FRACTA

Bringing AI
to Infrastructure

Machine Learning for Water Main Condition Assessment

Artificial Intelligence and Machine Learning for Water Main Data

June 1st, 2022

Fracta Overview – Bringing AI to Infrastructure

FRACTA | Bringing AI to Infrastructure

- Founded in 2015
- Presence in North America, Japan, and Europe.

- Strategic Investor: Kurita Water Industries

Corporate Philosophy

Study the properties of water, master them, and we will create an environment in which nature and man are in harmony

KURITA

Fracta – References

FRACTA | Bringing AI to Infrastructure

Over 100 utilities around the world (US, UK, Asia) have used Fracta's M.L. network to analyze more than 150,000 miles of pipe and 300,000 individual breaks.

San Francisco Water Power Sewer

DENVER WATER

CITY OF SANTA CRUZ Water Department

love every drop anglianwater

NORTHUMBRIAN WATER living water

East Bay Municipal Utility District EBMUD

CITY OF NAPA

The City of SAN DIEGO

KANAGAWA

川崎市 KAWASAKI CITY

San Antonio Water System

ARLINGTON

TOHO GAS

神奈川県 KANAGAWA

THE CAPITAL CITY OF KANSAS GOLDEN CITY TOPEKA

CITY OF Guntersville ALABAMA

OSAKA CITY 大阪市

川崎市 上下水道局 Waterworks Bureau, City of Kawasaki

Boston Water and Sewer Commission

KOBE UNESCO City of Design

What we do

FRACTA

Bringing AI
to Infrastructure

- **Fracta partners with Utilities to assist in updating, improving, and optimize their infrastructure data.**
  - From missing and inaccurate data, to advanced programs. We help utilities with their data needs by utilizing machine learning.
- **Digital Desktop Condition Assessment – Water Distribution Networks**
- Automated Pipe Data Reconstruction
- **LoF, CoF, and Total Risk** analysis for over 150,000 miles of water main
- Sewer Distribution Model (LoF)
- Gas Pipeline Model

Case study - Johnstown

FRACTA | Bringing AI to Infrastructure

Network properties:

- Length: 303 Miles
- Average consumption: 6.5 MGD
- Summer consumption: 10 MGD
- End Customers: 21 000

Results:

Within the first seven months of using Machine Learning LoF results, GJWA was able to correctly identify **75%** of the hidden leaks in 15 pipe segments, saving the utility **20%** in Non-Revenue Water loss.

FRACTA KURITA

FRACTA CASE STUDY

Using Artificial Intelligence to reduce non-revenue waterloss in Pennsylvania

THE UTILITY

GREATER JOHNSTOWN WATER AUTHORITY

The Greater Johnstown Water Authority (GJWA) in Pennsylvania was incorporated under the Municipality Authorities Act in 1964 by the city of Johnstown and boroughs of Westmont and Southmont as a joint

municipal authority to provide potable water to the Greater Johnstown area.

GJWA serves a base of more than 21,000 customers through 303 miles of water distribution pipes. The average consumption is approximately 6.5 million gallons per day (MGD) with peak consumption in the summer at 10 MGD. It operates three dams, two wells, a water

treatment plant at Riverside, a water treatment plant at the Saltlick Reservoir, and numerous storage tanks and pump stations. pipe being 75-100 years old.

21,000 CUSTOMERS

303 MILES

6.5 MGD AVERAGE CONSUMPTION

10 MGD SUMMER CONSUMPTION

THE CHALLENGE

REDUCING NON-REVENUE WATER LOSS WITH LIMITED RESOURCES

Reducing Non-Revenue (NRW) water loss is challenging since it is not apparent where it is happening within the network, or what could be causing it.

While pumping stations can signal when water loss may be happening somewhere in the distribution network, the precise location of that loss is not known. Sending a crew out to hunt for the source of loss can be time-consuming, costly, and often inconclusive.

Over time, leaks can become breaks which present an even greater risk to community safety and business operations. As a challenge, managing pipeline integrity is as important to address as it has been difficult to address—up until now.treatment plant at Riverside, a water treatment plant at the Saltlick Reservoir, and numerous storage tanks and pump stations. pipe being 75-100 years old.

