The Provision of Safe Drinking Water; Utility Roles and Responsibilities, March 21, 2006

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Halifax Water Commission: Established 1945

What is the Water Commission?

- Originally incorporated in 1945
- Merger in 1996 to create Regional Utility
- Operates in accordance with Act of Provincial Legislature with rules and regulations approved by NS Utility and Review Board.

What is the Water Commission?

- Operates like a business; governed by board of directors; owned by HRM.
- Self financed water utility; capital and operating budgets are funded directly from water sales and fire protection revenue.

HRWC Physical Infrastructure

- Pockwock Treatment Plant (227 ML/Day)
- Lake Major Treatment Plant (94 ML/Day)
- Seven Small Plants (8,000 to 405,000 L/Day)
- 1,300 km of Transmission & Distribution Main
- 16 Storage Reservoirs (269 ML Capacity)
- 19 Distribution Booster Stations, 102 Pressure Control/Flow Chambers & 7,300 Fire Hydrants
- 75,000 Customer Connections
- Total Assets in Excess of $300 Million

HRWC Physical Infrastructure

Backup Supply Systems

- Diesel Generators at Pockwock & Lake Major
- Halifax - Chain Lake; 90 ML/Day
- Dartmouth - Lake Lamont; 50 ML/Day

State of the Art Water Treatment Plants

- J. Douglas Kline Water Supply Plant
  - Halifax, Bedford, Sackville, Beaverbank, Lakeside/Timberlea, Waverley
  - Commissioned in 1977
  - 21 MIGD

SYSTEM CERTIFICATION
CERTIFICATION DE SYSTÈMES
ISO 14001
SGS

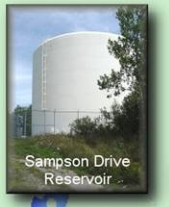
State of the Art Water Treatment Plants

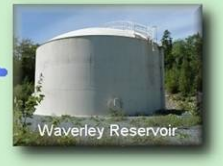
- Lake Major Water Supply Plant
  - Dartmouth, Cole Harbour, Eastern Passage, Westphal
  - Commissioned in 1999
  - 10 MIGD

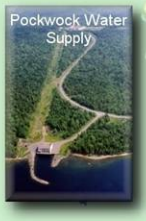
Small Systems

- 8 HRWC Owned Water Utilities:
  - North Preston, Middle Musquodoboit, Collins Park
  - Churchill Estates, Lively, Silver Sands, 5 Island Lake, Miller Lake
- 2 Fee-for-Service Operated Systems:
  - Otter Lake Waste Resource Facility
  - Bomont Subdivision

Silver Sands Treatment Plant







Collins Park Satellite System

Middle Musquodoboit Satellite System

Miller Lake Satellite System

Lively Subdivision Satellite System

Five Island Lake Satellite System

North Preston Satellite System

Churchill Estates Satellite System

Silver Sands Satellite System

Beaverbank

Windsor Junction

Waverley

Lower Sackville

Lucasville

Hammonds Plains

Bedford

Central Operations Office

Lake Major

Lake Major Water Supply Plant

Cherrybrook

Cole Harbour

Dartmouth

East Operations Office

Halifax

Timberlea

Lakeside

Administration/ West Operations Office

Eastern Passage

Pockwock Lake

Tomahawk Lake

JD Kline Water Supply Plant

Bedford Basin

Halifax Harbour

1500mm Main

750mm Main

450mm Main

450mm Main

1200mm Main

750mm Main

900mm Main

600mm Main

1050mm Main

WATER SERVICE DISTRICTS & SUPPORTING INFRASTRUCTURE

LEGEND

Reservoir

Operations Facility

Transmission Main

Areas which have central water services or areas where water services may be extended in the future

Satellite System

Utility Roles & Responsibilities

- Utilities are responsible to provide safe drinking water.
- Safe drinking water is water that conforms to all health related parameters in the Guidelines for Canadian Drinking Water Quality [the new standard of care].
- If tests reveal that the water does not conform to the GCDWQ or when coliform bacteria are detected, notify authorities ASAP.

