# - Unidirectional Flushing -

# 2013 Clean and Safe Drinking Water Workshop

## Training Course

Tom Cameron
President / CEO

Aqua Data Atlantic

# Let's introduce ourselves and where we are from and our duties…

**# 1 – Do we have a hydrant inspection program and to what extent?**

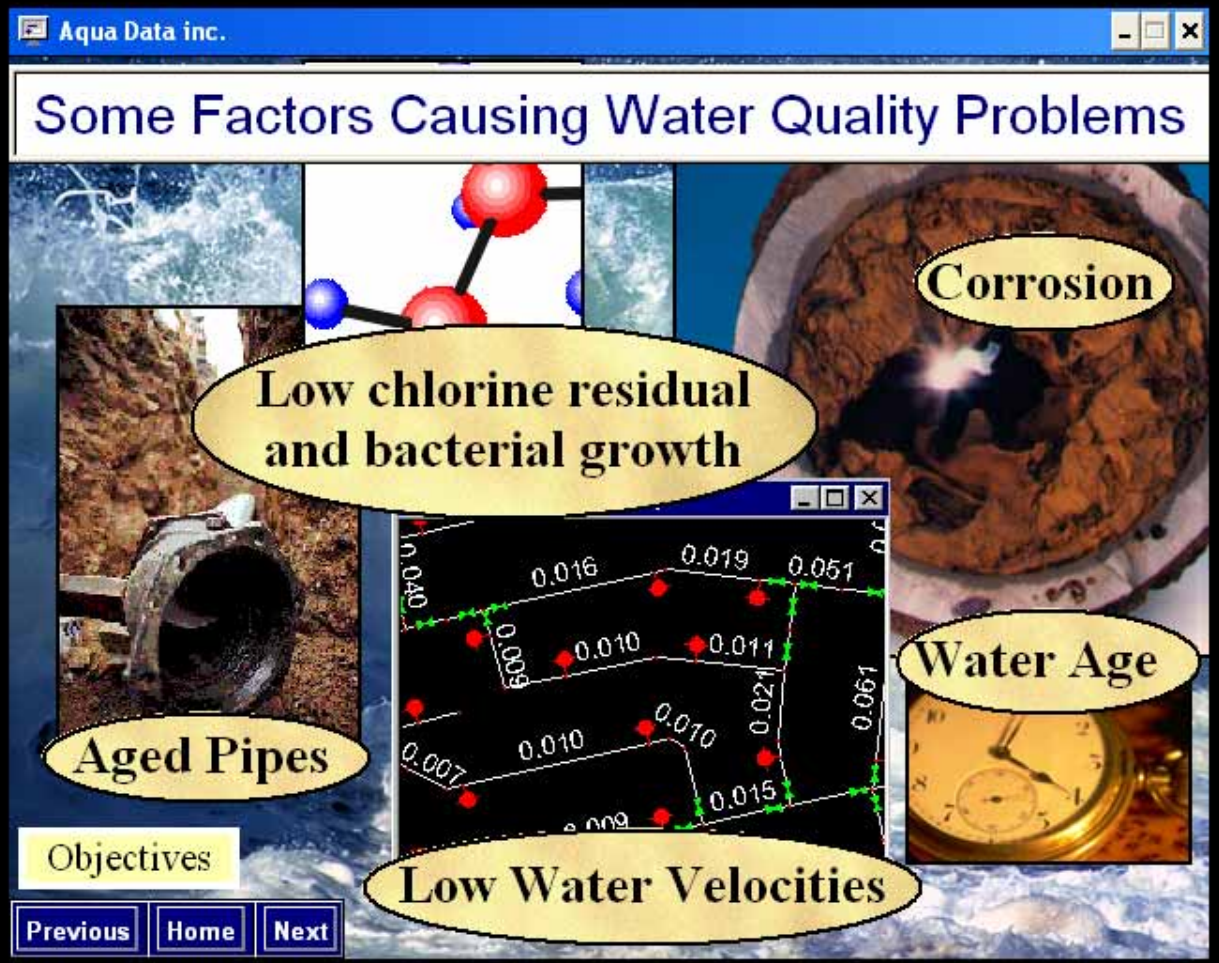
**# 2 – Do we have a valve inspection program and to what extent?**

**# 3 – What do we have for a data base ( paper maps or electronic)?**

**# 4 – Do we have all hydrants and valves in our data base? Do we have all pipes above 4 in?**

# Unidirectional Flushing

## One Component of a Water System Maintenance Program


Aqua Data inc.
Some Factors Causing Water Quality Problems
Corrosion
Low chlorine residual and bacterial growth
Water Age
Aged Pipes
Low Water Velocities
0.040
0.016
0.019
0.051
0.009
0.010
0.011
0.021
0.061
0.007
0.010
0.010
0.015
Objectives
Previous
Home
Next

# Objectives for flushing your water system

**One component of the water system maintenance management program is flushing, the latest term being used is Unidirectional Flushing. Unidirectional Flushing is a process which can provide both cleaning of the water distribution system, and the evaluation of the system, in terms of bio-film growth, pipe conditions, valve and hydrant operation, chlorination effectiveness, and any other conditions before they become problems.**

Aqua Data inc.

