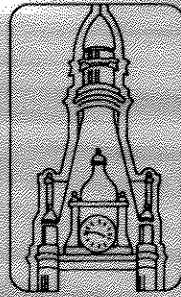
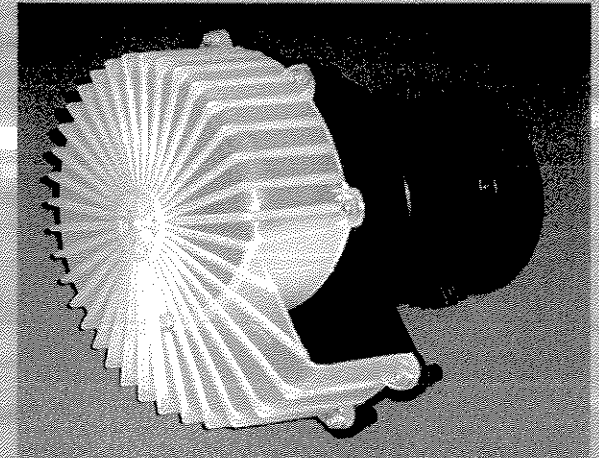


# Status of the Infiltration & Inflow Reduction Pilot Projects



City  
of  
Milwaukee



# The Problem with Infiltration & Inflow

- During severe rain events, excess rainwater that enters the combined and sanitary sewers can overwhelm Milwaukee Metropolitan Sewerage District (MMSD) and City sewer facilities.
- Overwhelming sewer facilities causes overflows into local rivers and Lake Michigan and backups into basements.
- This excess rainwater is termed infiltration & inflow (I & I).
- I & I enters sanitary sewers primarily through foundation drains and leaks in sewer mains, private sewer laterals, manholes, and illegal connections.

# I & I Reduction Pilot Projects – Background

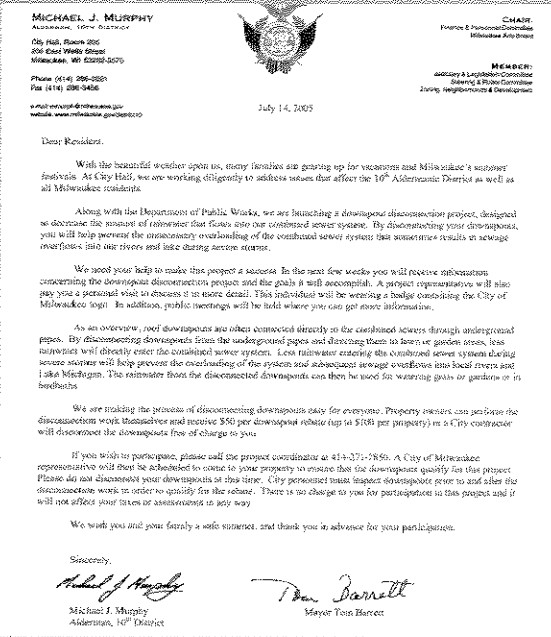
- Purpose of the projects was to demonstrate methods of addressing overflows into our rivers and Lake Michigan.
- Mayor Barrett, with concurrence of the Common Council, included \$1,206,000 in the 2005 Sewer Maintenance Fund budget to fund the four pilot projects.
- The projects are: Downspout Disconnection, Inlet Restrictors, Roof Restrictors and Foundation Drain Disconnection.
- Grants were obtained from MMSD to offset part of the costs for the Foundation Drain Disconnection and Inlet Restrictors projects.

# Downspout Disconnection Project –Overview

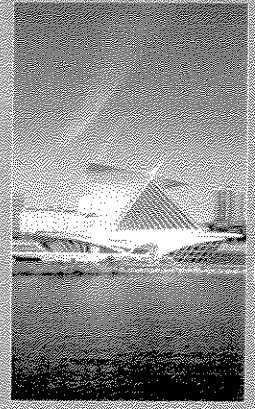


- Purpose was to disconnect roof downspouts from combined sewers and direct rainwater onto grass and garden areas.
- Work was performed upon voluntary consent of private property owners within targeted area.
- Project Budget was \$300,000.
- Professional marketing firm was retained to provide public outreach services.

