No-Dig Leak Repair: From Concept to Reality

Ofwat Innovation Fund WBC4 Transform Project

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25th Annual Leakage Conference, 2-3 December 2024
Birmingham Conference and Events Centre

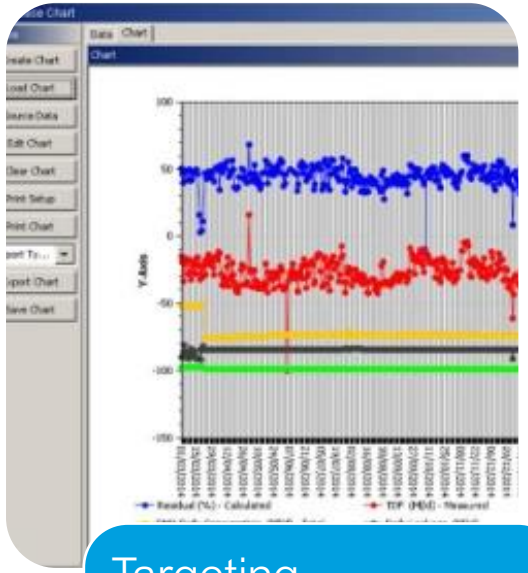
No-Dig Leak Repair

Agenda

1. Traditional leak repair process
2. Why we're interested in no-dig repairs and what we mean by them
3. The journey to the project kicking-off
4. Technical requirements
5. Technology concept and sub-system possibilities
6. Project headlines

No-Dig Leak Repair

Typical leak locating process – not the subject of this project



Targeting

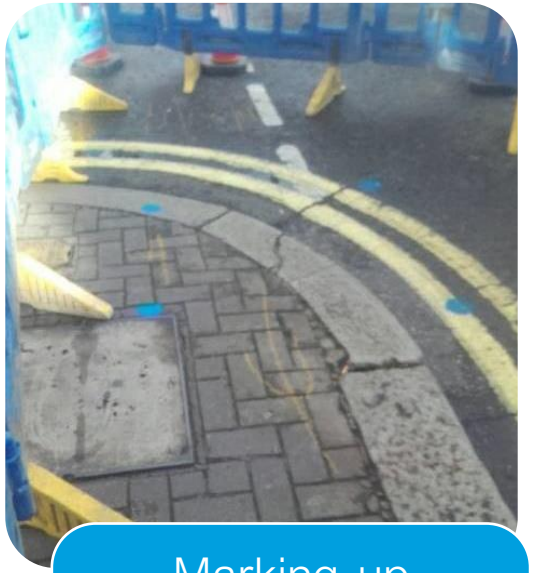
- District Metered Area (DMA) analysis
- Acoustic loggers
- Hydraulic modelling
- Satellite image analysis
- Other methods

Detecting

- Listening stick (valves, hydrants, stop taps)
- Leak noise correlation
- Step testing

Pinpointing

- Listening stick
- Ground microphone
- Leak noise correlation



Marking-up

- Typically 1m square

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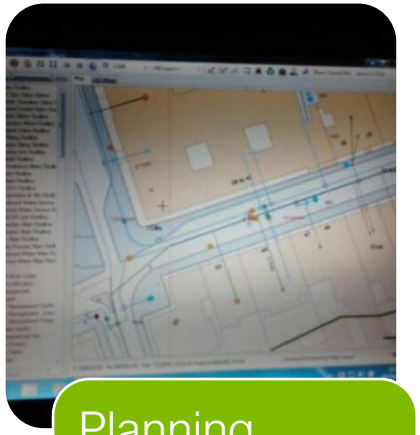
Traditional dig-based leak repair process – what we want to innovate away from

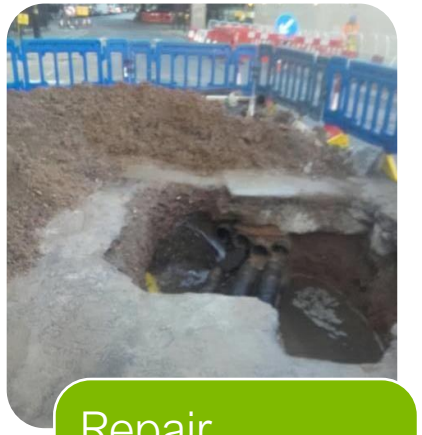


Planning

- Traffic management
- Scheduling
- Liaison with highway authority / streetworks permit
- Operational enabling
- Customer notifications

