



# 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

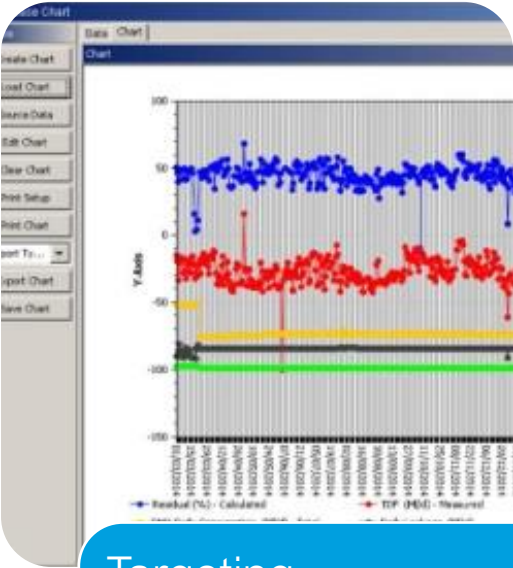
## Agenda

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



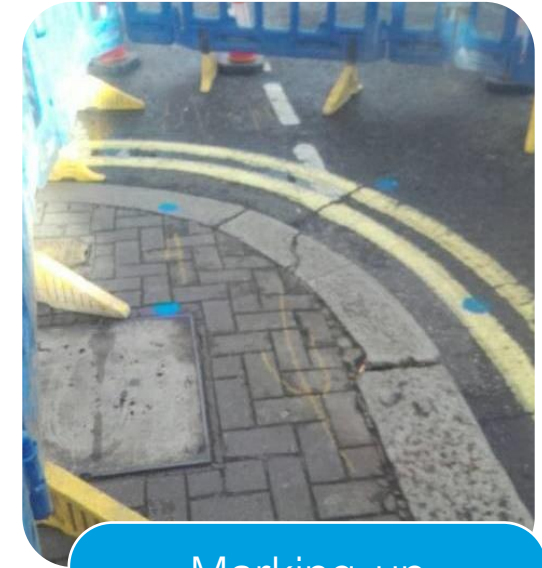
## Detecting

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



## Pinpointing

- Listening stick
- Ground microphone
- Leak noise correlation

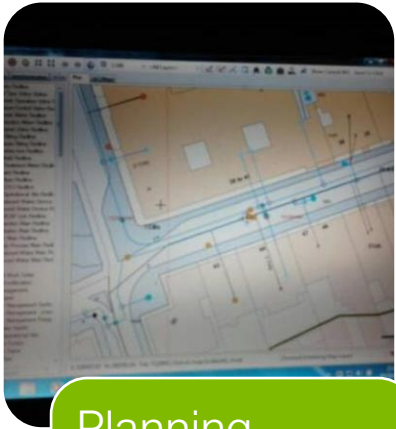


## Marking-up

- Typically 1m square

# No-Dig Leak Repair

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



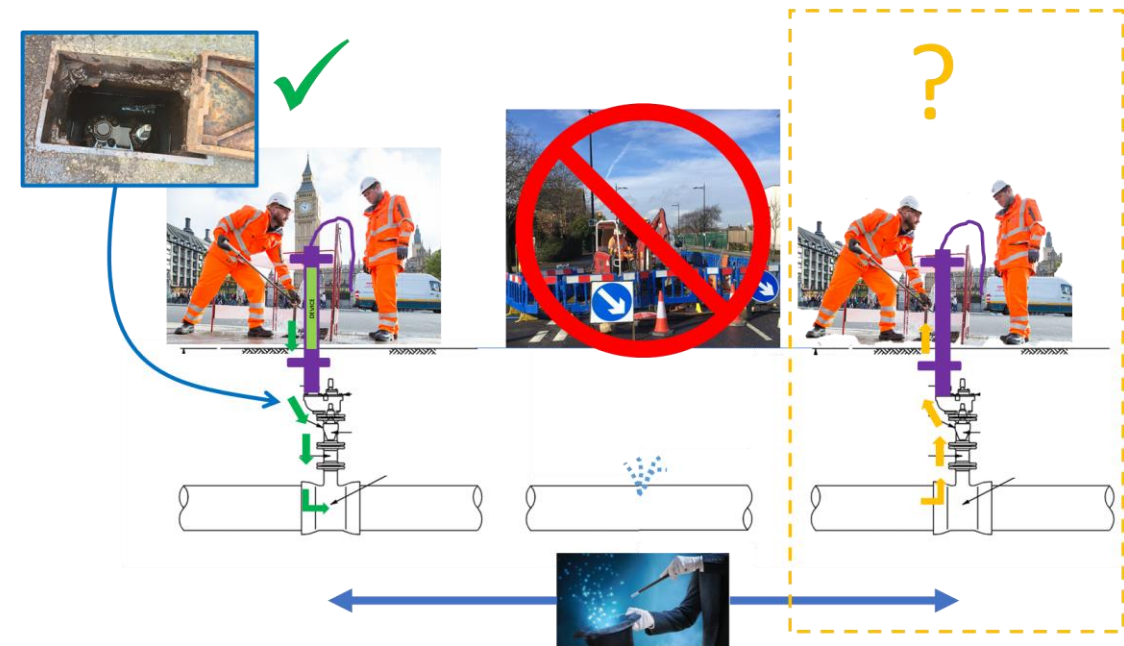
# No-Dig Leak Repair

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 itand:
  - 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

- 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

### Requirements

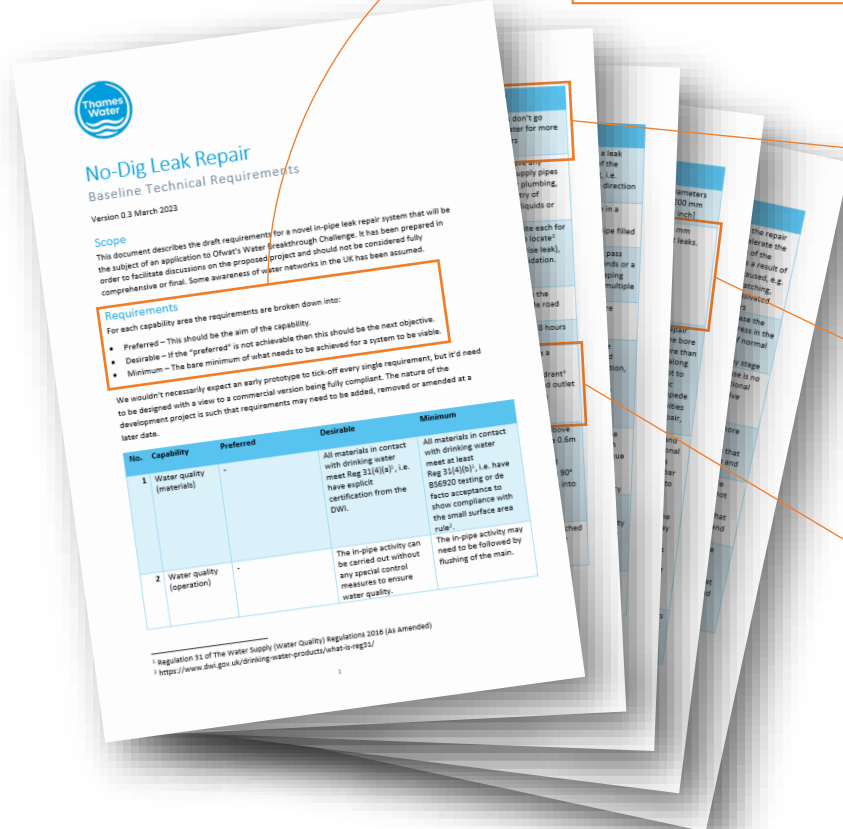
For each capability area the requirements are broken down into:

- 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. |
|----|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|

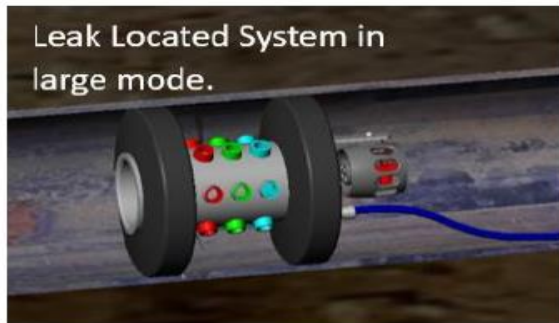
|   |                   |                                                                                                                                       |                                                                                                              |                                                                                                                          |
|---|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 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 <sup>4</sup> with the threaded outlet removed (80 mm [3 inch] bore) |
|---|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|