# Common Flushing Objectives

- Restore chlorine residual
- Reduce bacteria counts

- Remove colored water
- Eliminate taste & odor

- Dislodge biofilm
- Reduce turbidity

- Remove sediment and corrosion
- Respond to customer complaints

Objectives

Previous | Home | Next

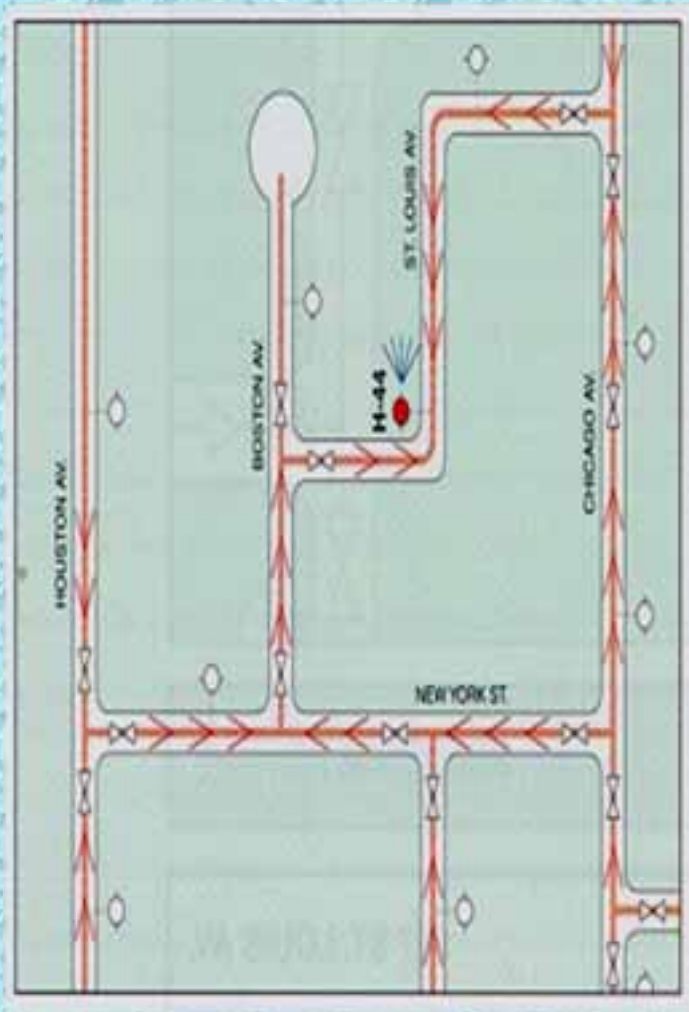
# Comparison Between

## Conventional Flushing

## &

## Unidirectional Flushing

# Conventional Flushing



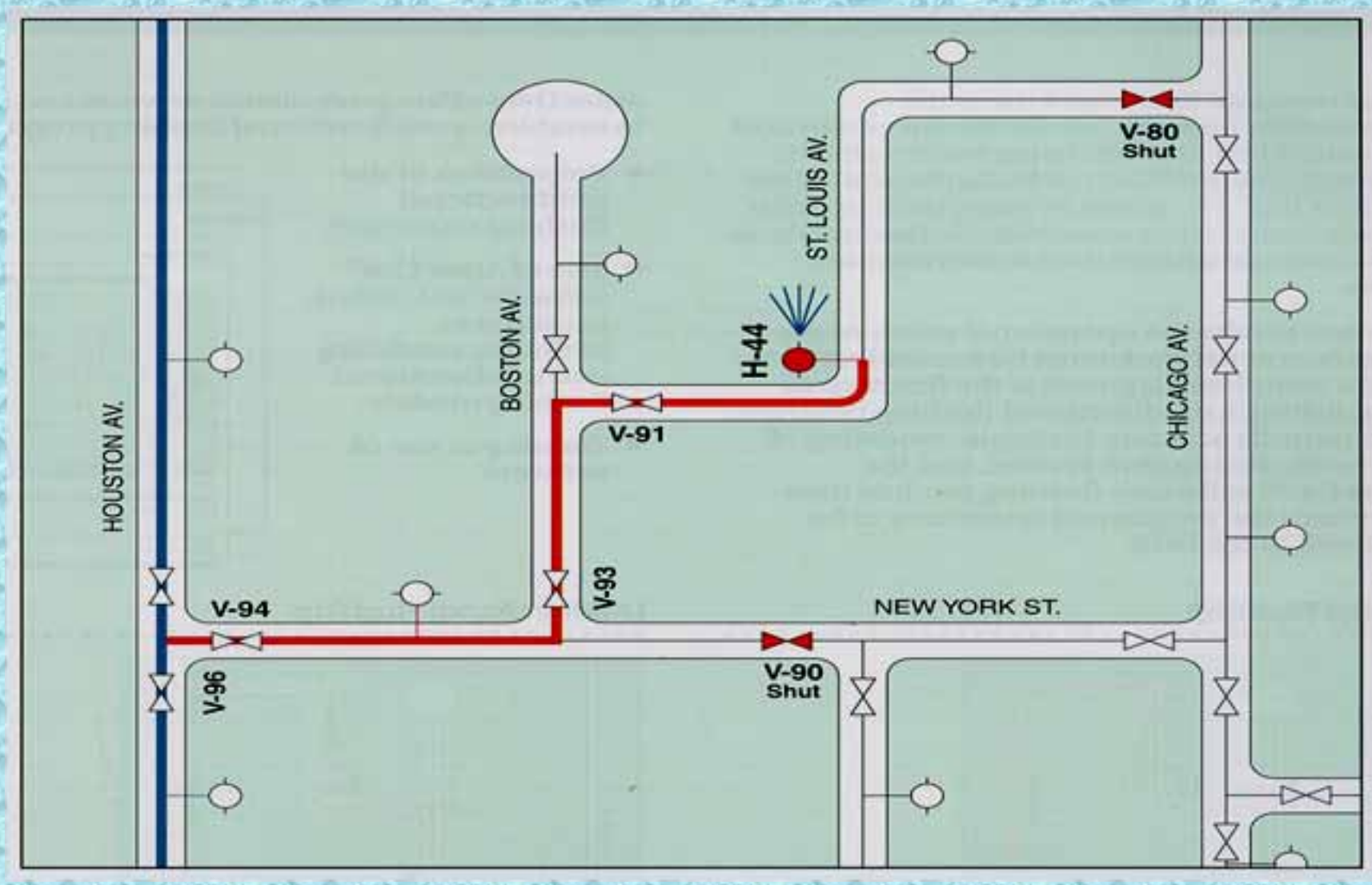

***Conventional flushing very often was simply the process whereby a utility worker opened up a hydrant, and let it flow until clean water came out. There was no attempt to shut any mainline valves to control the direction of flow to the hydrant being used to discharge the dirty water from the system, or to evaluate where the chlorinated or source water was coming from. The same process was repeated year after year and no concrete results could be noted. The flushing times were the same every year and red water complaints did not decrease.***

***Unidirectional Flushing is similar in some ways to conventional flushing but involves a different process. It is similar because water is flushed from the distribution system with the use of the hydrants, with the objective of cleaning the system.***

***But it is different in the following ways:***

***Unidirectional Flushing of the water distribution network is the systematic removal of non-solidified deposits using water velocity. Strategic manipulation of hydrants and valves ensures that the water used to clean the pipes always comes from previously flushed sections, with minimal disturbances to surrounding areas.***