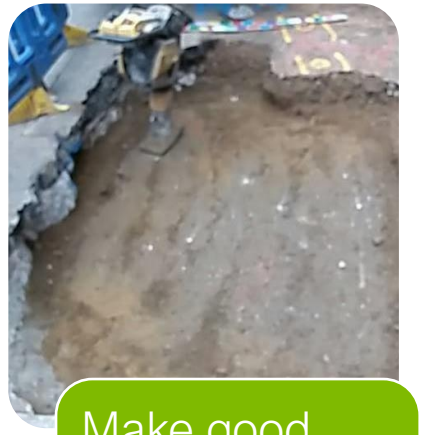
Site set-up

- Signage and temporary traffic lights
- Guarding
- Buried utility tracing



Repair

- Excavation
- Pump-out
- Mains throttling/isolation
- Pipe repair



Make good

- Backfill
- Surface reinstatement

Site clearance

No-Dig Leak Repair

Water main failures and current repair methods

Failed joint seal

Ring fracture

Longitudinal fracture

Pinhole

Failed repair

Blow-out

Failed ferrule*

Repair clamp

Encapsulation collar

Pipe cut-out

Ferrule exchange*

Others:

- Welding
- Tape wrap
- Joint repair clamp

*ferrules aren't strictly considered to be part of the water main

No-Dig Leak Repair

Key issues with traditional repair

Cycle time

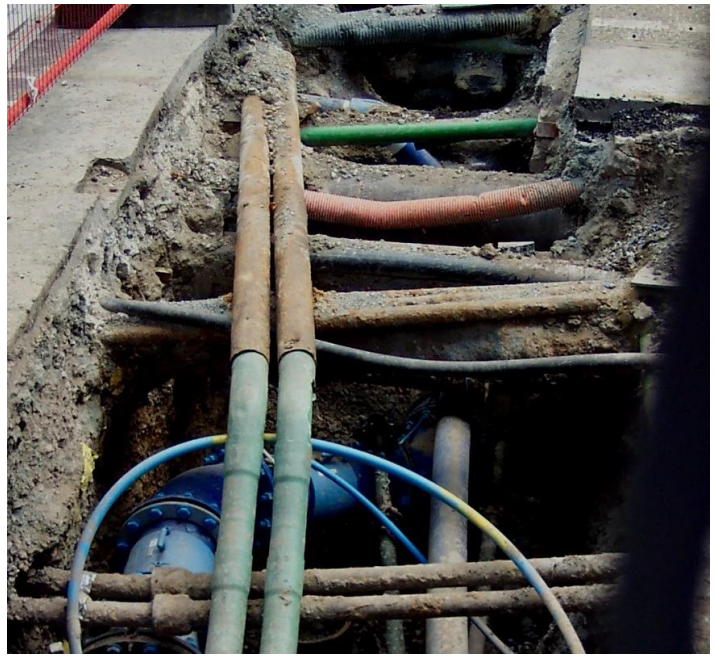
- More water lost through leakage
- Cost of multiple activities

Transport disruption

- Inconvenience, poor perception
- Societal cost

Damage to other utilities and roads

- Safety risk
- Additional costs



No-Dig Leak Repair

Why are we interested in no-dig leak repairs?

- [There's no need to tell the Annual Leakage Conference the scale of the UK's leakage problem!]
- Efforts to improve leakage solutions have focused on Aware and Locate, with less attention on Prevent and Mend
- Leakage prevention via substantially increasing mains renewal?
  → challenging to fund and to deliver
- Ramping-up traditional dig repairs?
  → disruptive (utility streetworks cost the UK economy >£7bn/yr)
- A repair solution that minimises/avoids interruptions to supply and traffic disruption could play a key role in meeting leakage targets

We're seeking to transform water mains repairs to increase the rate of leakage reduction whilst simultaneously reducing cost

