The Use of Artificial Intelligence in Asset Management

Water & Wastewater Perspectives —

PIA-Global | Clearwater Inu + Clearwater Municipal Services | Greenland Consulting Engineers (Ontario)

Bridging Innovation, Infrastructure, and Indigenous Stewardship

Setting the Stage:
The Asset Management Challenge

- Aging infrastructure; increasing failures and replacement backlog
- Regulatory expectations and Environmental pressures are rising
- Climate uncertainty and extreme weather stress systems
- Capital and O&M budgets are constrained—reactive approaches fall short

The Role of AI in Asset Management

- AI turns raw operational and condition data into predictions and priorities
- Shift from inspection → prediction → prioritization (risk-based planning)
- Applications: leak/failure prediction, process optimization, early-fault detection
- Outcome: fewer surprises, better service levels, smarter capital allocation

complements, not replaces, engineering judgment

Barriers and Enablers

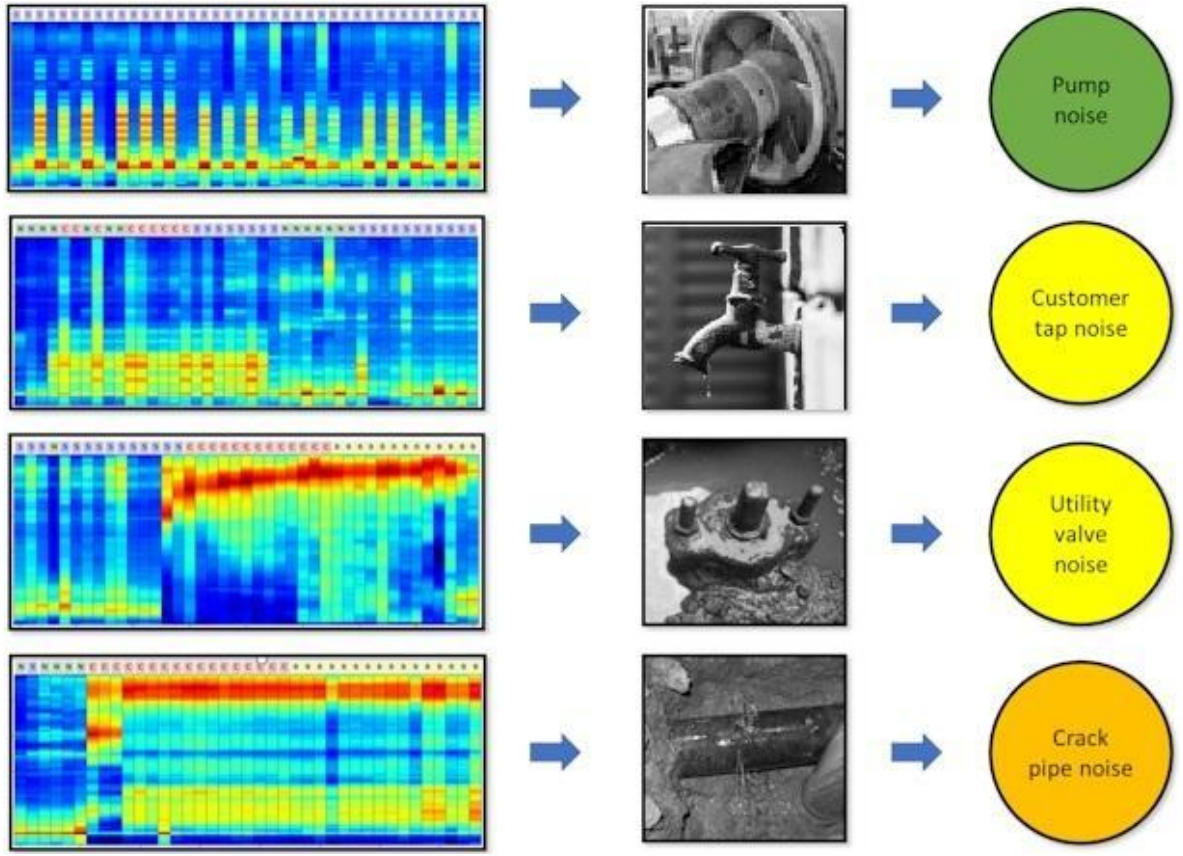
- Barriers
- Data silos and uneven data quality
- Change management and skills gap
- Model transparency and trust
- Integration with SCADA/GIS

