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Pipe Condition Assessment
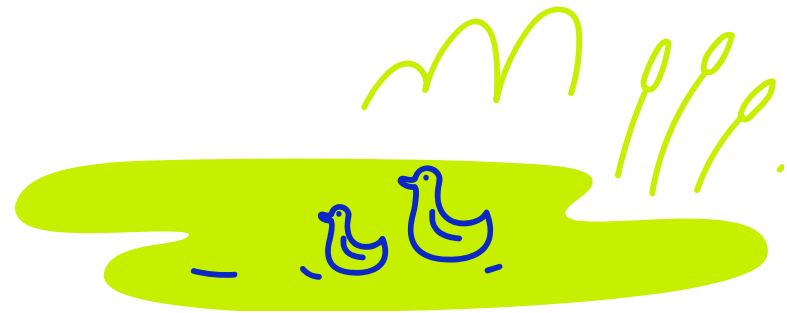
Bogusia Zazula-Coetzee
Ximena Gonzalez Bossa
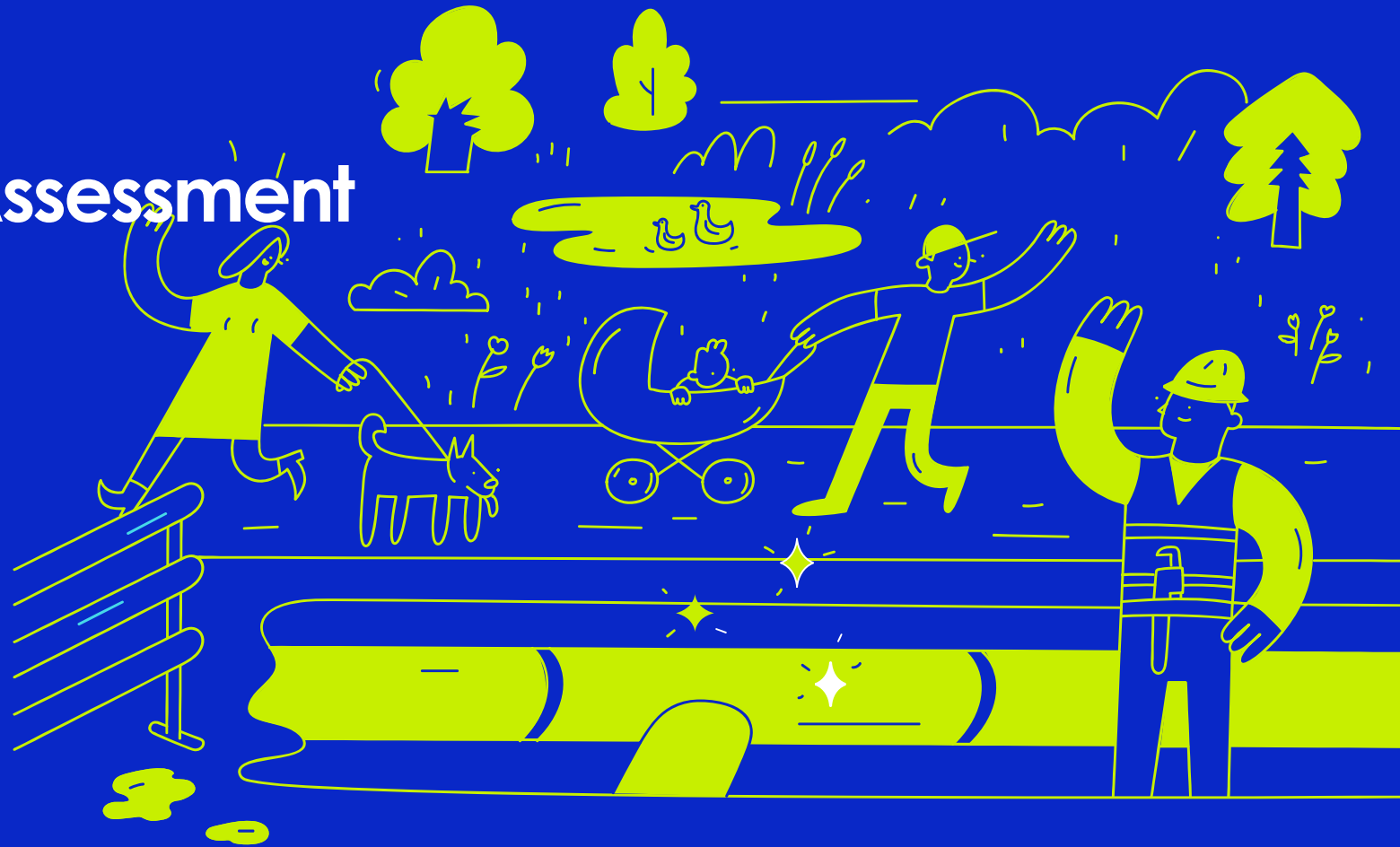
CwMAG Conference 2023
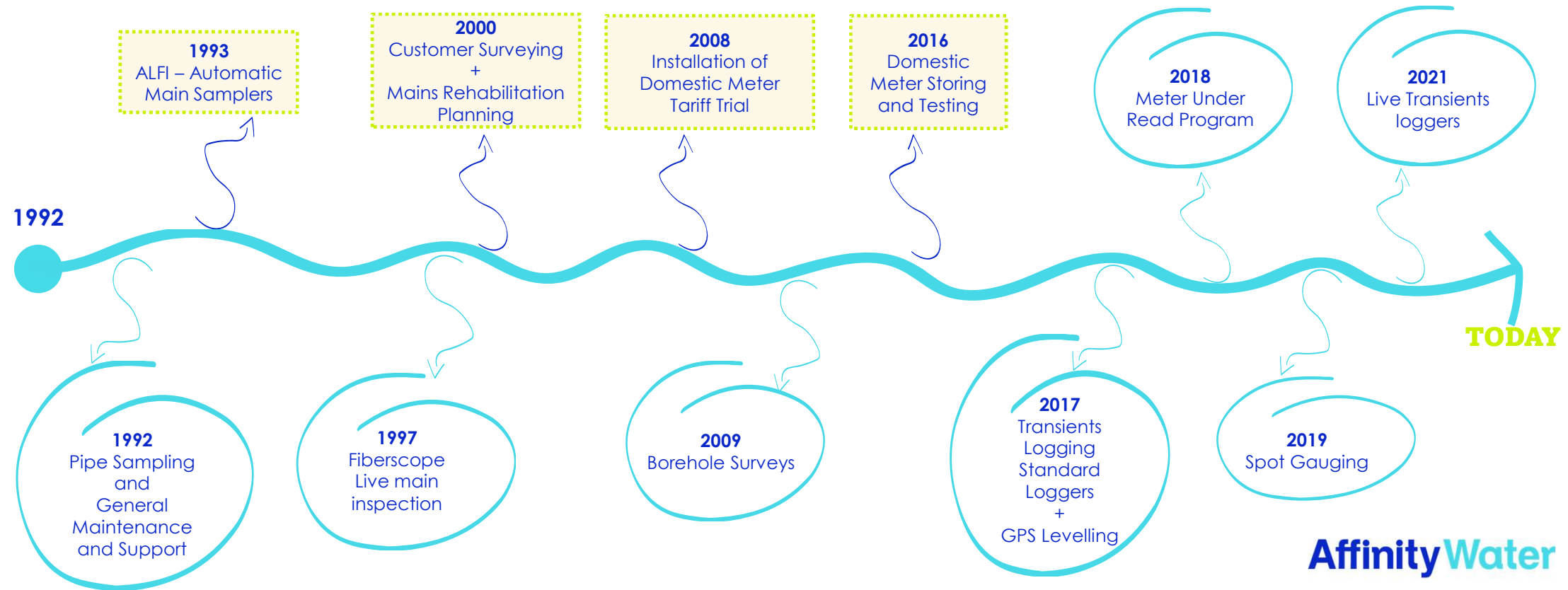
Introduction

