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Métodos Não Destrutivos

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Methods for Rehabilitation of Water Mains

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Water Losses

- 50% of the World's population live in urban areas
- On average, 30% of drinking water is lost from distribution systems, up to 80% in the worst cases
- Water consumption is expected to increase by 40% in 2025 when 33% of the world population will be affected by shortages
- Only 10% of leaks are visible above ground

WE HAVE A MAJOR PROBLEM WITH OUR WATER NETWORKS

Materials of Choice

Traditional

- Cast Iron
- Steel
- Asbestos Cement
- Reinforced Concrete

Modern

- Plastic Coated Ductile Iron
- Fibre Reinforced Plastic
- PCCP
- Polyethylene
- PVC

**OUR HISTORIC CHOICES HAVE BEEN POOR AND MODERN
CONSTRUCTION METHODS COULD DO BETTER**

Corrosion and Ageing

- >50% of CI, DI and Steel is unprotected and prone to stray currents and corrosive soils
- Asbestos Cement is 30-50 years old and prone to attack from acid water and soil
- Cement based pipe is subject to leaching in acid soils
- Steel reinforcement may be embrittled and corroding

Detection Methods

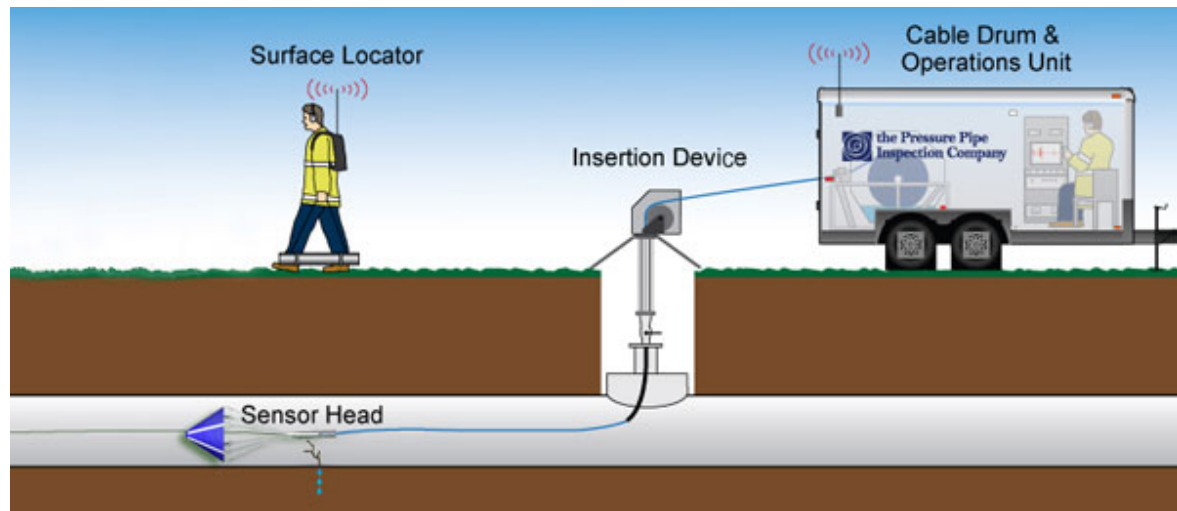
- Observation of 'Red Water'
- Investigation of flow and pressure loss
- Inspection of exposed pipe sections
- External Acoustic sensors
- Hydrogen tracer gas methods
- Internal Acoustic sensors
- Ultrasonic wall thickness and coating monitors
- Eddy current and electromagnetic sensors