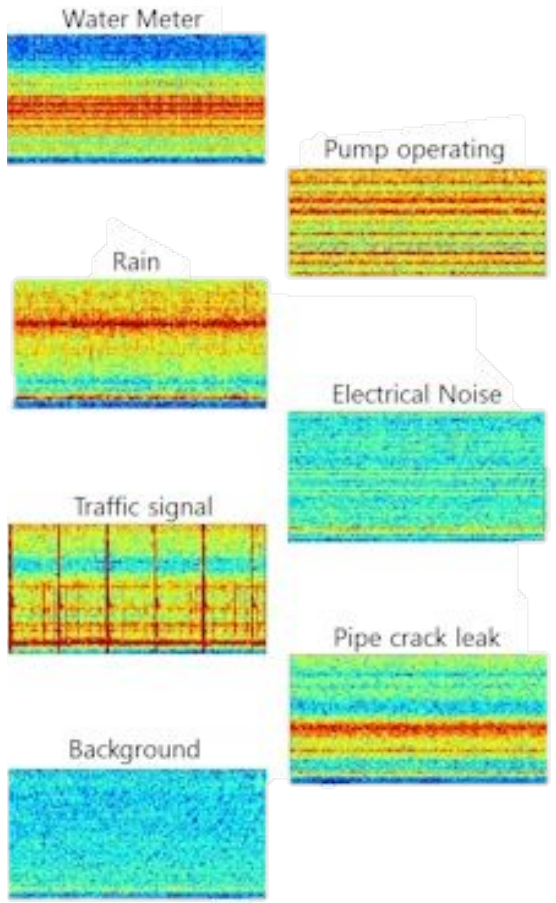
- **Enablers**
- Data governance
- Cloud and integration platforms; open standards
- Utility–vendor–academic collaboration

AI for Water Systems

- Fuses diverse sensor and SCADA outputs with historical data
- Self-learning characterisation / classification of sensor signatures
- Vast improvement in pre-failure fault detection (up to a month out)
- Improve accuracy of leak location
- Digital twinning, supplemented by monitoring can predict remaining service life, capacity, and responses to changes such as increased traffic or extreme weather events