# Downspout Disconnection – Outreach Efforts



**Disconnect  
&  
Redirect**

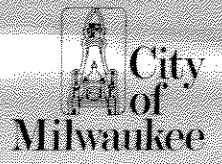


**The Future of  
Milwaukee's  
Water Is Clear!**

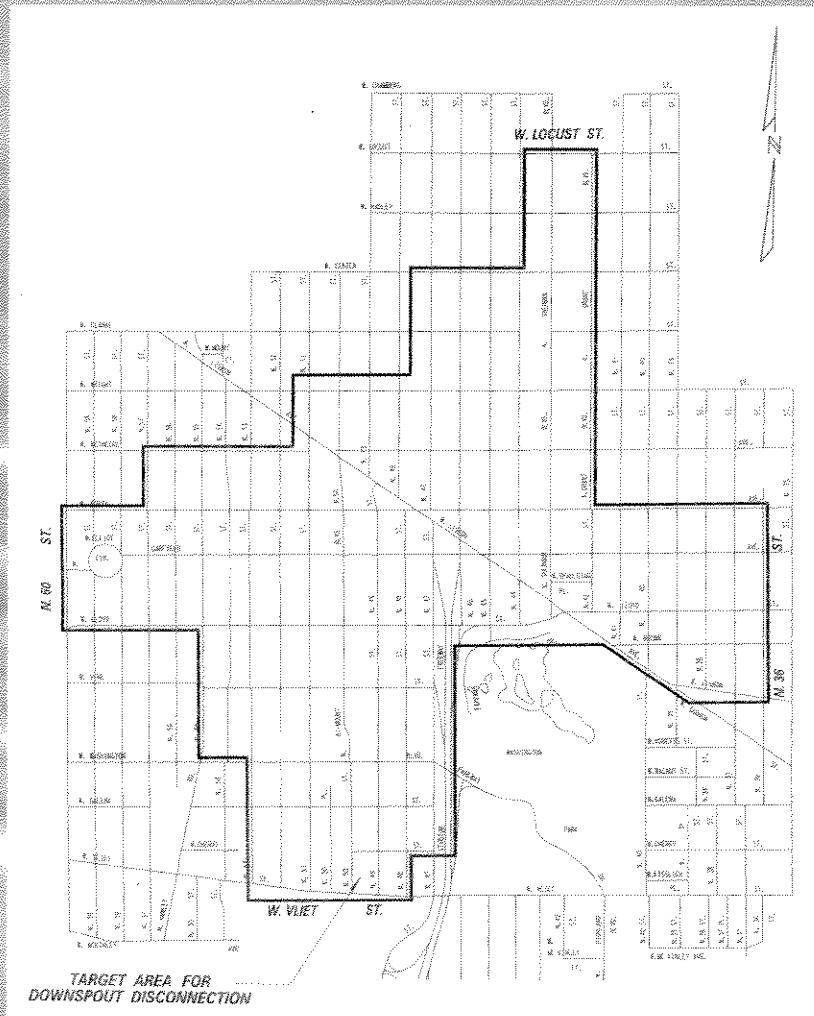


- The public outreach effort was titled “Disconnect & Redirect” and was conducted in the summer and fall of 2006.
- Letters, brochures, a press event, press releases, and public open houses were used to inform property owners of the project.