HYDROGEN METHOD

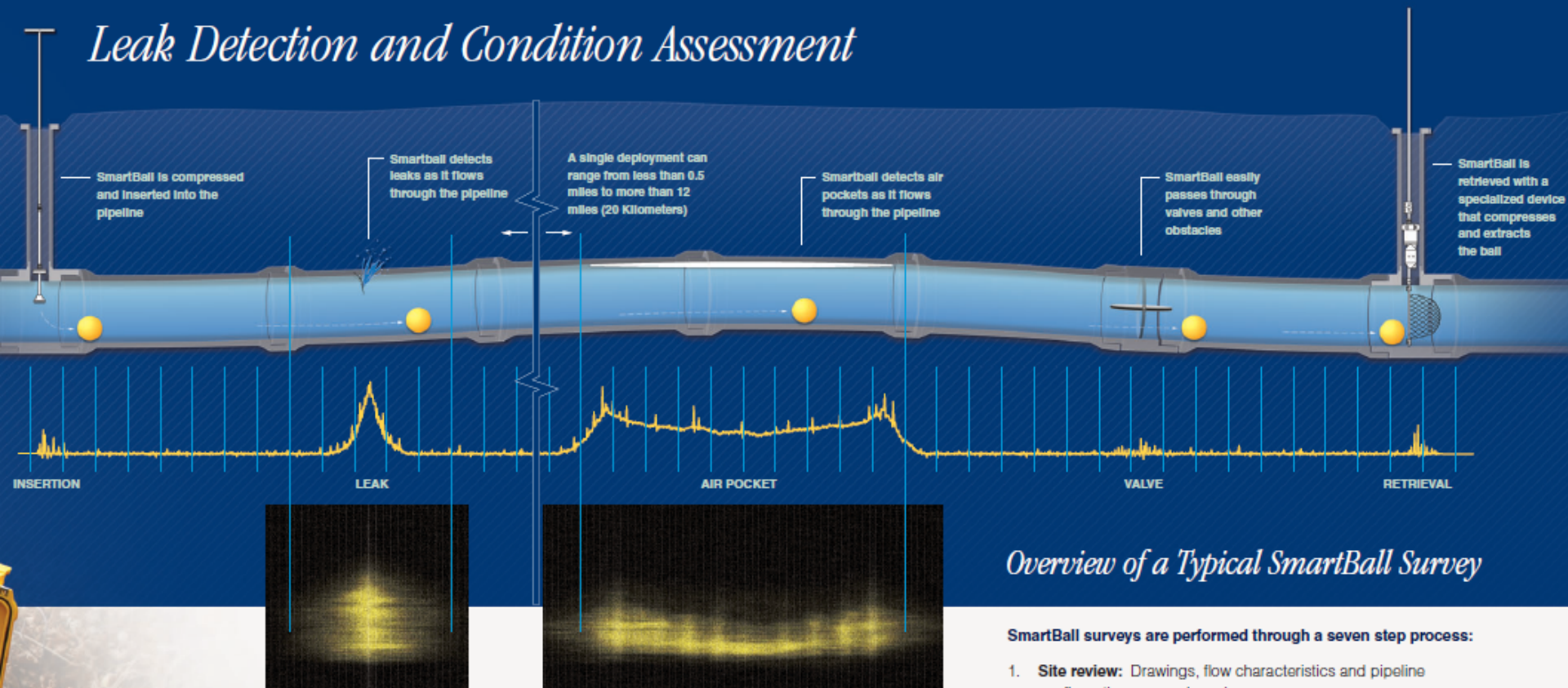


Ideally drain and fill with tracer gas mix (95% Nitrogen 5% Hydrogen) or inject gas into water, detect and measure H concentration at surface to locate leak at peak concentration

Acoustic Methods



Leak Detection and Condition Assessment



Overview of a Typical SmartBall Survey

SmartBall surveys are performed through a seven step process:

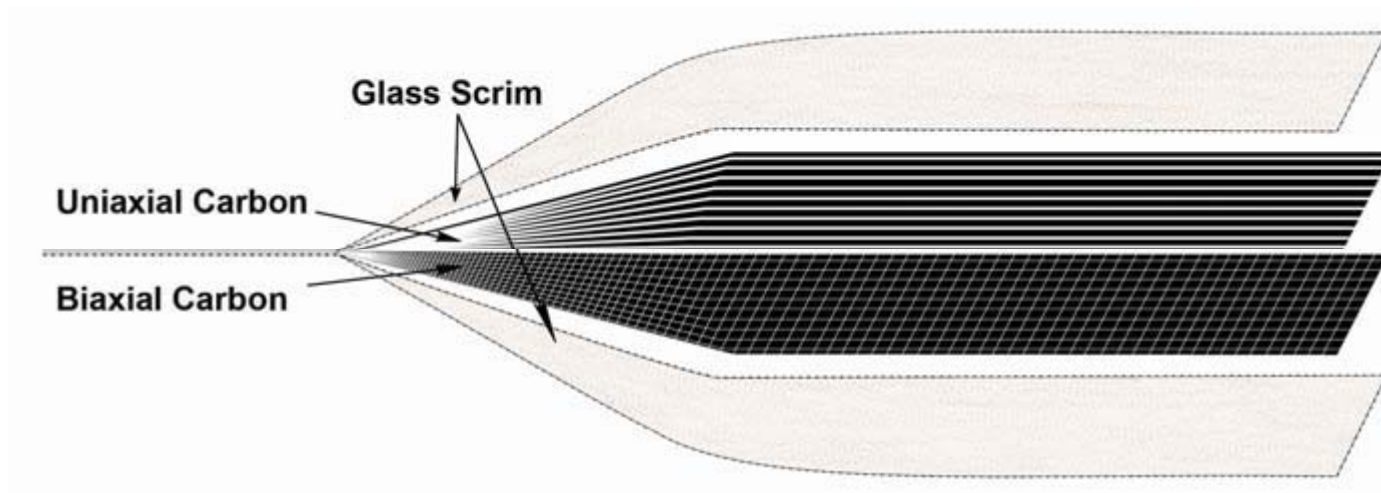
1. **Site review:** Drawings, flow characteristics and pipeline configurations are reviewed.