Learning to Identify and Predict Faults





Predicting Future Asset Health and Failures

Break History

'Wall thickness

Traffic levels

Pressure transients

C-factor

Present Conditions

Deep learning

Earthquake

Increased flow

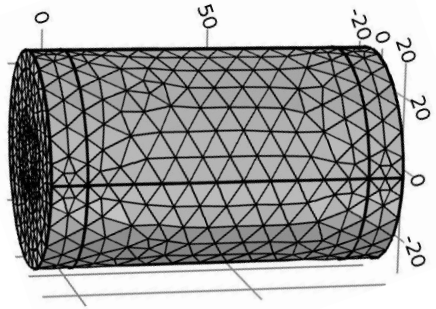
Road resurfacing

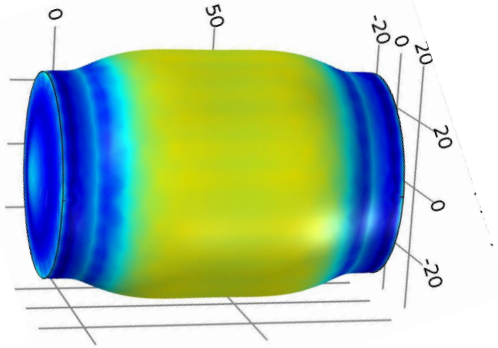
Temperature cycling

Stray current

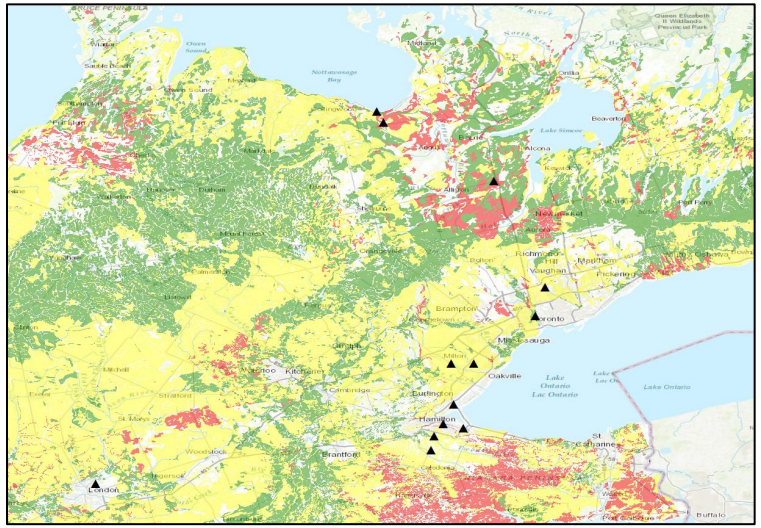
Future events

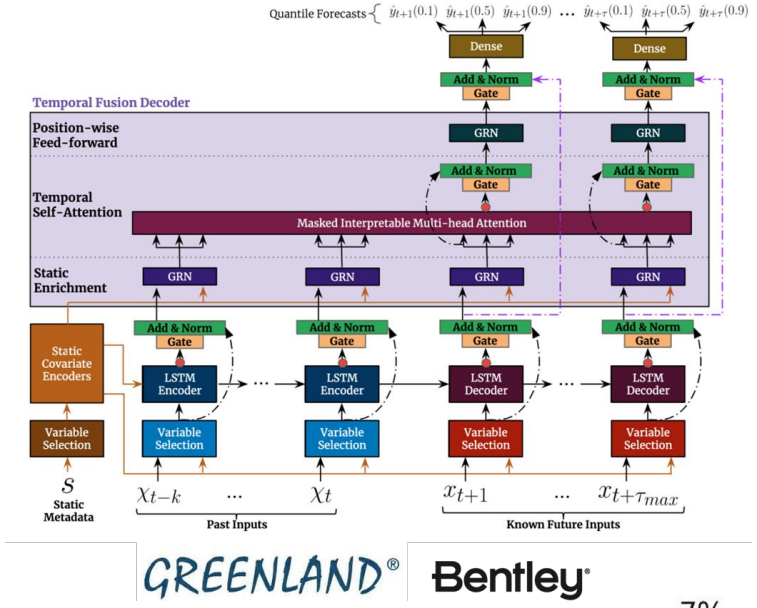
Possible outcomes and alternatives



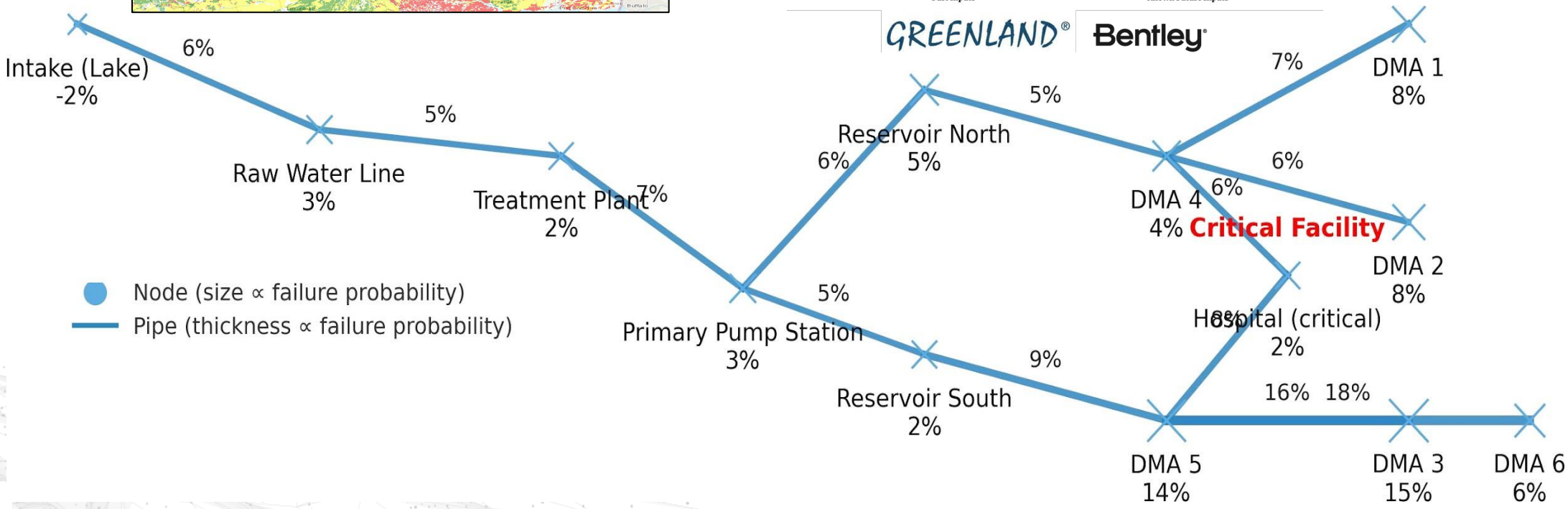


Identify Assets for Inspection – Predict Condition for Similarly Situated Assets in Other Areas





GREENLAND® Bentley



AI for Wastewater

- Artificial intelligence is being applied to wastewater piping systems for improved monitoring, predictive maintenance, and infrastructure management.
- Conveyance networks: pump station health, force main integrity, I&I pattern detection
- Treatment plants: aeration control, sludge handling, chemical dosing
- Event/anomaly detection across SCADA + GIS + inspection data