Utility Roles and Responsibilities

- A word about coliform bacteria testing; not all coliforms are created equal.
- The standard test utilized in Nova Scotia is called Colilert [the test takes 18 hours in total to complete].
- The test checks for total coliforms first; simply presence or absence.
- If total coliforms are absent; the test is complete.

Utility Roles and Responsibilities

- If total coliforms are present, test continues to check for E.Coli.
- E.Coli is associated with the intestinal tract of mammals and is a public health indicator.
- Boil water advisories are now primarily based on the presence of E.Coli and not total coliforms.
- All water tests submitted for compliance must be carried out by a certified laboratory.

Utility Roles and Responsibilities

- Keep meticulous records of water quality results [a good database helps].
- In NS, sample results for microbiological and chemical/physical water quality must be kept for two and ten years, respectively.
- Report water quality results to Regulator upon request, and in compliance with Approval to Operate.

Utility Roles and Responsibilities

- Employ certified operators and keep them trained; level of certification tied to classification of treatment facility or distribution system [Levels 1 to 4].
- Seek approvals from Regulator to construct or operate new or upgraded water systems.

Utility Roles and Responsibilities

- Set adequate water rates; rates and charges must cover all operating, maintenance and capital expenses, including depreciation and debt servicing. Development or local improvement charges can also be levied for system expansion.
- Water rates, rules and regulations should be approved through a public process.

Utility Roles and Responsibilities

- Special challenges with small systems; no economies of scale.
- Smaller systems should consider regional cooperation and sharing of resources; the recommendations in Watertight, [publication of the Ontario Ministry of Public Infrastructure Renewal] hit the nail on the head.
- Network with other utilities and stakeholders.

Utility Roles and Responsibilities

- Minimize liability through due diligence.
- Due diligence is more than following industry standards or compliance with regulations.
- Due diligence also includes the identification and management of risks associated with your particular system.
- Due diligence includes preparation for all foreseeable problems [a reasonable person exerting reasonable care].

Utility Roles and Responsibilities

- The Provision of High Quality Water and Service can be done.
- Adopt best management practices recognized by AWWA, IWA, CWWA, NRC InfraGuide, USEPA and others!
- Pay your staff well and ensure they have a commitment to continuous improvement.

Utility Roles and Responsibilities

- Communicate with your customers regularly; don't talk to them only when increasing rates.
- Above all else, take a multiple barrier approach to water quality.

Maintaining Water Quality
The Multiple Barrier Approach

- The multiple barrier approach refers to a series of physical and process barriers to prevent water contamination from the watershed to the customer's tap.
- Individually these barriers are not enough to ensure a safe water supply on their own, but collectively they are considered to be the most effective way to ensure public health protection.

The Multiple Barriers

- Watershed Protection
- Optimization of Treatment Process
- Sound Management of the Distribution System
- Cross Connection Control Program
- Continuous Monitoring and Testing
- Emergency Response Plans

Watershed Protection

- Watershed Protection is the First Line of Defense in a Multiple Barrier Approach to the Delivery of High Quality Water.
- The Main Components of the Watershed Protection Plan:
  - Watershed Manager
  - Designations under Environment Act
  - Watershed Management Committees
  - Land Ownership [>90 % of Watershed owned by HRWC and the Province]

Watershed Protection

- HRWC manages five major watersheds.
- Pockwock Lake; Tomahawk Lake; Chain Lakes; Topsail/Lamont Lakes; Lake Major