# *Unidirectional Flushing*



**The intent of the procedure is to utilize the highest water velocity available by the system to ensure proper pipe cleaning by directing the water out of the hydrant that has been designated as the flow hydrant and by controlling its flow direction using the mainline valves. Therefore it is necessary to know the system's performance and its operational configuration:**

**i.e. Are any valves closed or partially closed?**
**Are there any minor or major leaks?**
**Do all the hydrants and valves work?**
**Are there any reducers, or inaccuracies or discrepancies with the system drawings?**
**How is Unidirectional Flushing developed?**

*For best results, the operational status of the distribution network must be known.*

**Before a Unidirectional Flushing program can be developed, one must have a clear picture of how the system works. That is why a complete diagnosis of the system and its components is recommended before establishing and developing a Unidirectional Flushing program. A diagnosis involves an assessment of the conditions of the water distribution system based on the system's operating goals, dependability and efficiency of water utilization.**

**A diagnosis involves four basic components to study to evaluate the systems status:**

1. A mechanical assessment, whereby every fire hydrant, isolation valve and water main valve is inspected for deficiencies and evaluated for flushing purposes and manipulated for ease of use.

2. Water quality evaluation at each fire hydrant, for colour and odour problems, and at the same time purging stagnant water out of the hydrant pipe leads.

3. Leak detection , using an acoustic amplifier as a first step performed at each hydrant and valve thereby localizing possible leaks in the system. The correlator is used later only at the pre-identified locations.

4. A hydraulic assessment, whereby each hydrant's static and dynamic (flow) pressure is taken throughout the network in order to identify hydraulic weaknesses caused by leakage, closed valves, etc…

**Once the diagnosis is completed, and the database has been built, then the picture of the system should be fairly clear. This now permits a much more precise hydraulic modeling of the water distribution system, which becomes the best way to develop the Unidirectional Flushing Program of sequences to be followed in the field.**

**Optional additional tests on the system, such as C-factor, flow/pressure and validation tests on meters, for example, make the data more accurate and the hydraulic model more expressive of actual conditions in the field.**


AQUA DATA
Atlantic
Water & Waste Water Diagnosis Specialists


LPD-250
Dechlorinating
Diffuser

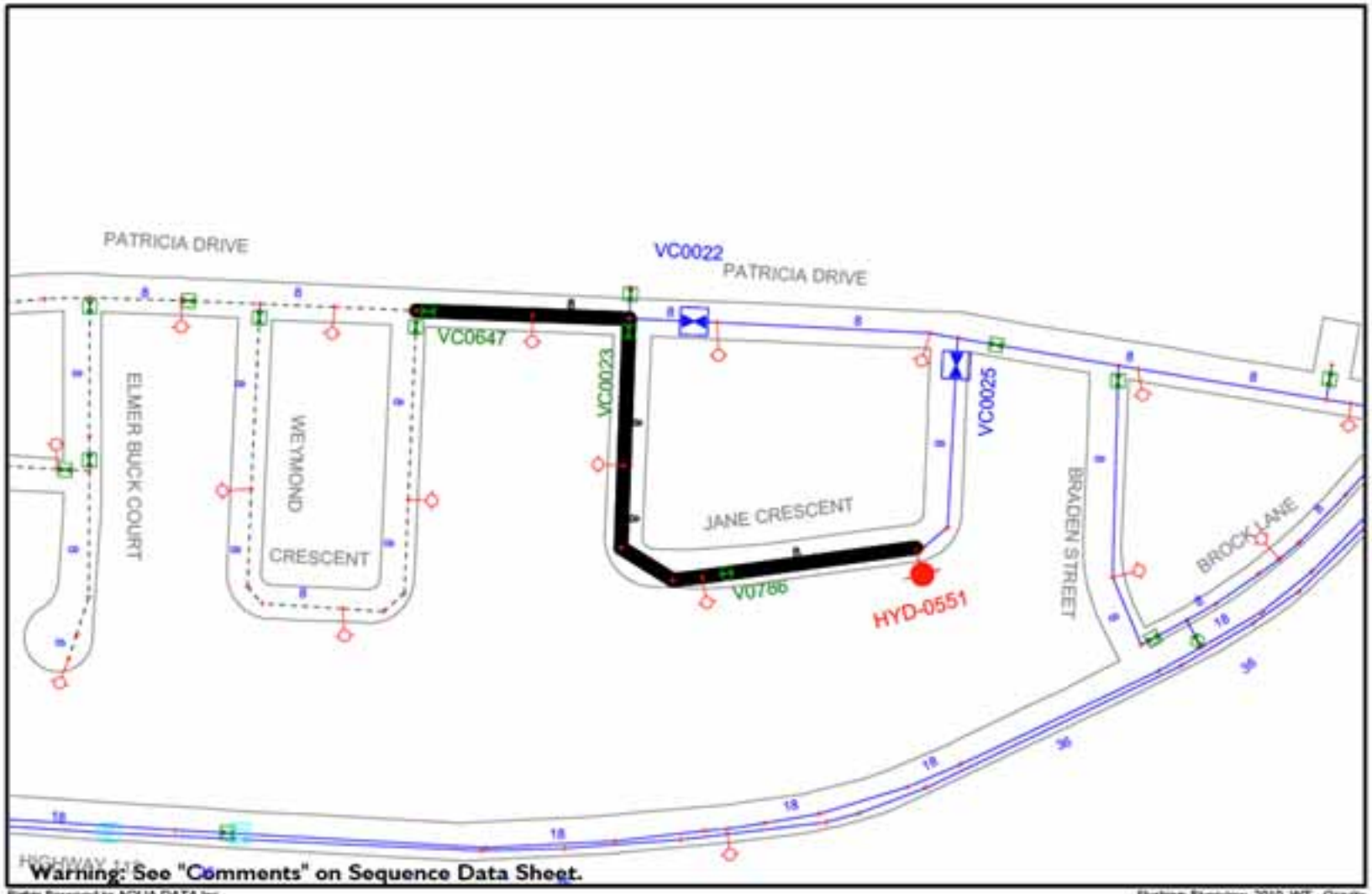

AIR LIQUIDE
AIR LIQUIDE

AQUA DATA

**Aqua Cad ® Unidirectional Flushing**
**Sequence Map**

**Town of Riverview - UDF 2010**
**Gravity**

| TEAM NO: 1 | SEQUENCE NO: 10 |
|---|---|



AQUA DATA

**Aqua Cad ® Unidirectional Flushing**
**Sequence Data Sheet**

**Town of Riverview - UDF 2010**
**Gravity**

**TEAM NO: 1** **SEQUENCE NO: 10**

## Fire Hydrant or Drain Valve to Operate

| Fire hydrant No. | Address | Outlet 2.5" | Outlet 1.5" | Elbow None | Elbow 45° | Elbow 90° | Pressure (psi) Static | Pressure (psi) Dynamic | Measured Flow (USg/min) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| HYD-0551 | 19 Jane Cr. | ☐ | ☐ | ☐ | ☐ | ☐ | | | | |