- Outcome: energy savings, stable effluent quality, fewer unplanned outages

Integrating SCADA and IoT

- Modern wastewater systems often combine AI models with Supervisory Control And Data Acquisition (SCADA) and Internet of Things (IoT) sensors, enabling
  - constant flow rate monitoring,
  - early detection of jams, and
  - swift anomaly recognition through pressure and level data analytics.

Leak and Fault Detection for Pressure Wastewater

Using advanced sensors and acoustic data, AI algorithms can identify leaks, pressure abnormalities, and other faults within underground sewer pipes, improving real-time detection compared to manual approaches.

Such predictive modeling allows for more focused repair efforts and increases the lifetime of assets.

AI for Network Health & CCTV Analytics

- Automated defect detection/classification using NASSCO MACP video/images

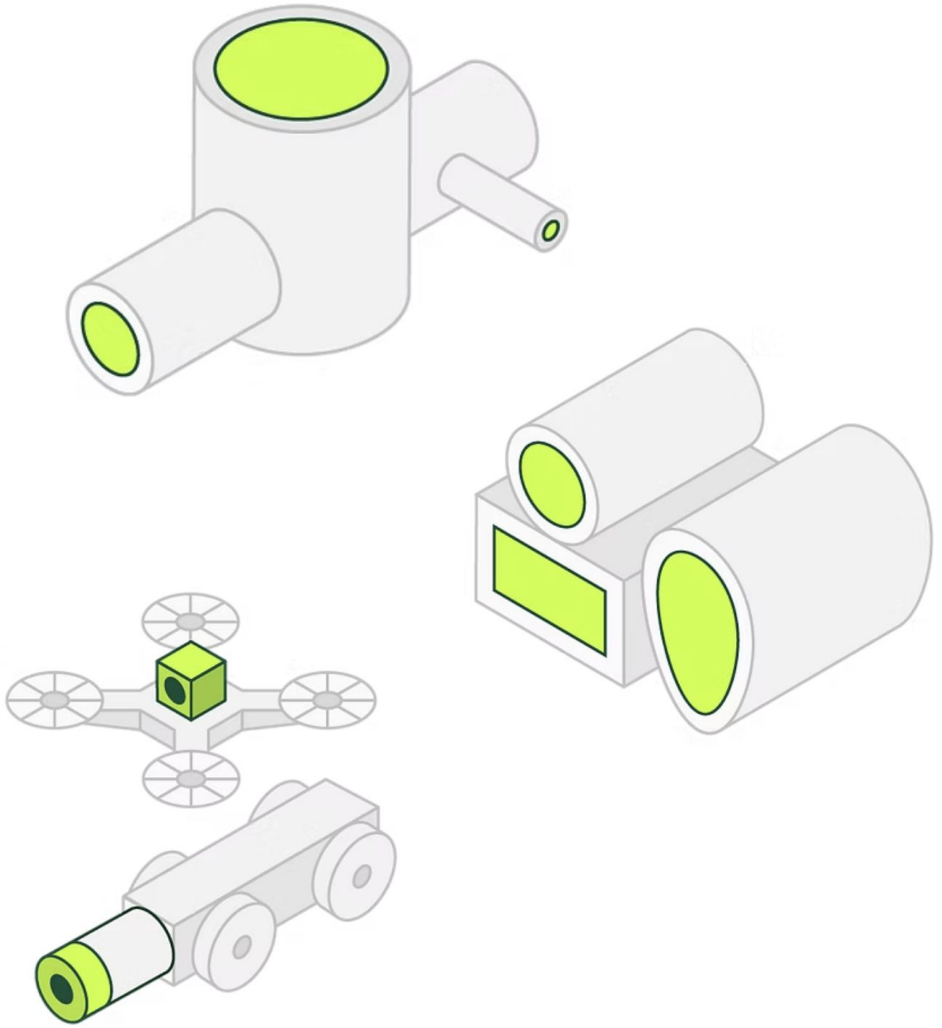
- Deterioration prediction to prioritize lining, spot repairs, and root control
- AI can fuse SCADA events, rainfall, groundwater, and work orders for risk scoring