Status of the Infiltration & Inflow Reduction Pilot Projects

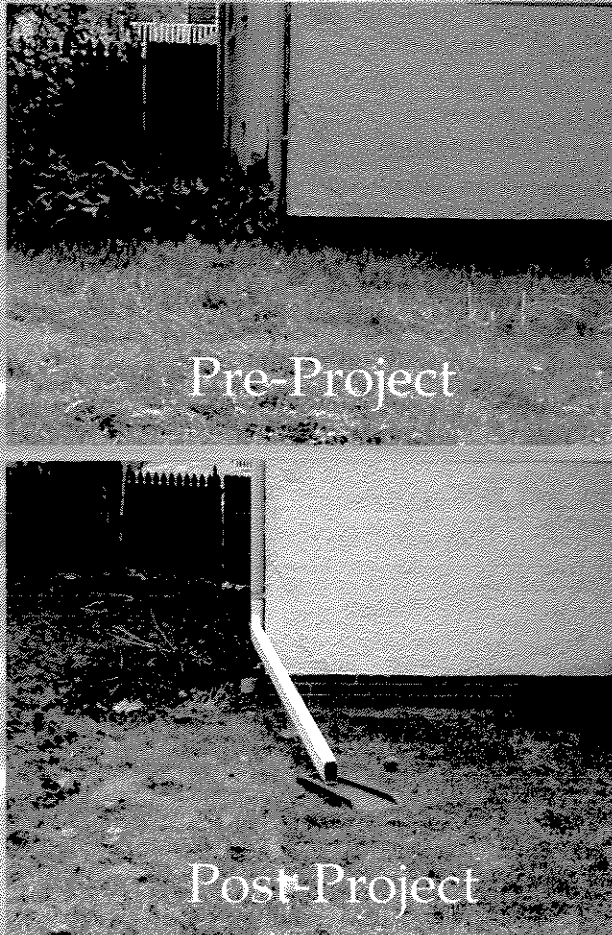


# Downspout Disconnection – Target Area



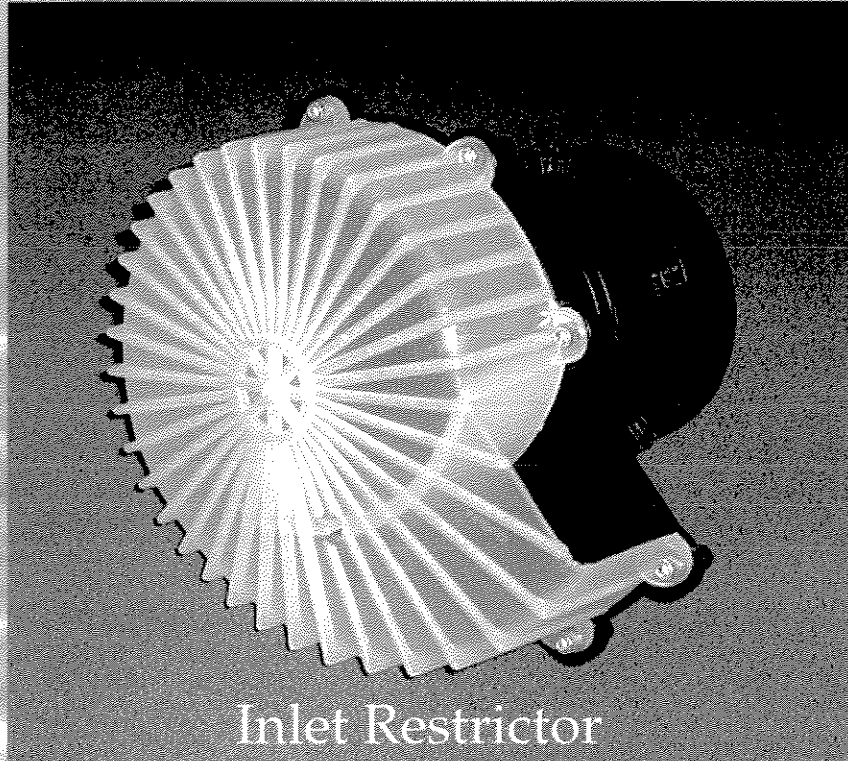
- Target area selection was based on the configuration of the sewer system and applicability of lots to legal disconnections.
- Approximately 3,000 property owners in targeted area were contacted through public outreach effort.
- Property owners could either have a City-retained EBE contractor perform the work at no cost or do the work themselves and receive a rebate from the City

# Downspout Disconnection – Results & Conclusion



- 106 property owners participated and disconnected 152 downspouts during the fall and winter of 2006.
- Low public participation resulted in no detectable difference in sewer flow between pre-project and post-project monitoring.
- Due to the low public participation in this project and two similar previous projects, it appears that voluntary downspout disconnection is not an effective method.