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Overview

Affinity Water in a nutshell:

- Over 900 million litres of water supplied each day
- Population of more than 3.83 million people
- Mixed rural and urban areas including north London (Luton, Stanstead, Heathrow Airports, Wembley, Holiday destinations)
- Mainly fed by the underground sources
- Over 17k km of mains
- 41 % in Spun Iron
- 57% older than 50 years

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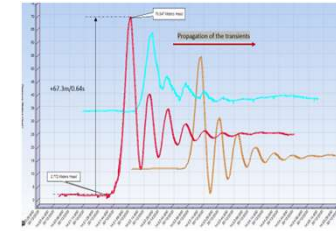
Asset Condition Laboratory – History

The Pipe Laboratory team provides services related to the condition of the assets currently in use, analysing and understanding our network to ensure we manage its day to day and future performance in a logical and cost-effective way to meet both regulatory and customer requirements.

1993
ALFI – Automatic Main Samplers

2000
Customer Surveying
+
Mains Rehabilitation Planning

2008
Installation of Domestic Meter Tariff Trial

2016
Domestic Meter Storing and Testing

2018
Meter Under Read Program

2021
Live Transients loggers

1992

TODAY

1992
Pipe Sampling and General Maintenance and Support

1997
Fiberscope Live main inspection

2009
Borehole Surveys

2017
Transients Logging Standard Loggers
+
GPS Levelling

2019
Spot Gauging

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Services

Transient Logging
- Network Calming
- Live Monitoring

Environmental Monitoring Support
- Borehole Surveys
- Ground Water Monitoring
- River Monitoring

Fiberscope Survey
- WQ Surveys
- Flushing Programme
- Anomalies/Restrictions

Pipe Sample Analysis
- Investment Planning
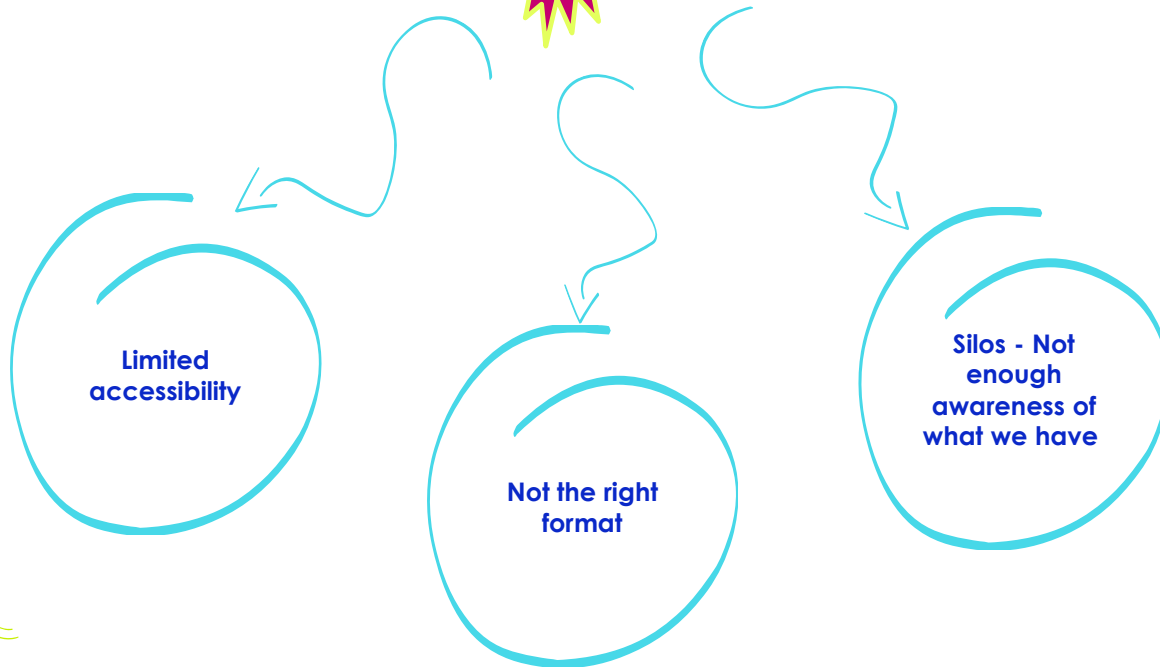- Asset Failure Root Cause
- PR 24 (Pioneer)

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Pipe Sample Analysis

- Collect sample details and compare with GIS
- Internal/external condition
- Measurements
- Shotblasting
- Pits/holes depth check

➢ 781 Pipe Samples to date (AMP7)

➢ 37 Samples - External Clients

➢ 1243 Cut-outs (63% Return Rate)

