

# Expect the Unexpected

## Preparing for Water Main Breaks

Presented at

Massachusetts Environmental Health Association

Fall Seminar

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Marlborough, Massachusetts

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City of Worcester Department of Public Works & Parks



# Water Main Breaks

- Inevitable in all water systems
- Causes
  - Old infrastructure
  - Corrosion of pipes
  - Poor installation
  - Defective materials
  - Underground construction activities
  - Water hammer
  - Unknown
  - Odd happenings

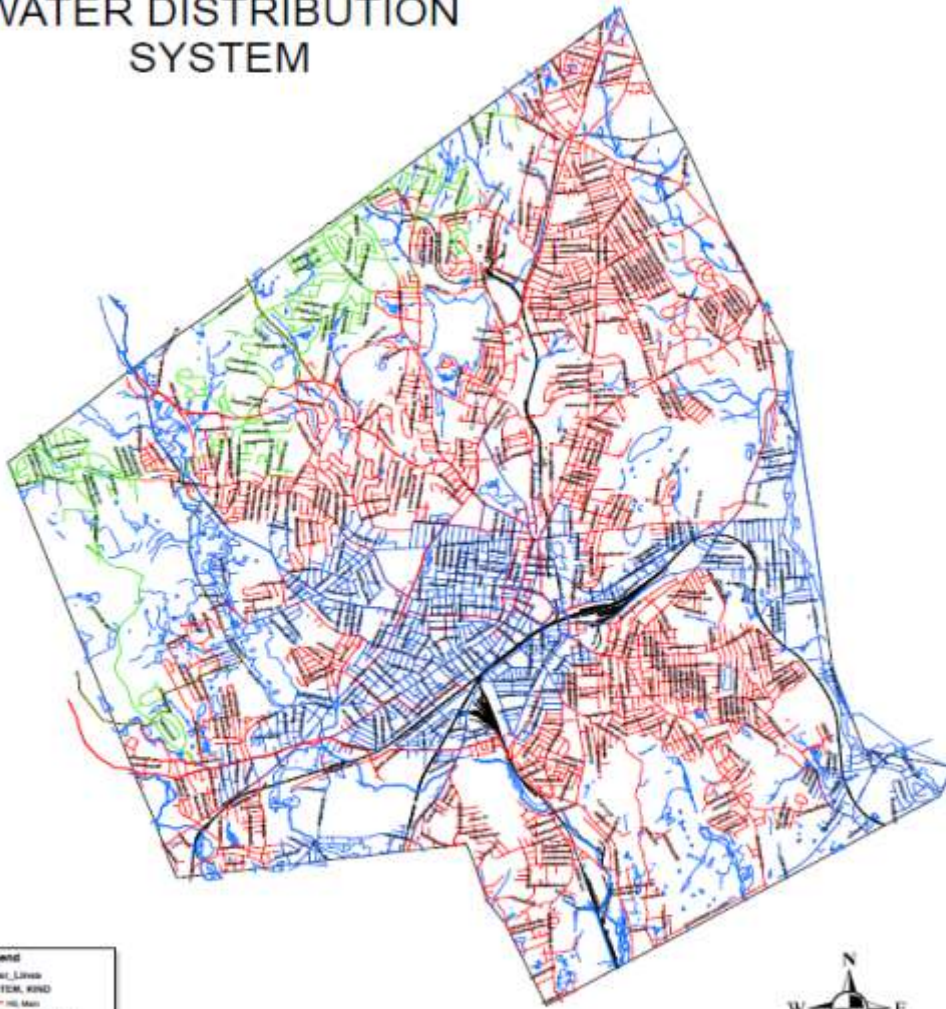
# Water Main Breaks

- Impacts
  - Loss of service
  - Loss of fire protection
  - Damage
  - Water quality impacts
  - Customer impacts
  - Financial implications

# Worcester Water System

- 10 Surface Water Reservoirs
- 1 Water Treatment Plant (50 mgd)
- 2 Clearwells and 8 Water Storage Tanks
- High Service/ Low Service/ Super-High Service
- 565 miles of water mains
- 6,000 Valves
- System Demand of 23 MGD average day
- Staffing Levels-132 approved positions
- Customer Base of 40,000 accounts; 200,000 people
- Interconnections / Regional System

