



**Environmental
Hydraulics
Group**

Hydraulic Transients (HT)
- Water & Sewage

Project: Computer Model and Tests of Pipe Leakage – Event Investigation

1990-351

Location: Chesterville, Ontario, Canada

Client: Ontario Ministry of the Environment (MOE)

Completed: March 1991

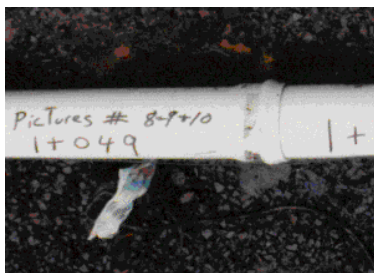
Description: EHG investigated leakage in a new 200 mm diameter, 4 km long water pipeline. Within three months of commissioning the new pump station, over 20 pipe leaks had been recorded and more were found daily. EHG was retained to identify the causes and to suggest remedial works.

Findings: Field investigations and computer modeling led to the following conclusions:

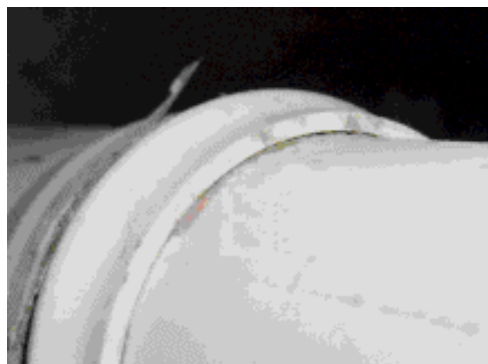
- i) Numerical modeling did not predict high transient pressures upon pump shutdown or start up. However, severe sub-atmospheric pressures were predicted along most of the line upon each pump shutdown. This meant that during normal pump operating conditions groundwater, air, sand, and debris could get sucked back into the line (while pressure was lower than outside it).
- ii) In-site investigation of a leaking pipe section revealed that a large amount of fine sand and debris had been sucked into the line as evidenced by sand jammed into pipe joints (photos a & b) and inside the pipe near the failed joints (photo c). Cracks large enough to allow such intrusion would result in significant leakage upon the resumption of pumping operations and positive pressures.
- iii) EHG suggested that tests be conducted at an independent laboratory (discussed in 1990-353 project sheet) to determine the conditions under which pipe joints would be susceptible to sub-atmospheric pressures and intrusion. Were leaks due to poor installation, joint geometry or gasket design? This was tested in the lab under practical and controlled conditions.

Benefits to the Client: EHG identified the cause of leaks and suggested remedial measures to protect against low pressure including: increased pump control valve closing and opening times, replacement of the upstream part of the pipeline, and installation of air vacuum and release valves at two local points and of a pressure sustaining valve at the downstream end. Leaks did not reoccur.

a) Excavated Pipe Section at Leakage Location



b) Pipe Joint Jammed by Sand & Dust Residue



c) Sample of Failed Pipe Joint