## Valves to Operate

| Valve Nbr. | Flushing | After | Next | Comments | Valve Nbr. | Flushing | After | Next | Comments |
|---|---|---|---|---|---|---|---|---|---|
| VC0025 | Closed ☐ | Opened ☐ | | | | ☐ | ☐ | | |
| VC0022 | Closed ☐ | Opened ☐ | | | | ☐ | ☐ | | |
| | ☐ | ☐ | | | | ☐ | ☐ | | |
| | ☐ | ☐ | | | | ☐ | ☐ | | |
| | ☐ | ☐ | | | | ☐ | ☐ | | |
| | ☐ | ☐ | | | | ☐ | ☐ | | |
| | ☐ | ☐ | | | | ☐ | ☐ | | |
| | ☐ | ☐ | | | | ☐ | ☐ | | |

## Flushing Time

| Dynamic Pressure (psi) | Time (min) 2.5" | Time (min) 1.5" |
|---|---|---|
| 110-120 | 3 | 6 |
| 100-110 | 3 | 6 |
| 90-100 | 3 | 7 |
| 80-90 | 3 | 7 |
| 70-80 | 3 | 8 |
| 60-70 | 3 | 8 |
| [50-60] | 3 | 9 |
| 40-50 | 4 | 10 |
| 30-40 | 4 | 11 |

## Flushing Characteristics

Pipe Diameter (in)

Min.: 8 Max.: 8

Required Flow (USg/min)

15178

| Pipe Length (ft) | Flushing Time (min) |
|---|---|
| 1302 | |

## Water Quality

| | Initial | During | Final |
|---|---|---|---|
| Clear | ☐ | ☐ | ☐ |
| Particles | ☐ | ☐ | ☐ |
| Colored | ☐ | ☐ | ☐ |
| Opaque | ☐ | ☐ | ☐ |

Comments:

Start Time:

End Time:

Crew:

Date:

Comments: used a diffuser

# *A summary of the Advantages of Unidirectional Flushing*

1. Encourages the need to diagnose the whole system to develop a true picture of the system's performance and configuration before undertaking a Unidirectional Flushing program.

2. Ensures proper pipe cleaning using the highest water velocities available by the system using the least amount of water.

3. Removes non-solidified deposits inside the pipes which helps maintain chlorine residuals.

4. Reduces taste and odour problems.

5. Slows the deterioration of hydraulic performance and even may improves C-factors over time.

6. Confirms efficient network cleaning due to systematic water routing and flushing with clean water at all times.

7. Minimizes disturbances to residents during flushing and greatly reduces water waste.

# Do You Have Any Questions at this time ??????

**Let do some simulations to show the effects of Traditional Flushing Versus Unidirectional Flushing on a water distribution system…**