Case study Greater Johnstown Water Authority

Case Study – Topeka, Kansas

FRACTA

Bringing AI to Infrastructure

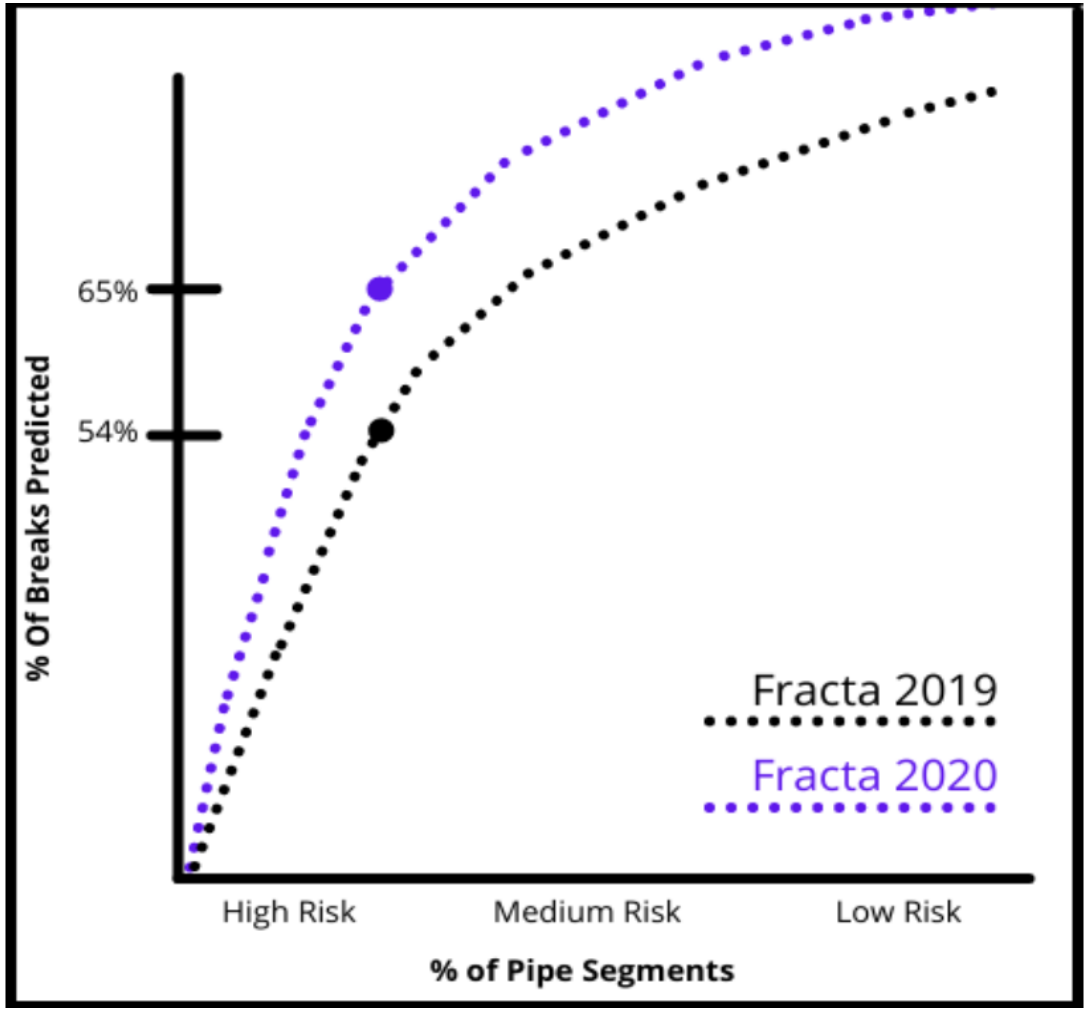
Network properties:

- Miles of Pipe: 870
- Population Served: 126,000

Results:

- Fracta's 2020 model correctly predicted 65% of pipe failures in the highest-risk tier. An 11% increase in accuracy in just one year.

"Given the fact that myself and two engineers are managing $6.5M worth of waterline replacements each year, we find that having a resource like Fracta to help make data driven decisions on which line to replace, is invaluable" Braxton Copley, Director