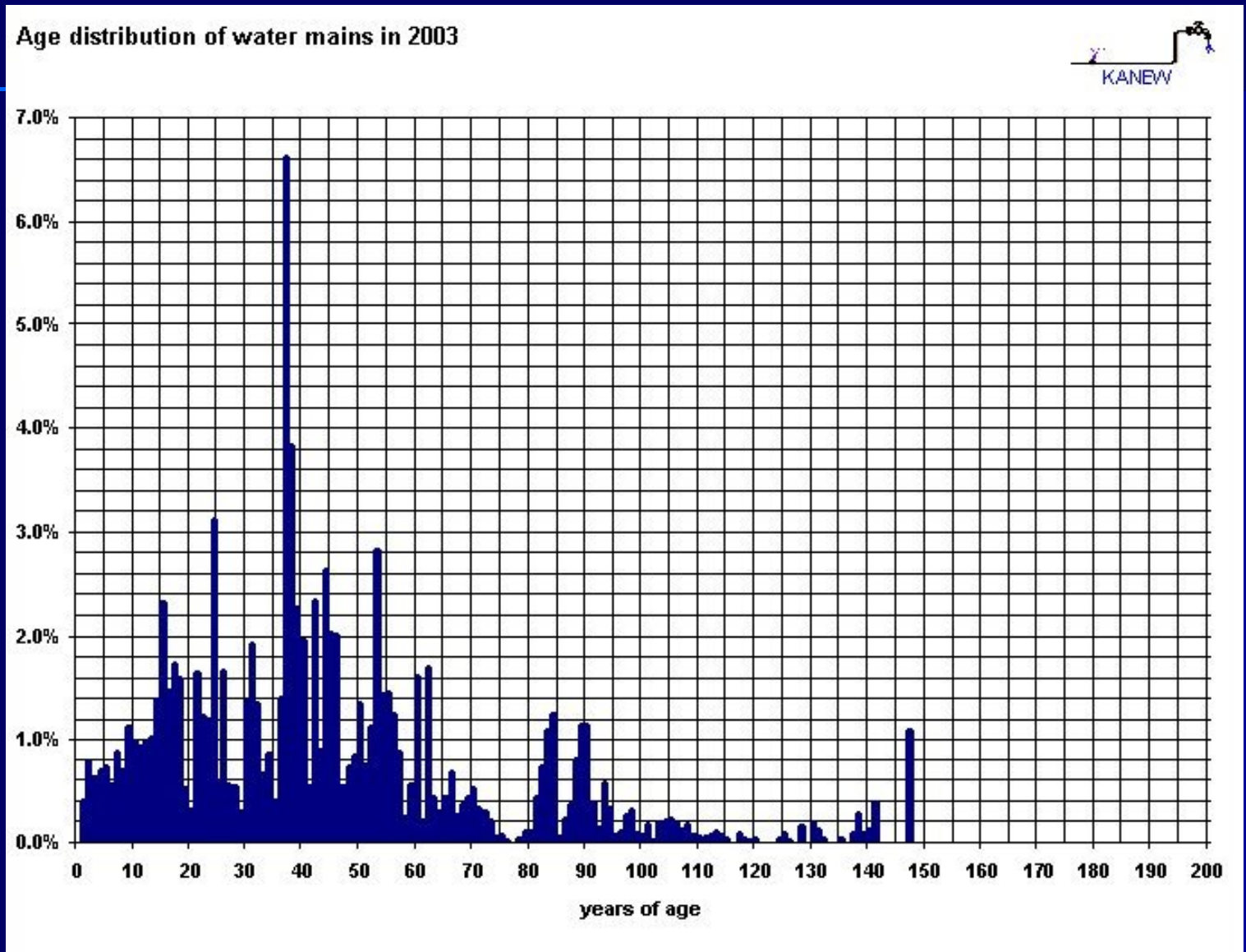
Optimization of Treatment Process

- More than producing water that meets Guidelines for Canadian Drinking Water Quality.
- Optimization means being the best that you can be at no additional cost.
- There is a symbiotic relationship between a treatment plant and the distribution system; water produced at the plant must be compatible with the distribution piping.

Sound Distribution System Management

- Proactive water main renewal program. Proposing to double investment over next five years [Increase from 0.4% to 0.8% of distribution system].
- Best Practice Operation & Maintenance.
- Water Accountability program in conformance to International Water Assoc. [IWA] Standards.

Distribution System Demographics



Distribution Water Main Renewal

Before & After-Main Rehab

Hydrant & Water Main Flushing

Spring Cleaning & Post Repairs

Water Accountability

- First utility in North America to adopt International Water Association [IWA] methodology.
- IWA Methodology adopted by HRWC in 2000; IWA Methodology endorsed by American Water Works Association [AWWA] and National Research Council of Canada in 2003.