➢ Bursts main

➢ Planned work

Our journey

Services	Data	Analysis	Insight	Make Driven Decisions	GET MORE VALUE

Limited accessibility

Not the right format

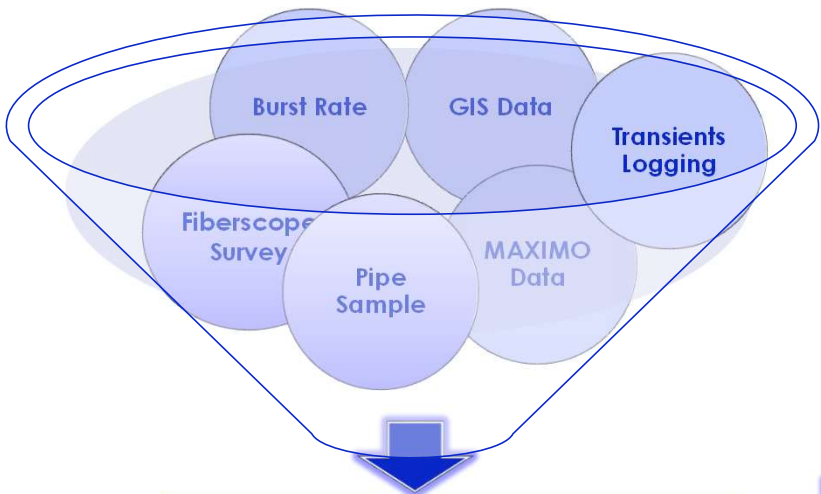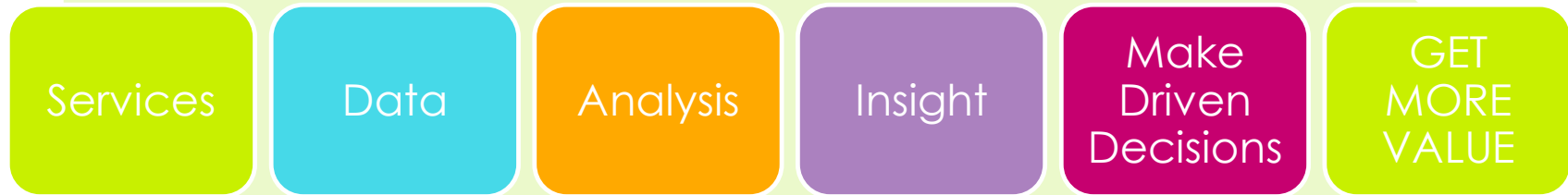**Silos - Not enough awareness of what we have**

How to solve it?

➢ Create Datasets for cumulative data (GIS) – Transients Logging Layer/ Camara Survey Layer

➢ Improving Data quality (highlighting important data) **Upgrading** Database/Visualizations tools