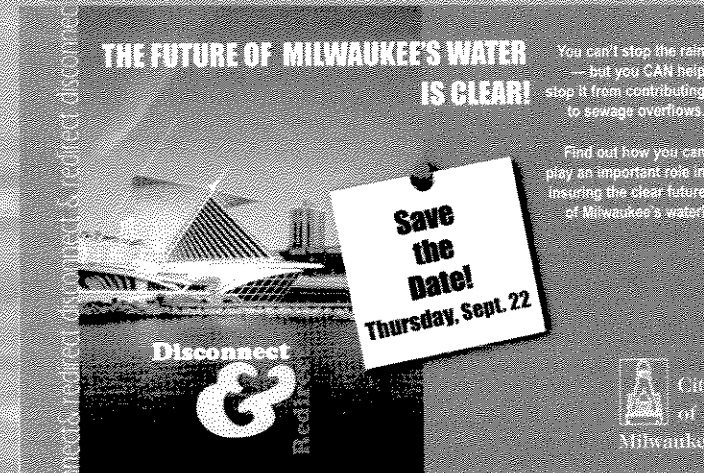
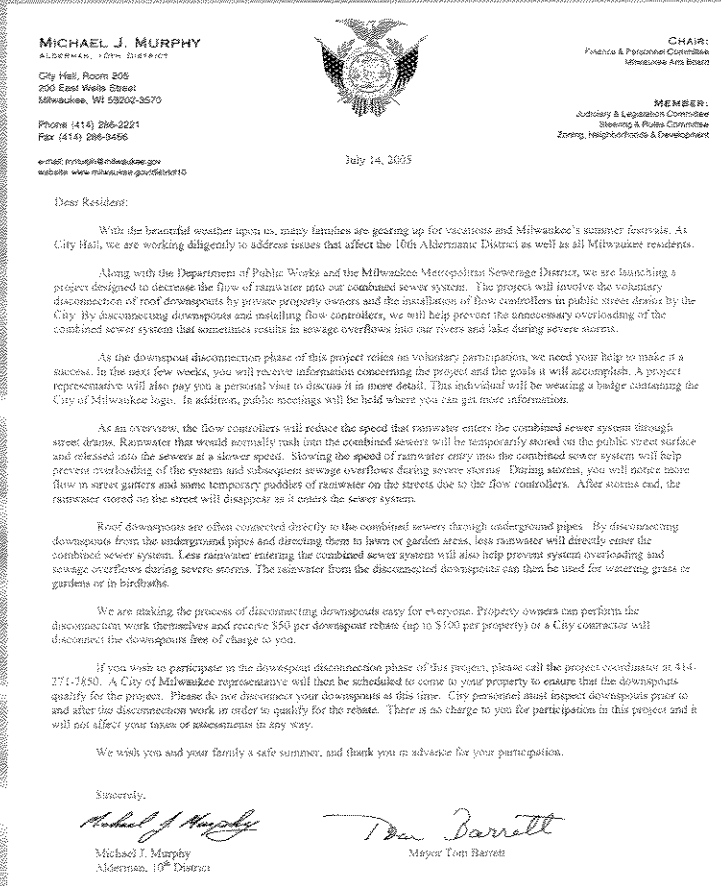
# Inlet Restrictors - Overview



- Purpose was to install street inlet flow restrictors to reduce the rate of runoff into the combined sewer system.
- Restrictors force streets to store rainwater temporarily until it can be released to the combined sewer at the restricted rate.
- Project budget was \$275,000 (including a grant of up to \$137,500 from MMSD)
- Public outreach was conducted through the Disconnect & Redirect campaign implemented by a professional marketing firm.