# City Of Worcester WATER DISTRIBUTION SYSTEM



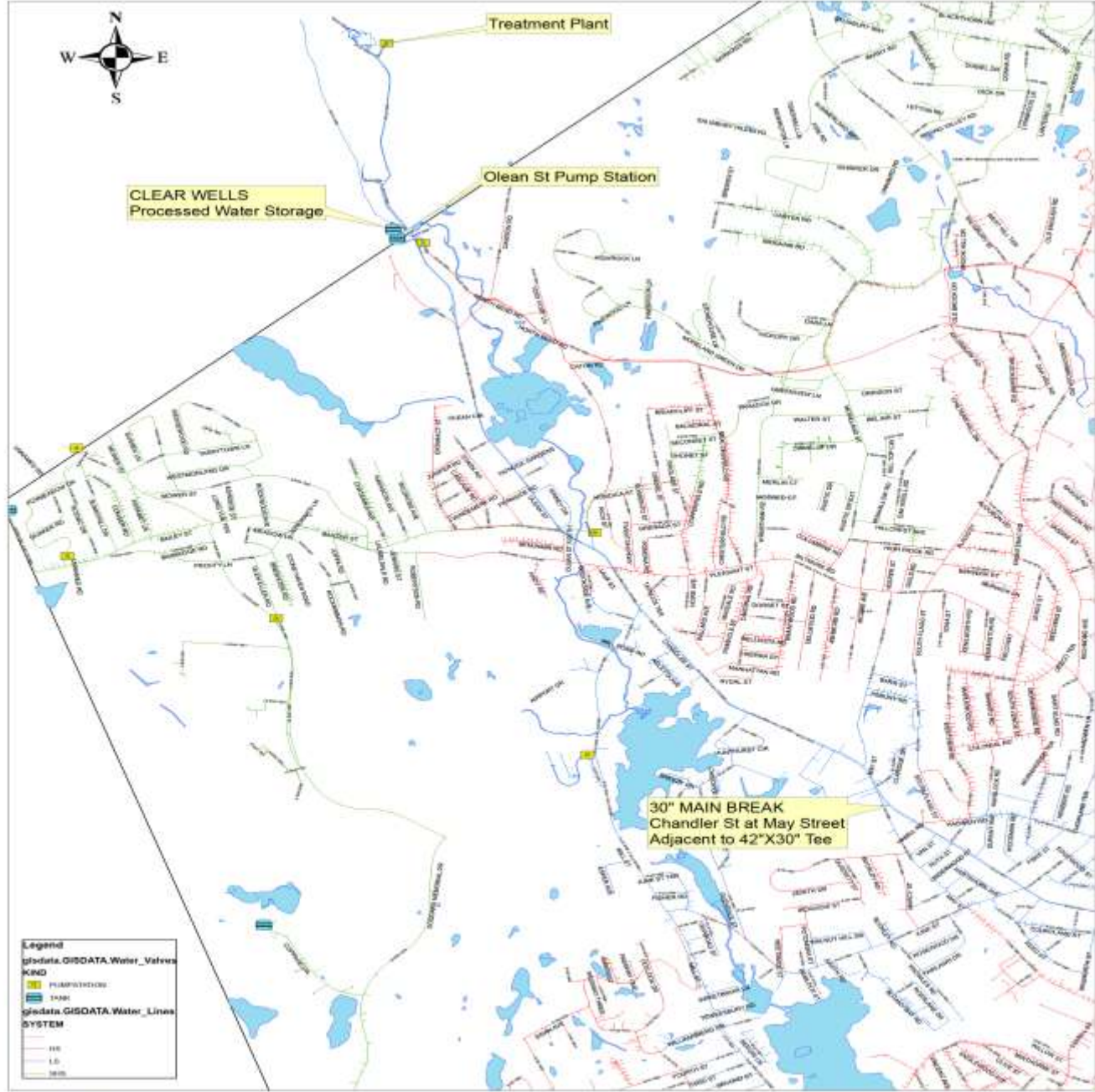
Legend	
Water_Lines	SYSTEM_KIND
—	HL Main
—	HL, Trunked Main
—	DL Main
—	DH, Main
—	Trunked Main, Trunked Main





# November 12, 2012: Water Main Break

- First reports received at 12:25 PM
- Holiday (Veteran's Day) – Limited Staff
- 30 inch main, cast iron off of a 40 inch main (Low Service Transmission)
- Flooding near break
- Loss of Low Service pressure
- Clearwells drop rapidly leading to the loss of High Service pumping
- High Service Tank levels drop rapidly



