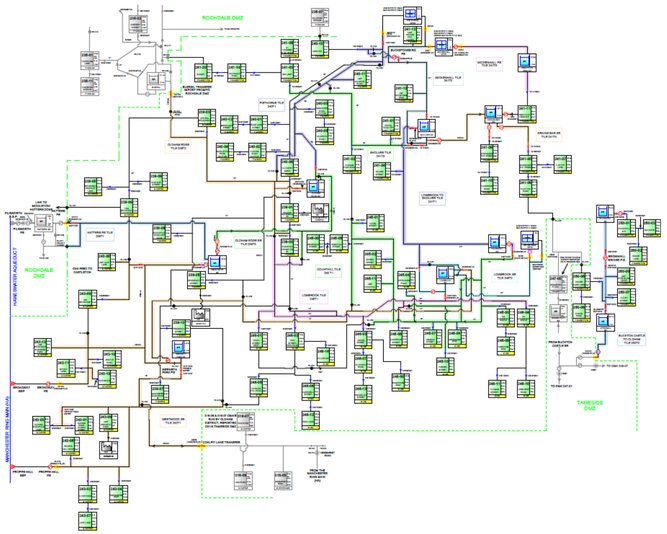
APPLICATION OF ARTIFICIAL INTELLIGENCE FOR WATER AND WASTEWATER SYSTEMS

CHALLENGES FACING UNITED UTILITIES

- **Integrated Control Centre** staff make dozens of complex operational decisions based on human judgement and experience.
- This leaves United Utilities' water distribution network vulnerable to the impacts of:
  - Extreme weather events;
  - Increasingly complex operations; and
  - Aging and deteriorating assets

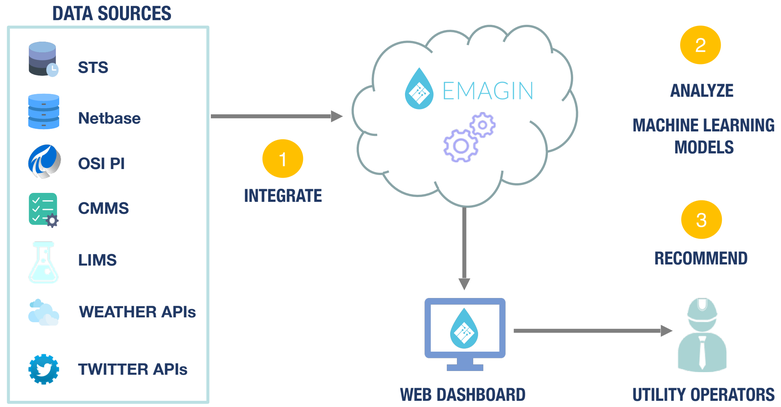


CASE STUDY AT A GLANCE

The **Oldham District Metered Zone** was selected as the demonstration site to rapidly prove out the benefits of AI-driven real-time optimization. The site was selected due to its remote control capabilities and high degree of instrumentation at sites (i.e. level sensors at service reservoirs, flowmeters and power meters at pumping station).

Quick facts:

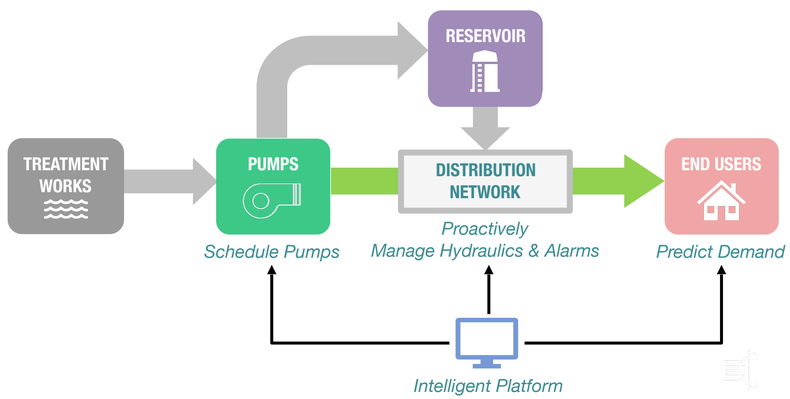
- ➢ Oldham is the 5th most populous area in the Greater Manchester Region
- ➢ Supplies 55 MLD (or 20,000 ML annually)
- ➢ Services 19 DMAs and 3 large industrial users
- ➢ Had 5 out of 10 Pump Stations remotely controlled
- ➢ 4 out of 10 Service Reservoirs monitored



DEMONSTRATED TECHNOLOGY

- Platform generated real-time pump schedules to minimize the cost of operations while guaranteeing compliance and maintenance requirements
  - Leveraged Machine Learning to predict expected demand of system and dynamically adapt operations with least cost trajectory.
  - Machine Learning models are **self adapting** and adjust to new patterns as they emerge, making them an ideal tool for predicting future states of complex ever-changing systems.
- Collected and developed pipeline to ingest data from a variety of decentralized sources (SCADA, flowmeters, billing etc.)

"Shifting the paradigm of operations from reactive to proactive control"



RETURN ON INVESTMENT

After a 12 week programme, EMAGIN, in conjunction with United Utilities, was able to demonstrate the following outcomes and benefits:

Demonstrated Outcomes

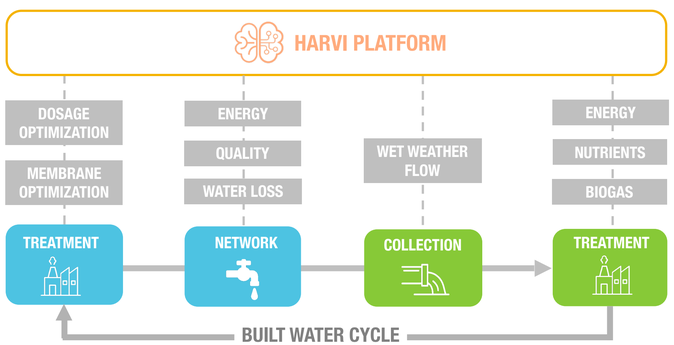
- Generated **22% cost savings** (approximately 3 £/ML) relative to baseline operations. This corresponded to a **payback period of 5 months**
- **Improved resiliency of network** by imposing terminal constraints on service reservoirs, ensuring volumes were continuously maintained over daily operational cycles.
- **Enhanced visibility of network** by providing staff with information on impact of operational decisions on key performance indicators.

Ancillary Benefits

- Potential to save 4,000 staff-hours in terms of alarm management and response time
- CO2 Emission Reduction Equivalent: **300 homes**

	MIN	AVG.	MAX.
Baseline Annual Operational Cost (£)		**230,367**	
Optimized Annual Operational Cost (£)	192,326	**180,148**	125,823
Savings (%)	17%	**22%**	45%
Savings per Annum (£)	38,041	**50,219**	104,544
Normalized Savings (£/ML)	2.1	**2.8**	5.7
Payback Period	7 months	**5 months**	2 months

HARVI PLATFORM APPLICATIONS



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