Rehabilitation Methods

- Joint repair clamps
- Short length patch repairs
- Internal Spray Linings
- Semistructural bonded and independent liners
- Fully structural close fitting liners
- Pipe upsizing or replacement by bursting



Pipe Repair Clamps



QuakeWrap – Epoxy bonded Carbon and Glass Fibre Superlaminates

ASTM Classification

Class 4

Class 3

Class 2

Class 1

Liner characteristics

Class A

Class B

Class C

Class D

Can survive internally or externally induced (burst, bending or shear) failure of host pipe

✓

-

-

-

Long-term pressure rating \geq maximum allowable operating pressure (MAOP)

✓

-

-

-

Inherent ring stiffness¹⁾

✓

✓

- 2)

- 2)

Long-term hole and gap spanning at MAOP

✓

✓³⁾

✓

-

Provides internal barrier layer⁴⁾

✓

✓

✓

✓

NOTES: 1) minimum requirement is for liner to be self-supporting when pipe is depressurized

2) relies on adhesion to the host pipe to be self-supporting when depressurized

3) becomes sufficiently close-fit for radial transfer of internal pressure stress to host pipe, either during installation or within a short period from initial application of operating pressure

4) serves as barrier to corrosion, abrasion and/or tuberculation/scaling of host pipe, and to contamination of pipe contents by host pipe; also generally reduces surface roughness for improved flow capacity

Whirlwind



- Patented Technology for 3-12” Pipe
- Yorkshire Water and Balfour Beatty have cleaned 150-200miles of mains
- Uses natural stone as cutting medium – ease of disposal
- Highly rated means of cleaning heavily corroded pipe
- Cost competitive and highly productive



Cement Mortar Lining

Epoxy Spray Lining – Sub Terra ELC 173/90 and ELC 257/91

Polyurethane Spray Lining – FastLine Plus™

Cured in Place Linings

- Insituform PPL (Semi Structural)
- Insituform RPP (Fully Structural)
- Insitumain (Fully Structural)
- Sekisui Tubetex (Semi Structural)
- Sekisui Nordipipe (Fully Structural)
- Sanexen Aquapipe (Fully Structural)

Plastic coated woven or non woven liner polyester, glass , kevlar or carbon fibre fabrics impregnated with epoxy resin, inflated or inverted and cured with steam or hot water. Proprietary end seals and connections