IWA Standard Water Balance
- Assessment -

<table>
<tr><td rowspan="8">System Input Volume</td><td rowspan="3">Authorised Consumption</td><td rowspan="2">Billed Authorised Consumption</td><td>Billed Metered Consumption</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="6">Non Revenue Water</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorised Consumption</td></tr>
<tr><td>Customer Meter Inaccuracies</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission & Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Reservoirs</td></tr>
<tr><td>Leakage on Service Connections up to metering point</td></tr>
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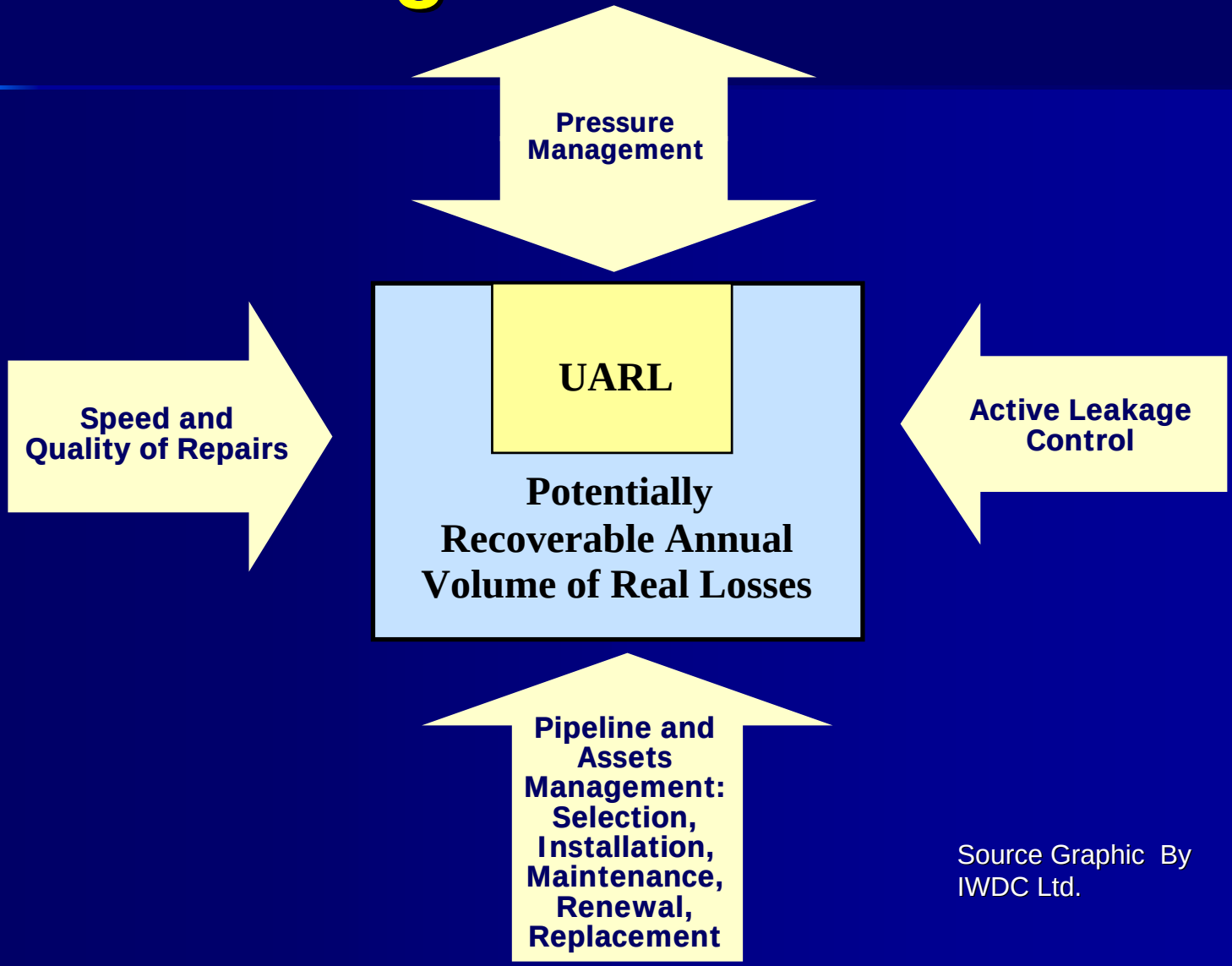
The Four Tactical Leakage Management Activities



Source Graphic By IWDC Ltd.