No-Dig Leak Repair

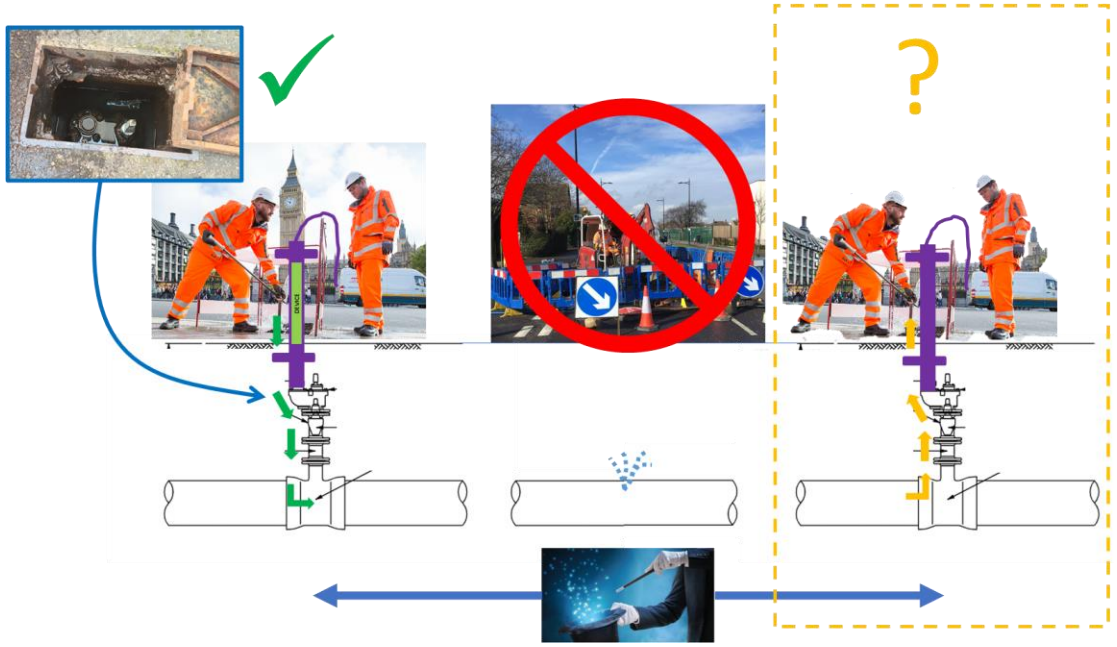
What are we aiming to achieve?

- We're seeking a technology that can:
  1. enter a water main via existing/standard assets
  2. locate and identify the leak
  3. execute an internal repair and test it

  and:
  - requires no excavations
  - won't cause any supply interruption
  - minimises transport disruption
  - can be completed faster than dig repairs
  - is competitive on cost, H&S, carbon, etc

Our goal is to develop a prototype no-dig leak repair solution that's viable for commercialisation

The ambitious vision



No-Dig Leak Repair

The journey to our project

- Developed a business case and technical requirements for a challenge-led project
- OIF WBC1 Transform proposal → not awarded
- Commissioned a technology review, secured £250k TfL funding and rewrote our submission
- OIF WBC2 Transform proposal → not awarded
- Discussions with Ofwat → execute the challenge-led aspect internally
- Hosted sprint at the 2022 Northumbrian Innovation Festival → industry and supply chain engagement and improved technical requirements
- Sourcing process for development partners → 6 bidders, from which 2 selected to carry out a Thames-funded concept development
- 2 credible project plans received → Synthotech chosen as our principal development partner (with ALH Systems and WRc)
- OIF WBC4 Transform proposal → awarded