Potable Water CIPP



Sanexen Aquapipe™

DN150-300

Polyester Jacket+Epoxy

InsituMain™

DN150-300-900mm

Glass Fibre Jacket+Epoxy

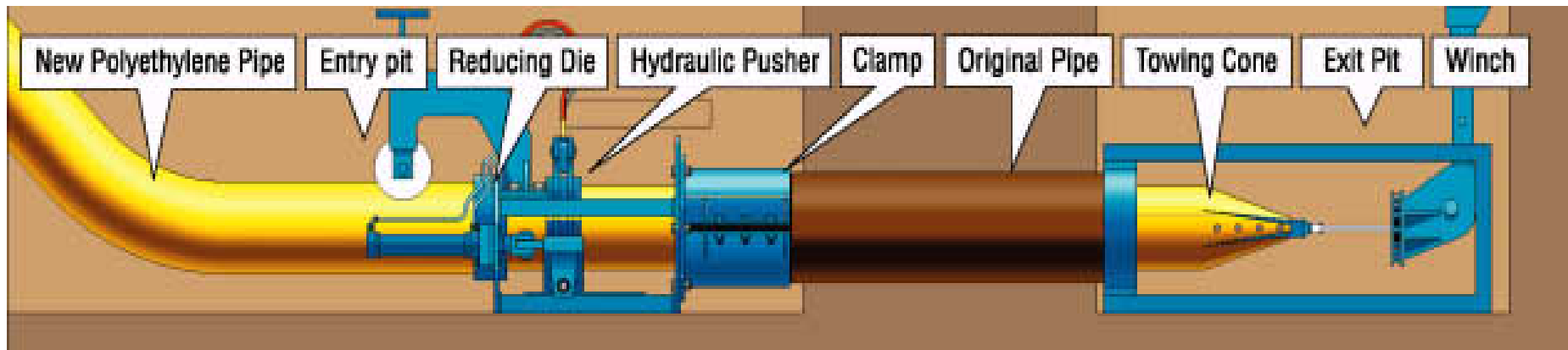
Fully Structural 10bar AWWA Class IV

NSF 61 Approved

Close Fit PE Linings

- Swagelining
- Rolldown
- Subline
- Subcoil
- Titeliner
- InsituGuard (Flexing and Folding)

PE 80 or 100, SDR 11 and up, pulled through a die or folded to reduce cross section, pulled or inserted into the main and relaxed or reverted to form a tight fitting liner. Proprietary fusion or electro formed seals and connections



Pipe is reduced by Pulling through a die or roller box in the Swagelining ,Titeliner or InsituGuard Process

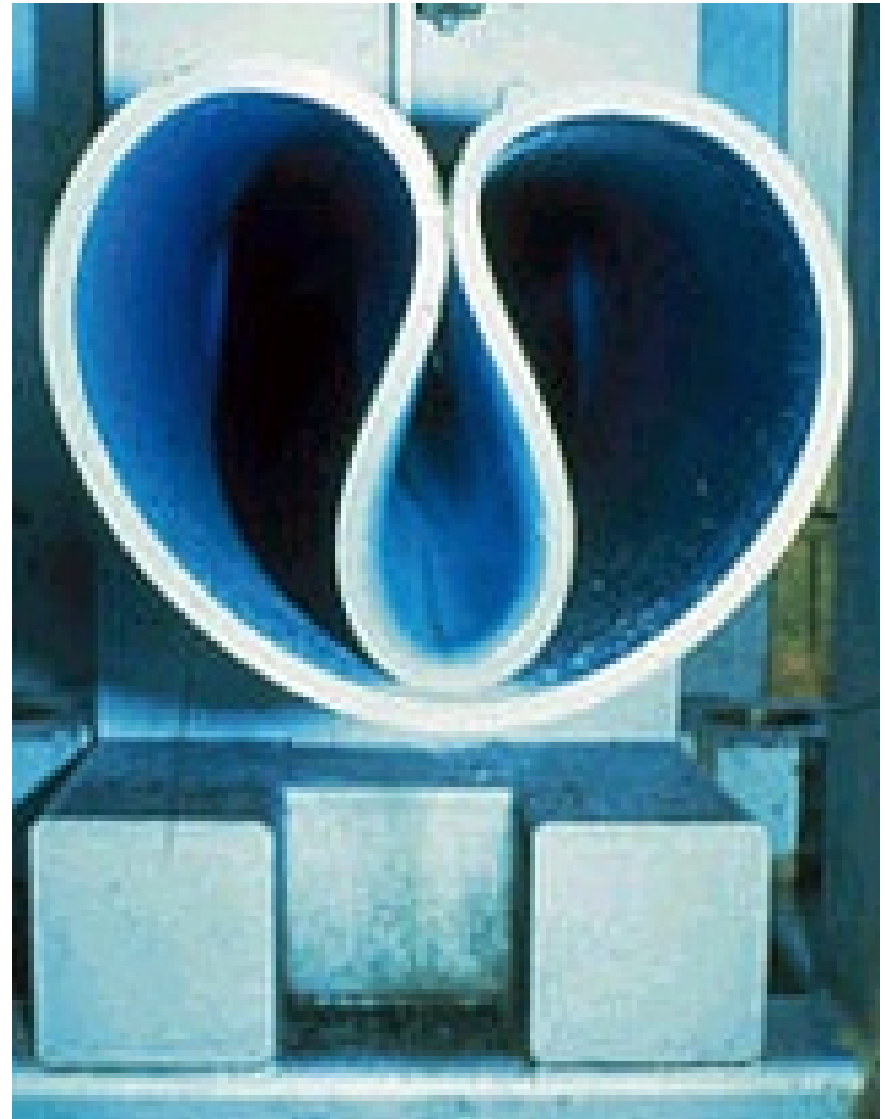
In Rolldown the pipe is pushed through the rollers . Pipe recovers on release of tension or is reverted with water pressure



Folding Process

This principle is used in Subline, Subcoil, InsituGuard EX Pipe, Omega Pipe, Ultra Liner AM liner. Smaller diameters (<450) are usually factory folded.

