

### Introduction

MMI Engineering's water experts have specialist knowledge in the analysis of pressure surge ("Water Hammer") events in piping systems and can determine safety critical conditions before recommending necessary suppression equipment. MMI's Surge Analysis team are highly experienced in the use of generalised surge analysis software packages, to solve problems associated with equipment operation, such as pump start-up/stop trip, valve actuations and pipe failures.

### Water Hammer

Surge or "Water Hammer" is an effect that occurs due to a sudden change in conditions in a pressurised flow system. Due to its momentum and weak compressibility, a flowing column of liquid cannot stop immediately and large pressure transients can travel rapidly through the system. Positive pressure transients in surge can typically significantly exceed the normal operating pressure, and so pipelines and fittings must be designed to withstand this, or additional surge protection must be provided. Negative surge pressure transients can develop almost total vacuum conditions and cause pipe collapse, or in potable water systems, pollution to the drinking water due to groundwater ingress. Vapour pocket formation and subsequent cavity collapse can also be a significant issue at high points in any system.

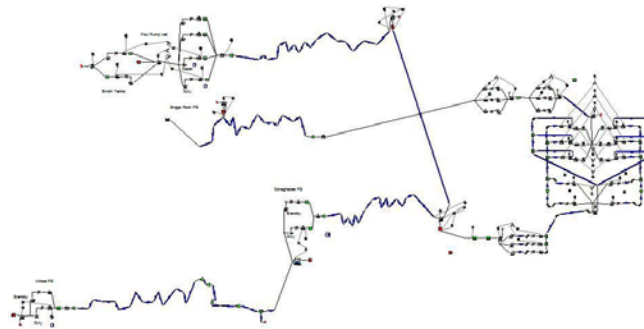


Figure 1: Sample wastewater collection, sequence batch reactor facility & transfer system

### Water Supply / Waste Water Transfer

In water systems, surge protection is usually provided by surge vessels in the system – these are cylinders containing water and an optimum volume of gas under normal operation. In waste water applications the vessels typically include a bladder to keep the air and waste water separate. When a pressure wave passes the vessel, it is attenuated by the contraction/expansion of the air pocket. MMI can advise on the optimum size, minimum air/water volume and placement of surge vessels. Differential flow inlet arrangements can be optimised to reduce the size of vessels if space constraints prevent the use of a conventional surge vessel. Alternatively, modifications to a system's control (e.g. valve actuation times) or equipment (e.g. pump selection) can be advised to mitigate the causes of surge.

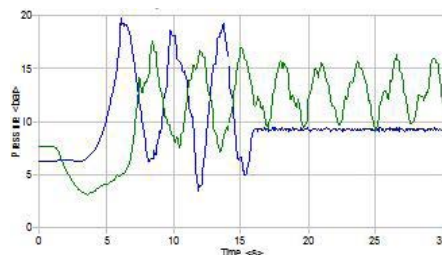


Figure 2: Typical Surge Pressure Results

### Value Added

MMI Engineering can assess the water hammer issues in any piping system and recommend surge equipment or revised operational control to suppress or prevent excessively high or low system pressures that could lead to system failure.