



**Environmental
Hydraulics
Group**

Hydraulic Transients (HT)
- Water & Sewage

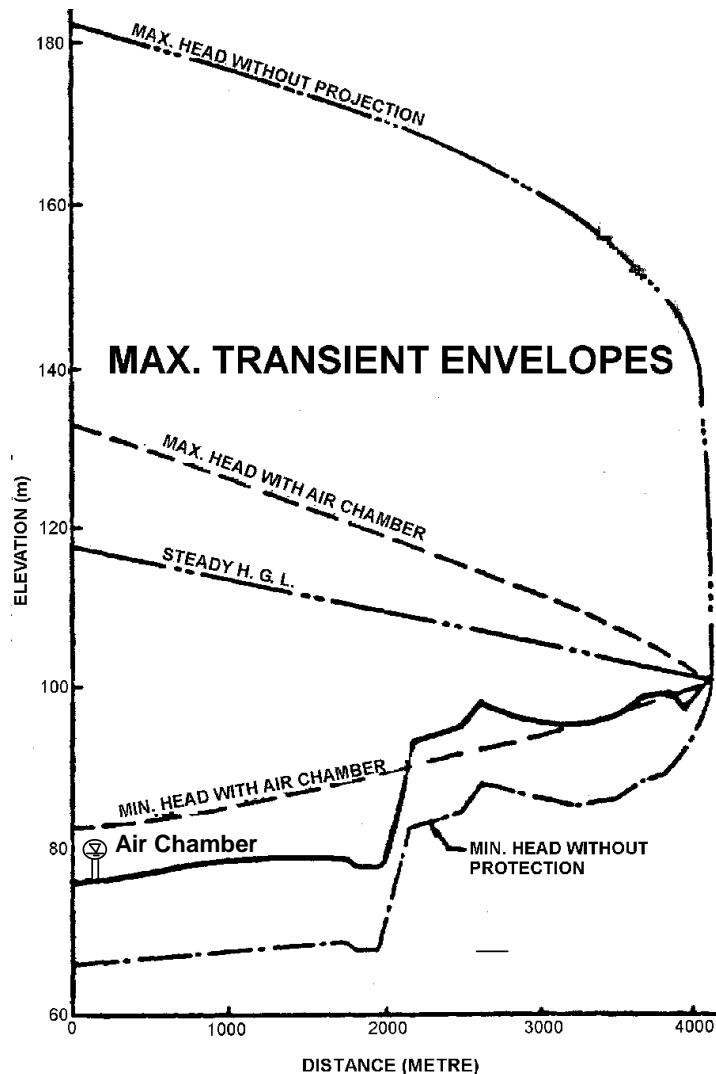
Project: Carruthers Creek Sanitary Forcemain
Transients

1989-091

Location: Ajax, Ontario

Client: M.M. Dillon Ltd.

Completed: 1989



Description: EHG reviewed and updated the hydraulic transient (HT) analysis for the Carruthers Creek sanitary forcemain (2 years after EHG's original analysis). The forcemain is 4.1 km in length, 750 mm in diameter, and conveys a flow of 980 L/s. The focus was on the air chamber installation which provides surge protection.

Findings:

- HT in the system caused vapour pressure conditions to occur over most of the line, with large cavities or pockets at vertical bends (or knees). Intolerably high pressures were predicted during the subsequent upsurge.
- EHG recommended changes to the air chamber to eliminate vapour pressure and to safely limit upsurge pressures.
- During normal operations (i.e. pump shifting or sequential shut-down or start-up) the water level inside the chamber may drop, potentially allowing air into the pipe system. This condition is undesirable due to its frequent occurrence.

Benefits to the Client: EHG showed the existing air chamber installation could be modified to safely control surges.

The following modifications were suggested:

- Suitable changes to the air chamber to effectively eliminate vacuum and high upsurge pressures.
- The riser connecting the top of the pipeline to the bottom of the air chamber was modified to prevent air from entering the pipe.
- Operational procedures were recommended for normal and emergency conditions.

Value Added: EHG's input reduced the risk of pipe breaks during power failures while improving day-to-day operations to maximize infrastructure life and address local hydraulic constraints. The review led to a solution that fit the available chamber and building space, resulting in a high return on investment (ROI) for the additional design effort spent by EHG.