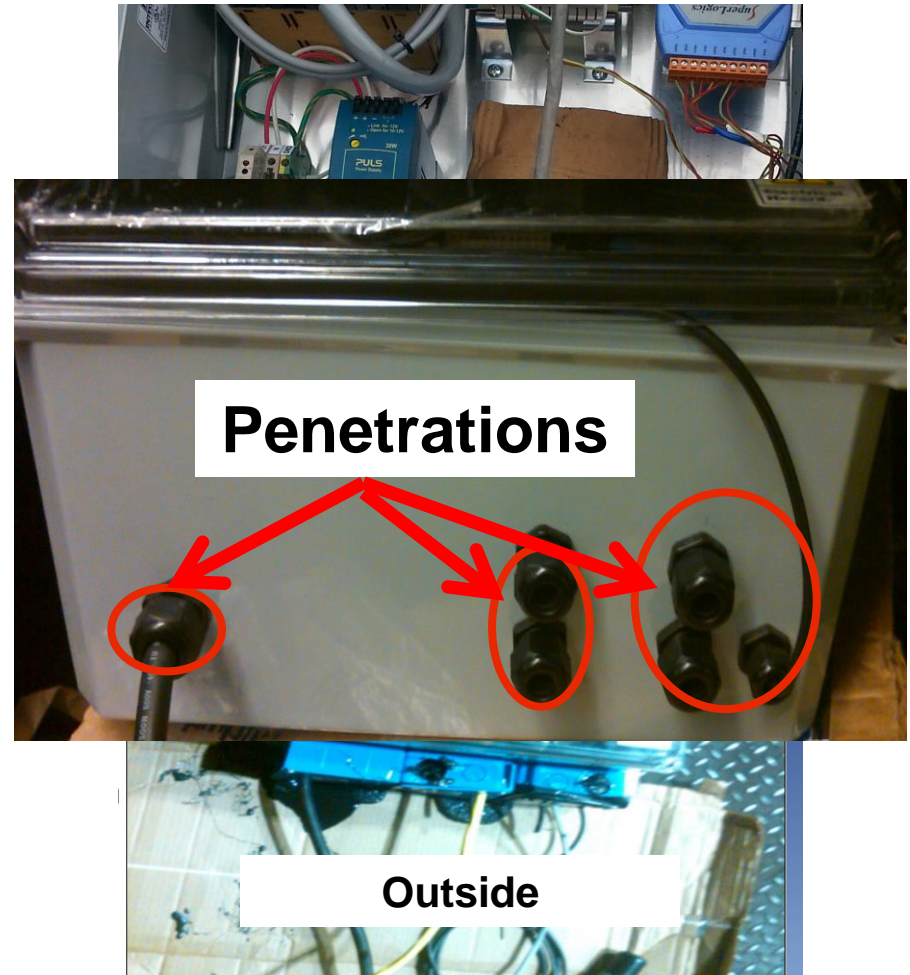


Remote Monitoring System: Lessons Learned

- Water Infiltration
 - Wire penetration sealing
 - Rubberex Epoxy
 - Electric Junction Boxes w/ Foam



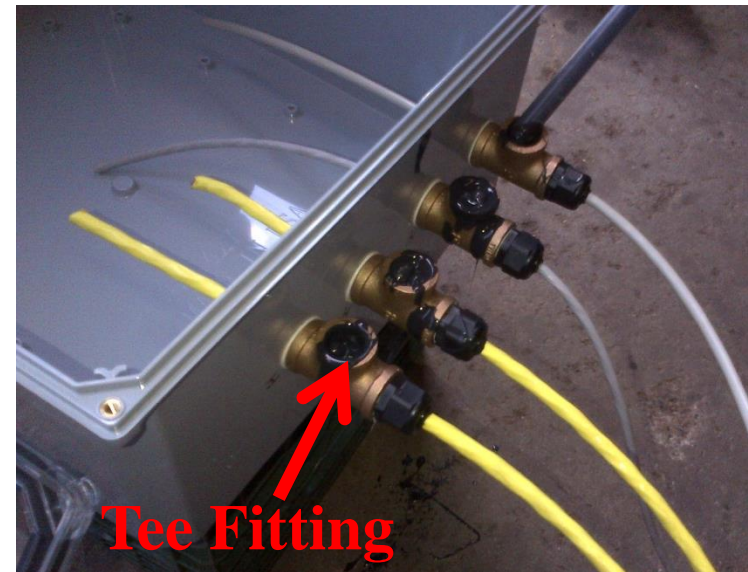
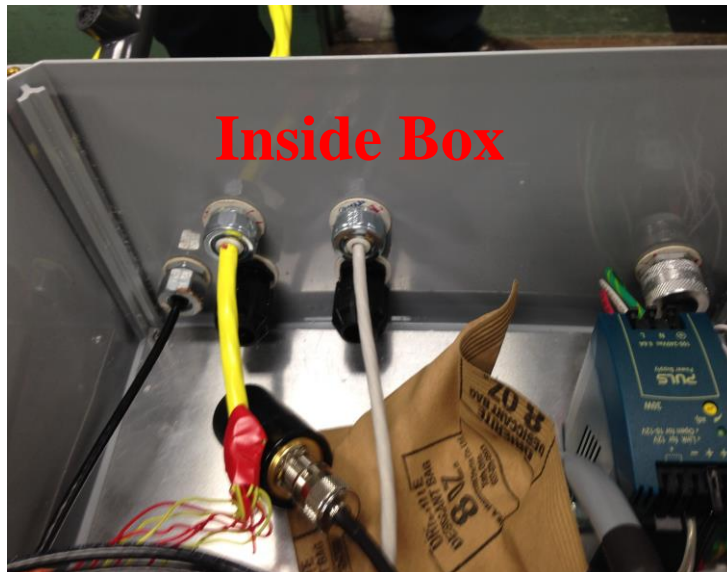
Rubberex Epoxy