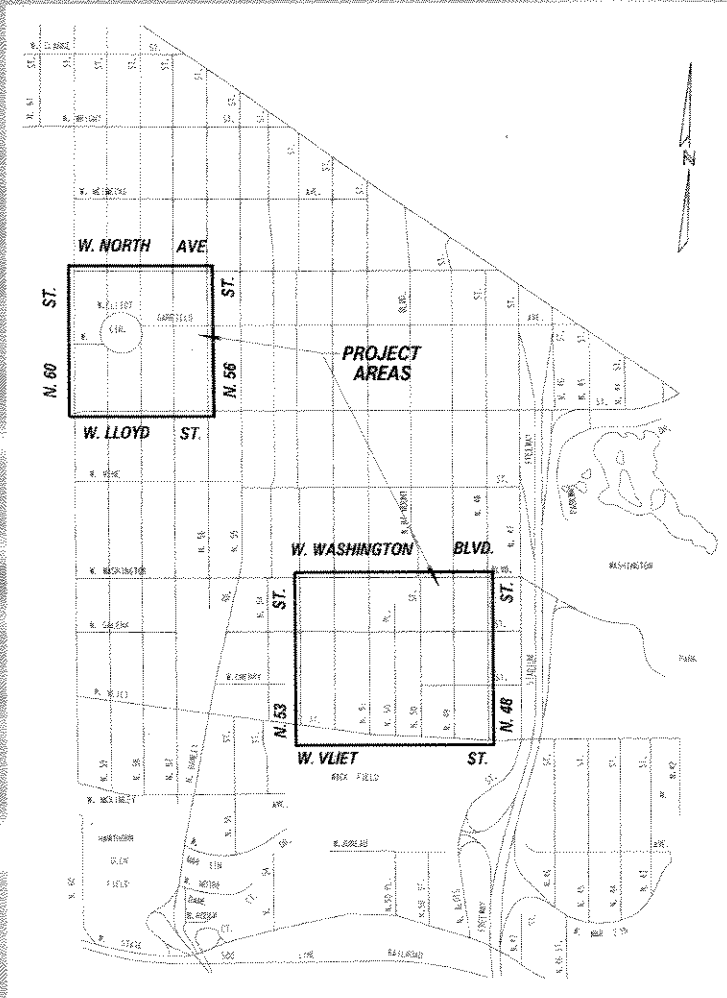


# Inlet Restrictors – Outreach Efforts



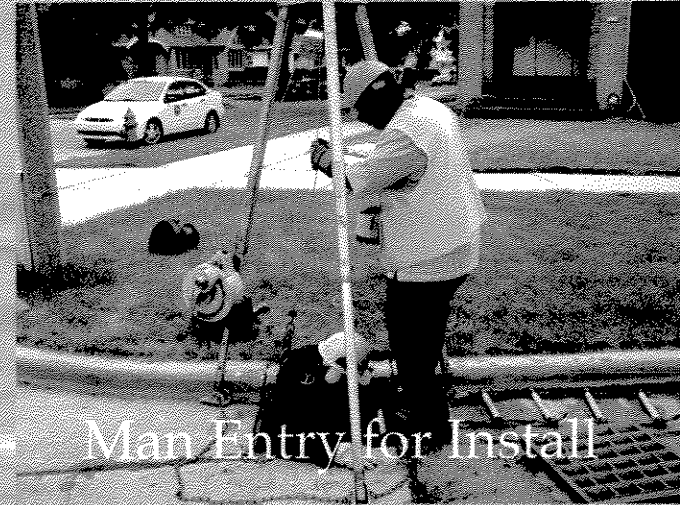
- The public outreach effort was part of the “Disconnect & Redirect” campaign that was conducted in the summer and fall of 2006.
- Letters and public open houses were used to inform property owners of the project.