***Using the AquaCad Suite Modeling Software.***

# EXECUTION OF THE 2005 UNIDIRECTIONAL FLUSHING PROGRAM - TOWN OF RIVERVIEW

| Sequence | Start Date | End Date | Operator | Hydrant Number | Address | Status | Color | Static Pressure (psi) | Dynamic Pressure (psi) | Required Flow (US gpm) | Calculated Flow (US gpm) | Nominal Diameter (in) | Internal Diameter (in) | Length (ft) | Material | Age | Minimum Velocity (ft/s) | Maximum Velocity (ft/s) | Theoretical Time (min) | Actual Time (min) | Theoretical Volume Factor | Actual Volume Factor | Theoretical Water Volume (US gal) | Used Water Volume (US gal) | Initial Turbidity (NTU) | Final Turbidity (NTU) | Initial Appearance | During Appearance | Final Appearance | Comments Before |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4/18/2005 8:33 | 4/18/2005 8:52 | Richard Daley | HYD.0468 | 1055 Highway 112 | 45° | DW | 90 | 82 | 1,604 | 1,376 | 8 | 10 | 1,100 | ductile iron | 30 | 3.7 | 6.4 | 14 | 17 | 3 | 3.7 | 17,010 | 21,060 | 4.44 | 0.5 | Particles | Particles | Clear | |
| 2 | 4/18/2005 9:03 | 4/18/2005 9:18 | Richard Daley | HYD.0469 | Highway 112 | 45° | DW | 94 | 82 | 1,604 | 1,376 | 12 | 12 | 1,200 | ductile iron | 30 | 3.7 | 3.7 | 18 | 18 | 3 | 3.0 | 26,652 | 26,417 | 4.19 | 0.73 | Particles | Particles | Clear | |
| 3 | 4/18/2005 9:28 | 4/18/2005 9:40 | Richard Daley | HYD.0469+ | 1118 Highway 112 | 45° | DW | 80 | 77 | 1,604 | 1,237 | 12 | 12 | 843 | ductile iron | 30 | 3.6 | 3.6 | 11 | 12 | 3 | 3.2 | 13,005 | 14,639 | 5.14 | 0.94 | Particles | Particles | Clear | Liquo circuit |
| 4 | 4/18/2005 9:49 | 4/18/2005 10:10 | Richard Daley | HYD.0469 | 1174 Highway 112 | 45° | DW | 77 | 66 | 1,604 | 1,145 | 12 | 12 | 1,531 | ductile iron | 30 | 3.4 | 3.4 | 23 | 23 | 3 | 3.0 | 25,139 | 25,331 | 4.25 | 0.45 | Particles | Particles | Clear | |
| 5 | 4/18/2005 10:24 | 4/18/2005 10:35 | Richard Daley | HYD.0479 | 122 Patricia ct. | 90° | DW | 96 | 80 | 455 | 1,092 | 8 | 8 | 1,700 | Polyvinyl chloride | 15 | 7.0 | 7.0 | 8 | 11 | 3 | 3.9 | 9,185 | 12,007 | 21.6 | 0.87 | coarse | Particles | Clear | |
| 6 | 4/18/2005 10:40 | 4/18/2005 10:59 | Richard Daley | HYD.0479 | 122 Patricia ct. | 90° | DW | 95 | 98 | 455 | 1,073 | 8 | 8 | 1,034 | Polyvinyl chloride | 9 | 7.1 | 7.1 | 7 | 13 | 3 | 5.3 | 7,847 | 13,952 | 44.5 | 0.91 | coarse | Particles | Clear | |
| 7 | 4/18/2005 11:07 | 4/18/2005 11:13 | Richard Daley | HYD.0476 | 2 Elmer ct. | 45° | DW | 71 | 54 | 455 | 1,030 | 8 | 8 | 331 | Polyvinyl chloride | 9 | 6.8 | 12.1 | 2 | 5 | 3 | 6.6 | 2,365 | 5,178 | 7.61 | 0.73 | Particles | Particles | Clear | |
| 8 | 4/18/2005 11:23 | 4/18/2005 11:30 | Richard Daley | HYD.0496 | waymore cr. | 45° | DW | 72 | 80 | 455 | 998 | 8 | 8 | 674 | Polyvinyl chloride | 7 | 6.6 | 6.6 | 7 | 9 | 3 | 3.6 | 7,392 | 8,980 | 17.5 | 0.9 | coarse | Particles | Clear | |
| 9 | 4/18/2005 11:40 | 4/18/2005 11:51 | Richard Daley | HYD.0496 | waymore cr. | 45° | DW | 75 | 48 | 455 | 816 | 8 | 8 | 860 | Polyvinyl chloride | 7 | 6.4 | 6.4 | 7 | 11 | 3 | 4.8 | 6,710 | 10,740 | 7.04 | 0.68 | Particles | Particles | Clear | |
| 10 | 4/18/2005 12:03 | 4/18/2005 12:17 | Richard Daley | HYD.0554 | 19 Jura ct. | 45° | DW | 79 | 55 | 455 | 1,045 | 8 | 8 | 1,299 | Polyvinyl chloride | 7 | 6.9 | 6.9 | 9 | 14 | 3 | 4.5 | 9,855 | 14,631 | 7.66 | 0.79 | Particles | Particles | Clear | |
| 11 | 4/18/2005 12:33 | 4/18/2005 12:46 | Richard Daley | HYD.0554 | 19 Jura ct. | 45° | DW | 80 | 54 | 455 | 1,030 | 8 | 8 | 959 | Polyvinyl chloride | 7 | 6.8 | 6.8 | 7 | 13 | 3 | 5.5 | 7,340 | 13,462 | 3.94 | 0.80 | Particles | Particles | Clear | |
| 12 | 4/18/2005 13:01 | 4/18/2005 13:07 | Richard Daley | HYD.0507 | 14 Patricia ct. | 45° | DW | 84 | 59 | 455 | 1,082 | 8 | 8 | 347 | Polyvinyl chloride | 19 | 7.1 | 7.1 | 3 | 6 | 3 | 6.1 | 2,403 | 6,465 | 48.4 | 0.78 | coarse | Particles | Clear | |
| 13 | 4/18/2005 13:14 | 4/18/2005 13:28 | Richard Daley | HYD.0507 | 14 Patricia ct. | 45° | DW | 85 | 72 | 455 | 1,196 | 8 | 8 | 870 | Polyvinyl chloride | 17 | 7.9 | 7.9 | 4 | 6 | 3 | 4.2 | 5,165 | 7,174 | 26 | 0.95 | coarse | Particles | Clear | |