Fracta Project – 3-Step Implementation Process

FRACTA

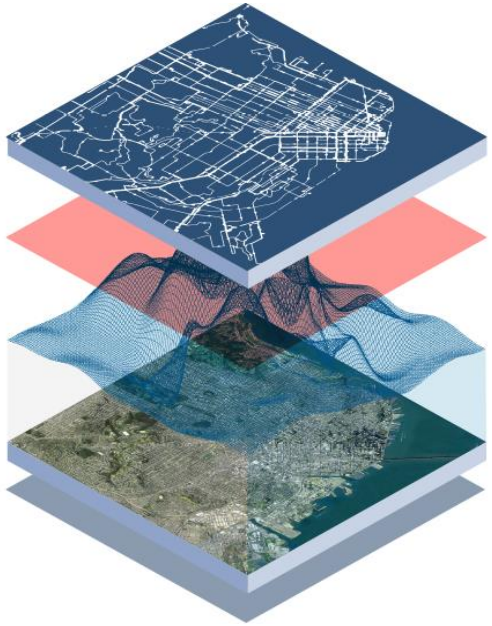
Bringing AI to Infrastructure

1

Collect pipe asset & failure data from utility*

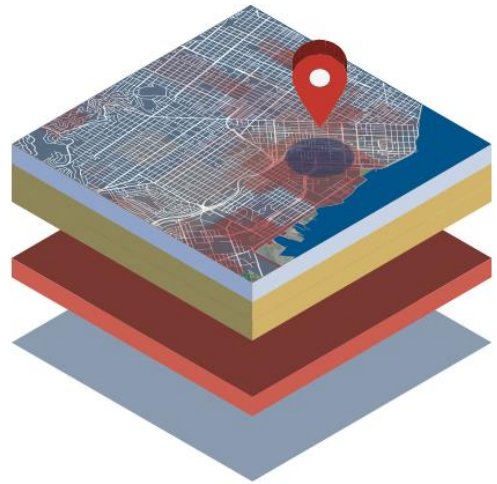
2

Analysis using ML including all pipe, break, environmental and proprietary data



3

Break prediction mapping and visualization



*Cleansing and rectifying data is done automatically by Fracta

Differences of Fracta ML Technology

FRACTA

Bringing AI to Infrastructure

Age/Break Model

Pipe Asset Data & Break history

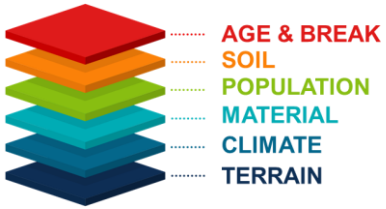
Minimal geographical factors

Local Learning Network

- Manual customization necessary
- High data processing and data acquisition costs
- No match with other customers
- Limitations for clouded areas

Machine Learning Technology

Pipe Asset Data & Break history



150 geographical factors

Global Machine learning data base

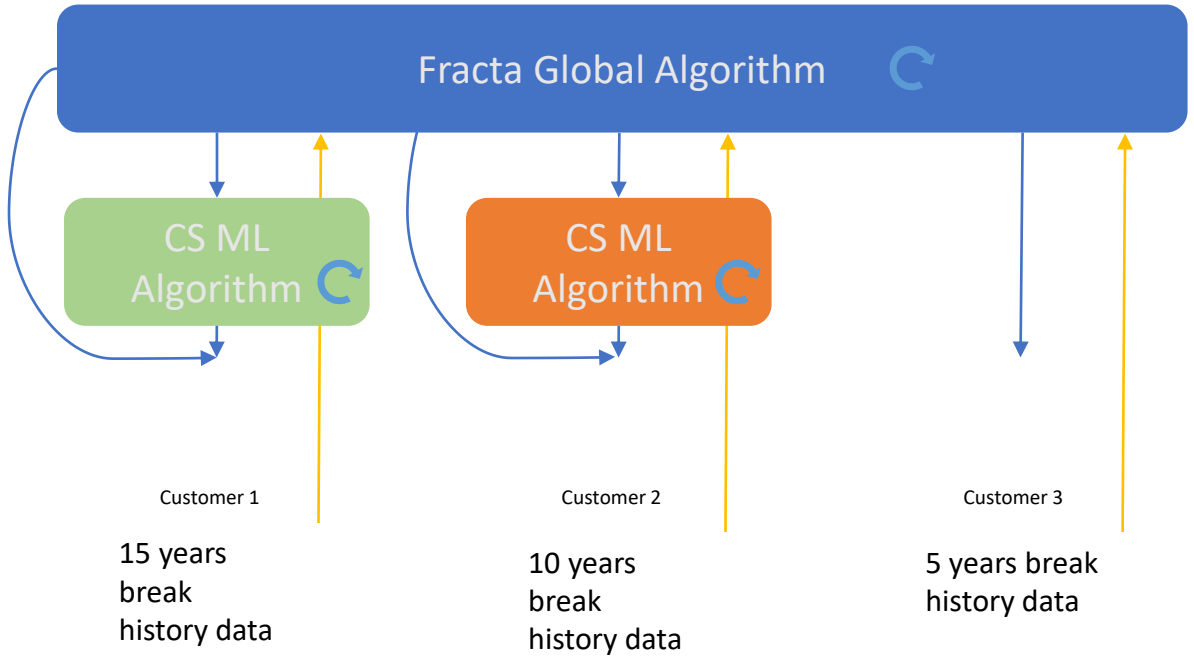
- Continuous improvement through self-learning
- Access to large database (big data solution)
- Applicable even with incomplete/limited customer data
- Automatic model updates with new data

Fracta solution provides higher accuracy and useful predictions to plan ahead.