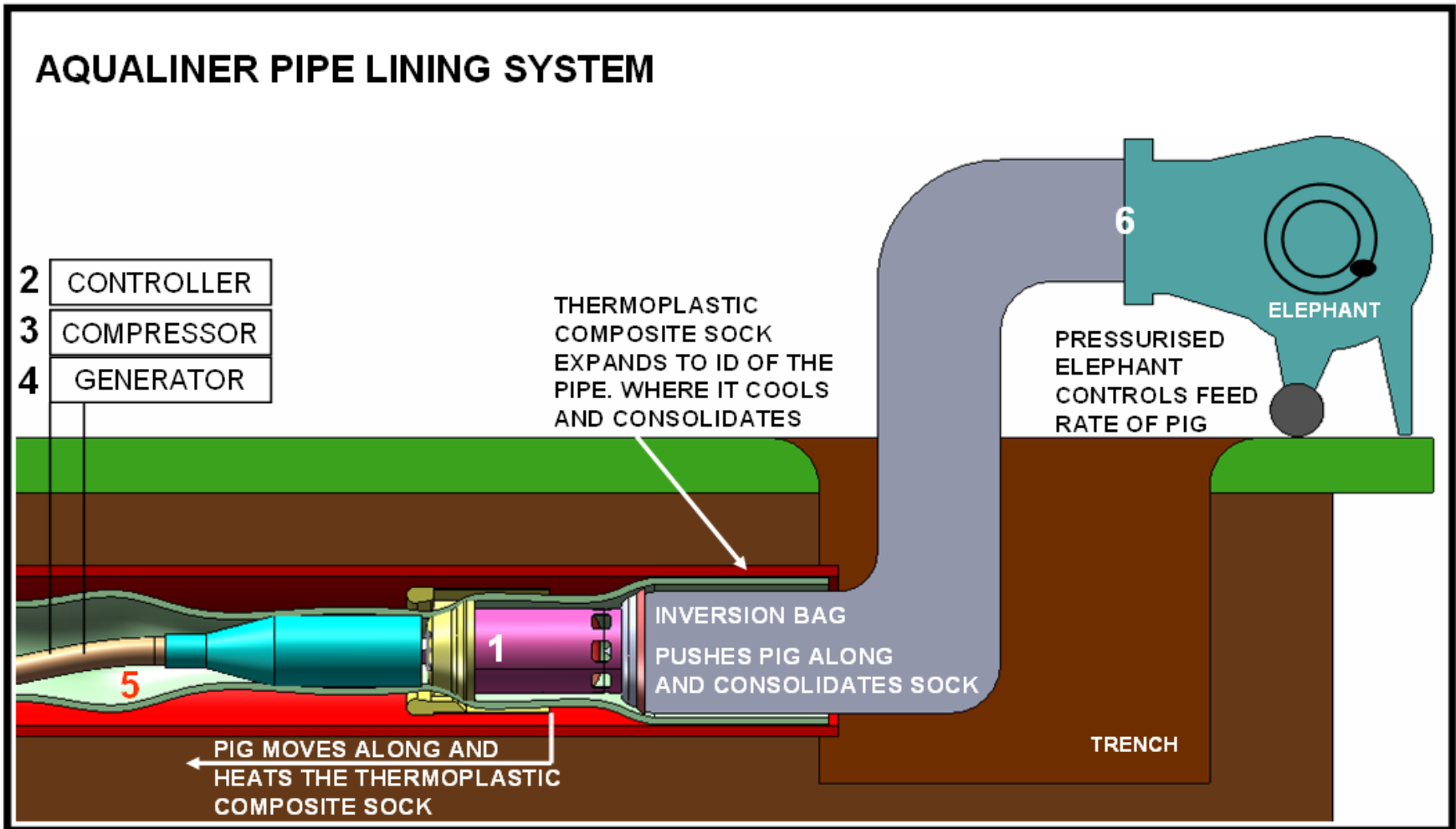
Folded liners are reverted with water or steam pressure