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Our journey

Services	Data	Analysis	Insight	Make Driven Decisions	GET MORE VALUE

Burst Rate

GIS Data

Transients Logging
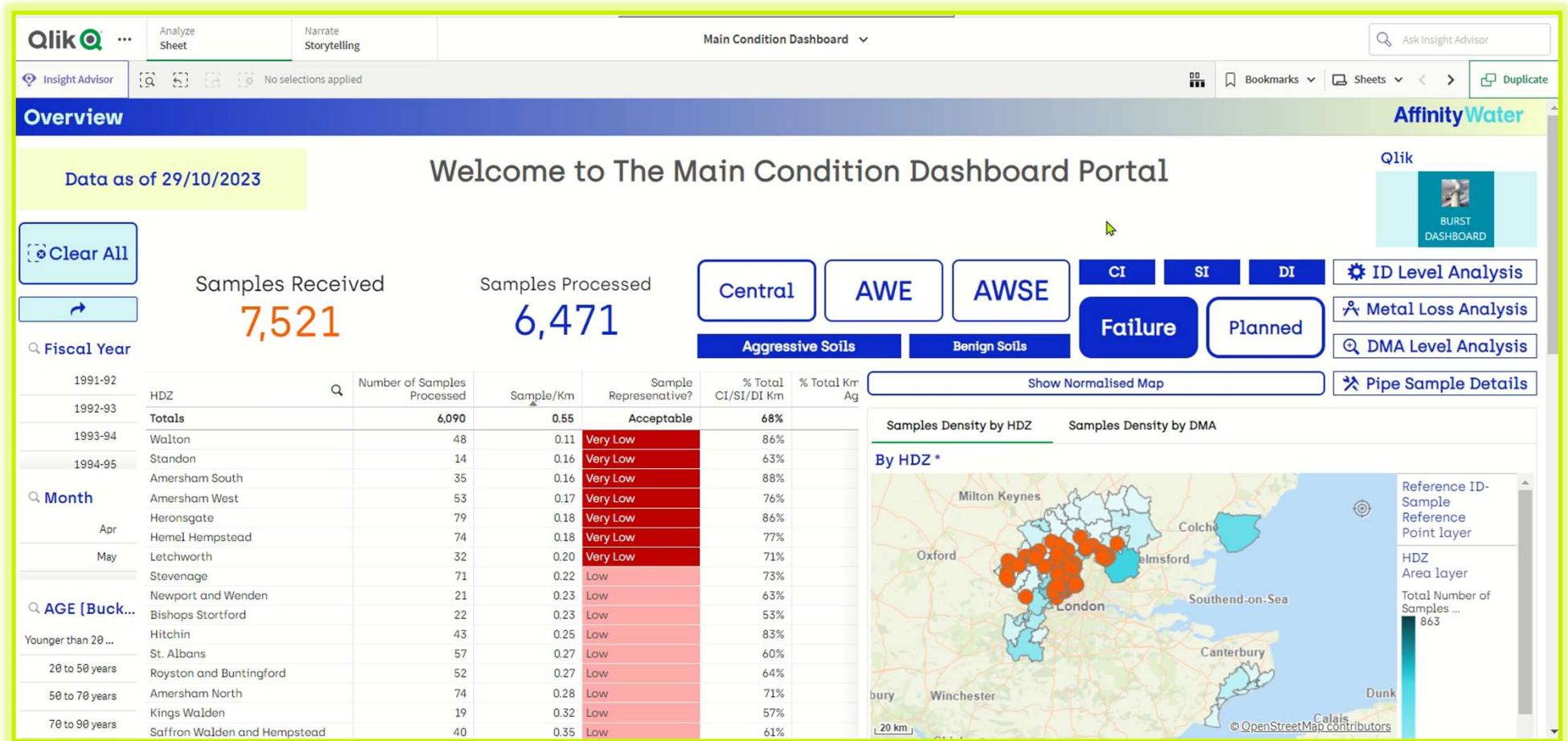
Fiberscope Survey

Pipe Sample

MAXIMO Data

What are our biggest advantages?

➢ Variety of data available for analysis

➢ 30 years of main condition related data

Burst Dashboard
Main conditions Dashboard

+

DATA ANALYTICS

=

ASSET HEALTH AWARENESS

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Main condition Dashboard

Insights

WHERE ARE OUR OLDEST MAINS?

By HDZ | By DMA

HDZ Layer
Area layer

Km Older than 50 years
0.88
0.38

20 km

CHOOSE AGE: % of Km Mains Over [50] years

Material and Age

Total Km of Main

Younger than 20 years | 20 to 50 years | 50 to 70 years | 70 to 90 years | Over 90 years

AGE (Bucketed) ▼ , Material ▼

Material
■ Black Poly ■ Concrete ■ Hep30 ■ MDPE ■ Poly ■ PVC
■ CI/SI/DI ■ HDP ■ HPPE ■ P-Line ■ Profuse PE100 ■ SST

Soil Corrosivity

Total Km of Main (In Use)

1_Non-aggress... | 2_Slightly agg... | 3_Moderately ... | 3+_Slightly to ... | 4_Highly aggre... | 4+_Moderately... | 5+_Highly to v... | -

Material
■ AC ■ CI/SI/DI ■ Copper ■ HDP ■ Lead ■ P Clay
■ Black Poly ■ Concrete ■ DU ■ HPPE ■ MDPE ■ P-Line

Benefits from data collection:

➤ Understand our network

➤ Prioritize – monitor key areas

➤ Implement new opportunities

➤ Improve decision making
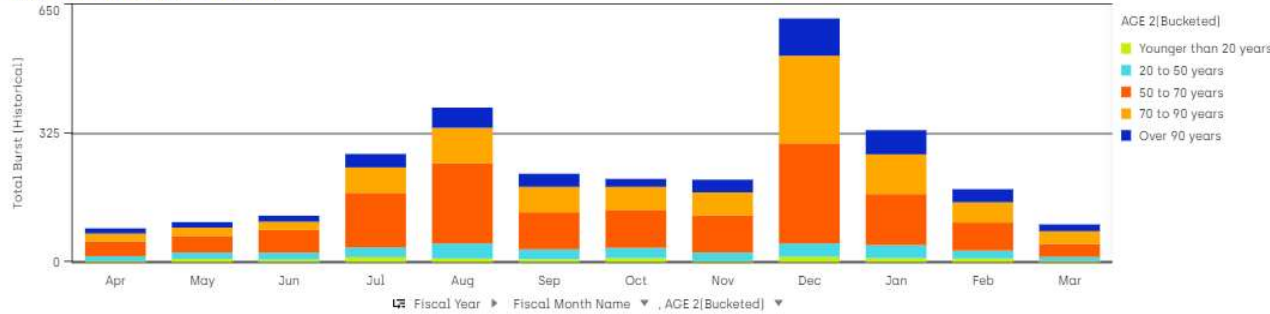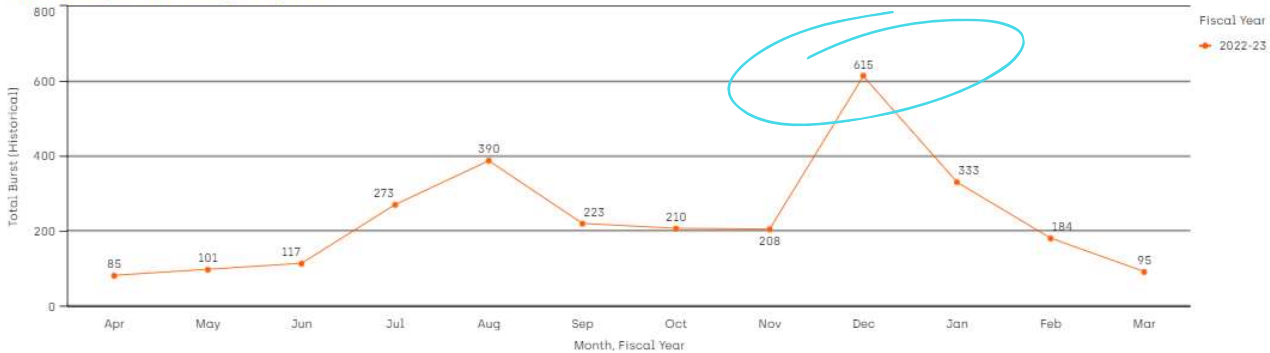
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Insights

Benefits of our linked data:

➢ Quick and effective data analysis

➢ Easy performance
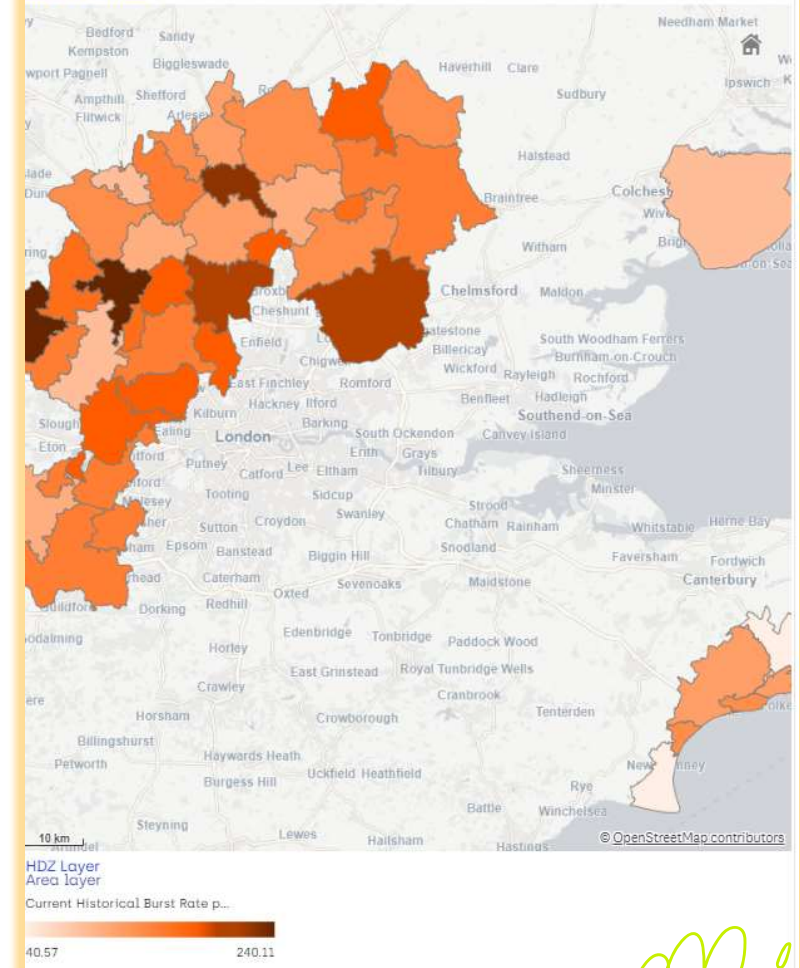
➢ Current progress evaluation