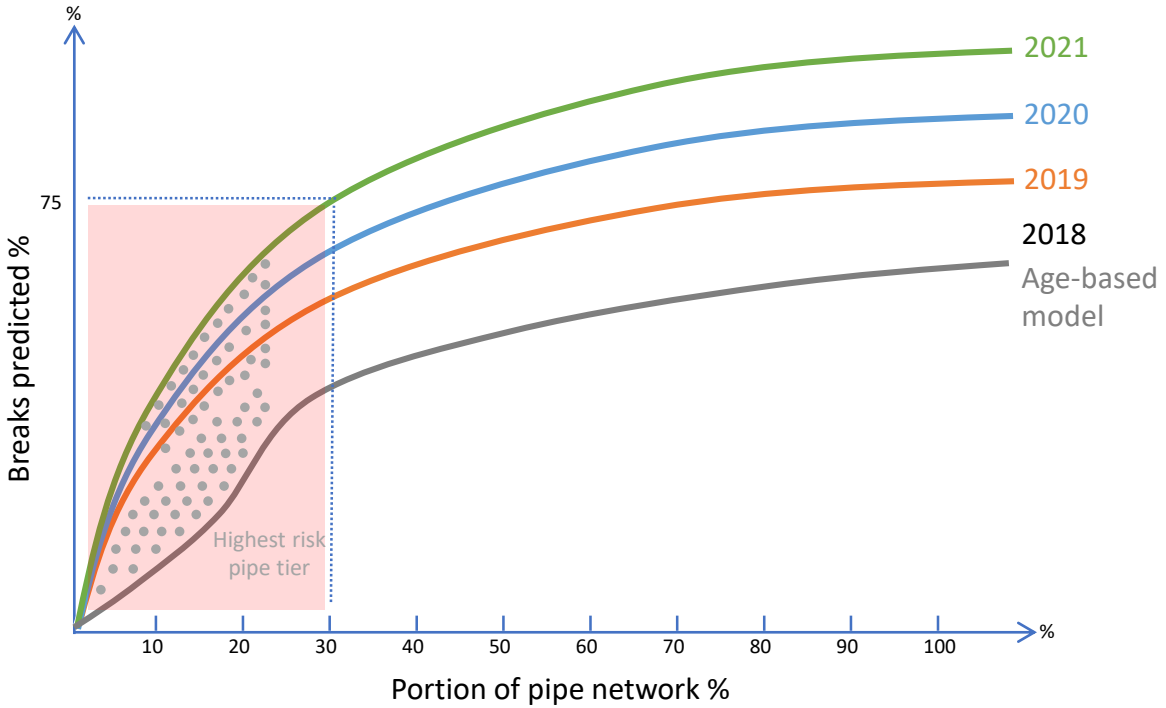
Fracta Model

Bringing AI to Infrastructure

More data for better AI



Continuous improvement of Machine Learning Model



In a time shift study, break history data is an important deciding factor. More break data allows Fracta to deliver an advanced customer specific ML algorithm to deliver the most accurate customer solution, thus best value, for the following two years.

- Fracta model improves year to year. In 2021, 75% of breaks were correctly predicted in the highest risk pipe tier.
- Since 2018, Fracta model has been recording better than customers age-based model the breaks in the top 30% risking area of the networks.

Advantages of Fracta

FRACTA

Bringing AI to Infrastructure

Easy and Flexible

- No hardware required
- Accept any format of pipe and break history data

Fast

- Results come in 4 – 6 weeks
- Results can be updated whenever desired

Constant Improvement

- New features improvements regularly
- AI & ML make quarterly updates

Fracta assesses the condition and risk of water mains and determines which pipes to replace (and which not to replace).

Fracta Features

LoF: Likelihood of Failure

FRACTA | Bringing AI to Infrastructure

Definition

LoF determines the statistical probability that a water main will fail, leveraging existing data with hundreds of variables.

