Test Report

Effective Cleaning of Water Mains
WHICH METHOD WORKS BEST AND WHY?

In this report we compare three of the most commonly used methodologies for cleaning Water Mains and provide laboratory test results.

Horizon Industrial Pty Ltd provides a complete range of specialist Pipeline Services to customers throughout Australia, South East Asia and the Pacific Region including:

- Air Scouring Services
- Pipeline Pigging Services
- Pipeline Cleaning & Disinfection
- Planning & Installation of Reticulation Systems
- Pipeline Pigging System Design & Supply
- Supply of consumables such as Pipeline Pigs
- Supervisory Services

Preamble
Water Authorities and service providers have differing views on the most effective methods for cleaning potable water reticulation and transmission mains. In this test the same section of pipe was cleaned 3 (three) times in succession and the water quality was tested during each procedure and again after the mains was re-charged and placed back on-line.

The following cleaning methods were employed:

1. Flushing
2. Air Scouring
3. Pipeline Pigging

1. Flushing
When flushing a pipe section the line is opened to atmosphere at full flow and pressure. The high velocity flow rate is designed to dislodge and remove debris and turbidity from the internal bore.

It was found that whilst this method provided some cleaning efficiency, it used large volumes of water and the majority of debris was not removed. The procedure was found to be both inefficient and ineffective.
2. Air Scouring
Air Scouring uses turbulent flow to clean the Mains by introducing a balanced mixture of clean filtered compressed air and water into the pipeline.

This method was more effective and efficient than Flushing, and is particularly suited to smaller pipe diameters up to DN200 and distances of less than 1,000 metres. The introduced turbulence removed debris such as bio-films, scale, rust, silt and other contaminants. This procedure was more efficient than Flushing and provided a significantly better result when the water was tested.

3. Pipeline Pigging
This specialised technology utilises Pipeline Pigs, devices that are propelled through the line to clear and clean debris from the internal bore. Many different types of Pipeline Pigs are available to cater for a range of duties. In some cases Pipeline Pigs are capable of deforming by up to 80% of their original size and are often used in Multi-Diameter Pipelines. Pipeline Pigs can be used for cleaning over long distances which increases the level of cost-effectiveness against other cleaning methods.

The results from cleaning the same pipe section employing a Pipeline Pig are exceptional. The levels of suspended solids, COD and other impurities removed from the line were many times greater than those achieved by Flushing or Air Scouring.

The test results prove that Pipeline Pigging is far superior to both Flushing and Air Scouring and whilst the costs associated with Pipeline Pigging are usually higher than the other methods, the net cost is comparable as the frequency of cleaning cycles is significantly reduced due to the high levels of cleanliness achieved.
Test Results

The test samples below were taken during each procedure and again after the main had been recharged and back on line.

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Flushing</th>
<th>Air Scouring</th>
<th>Pigging</th>
<th>Recharged</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH mg/L</td>
<td>7.0</td>
<td>7.1</td>
<td>7.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Suspended Solids</td>
<td>309</td>
<td>110</td>
<td>3930</td>
<td>-4</td>
</tr>
<tr>
<td>COD (Chemical Oxygen Demand)</td>
<td>24</td>
<td>11</td>
<td>931</td>
<td>5</td>
</tr>
<tr>
<td>Total Phosphorous</td>
<td>0.2</td>
<td>0.3</td>
<td>1.2</td>
<td>-0.1</td>
</tr>
<tr>
<td>Kjeldahl N</td>
<td>2.2</td>
<td>1.3</td>
<td>24.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Nitrate N</td>
<td>-0.1</td>
<td>0.6</td>
<td>0.7</td>
<td>-0.1</td>
</tr>
<tr>
<td>Nitrate N</td>
<td>0.3</td>
<td>0.1</td>
<td>-0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>2.5</td>
<td>2.0</td>
<td>25.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Aluminium</td>
<td>0.27</td>
<td>0.10</td>
<td>9.9</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

Test Notes:

- Ph neutral is 7. Less than Ph 7, the water becomes acidic and breaks down chloride.
- A higher Ph level than 7 is alkaline and 7.5 is considered to be a good level.
- Suspended solids of less than 20ppm after cleaning is deemed acceptable.
- COD (chemical oxygen demand) is a chemical analysis of water. The more chemicals there are in the water, the more oxygen levels are decreased and this can lead to the water becoming stale or odorous. Less than 100g is considered acceptable.
- Total Phosphorous measures the amount of organic material and bacteria in the water.
- Nitrite levels are reduced if Nitrate levels are high.
- If Nitrate is high this will encourage growths such as algae
- Total Nitrogen is the total of nitrogens present as above.
- Alum is used for water clarity. The Aluminium readings above were found to be present in Alum.

About HORIZON Industrial

Horizon Industrial possesses a wealth of field-proven experience, having completed many pipeline cleaning and rehabilitation projects for customers, for more than 25 years. This experience equals a high level of service, quality and safety through sound knowledge and understanding of pipeline systems.

Our project portfolio includes Pigging and Air Scouring pipelines ranging in size from 2” (50mm) through 95” (2,400mm) along with multi-diameter pipelines. In addition to cleaning transmission and reticulation mains HORIZON Industrial also cleans sewerage mains, wastewater mains, fire services mains and raw water mains.

Our expertise encompasses the removal of deposits such as Calcium Carbonate, Manganese Iron, Bio-Films and other organic materials, through to “high compaction” debris such as sand and silt. Fully trained technicians employ high efficiency cleaning equipment and associated products to ensure the end result meets or exceeds our customer’s expectations in the shortest possible time and with minimum interruption to supply.