| 14 | 4/18/2005 13:28 | 4/18/2005 13:37 | Richard Daley | HYD.0507 | 14 Patricia ct. | 45° | DW | 85 | 66 | 455 | 1,162 | 8 | 8 | 699 | Polyvinyl chloride | 19 | 7.7 | 7.7 | 7 | 9 | 3 | 4.1 | 7,364 | 10,456 | 9.86 | 0.91 | Particles | Particles | Clear | |
| 15 | 4/18/2005 14:01 | 4/18/2005 14:08 | Richard Daley | HYD.0471 | 17 Craig ct. | 90° | DW | 82 | 45 | 256 | 918 | 6 | 6 | 655 | ductile iron | 17 | 10.3 | 10.3 | 4 | 7 | 3 | 5.1 | 3,648 | 6,143 | 4.11 | 0.95 | Particles | Particles | Clear | |
| 16 | 4/18/2005 14:27 | 4/18/2005 14:54 | Richard Daley | HYD.0438 | 124 Cirkuit Dr. | 45° | DW | 75 | 63 | 1,604 | 1,119 | 12 | 12 | 1,964 | Polyvinyl chloride | 9 | 3.3 | 3.3 | 29 | 27 | 3 | 2.8 | 31,809 | 30,200 | 139 | 0.66 | coarse | Particles | Clear | Cannot use now monday because of reading |
| 17 | 4/18/2005 15:06 | 4/18/2005 15:27 | Richard Daley | HYD.0434 | 39 Gurgery Ln. | 45° | DW | 54 | 18 | 256 | 368 | 6 | 6 | 882 | cast iron | 32 | 7.0 | 7.0 | 6 | 21 | 3 | 9.9 | 3,868 | 12,555 | 335 | 0.91 | opaque | Particles | Clear | Liquo circuit |
| 18 | 4/18/2005 15:39 | 4/18/2005 15:50 | Richard Daley | HYD.0434 | 39 Gurgery Ln. | 45° | DW | 54 | 13 | 256 | 308 | 6 | 6 | 1,007 | ductile iron | 34 | 6.0 | 6.0 | 8 | 10 | 3 | 4.3 | 4,299 | 6,097 | 361 | 0.95 | opaque | Particles | Clear | Liquo circuit |
| 19 | 4/18/2005 15:52 | 4/18/2005 16:25 | Richard Daley | HYD.0434 | 39 Gurgery Ln. | 45° | DW | 54 | 14 | 256 | 327 | 6 | 6 | 1,318 | cast iron | 36 | 6.2 | 6.2 | 11 | 23 | 3 | 6.5 | 5,626 | 12,127 | 424 | 0.89 | opaque | Particles | Clear | Liquo circuit |
| 20 | 4/18/2005 16:41 | 4/18/2005 16:59 | Richard Daley | HYD.0437 | 34 Hendy Ln. | 45° | DW | 59 | 22 | 256 | 661 | 6 | 6 | 959 | cast iron | 36 | 7.7 | 7.7 | 4 | 17 | 3 | 12.0 | 2,812 | 11,296 | 413 | 0.78 | coarse | Particles | Clear | |
| 21 | 4/18/2005 17:12 | 4/18/2005 17:29 | Richard Daley | HYD.0437 | 34 Hendy Ln. | 45° | DW | 60 | 31 | 256 | 846 | 6 | 6 | 678 | ductile iron | 34 | 7.8 | 7.8 | 3 | 17 | 3 | 12.4 | 2,062 | 10,978 | 388 | 0.84 | opaque | Particles | Clear | |
| 22 | 4/18/2005 17:48 | 4/18/2005 18:04 | Richard Daley | HYD.0458 | 149 Cirkuit Dr. | none | DW | 58 | NA | 1,604 | 1,284 | 12 | 12 | 2,147 | ductile iron | 34 | 3.6 | 3.6 | 25 | 36 | 3 | 7.1 | 19,594 | 46,218 | 26 | 0.89 | coarse | Particles | Clear | Liquo two now monday |
| 23 | 4/18/2005 18:41 | 4/18/2005 18:54 | Richard Daley | HYD.0457 | 39 Gurtonell Dr. | 45° | DW | 69 | 51 | 256 | 648 | 6 | 6 | 921 | cast iron | 28 | 7.6 | 7.6 | 6 | 13 | 3 | 6.5 | 3,846 | 8,395 | 153 | 0.91 | coarse | Particles | Clear | |
| 24 | 4/18/2005 19:08 | 4/18/2005 19:31 | Richard Daley | HYD.0457 | 39 Gurtonell Dr. | 45° | DW | 69 | 46 | 455 | 958 | 8 | 8 | 2,110 | Polyvinyl chloride | 3 | 6.3 | 11.2 | 17 | 20 | 3 | 4.2 | 15,801 | 21,982 | 71.9 | 0.96 | coarse | Particles | Clear | |
| 25 | 4/18/2005 19:46 | 4/18/2005 9:11 | Richard Daley | HYD.0438 | Meyer ct. | 90° | DW | 79 | 38 | 455 | 999 | 8 | 8 | 540 | Polyvinyl chloride | 0 | 6.6 | 6.6 | 4 | 5 | 3 | 3.6 | 4,320 | 4,961 | 109 | 0.78 | coarse | Particles | Clear | |
| 26 | 4/18/2005 9:39 | 4/18/2005 10:03 | Richard Daley | HYD.0490 | Greg's Block Ct. | 45° | DW | 80 | 47 | 455 | 998 | 8 | 8 | 1,331 | Polyvinyl chloride | 0 | 6.4 | 6.4 | 11 | 13 | 3 | 3.7 | 10,104 | 12,559 | 115 | 0.88 | Particles | Particles | Clear | |
| 27 | 4/18/2005 10:14 | 4/18/2005 10:23 | Richard Daley | HYD.0490 | Greg's Block Ct. | 45° | DW | 84 | 46 | 455 | 986 | 8 | 8 | 1,004 | Polyvinyl chloride | 0 | 6.5 | 6.5 | 8 | 9 | 3 | 3.2 | 8,062 | 8,978 | 18.8 | 0.88 | Particles | Particles | Clear | |
| 28 | 4/18/2005 10:33 | 4/18/2005 10:38 | Richard Daley | HYD.0504 | 22 Hamilton St. | 45° | DW | 69 | 43 | 256 | 945 | 6 | 6 | 240 | ductile iron | 34 | 11.1 | 11.1 | 1 | 3 | 3 | 8.3 | 1,824 | 2,838 | 117 | 0.87 | Particles | Particles | Clear | |
| 29 | 4/18/2005 10:58 | 4/18/2005 11:09 | Richard Daley | HYD.0518 | 33 Tribe Rd. | 45° | DW | 55 | 38 | 711 | 869 | 10 | 10 | 1,340 | cast iron | 36 | 3.7 | 3.7 | 18 | 20 | 3 | 3.6 | 15,093 | 19,111 | 17.1 | 0.95 | Particles | Particles | Clear | |