Interpretation

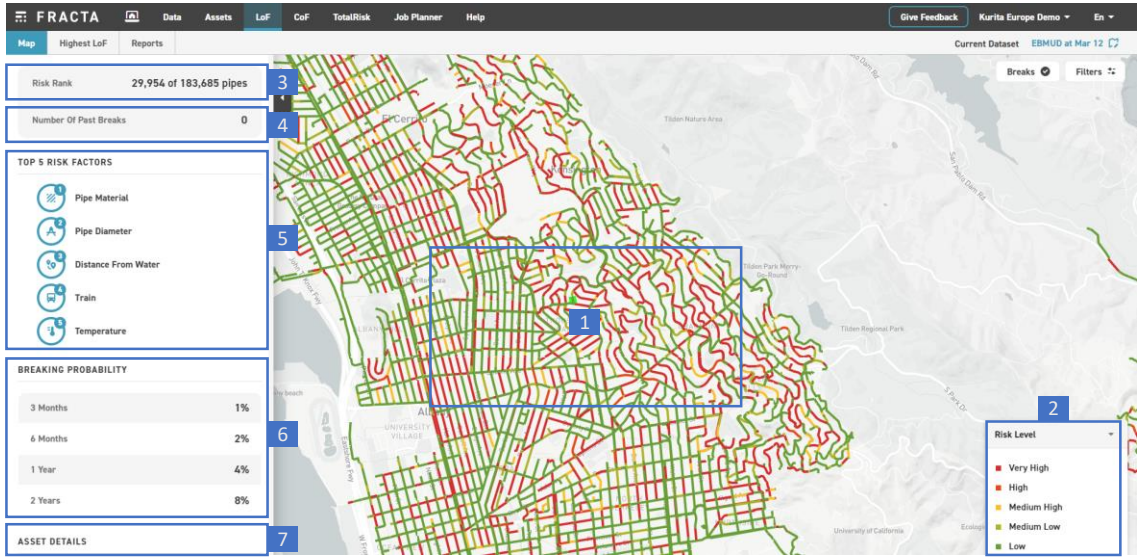
High LoF means high risk of failures. Fracta detects the potential sources of leakages and determine the remaining time before the first break.

Feature advantages

Breaks

Risk Factors

LoF indicator based on the customer data set uses AI & ML to display how likely breaks can occur in the area.



LoF map feature

1	Map: Visualize the pipes of your area according the chosen filters.
2	Filters: Select how display the pipes on the map, by Risk Level for example.
3	Risk Rank: LoF Ranking of the selected pipe out of the total pipes composing the water network.
4	Number of Past Breaks: Break history of the selected pipe
5	Top 5 risk factors: Environmental factors that could explain future leakages or breaks.
6	Breaking probability: Probability of the selected pipe to break in the coming month/year.
7	Asset Details: Detail about the selected pipe (length, diameter, material…).

CoF: Cost of Failure

FRACTA | Bringing AI to Infrastructure

Definition

CoF determines the consequences, or severity, of the water main failure and quantifies the direct and indirect costs of those failures.

Interpretation

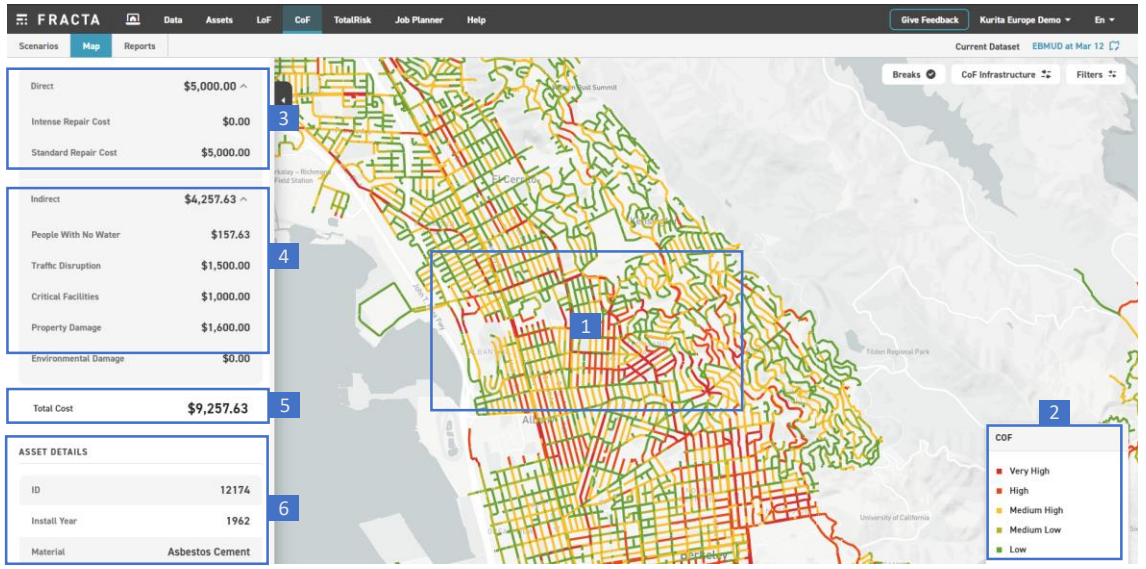
High CoF means a high cost to replace the pipe. Fracta crosses direct cost (maintenance, etc.) with indirect cost (Traffic, property damages, etc.) to provide the most accurate pricing.