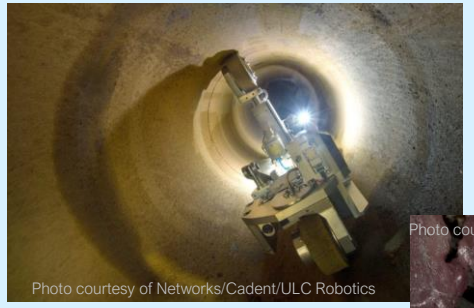


Photo courtesy of Networks/Cadent/ULC Robotics


Photo courtesy of Human Studio/University of Sheffield

Photo courtesy of MayorWatch

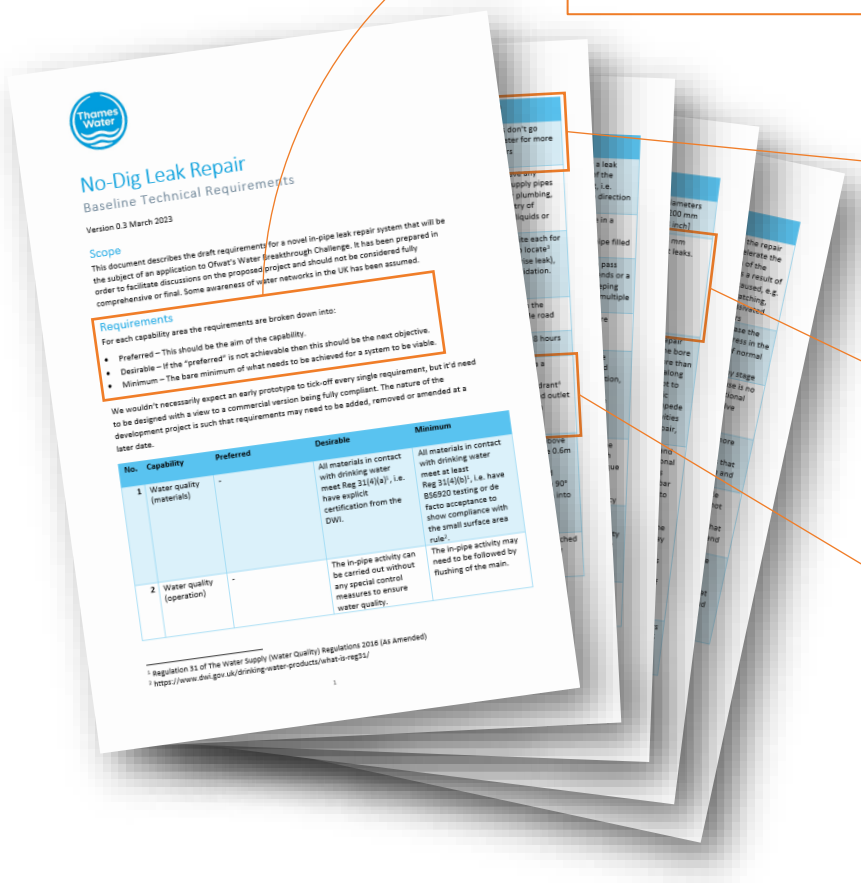
No-Dig Leak Repair

Baseline technical requirements

Requirements

For each capability area the requirements are broken down into:

- Preferred – This should be the aim of the capability.
- Desirable – If the "preferred" is not achievable then this should be the next objective.
- Minimum – The bare minimum of what needs to be achieved for a system to be viable.