| 30 | 4/18/2005 11:27 | 4/18/2005 11:53 | Richard Daley | HYD.0518 | 129 Tribe Rd. | 45° | DW | 59 | 35 | 711 | 980 | 10 | 10 | 1,324 | cast iron | 34 | 3.7 | 3.7 | 18 | 26 | 3 | 4.8 | 14,915 | 22,881 | 84.7 | 0.95 | coarse | Particles | Clear | |
| 31 | 4/18/2005 12:04 | 4/18/2005 12:14 | Richard Daley | HYD.0434 | 55 Wolumbi Dr. | 45° | DW | 74 | 37 | 711 | 957 | 8 | 10 | 1,526 | cast iron | 34 | 3.6 | 5.6 | 15 | 30 | 3 | 6.0 | 12,799 | 25,715 | 60 | 0.89 | coarse | Particles | Clear | |
| 32 | 4/18/2005 12:30 | 4/18/2005 12:53 | Richard Daley | HYD.0434 | 55 Wolumbi Dr. | 45° | DW | 72 | 38 | 455 | 1,073 | 8 | 8 | 76 | ductile iron | 34 | 7.1 | 7.1 | 1 | 3 | 3 | 10.8 | 576 | 3,226 | 31.6 | 0.8 | coarse | Particles | Clear | |
| 33 | 4/18/2005 13:06 | 4/18/2005 13:21 | Richard Daley | HYD.0434 | 55 Wolumbi Dr. | 45° | DW | 72 | 30 | 455 | 930 | 8 | 8 | 1,460 | ductile iron | 34 | 4.2 | 7.4 | 12 | 15 | 3 | 3.8 | 7,520 | 9,413 | 29.5 | 0.87 | coarse | Particles | Clear | |
| 34 | 4/18/2005 13:31 | 4/18/2005 13:49 | Richard Daley | HYD.0439 | 96 Wilson Rd. | 45° | DW | 56 | 22 | 256 | 661 | 6 | 6 | 626 | cast iron | 36 | 7.7 | 7.7 | 4 | 18 | 3 | 13.4 | 2,672 | 11,807 | 115 | 0.87 | coarse | Particles | Clear | |
| 35 | 4/18/2005 14:01 | 4/18/2005 14:15 | Richard Daley | HYD.0439 | 96 Wilson Rd. | 45° | DW | 56 | 17 | 256 | 581 | 6 | 6 | 843 | cast iron | 36 | 6.8 | 6.8 | 6 | 14 | 3 | 7.0 | 3,470 | 8,134 | 131 | 0.95 | coarse | Particles | Clear | |
| 36 | 4/18/2005 14:42 | 4/18/2005 15:29 | Richard Daley | HYD.0550 | 196 Whitpins Rd. | none | DW | 56 | NA | 1,604 | 1,080 | 12 | 12 | 1,330 | cast iron | 26 | 3.1 | 3.1 | 24 | 38 | 3 | 5.3 | 22,713 | 40,504 | 31.5 | 0.98 | coarse | Particles | Clear | Liquo two now monday. |
| 37 | 4/18/2005 15:33 | 4/18/2005 15:39 | Richard Daley | HYD.0461 | 25 Gisonis Dr. | 45° | DW | 59 | 22 | 256 | 661 | 6 | 6 | 616 | cast iron | 28 | 7.7 | 7.7 | 4 | 6 | 3 | 4.5 | 2,631 | 3,906 | 10.7 | 0.78 | Particles | Particles | Clear | |
| 38 | 4/18/2005 15:40 | 4/18/2005 15:51 | Richard Daley | HYD.0504 | 14 Vineyview Ct. | 90° | DW | 52 | 48 | 455 | 970 | 8 | 8 | 240 | Polyvinyl chloride | 17 | 5.8 | 5.8 | 2 | 3 | 3 | 4.3 | 1,843 | 2,633 | 3.4 | 0.91 | Particles | Particles | Clear | |
| 39 | 4/18/2005 15:59 | 4/18/2005 16:39 | Richard Daley | HYD.0435 | Whitpins Rd. | none | DW | 49 | NA | 1,604 | 1,197 | 12 | 12 | 951 | cast iron | 32 | 3.4 | 3.4 | 14 | 35 | 3 | 6.5 | 12,239 | 35,006 | 41.1 | 0.82 | coarse | Particles | Clear | Liquo two now monday. |
| 40 | 4/18/2005 17:03 | 4/18/2005 17:32 | Richard Daley | HYD.0435 | Whitpins Rd. | 45° | DW | 48 | 30 | 1,604 | 797 | 10 | 10 | 1,536 | cast iron | 34 | 3.3 | 3.4 | 25 | 29 | 3 | 3.5 | 16,935 | 23,118 | 45.6 | 0.82 | coarse | Particles | Clear | |
| 41 | 4/18/2005 17:40 | 4/18/2005 18:04 | Richard Daley | HYD.0469 | Tribe Rd. | 45° | DW | 49 | 36 | 1,604 | 946 | 12 | 12 | 1,089 | cast iron | 33 | 3.5 | 3.5 | 22 | 44 | 3 | 6.0 | 18,599 | 37,262 | 589 | 0.87 | opaque | Particles | Clear | |
| 42 | 4/18/2005 18:48 | 4/18/2005 19:06 | Richard Daley | HYD.0439 | 26 Mcdowell Av. | 45° | DW | 48 | 24 | 455 | 890 | 8 | 8 | 959 | cast iron | 32 | 4.5 | 4.5 | 11 | 18 | 3 | 5.1 | 7,353 | 13,407 | 479 | 0.87 | opaque | Particles | Clear | |
| 43 | 4/18/2005 18:14 | 4/18/2005 18:44 | Richard Daley | HYD.0444 | 9 Dale St. | 45° | DW | 45 | 14 | 256 | 327 | 6 | 6 | 646 | cast iron | 32 | 6.2 | 6.2 | 5 | 32 | 3 | 17.2 | 2,758 | 15,840 | 1000 | 0.89 | opaque | Particles | Clear | |
| 44 | 4/18/2005 8:29 | 4/18/2005 8:52 | Richard Daley | HYD.0444 | 9 Dale St. | 45° | DW | 38 | 14 | 455 | 327 | 8 | 8 | 768 | cast iron | 32 | 3.5 | 6.2 | 8 | 24 | 3 | 8.3 | 3,686 | 11,873 | 370 | 0.86 | opaque | Particles | Clear | |
| 45 | 4/18/2005 8:55 | 4/18/2005 9:11 | Richard Daley | HYD.0440 | 26 Cunudon Dr. | 45° | DW | 56 | 13 | 256 | 308 | 6 | 6 | 662 | cast iron | 32 | 6.0 | 6.0 | 6 | 16 | 3 | 8.6 | 2,824 | 8,109 | 536 | 0.91 | opaque | Particles | Clear | |