# Inlet Restrictors – Project Areas & Details

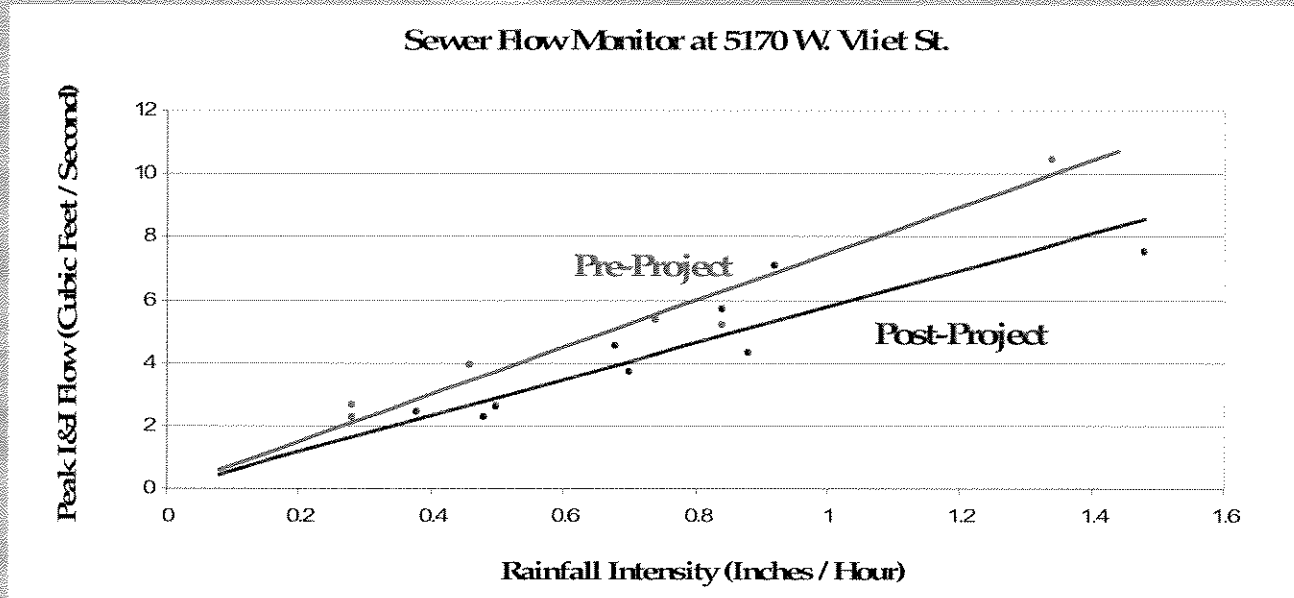


- Project areas were selected due to topography and sewer configuration.
- In the fall of 2006, City forces installed a total of 79 inlet restrictors within the two project areas.
- Restrictors were carefully placed to limit street storage ponding to a maximum depth of approximately 6 inches.