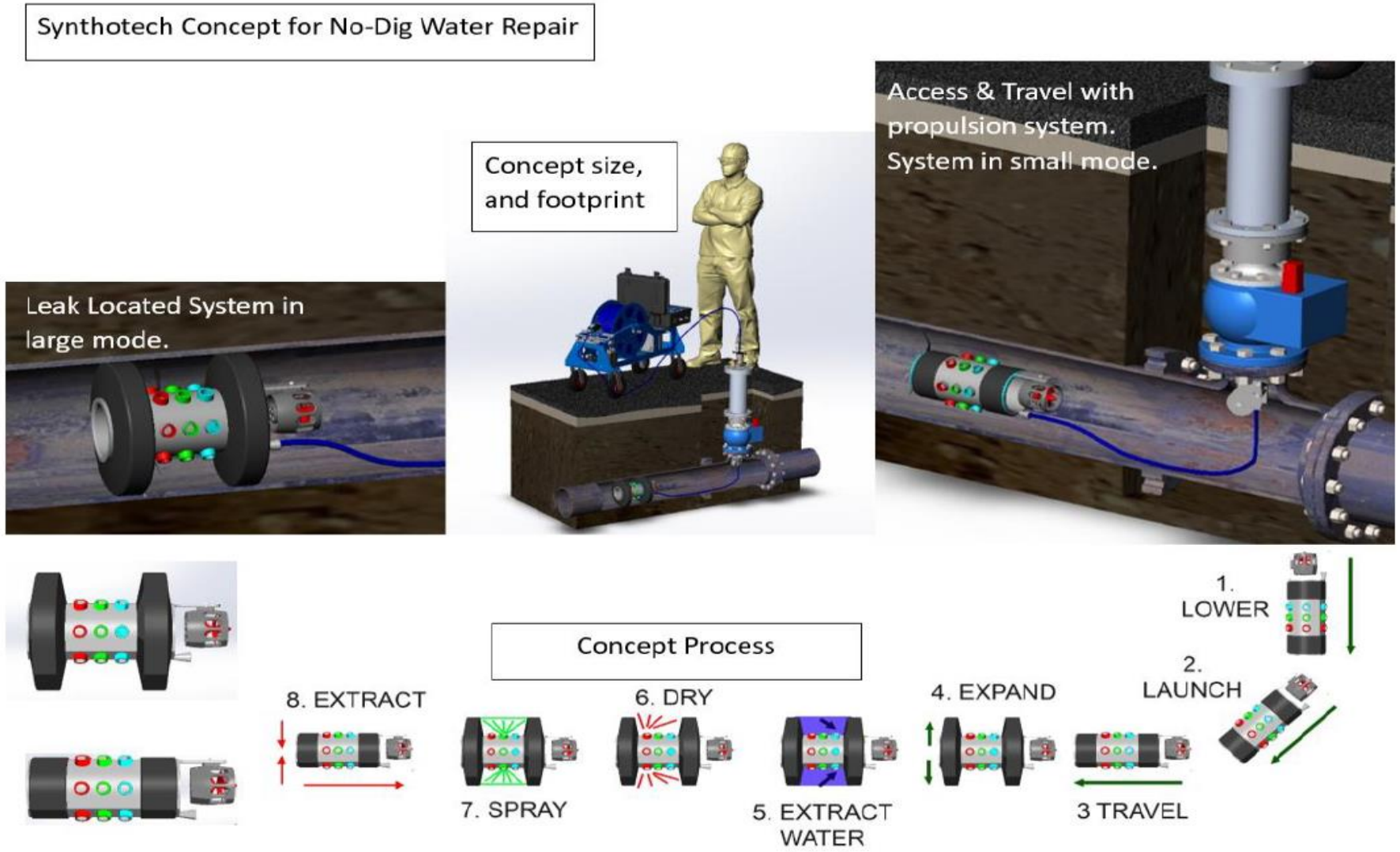


No.	Capability	Preferred	Desirable	Minimum
3	Customer (water supply)	No interruption to supply or reduction in pressure at taps	No interruption to supply, but possible temporary reduction in pressure at taps	Customers don't go without water for more than 2 hours
20	Leak suitability (nature of failure)	Holes traditionally repairable by an external repair clamp, i.e. up to 33% of pipe diameter or 65 mm [2.5 inch], whichever is smaller; joint leaks; ring fractures; longitudinal fractures.	Holes traditionally repairable by an external repair clamp, i.e. up to 33% of pipe diameter or 65 mm [2.5 inch], whichever is smaller; joint leaks; ring fractures.	Holes up to 15 mm [0.6 inch]; joint leaks.
8	Insertion (asset)	Able to enter through a conventional screw-down BS750 Type 2 underground hydrant or other opening that's smaller than the target pipe	Able to enter via a through-bore underground hydrant with the threaded outlet in place (50 mm [2 inch] bore)	Able to enter via a through-bore underground hydrant[4] with the threaded outlet removed (80 mm [3 inch] bore)

- The project seeks to achieve at least the minimum level against each requirement, and in many cases higher than this
- Stretch targets also set, but may need some trade-offs as the development progresses