Burst History by Age & Material
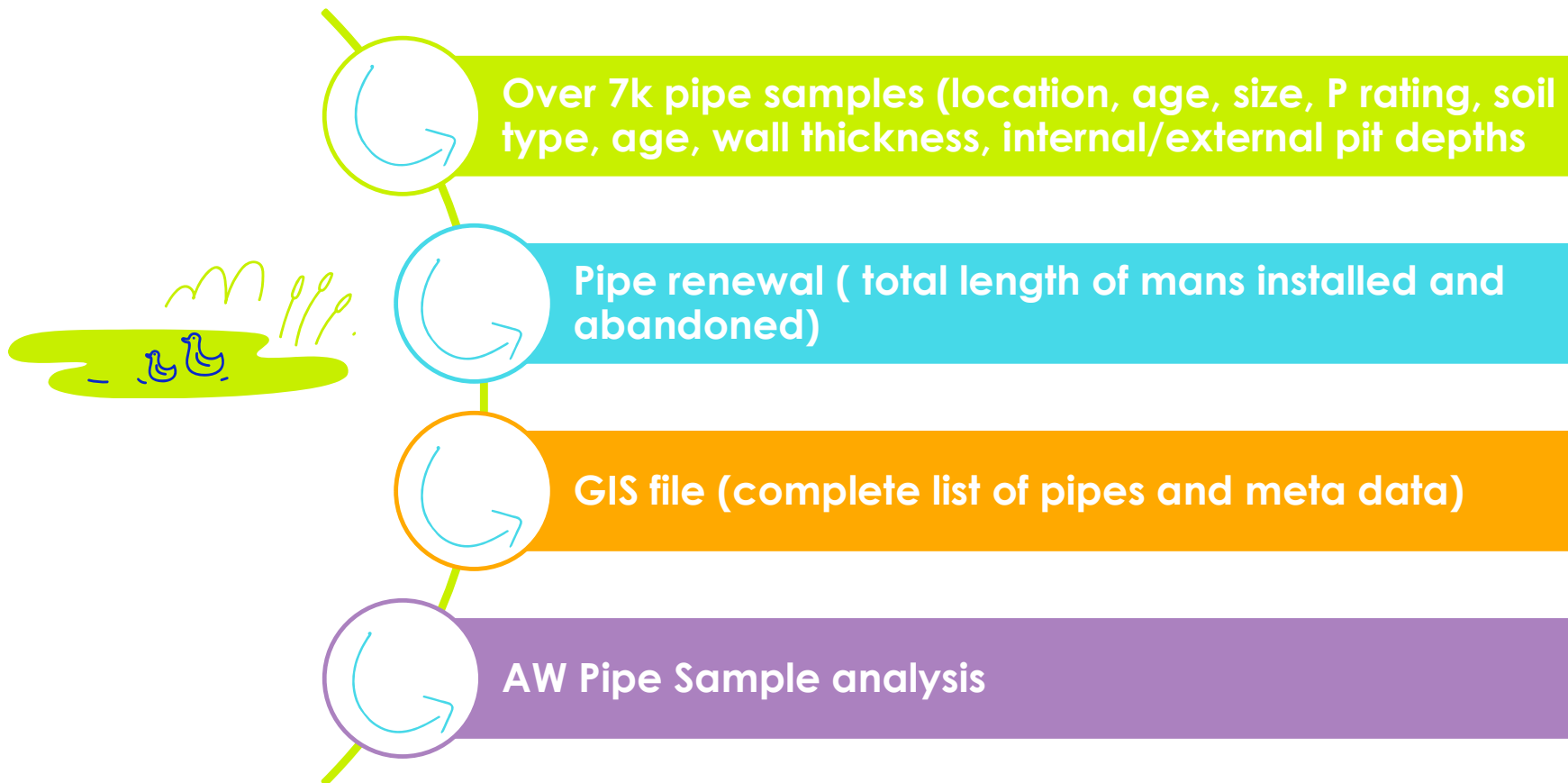

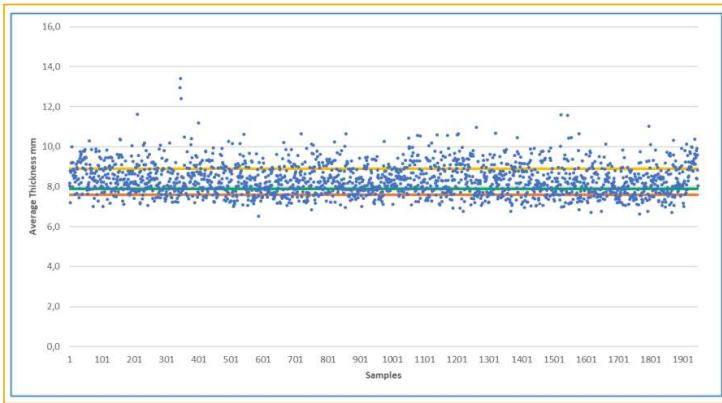Month Comparison through the years

Bursts by HDZ

Pipe Deterioration – statistical analysis by Mott MacDonald

Can pipe deterioration be statistically demonstrated with the use of the pipe sample data?