# Inlet Restrictors - Installation

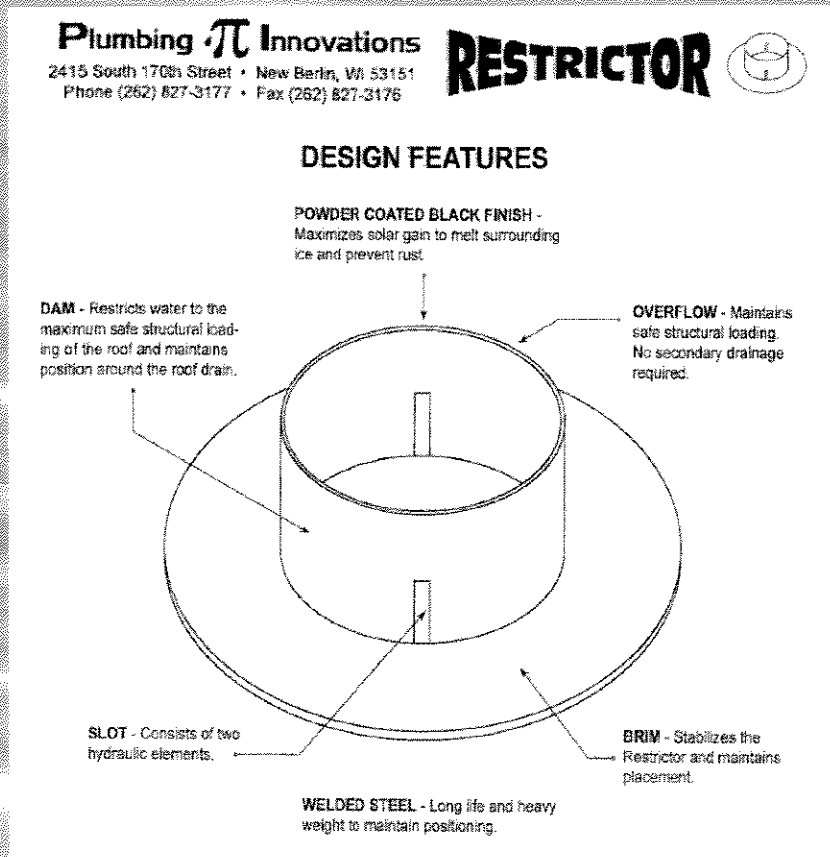


# Inlet Restrictors – Results & Conclusion



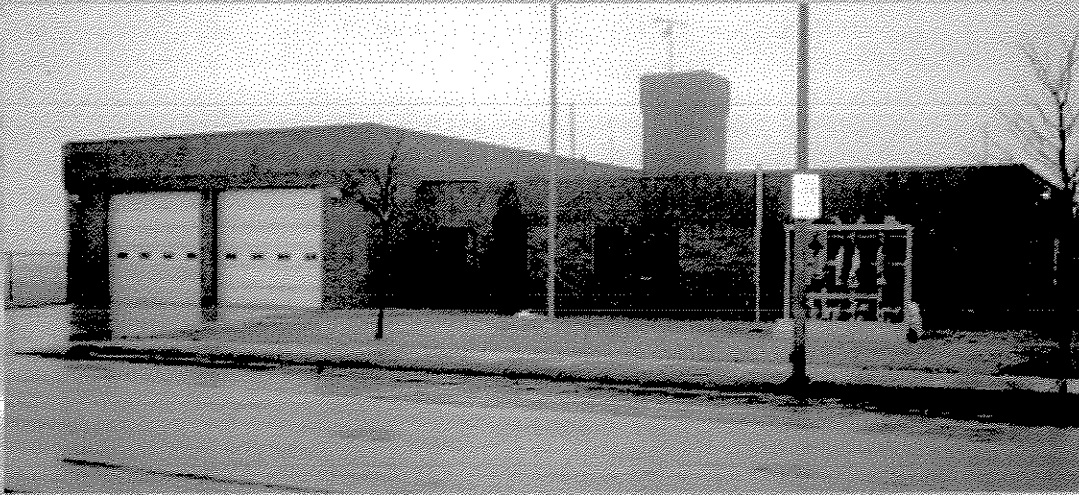
- Comparing sewer flow monitoring data from pre-project and post-project shows a reduction in peak I&I flow that increases with rainfall intensity.
- Based on the project results, inlet restrictors appear to be a viable combined sewer overflow reduction method.

# Roof Restrictors - Overview



- Purpose was to install roof drain restriction devices on existing City-owned buildings to reduce the rate of runoff into combined sewers.
- Roof restrictors force building roofs to store rainwater temporarily until it can be released to the combined sewer at the restricted rate.
- Project budget was \$126,000.

# Roof Restrictors – Fabrication & Installation (Cont'd)



- Flat-roofed City buildings were surveyed to determine the best locations for roof restrictor installation.
- During the fall of 2005, 55 roof restrictors were installed on 8 City-owned buildings (Phase I).
- During the summer of 2006, 80 roof restrictors were installed on 7 City-owned buildings (Phase II).

# Roof Restrictors – Fabrication & Installation



- Each roof restrictor was custom fabricated.
- Installation was performed by a local contractor with assistance from an EBE firm in the Mentor Protégé Program.

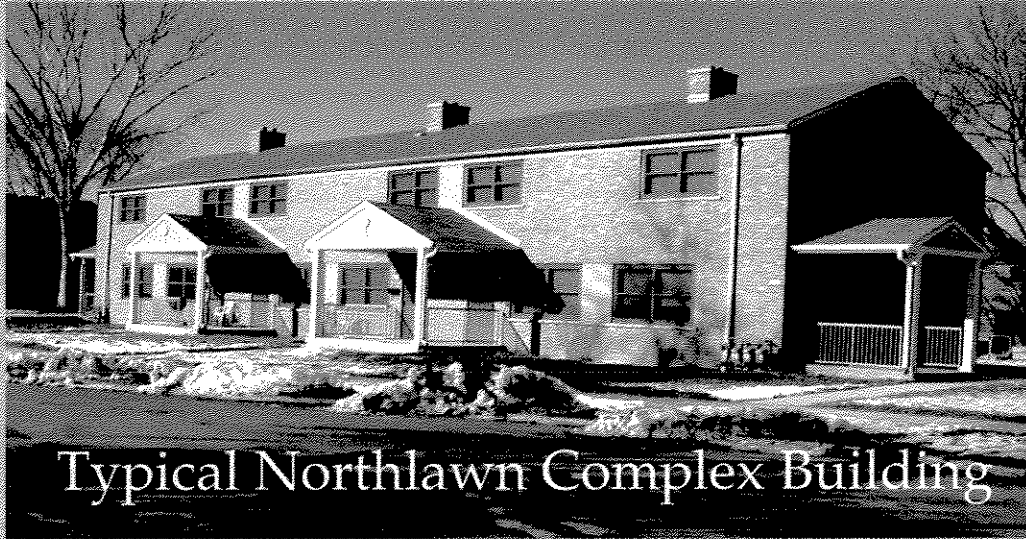
# Roof Restrictors – Results & Conclusion