Melt in Place Pipe

- Aqualiner – developed in UK by EPL
- Stake holders Anglian, Yorkshire & Severn Trent Water
- WRc Approved
- NSF 61 Certified
- BS6920 & DWI Reg 31 (in process)
- Successful trials in sewer applications

Glass and polypropylene fibre sock 150-300mm heated to 210C and pressed against the pipe wall to consolidate forming a 3mm 10 bar stand alone liner



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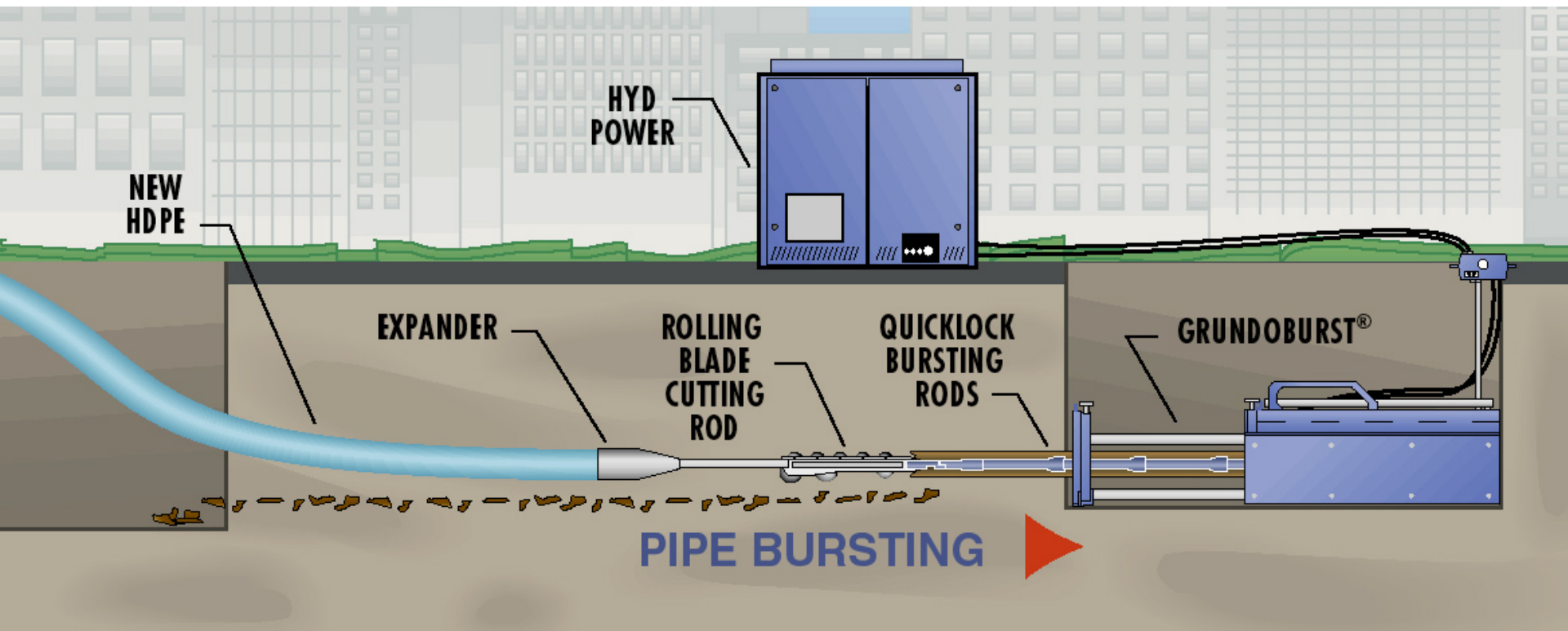
Conserving future water supplies

Spin Welded Ferrules

Stand Alone Hose Liners

- Thermopipe – woven polyester hose encapsulated in PE coating, good for 10 bar and pipe to 300mm for water applications
- Primus Line – woven kevlar hose encapsulated in PE or Polyurethane coating – good for up to 40 bar and pipe to 500mm for water, oil and gas applications.

Pipe Bursting can replace or upsize providing a new long life polyethylene or pvc pipe along the alignment of the existing pipe.



New pipe can be provided without major excavation

by

- Directional Drilling
- Impact Molding
- Pipe Ramming
- Auger Boring
- Microtunnelling

There is almost always a trenchless solution