No-Dig Leak Repair

Illustration of how an in-pipe repair technology might work

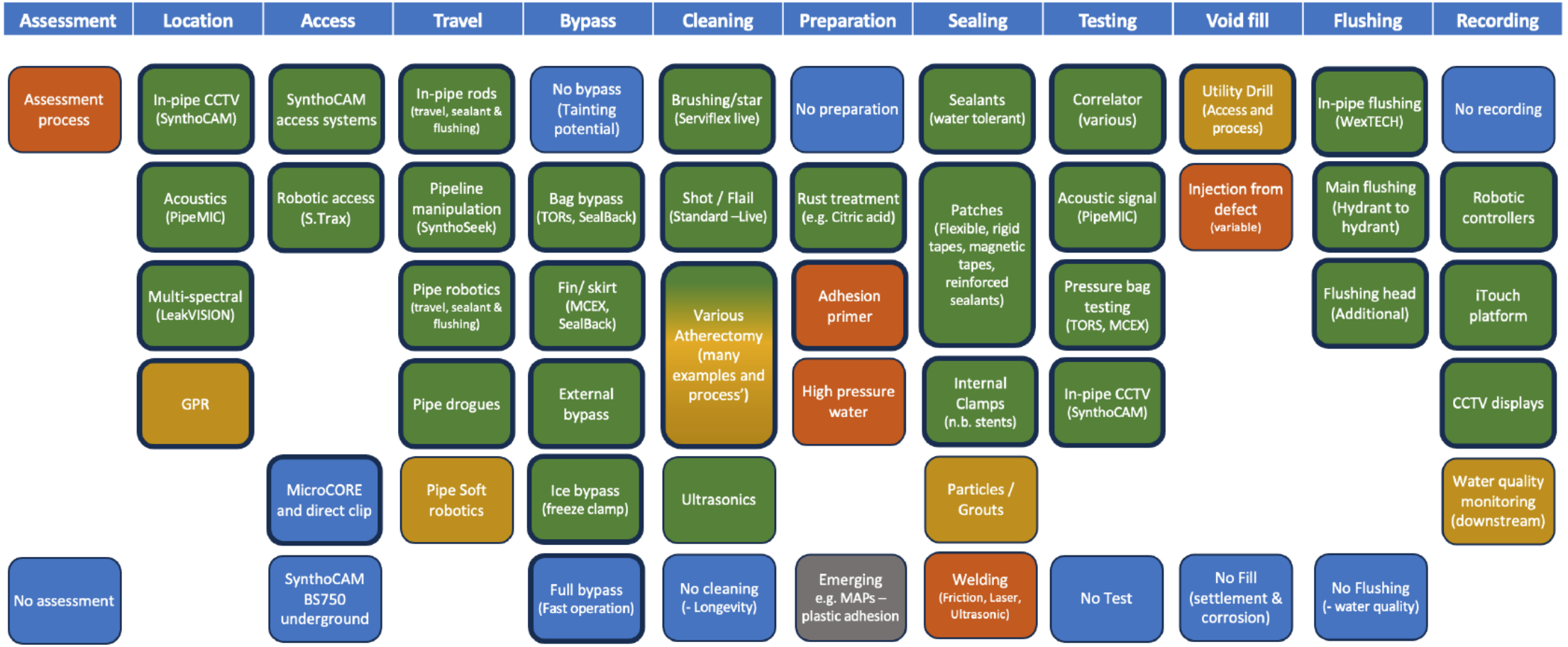


- Not all sub-systems/ functionalities are depicted
- The sub-system concepts are purely indicative

No-Dig Leak Repair

Sub-system technology stack

Could be used immediately
Transferrable technology
Development needed
Significant development needed



No-Dig Leak Repair

OIF WBC4 Transform project headlines

- £6.7M project running from October 2024 to January 2029

Collaboration

- Lead water company: Thames Water
- Principal delivery partner: Synthotech [with ALH Systems and WRc]
- Funding partners: DCWW, Southern Water, Transport for London
- Other partners: Affinity Water, Anglian Water, NWG, SES Water, Uisce Éireann Irish Water, Yorkshire Water, University of Sheffield

Project phases

- Phase 1: Concept Development (TRL4)
- Phase 2: Pilot Demonstration (TRL5)
- Phase 3: Whole System Demonstration (TRL6)
- Phase 4: Field Trials (TRL7)
- Phase 5: Knowledge Transfer (throughout)

Synergies with other OIF projects

- National Leakage Research & Test Centre (NLRTC), Designer Liner, Universal Access Point for Water (UAP4W)

Thank you