Electric Junction Boxes

Remote Monitoring System: Lessons Learned

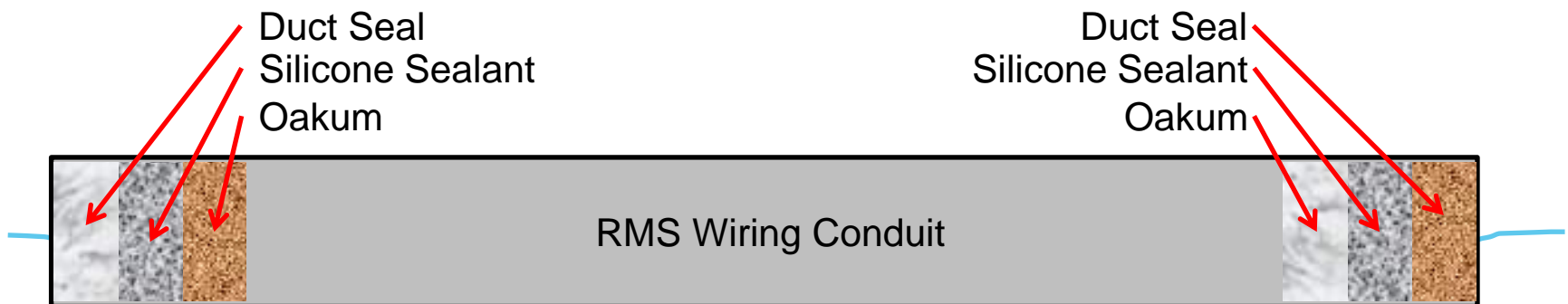
- Water Infiltration
 - Successful wire penetration sealing design
 - Piping Tee with RTV Foam



Remote Monitoring System: Lessons Learned

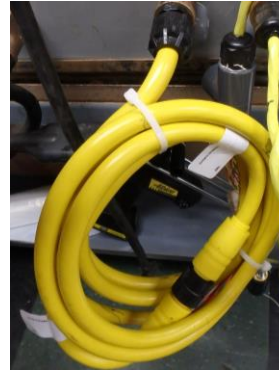
- Thermal Impact
 - RTU internal temperature probe and alarm
 - Enhanced conduit packing

Field Data : **Upto Date** Box Temperature : **58.01 F**
Location Type: **Street** Functional Priority: **E** Location Priority: **5** Response Group: **SDS**
Crew Name: WMS Job Number :



Remote Monitoring System: Lessons Learned

- Improved Work Practices
 - Pre-configured all equipment
 - Limited field work
 - Quick disconnects
 - Floats
 - Traps
 - Antenna (pending)
 - Quality controls



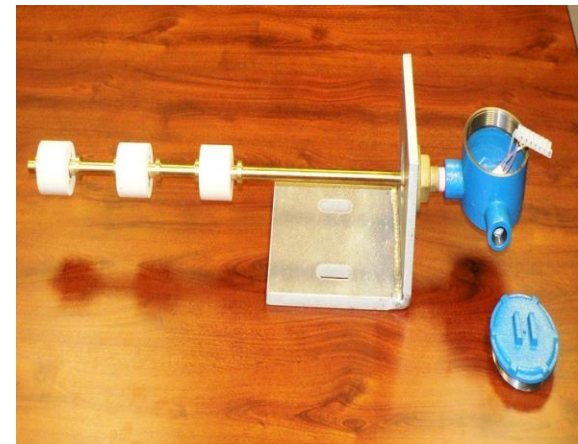
Remote Monitoring System: Lessons Learned

- Improved Equipment
 - Cellular modems
 - Industrial SIM Cards
 - Robust enclosures
 - Electronics coating



Remote Monitoring System: Lessons Learned

- Improved Water Level Equipment
 - Braided to solid wire
 - Stainless steel floats
 - Thermal conductivity
 - Capacitance
 - Resin floats with brass rod
 - Thermocouple temperature sensing – pending testing



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