- Design calculations indicate that using restrictors on a 4- inch drain, reduces the peak rate of roof runoff from 145 gallons per minute (gpm) to 30 gpm. This reduction is equivalent to 6,900 gallons in only one hour. This is equivalent to taking 276 5- minute showers in one hour.
- Based on the results of the project, the installation of roof restrictors appears to be a viable combined sewer overflow reduction method.

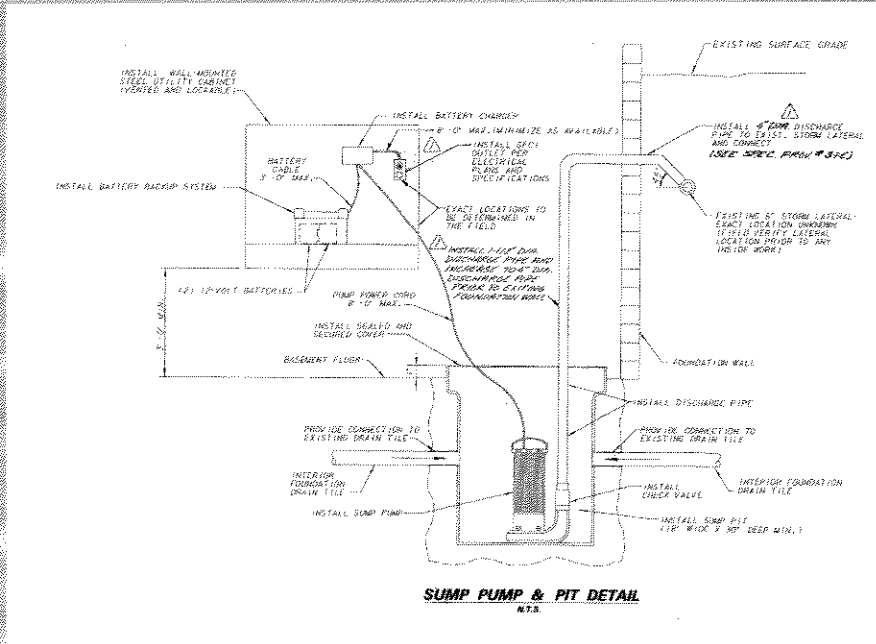


# Foundation Drain Disconnection - Overview



- Purpose is to disconnect building foundation drains from the sanitary sewer and redirect flow to the storm sewer via a sump pump.
- The location selected was at the HACM's Northlawn Veterans Permanent Housing Complex (N. 22<sup>nd</sup> Street & W. Villard Avenue).
- Project budget is \$505,000 (including a \$250,000 grant from MMSD).

# Foundation Drain Disconnection – Project Details



- Project will install sump pumps and remove “Palmer Valve” connections to the sanitary sewer in 21 of the complex’s multi-family buildings.
- Construction is ongoing and will be completed in summer of 2007
- Post-project sewer flow monitoring will be performed after completion of the project, and will be compared to pre-project monitoring to evaluate this I & I reduction method.

# I & I Reduction Pilot Projects – Conclusions & Recommendations

- Due to the low public participation in the Downspout Disconnection Project, it appears that voluntary downspout disconnection is not an effective method to reduce I/I and CSOs in the City of Milwaukee.
- Inlet restrictors appear to be a viable I/I and CSOs reduction method.
- the installation of roof restrictors appears to be a viable I/I and CSOs reduction method.