| Sequence | Start Date | End Date | Operator | FH Number | Address |
|---|---|---|---|---|---|
| 1 | 4/18/2005 8:33 | 4/18/2005 8:50 | Richard Daley | HYD-0480 | 1055 Highway 112 |
| 2 | 4/18/2005 9:02 | 4/18/2005 9:18 | Richard Daley | HYD-0482 | Highway 112 |
| 3 | 4/18/2005 9:28 | 4/18/2005 9:40 | Richard Daley | HYD-0484 | 1118 Highway 112 |
| 4 | 4/18/2005 9:49 | 4/18/2005 10:12 | Richard Daley | HYD-0486 | 1174 Highway 112 |
| 5 | 4/18/2005 10:24 | 4/18/2005 10:35 | Richard Daley | HYD-0579 | 122 Patricia Dr. |
| 6 | 4/18/2005 10:46 | 4/18/2005 10:59 | Richard Daley | HYD-0579 | 122 Patricia Dr. |

| Elbow | Outlet | Static Pressure (psi) | Dynamic Pressure (psi) | Required Flow (US gal/min) | Calculated Flow (US gal/min) | Minimum Diameter (in) | Maximum Diameter (in) |
|---|---|---|---|---|---|---|---|
| 45° | 2½" | 92 | 82 | 1,024 | 1,276 | 8 | 12 |
| 45° | 2½" | 94 | 82 | 1,024 | 1,276 | 12 | 12 |
| 45° | 2½" | 90 | 77 | 1024 | 1,237 | 12 | 12 |
| 45° | 2½" | 77 | 66 | 1,024 | 1,145 | 12 | 12 |
| 45° | 2½" | 86 | 60 | 455 | 1,092 | 8 | 8 |
| 45° | 2½" | 85 | 58 | 455 | 1,073 | 8 | 8 |

| Length (ft) | Material | Age | Minimum Velocity (ft/s) | Maximum Velocity (ft/s) | Theoretical Time (min) | Actual Time (min) | V |
|---|---|---|---|---|---|---|---|
| 1,100 | Ductile Iron | 30 | 3.7 | 8.4 | 14 | 17 | |
| 1,209 | Ductile Iron | 30 | 3.7 | 3.7 | 16 | 16 | |
| 813 | Ductile Iron | 30 | 3.6 | 3.6 | 11 | 12 | |
| 1,531 | Ductile Iron | 30 | 3.4 | 3.4 | 23 | 23 | |
| 1,210 | Polyvinyle Chloride | 10 | 7.2 | 7.2 | 8 | 11 | |
| 1,034 | Polyvinyle Chloride | 9 | 7.1 | 7.1 | 7 | 13 | |

| Theoretical Volume Factor | Actual Volume Factor | Theoretical Water Volume (US gal) | Used Water Volume (US gal) | Initial Turbidity (NTU) | Final Turbidity (NTU) |
|---|---|---|---|---|---|
| 3 | 3.7 | 17,616 | 21,693 | 4.44 | 0.5 |
| 3 | 3.0 | 20,652 | 20,417 | 4.19 | 0.76 |
| 3 | 3.2 | 13,885 | 14,839 | 6.14 | 0.94 |
| 3 | 3.0 | 26,136 | 26,331 | 4.25 | 0.45 |
| 3 | 3.9 | 9,185 | 12,007 | 21.6 | 0.87 |
| 3 | 5.3 | 7,847 | 13,952 | 44.5 | 0.91 |

| | Initial Appearance | During Appearance | Final Appearance | Comments General |
|---|---|---|---|---|
| | Particles | Particles | Clear | |
| | Particles | Particles | Clear | |
| | Particles | Particles | Clear | Used diffuser. |
| | Particles | Particles | Clear | |
| | Colored | Particles | Clear | |
| | Colored | Particles | Clear | |

# Town of Riverview

# New Brunswick

**Unidirectional Flushing Results Over a five year period…**

**Used to show the effects of a well run UDF program**

**and the results that can be achieved**

**UDF Project was executed with the Town of Riverview and managed in the field by Aqua Data Atlantic's technician. Permission was given by the Town to release the UDF report information for this presentation.**

| *Description* | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Number of Sequences | 362 | 362 | 363 | 375 | 376 |
| Total Length of Pipe Flushed (Km) | 95 | 96 | 97 | 99 | 101 |
| Number of Hydrants in network | 592 | 596 | 605 | 623 | 636 |
| Hydrants used for UDF | 210 | 210 | 211 | 217 | 217 |
| Number of Valves in network | 654 | 659 | 680 | 698 | 718 |
| Valves used for UDF | 421 | 424 | 428 | 441 | 440 |
| Average Valves operated during UDF | 4 | 4 | 4 | 4 | 4 |
| Average flushing time / Seq (Min) | 21 | 20 | 19 | 16 | 16 |
| Total flushing time (Hrs) | 129 | 123 | 114 | 100 | 98 |
| Theoretical Water Volume (M/US gal) | 2.6 | 2.6 | 2.6 | 2.7 | 2.7 |
| Actual Water Volume used (M/US gal) | 6.2 | 5.6 | 5.1 | 4.7 | 4.4 |
| Average Water Volume Factor /Seq | 10.4 | 9.0 | 8.0 | 7.35 | 7 |
| % of Sequences over 5 ft/s & 3ft/s | 62/90 % | 63/94% | 63/95% | 63/95% | 67/97% |
| Turbidity reached and % of Seq | n/a | .80/93% | .84/97% | .90/100% | .91/100% |

# City of Moncton

# New Brunswick

**Unidirectional Flushing Results Over a five year period…**

**Used to show the effects of a well run UDF program**

**and the results that can be achieved**

**UDF Project was executed with the City of Moncton and managed in the field by Aqua Data Atlantic's technician. Permission was given by the City to release the UDF report information for this presentation.**

| *Description* | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Number of Sequences | 1219 | 1221 | 1283 | 1326 | 1329 |
| Total Length of Pipe Flushed (Km) | 329 | 329 | 341 | 350 | 348 |
| Number of Hydrants in network | n/a | 2129 | 2168 | 2238 | 2329 |
| Hydrants used for UDF | 689 | 672 | 709 | 723 | 723 |
| Number of Valves in network | n/a | 3169 | 3205 | 3271 | 3395 |
| Valves used for UDF | 1530 | 1535 | 1608 | 1632 | 1634 |
| Average Valves operated during UDF | 5 | 5 | 5 | 5 | 4 |
| Average flushing time / Seq (Min) | 19 | 24 | 18 | 16 | 16 |
| Total flushing time (Hrs) | 396 | 480 | 390 | 358 | 344 |
| Theoretical Water Volume (M/US gal) | 10.7 | 10.3 | 10.7 | 10.9 | 10.6 |
| Actual Water Volume used (M/US gal) | 27.9 | 28.5 | 22.3 | 20.6 | 19.2 |
| Average Water Volume Factor /Seq | 11 | 11 | 8.3 | 7.3 | 7.5 |
| % of Sequences over 5 ft/s & 3ft/s | 81/97% | 80/97% | 81/97% | 71/94% | 70/93% |
| Turbidity reached and % of Seq | 1.04/97% | .93/97% | .83/98% | .83/99% | .91/100% |

# Any more questions ?????

**Thank you very much for coming and enjoy the rest of your day…**