Feature advantages

Pricing vision

Cost of breaks

CoF offers an accurate estimate about the real cost of pipes replacement in case of breaks/failures.



CoF map feature

1	Map: Visualize the pipes of your area according the chosen filters.
2	Filters: Select how display the pipes on the map, by Cost of Failure for example.
3	Direct costs detail: estimate cost of the operation, maintenance and replacement if a break occurs.
4	Indirect costs detail: estimate cost of the indirect consequences of the break: traffic disruption, people with no water, etc…
5	Total cost: Direct cost + Indirect cost
6	Asset Details: Detail about the selected pipe (length, diameter, material).

Total Risk

FRACTA | Bringing AI to Infrastructure

Definition

Total Risk crosses breaking probability and CoF to determine how worth it is to replace a selected pipe. This indicator is also known as Business Risk Exposure.

Interpretation

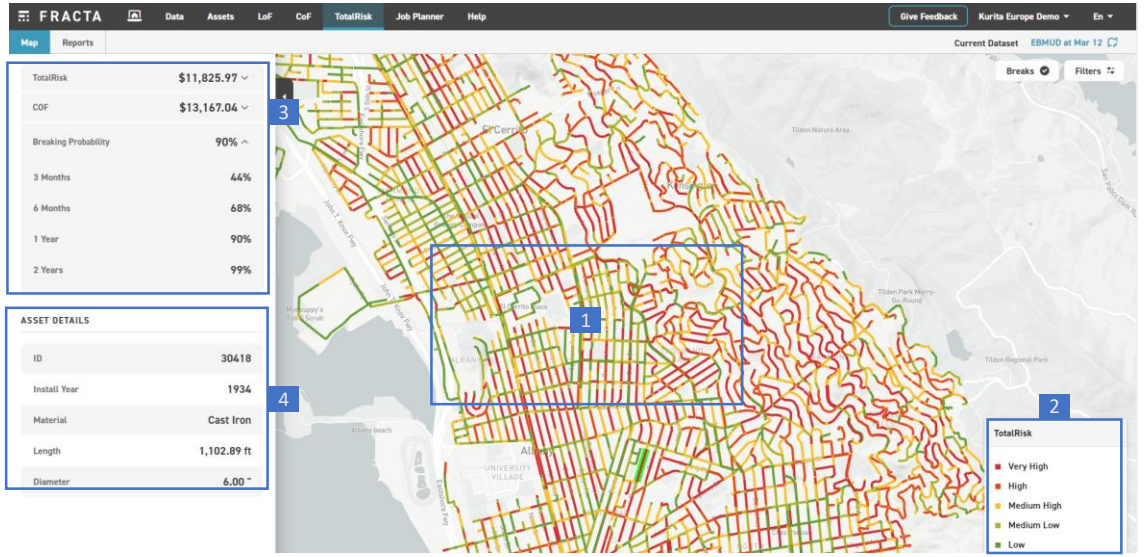
High Total Risk means high risk of breaks and or high cost to replace.

Feature advantages

Pricing vision

Target pipes to replace

Total Risk supports the decision maker by offering the possibility to target through price or breaking probability.



Total Risk map feature

1	Map: Visualize the pipes of your area according the chosen filters.
2	Filters: Select how display the pipes on the map, by Total Risk for example. A recommended analysis is to display very high total risk with low CoF to target breaks.
3	Total Risk = LoF x CoF
4	Asset Details: Detail about the selected pipe (length, diameter, material…).