Losses flex w/ pressure

Pressure Management

Economic Level of Real Losses

Speed and Quality of Repairs

Active Leakage Control

Current Annual Real Losses

Pipeline and Assets Management: Selection, Installation, Maintenance, Renewal, Replacement

Water Distribution Repairs

266 Last Year…

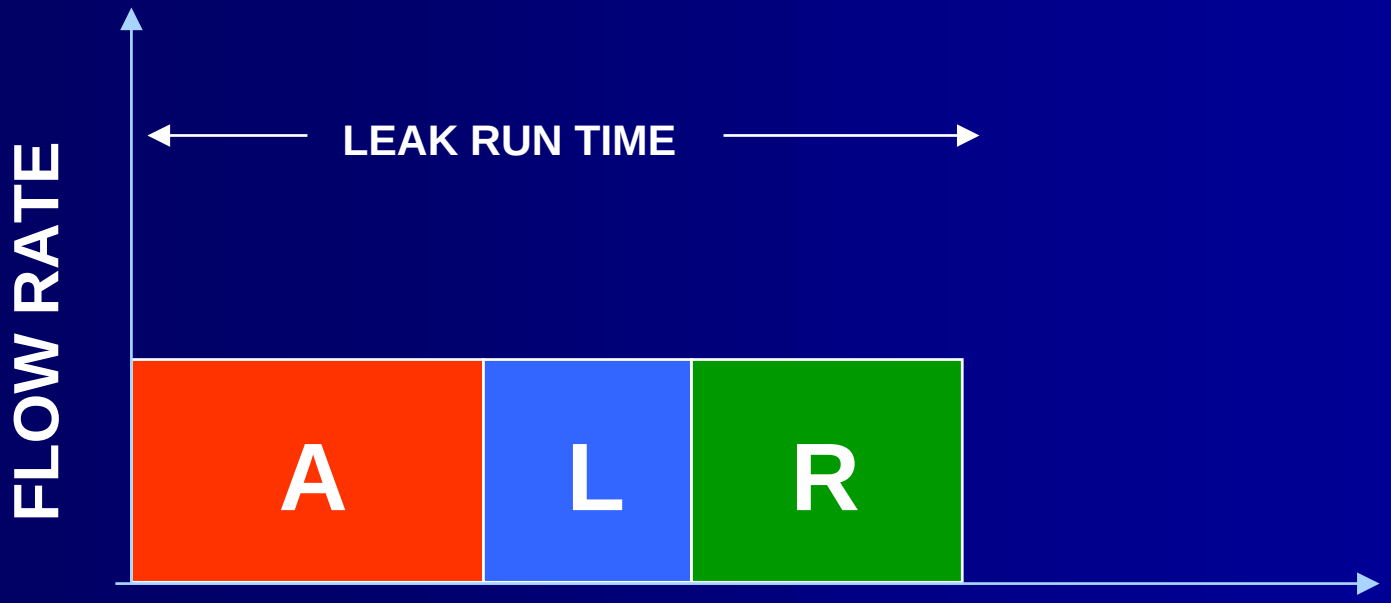
West Region: 109

East Region: 115

Central Region: 42

Leak Run Time Awareness

Leak Volume *Loss* = *(A+ L+R) Time x Flow Rate*



RUN TIME = **Awareness + Location + Repair*

*** Awareness Different for Reported & Unreported Leaks**

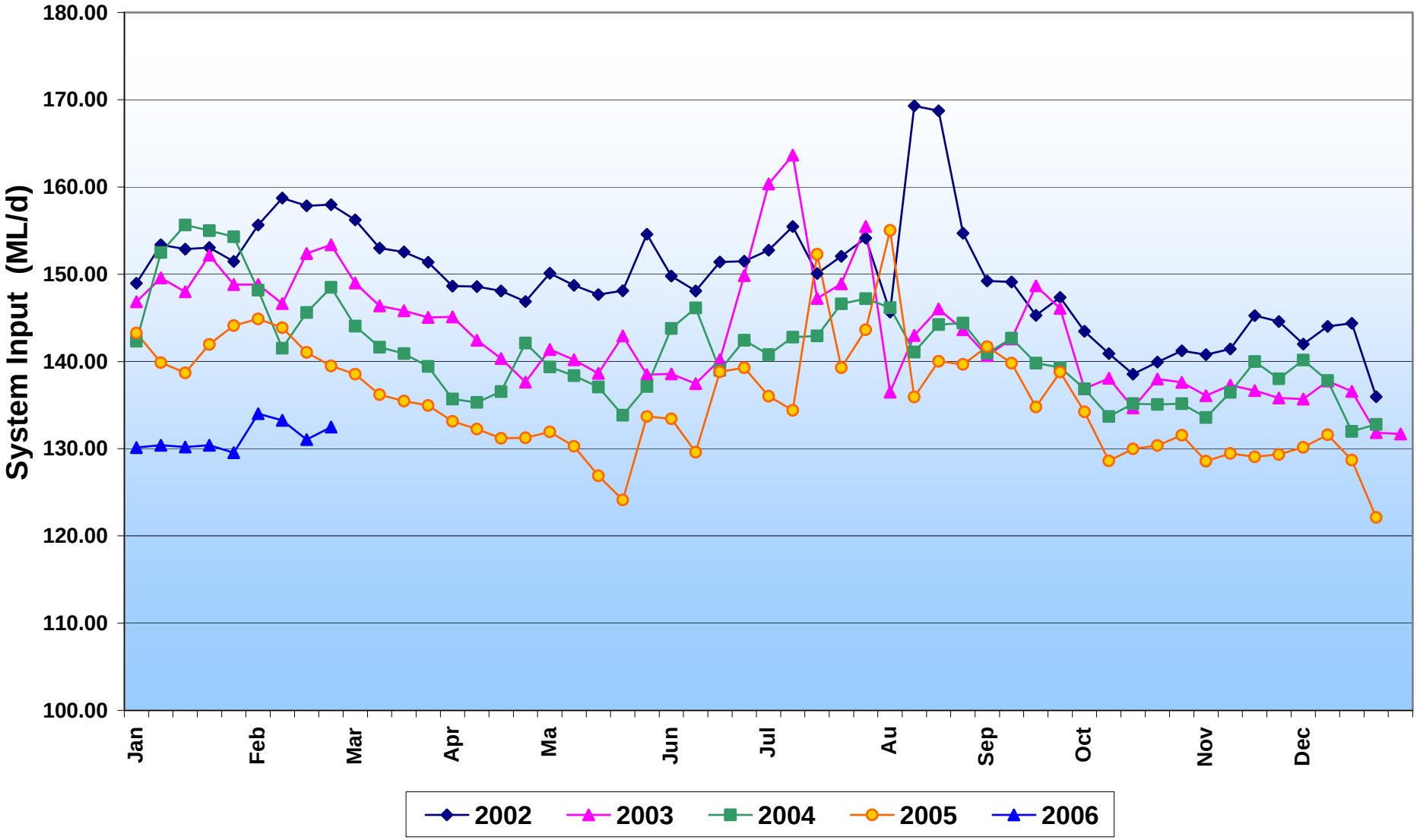
Water Loss Control Benefits

- Highly cost effective
- Improves public health protection
- Improves the level of service provided to rate payers; leaks are found in proactive manner
- Reduces property damage
- Leakage recovery often stands as the best source for new water resources for systems facing water supply shortage

HRWC Results

- System Inputs reduced from 168 MLD in 1997 to 136 MLD in 2005
- Direct annual savings of $550,000
- We are not there yet; pushing to attain economic level of leakage [another 1 MLD to give us an ILI of 3.0]
- International recognition of efforts; Involved in two AWWARF research projects, profiled by CTV Montreal, hosted IWA Leakage 2005 conference and won national FCM award

HRWC Regional System Input (ML/d)



Cross Connection Control

- Prevention of contaminants entering the distribution system from the customer's premise through backflow
- Backflow can occur when there is a reduction of pressure in the distribution system or as a result of pressurized equipment being used on the customer's premise

Cross Connection Control

- Backflow Prevention (BFP) devices are installed on service lines to high risk facilities;
  - Hospitals
  - Mortuaries
  - Laboratories
  - Port facilities
  - Sewage lift stations
  - Etc.