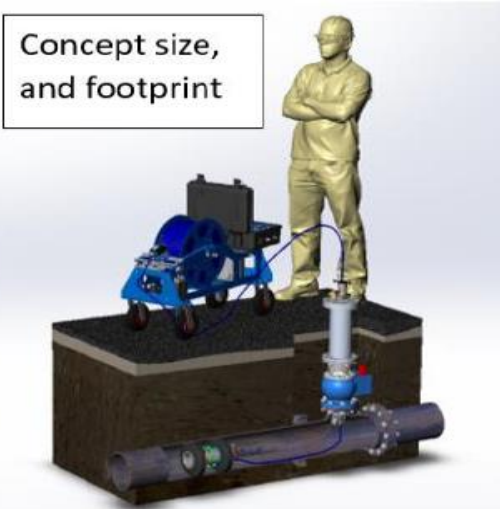
# No-Dig Leak Repair

Illustration of how an in-pipe repair technology might work

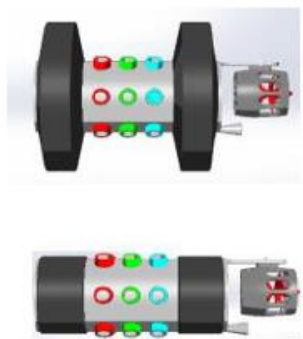
## Synthotech Concept for No-Dig Water Repair



Concept size,  
and footprint



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



## Concept Process

8. EXTRACT



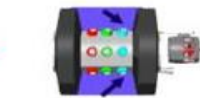
7. SPRAY



6. DRY



5. EXTRACT  
WATER



4. EXPAND



3 TRAVEL



2. LAUNCH



1. LOWER



# No-Dig Leak Repair

## Sub-system technology stack



Could be used immediately

Transferrable technology

Development needed

Significant development needed

| Assessment         | Location                    | Access                      | Travel                                     | Bypass                         | Cleaning                                         | Preparation                           | Sealing                                                              | Testing                           | Void fill                          | Flushing                           | Recording                             |
|--------------------|-----------------------------|-----------------------------|--------------------------------------------|--------------------------------|--------------------------------------------------|---------------------------------------|----------------------------------------------------------------------|-----------------------------------|------------------------------------|------------------------------------|---------------------------------------|
| Assessment process | In-pipe CCTV (SynthoCAM)    | SynthoCAM access systems    | In-pipe rods (travel, sealant & flushing)  | No bypass (Tainting potential) | Brushing/star (Serviflex live)                   | No preparation                        | Sealants (water tolerant)                                            | Correlator (various)              | Utility Drill (Access and process) | In-pipe flushing (WexTECH)         | No recording                          |
|                    | Acoustics (PipeMIC)         | Robotic access (S.Trax)     | Pipeline manipulation (SynthoSeek)         | Bag bypass (TORs, SealBack)    | Shot / Flail (Standard –Live)                    | Rust treatment (e.g. Citric acid)     | Patches (Flexible, rigid tapes, magnetic tapes, reinforced sealants) | Acoustic signal (PipeMIC)         | Injection from defect (variable)   | Main flushing (Hydrant to hydrant) | Robotic controllers                   |
|                    | Multi-spectral (LeakVISION) |                             | Pipe robotics (travel, sealant & flushing) | Fin/ skirt (MCEX, SealBack)    | Various Atherectomy (many examples and process') | Adhesion primer                       |                                                                      | Pressure bag testing (TORS, MCEX) |                                    | Flushing head (Additional)         | iTouch platform                       |
|                    | GPR                         |                             | Pipe drogues                               | External bypass                |                                                  | High pressure water                   | Internal Clamps (n.b. stents)                                        | In-pipe CCTV (SynthoCAM)          |                                    |                                    | CCTV displays                         |
|                    |                             | MicroCORE and direct clip   | Pipe Soft robotics                         | Ice bypass (freeze clamp)      | Ultrasonics                                      |                                       | Particles / Grouts                                                   |                                   |                                    |                                    | Water quality monitoring (downstream) |
| No assessment      |                             | SynthoCAM BS750 underground |                                            | Full bypass (Fast operation)   | No cleaning (- Longevity)                        | Emerging e.g. MAPs – plastic adhesion | Welding (Friction, Laser, Ultrasonic)                                | No Test                           | No Fill (settlement & corrosion)   | No Flushing (- water quality)      |                                       |

# 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)



Dŵr Cymru  
Welsh Water



from  
Southern  
Water.



TRANSPORT  
FOR LONDON  
EVERY JOURNEY MATTERS

AffinityWater



NWG  
living water





Thank you