
Wastewater Systems Reliability

By
City of Winnipeg, Water and Waste Department
for
Clean Environment Commission Hearings

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Wastewater Systems Reliability

Outline

- **Introduction**
- **Collection Systems**
- **Treatment Facilities**
- **September 16, 2002 Plant Shutdown**
- **Risk/Criticality Assessments**

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Introduction

- **Water & Waste Department Vision**
 - ◆ “Excellence in Environmental Services”
- **We value:**
 - ◆ “The important contribution our services make to the good health and quality of life of the citizens of Winnipeg”
- **We provide:**
 - ◆ Efficient reliable collection of wastewater for the protection of health and property
 - ◆ Dependable highly effective treatment of wastewater for environmental protection of river water quality

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Collection Systems

● **Statistics**

- **Approx. 2200 Km. collection sewers**
- **Approx. 130 Km. interceptor sewers**
- **71 wastewater lift stations**
- **Approx. 182,000 customer connections**

● **Design & Operation**

- **Gravity flow in collection sewers and interceptors**
- **Redundant pumping units in lift stations**
- **Power interruption to lift stations**
 - ▶ **System storage**
 - ▶ **High level overflows**
 - ▶ **Stand-by power**
- **Monitoring and alarm system**

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Collection Systems - Asset Management

- Sewer condition assessment
- Sewer renewal program
 - \$11.5 million per year
- Basement flood relief program
 - \$7.5 million per year

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Treatment Facilities

- **Three treatment plants**
- **Reliability, redundancy, standardization and flexibility are integral to design**
- **Water Environment Federation Manual of Practice No. 8 provides guidelines for reliability**
- **City's plants meet or exceed reliability guidelines**
- **Vital components designed to allow repair or replacement without interrupting treatment**

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Treatment Facilities – Reliability Examples

● Pumping

- ◆ multiple units, capacity can be provided with largest pump out of service

● Process

- ◆ multiple trains provide redundancy so that one can be removed from service while maintaining treatment

● Electrical

- ◆ two separate power feeds or stand-by power

● Computer Control Systems

- ◆ duplicate process modules provided for each function plus uninterruptible power supply

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September 16, 2002 Plant Shutdown

- Why a reliability review is required



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September 16, 2002 Plant Shutdown

- Maintenance planned on one of six raw sewage pumps
- Broken guide inside 36" gate valve on pump suction
- Valve lodged open by about 13.5 inches
- Raw sewage flowed into three 57-foot deep pump wells flooding all 6 raw sewage pumps
- Sewage couldn't be pumped through treatment process
- Overflow duration estimated at about 2 day and 9 hours
- Approx. 427 ML of untreated wastewater spilled to Red River



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September 16, 2002 Plant Shutdown

Response

- Immediately informed Manitoba Conservation, Environment Canada, Public Health officials, and downstream municipalities
- Daily media releases issued
- Intensive Daily Monitoring Initiated immediately
 - Upstream at Provencher Bridge to downstream past Selkirk
- Undertook analyses to predict downstream impacts
- Booms installed at 8 overflow locations



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September 16, 2002 Plant Shutdown

Recovery

- Department staff worked around the clock to restore service
- Electric motors removed and cleaned, dried, serviced before re-installation
- Full treatment restored by September 19 @ 2:00 a.m.
- Retained consultant services to:
 - ➔ Investigate cause of valve failure
 - ➔ Coordinate activities to remove and replace valve
 - ➔ Design temporary bulkhead between pumpwells
 - ➔ Inspect other 5 pump suction valves



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River Quality Impacts

- Higher river flows than normal, cool temps
- Overflow approximately 1 to 1.5% of river flow
- Reduced Dissolved Oxygen (DO)
 - Lowest DO level immediately upstream of Lockport, 5.4 mg/L
 - Downstream of Lockport 8.0 mg/L minimum
 - Above minimum level set by Province of 5 mg/L to protect aquatic life
- Elevated bacteria (fecal coliform) levels
- Odour, Floating Debris

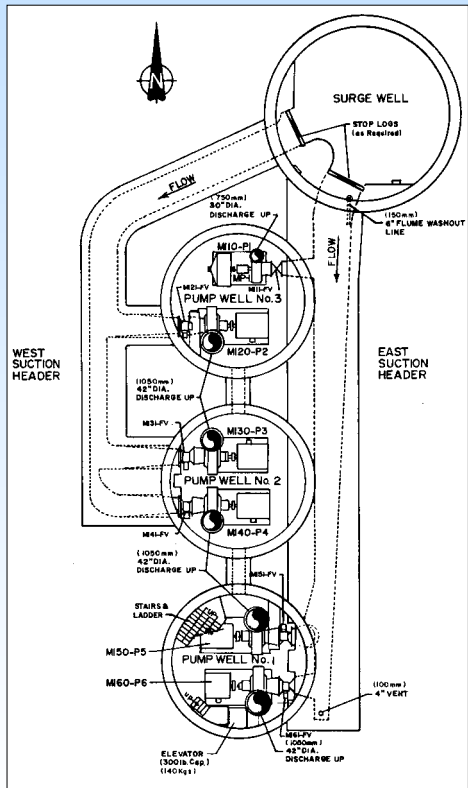
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September 16, 2002 Plant Shutdown

Immediate Action:

- Isolate the 3 pump wells at NEWPCC
- Develop written procedures for critical operations
- Review training
- Evaluate gate installation on the main interceptor to NEWPCC to isolate plant
- Consider recommendations of other reviews being undertaken by:
 - ▶ Province of Manitoba
 - ▶ Environment Canada
 - ▶ City of Winnipeg (independent review by Associated Engineering)



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Risk/Criticality Assessments

- **City to undertake Risk and Criticality Assessments at the three WPCCs**
 - **Assess reliability and backup capability of treatment systems**
- **Criticality assessment**
 - **Characterize system**
 - **Determine critical assets**
 - **Identify significant failures/adverse consequences**
 - **Assess likelihood of failure**
 - **Evaluate existing countermeasures**
 - **Estimate mitigation costs, and develop risk reduction plan**
 - **Implement mitigation measures to prevent future unplanned shutdowns**
- **12-month study, to be complete in 2004**