**Legend**

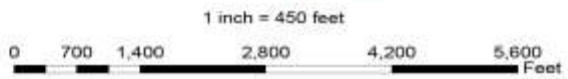
gldata.GISDATA.Water\_Valves  
KIND

- PLUMPTON/1000
- 1700

gldata.GISDATA.Water\_Lines  
SYSTEM

- 100
- 1.5
- 300

**30" MAIN BREAK**  
Chandler St at May Street  
Adjacent to 42"X30" Tee



**CITY OF WORCESTER DPW & P  
WATER OPERATIONS**

Location of 30" Main Break





















# Response

- First responder on scene within 30 minutes
- Crew at scene within 1 hour of initial report
- Attempts to shut valves to isolate break unsuccessful
- Order to shut plant issued after 4 hours of attempted valve shutdowns; no flow into City for over 8 hours
- Plant back on line to fill clear wells 6 hours after shutdown; high service pumps on-line 2 hours later
- Broken main repaired and in-service 15 hours after break began
- Staff remain on duty throughout

# Impacts

- Fire fighting capabilities compromised; Worcester Fire Dept activates mutual aid to bring tankers from surrounding towns
- Water for sanitary purposes limited; Holy Cross College brings in portable toilets for student use
- Flood damages at Worcester State University
- Hospitals activate emergency plans; limit water use; monitor pressures; cancel surgeries; secure bottled water
- Restaurants close
- Some areas never lost water or pressure









# Water Quality Issues and Boil Water Order

- Precautionary Boil Water Order Anticipated; Communications Planned With That In Mind
- At 8:00PM MassDEP Confirms Boil Order Will Be Issued
- Once System Restored Expedite Sampling and Testing to Minimize Duration of Boil Order
- Maximize Chlorine Dose When Flows Into City Resume
- Laboratory Opts for Coliform Test Method With Fastest Turnaround; Colilert-18 with 18 hour incubation rather than Membrane Filtration with 24-hour incubation and additional confirmation steps

# Distribution System Sampling

- Sampling commenced in late morning of November 13 after system pressures improved
- All coliform sample sites to be tested and checked for total chlorine residual; 39 sites in Worcester, 5 in Elm Hill WD
- Sampling efficiency improved by dividing sites geographically among 5 samplers (2 from Water Ops; 3 from Inspectional Services)
- All samples collected and run by 3:30 PM
- Total Chlorine average 1.23 ppm (max. 2.75 / min. 0.10)



# Water Quality Testing Results

- Lab Reported results at 9:30 AM on November 14
- **All samples negative for total coliform**
- Reported to MassDEP immediately
- Verbal notice from MassDEP at 11:30 AM that Boil Order Lifted; Email Notification from MassDEP received at noon

# Communications

- Public notification process begins 5 hours after break started with calls, social media (facebook and twitter)
- First press release and reverse 911 with boil advisory issued 8 hours after break started; R-911 issued to 53,000 households
- Second press release and R-911 issued in early morning on November 13
- Third press release issued mid-afternoon on November 13
- Final press release and R-911 to announce boil order lifted at noon on November 14
- Calls to hospitals every 4-6 hours with updates
- Press releases and messaging produced by Water Operations; disseminated through DPW&P Customer Service and Worcester Emergency Management

# Recovery

- Mains refilled slowly to minimize water hammer and further damage
- Hydrant opening coordinated with system “restart” to let out air and rusty water
- Chlorine dose maximized at Filtration Plant to reduce chances of bacterial growth
- Followup with total chlorine testing at all coliform sites on November 14 and full set of coliform samples on November 19
- Water chemical analysis at 15 locations on November 15
- Monitor water quality complaints by customers-air in water common for weeks



# Results Summary

- Start of Break to Repair Completion – 15 hours
- Volume of Water Lost – estimated 10 million gallons
- Maximum Flow Rate Through Break – estimated at 52 MGD
- Boil Order Duration – 40 hours
- Reverse 911 messages issued to 53,000 households on 3 occasions
- Press releases issued to media on 4 occasions
- Messaging to public via social media including facebook and twitter
- Direct calls to large users, consecutive systems, hospitals, colleges and major apartment complexes (indirectly reach 3,500 residents)

# Lessons Learned

- 2009 tabletop emergency planning exercise for this particular situation; emergency response plan for this event was already developed and followed; allowed for prompt decision making.
- Response and repair were completed in timely fashion and aided by favorable weather, availability of key personnel but need for better trained backup team.
- Boil Order duration shortened by way of rapid bacteria testing method and availability of fully certified in-house lab and multiple sample collectors.
- Communication between customers, MassDEP, media, City officials and DPW&P team was continuous.
- Single source of public information critical to controlling message.
- Valve exercising and maintenance must become higher priority.







It All Starts With A Plan...