Typical BFP Installation

Cross Connection Control

- A Case in Point; the Halifax Dockyards Incident
- On May 18, 1995, a ship's fire protection system was to be filled from a fire hydrant near the jetty
- The flow in the hose reversed and salt water from the ship's fire protection system was discharged into the Dockyard's potable water supply
- BFPs restricted contamination to Dockyard

Continuous Monitoring and Testing

- Raw water within source lakes/tributaries
- Continuous testing is carried out as an integral part of the treatment process; labs at Pockwock and Lake Major Plants
- HRWC take water samples at 47 locations throughout distribution systems, twice a week (NSDEL Requirements)
- HRWC samples for baseline Giardia and Cryptosporidium, twice a year

Emergency Response Plans

- ERP formalized in response to Y2K
- Expanded to include more probable risks including sleet storms and communication disruptions
- Formation of Local Water Quality Committee

Local Water Quality Committee

- Formed in 1996
- Reps from HRWC, NS Department of Environment, Medical Health Officer, QE II Department of Microbiology
- Meet 3 to 4 times a year
- Addresses Water Quality issues in a proactive manner and establishes protocol for emergency response

Brief History of Nova Scotia Regulations

- 2001 – A clean water strategy was identified as a priority in the Throne Speech
- 2001/2002 – New staff hired, strategy drafted
- May 2002 – Walkerton report released
- October 2002 – Drinking Water Strategy released

Requirements of Water Strategy

- All municipal systems to obtain new operating permits by January 31, 2003
- System assessments to be filed by April 1, 2004 [completed by P.Eng.] ; report card to identify operational and capital deficiencies compared to regulations.

Requirements of Water Strategy

- Phase 1 GUDI assessment for wells by March 31, 2004
- Phase 2 & 3 GUDI assessments to be completed by March 31, 2005
- Full compliance to regulations including capital upgrades must be complete by April 1, 2008

HRWC Response

- Regulations to protect public health have merit; for example, all surface water systems will require filtration plants by 2008
- Province insistence on coagulation and redundancy of filters will be costly, especially to small systems [coagulation makes sense]
- HRWC in consultation with other municipal water utilities formed a stakeholder group through MPWANS to discuss concerns with NSEL; MPWANS formally recognized in a MOU with province on May 8, 2003

Challenges: SW Small Systems

- Issues:
  - Filter redundancy: HRWC is prepared to guarantee no unfiltered water and truck potable water if filter is down for extended period.
  - Particle removal requirements: How do we achieve 3 log Giardia removal in unattended plants?
  - Waste Guidelines: How far can we take chemical coagulation if we do not know waste requirements?

Challenges: SW Small Systems

- Middle Musquodoboit:
  - 100 Customers.
  - 6 days elevated storage.
  - One direct filter train with chemical coagulation
  - Passive waste system

Challenges: SW Small Systems

- Middle Musquodoboit: Scenario A
  - Strict enforcement of current policies
- Build membrane filtration plant:
  - Capital cost $400,000
  - Water rates go from $471 to $928 per year

Challenges: SW Small Systems

- Middle Musquodoboit: Scenario B
  - NSEL accepts certain HRWC proposals
- Optimize coagulation to meet turbidity targets
- No filter redundancy with HRWC guarantee
- UV plus direct filtration to achieve removal credits
- Current waste system is acceptable
  - Capital cost: $50,000
  - Rates increase from $471 to $576

Challenges: GW Small Systems

- Ground water small systems have annual operating costs ranging from $20,000 to $70,000 per year.
- Extra Costs accepted to date:
  - Annual operating: $5,000 in sampling and analysis costs.
  - One time capital: $22,000 for UV, chlorine and turbidity analyzers, sampling stations.

Challenges: GW Small Systems

- GUDI Ph 2 and Water Withdrawal Permits:
  - 5 GW systems have 10 wells that all failed GUDI Ph 1.
  - Cost of Ph 2 is $15,000 per well.
  - Worse case: Miller Lake with 3 wells has an increase of 100% in operating cost for the year of the screening.
  - Withdrawal permits for wells have similar cost.

Discussion of Solutions

- What scope is there for pragmatic approaches to new regulations; workshops between HRWC & NSEL.
- Spend money first on improving water quality or quality assurance.
- Funding for one time costs:
  - Federal/Provincial programs.
  - This is a national problem.


Thank You