How pipe deterioration data can be used to determine a sustainable renewal strategy?

Over 7k pipe samples (location, age, size, P rating, soil type, age, wall thickness, internal/external pit depths

Pipe renewal (total length of mans installed and abandoned)

GIS file (complete list of pipes and meta data)

AW Pipe Sample analysis

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Can pipe deterioration be statistically demonstrated with the use of the pipe sample data?


Samples lie within a proximity of the standard thickness values.

Clear deterioration trend for pipes as they age - reducing the age range to exclude poorly represented cohorts can improve the R2 value
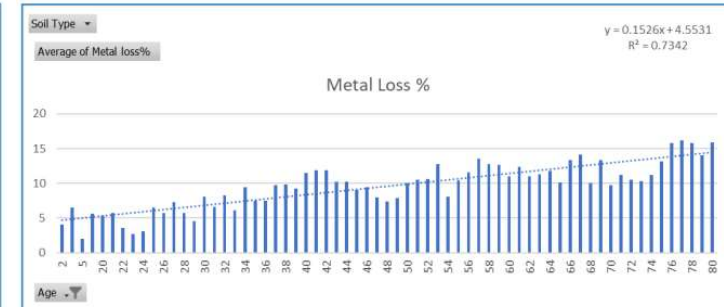
The most statistically reliable trends were observed for vertically cast iron of around 60 - 100 years and spun iron of around 20 - 80 years
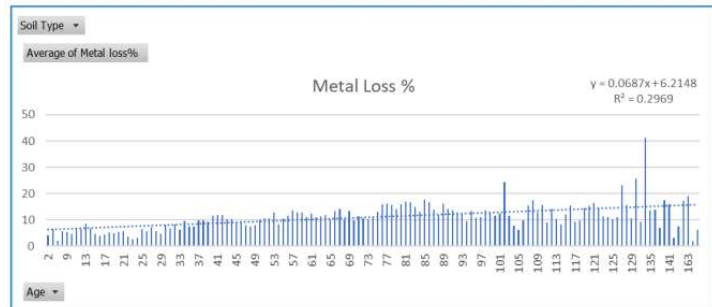
Deterioration trend based on metal loss (%)
All soils types over entire age range
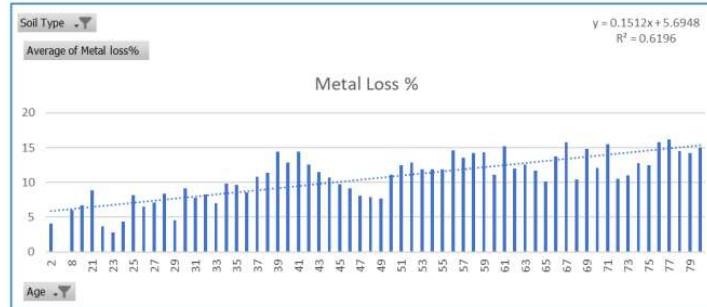
Moderately and (very) highly aggressive soil types for 20-80 years age range

All soil types for 20-80 years age range

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How pipe deterioration data can be used to determine a renewal strategy?

The lengths of cohorts that need replacing each year can be calculated to give the total renewal length each year.

It is intended as a guide to renewal volumes rather than a strict list of pipes to replace.

Age threshold	2023 (km)	2024 (km)	2025 (km)	2026 (km)	2027 (km)	2028 (km)	2029 (km)	2030 (km)
70	44.9	21.7	3.6	6.8	1.3	2.6	6.1	8.4
71	44.4	0.6	21.7	3.6	6.8	1.3	2.6	6.1
72	36.3	8.0	0.6	21.7	3.6	6.8	1.3	2.6
73	31.1	5.2	8.0	0.6	21.7	3.6	6.8	1.3
74	23.5	7.6	5.2	8.0	0.6	21.7	3.6	6.8

Example: Renewal rate for a cohort based on max age.

Example: Spun Iron samples. Metal loss vs Age

Spun iron pipe cohorts demonstrate clear deterioration profiles.

The main conclusion is condition data can and should be used to evaluate network deterioration and support a coherent renewal strategy.

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Any Questions ?