- Outcome: faster condition assessment, objective prioritization, better rehab timing

Automated Sewer Inspection

AI-powered platforms (such as Pallon AI) process video and image data from manhole inspections and pipe crawlers to rapidly detect defects, cracks, and obstructions.

These systems use machine learning to tag inspection measurements, create 3D models of the infrastructure, and provide data to recommend maintenance priorities to utilities and municipalities, enabling operators to inspect more network segments and spot issues before escalation.



Condition Assessment and Asset Management

AI solutions help utilities score, prioritize, and manage the condition of sewer pipelines with greater accuracy and speed, automating reporting to industry standards and optimizing rehabilitation schedules.

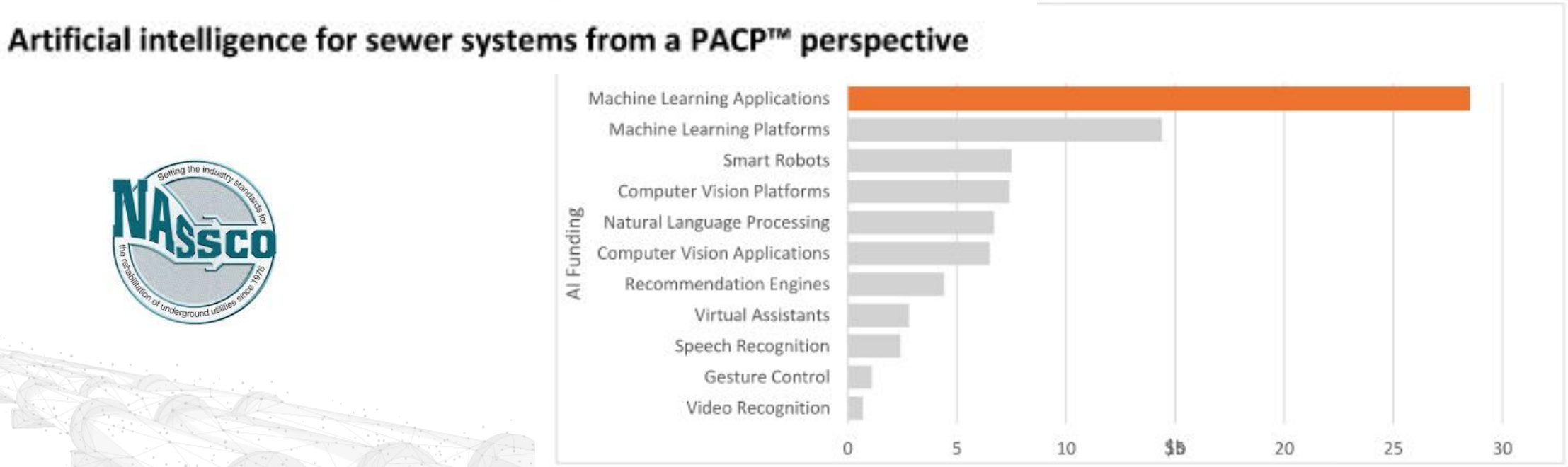
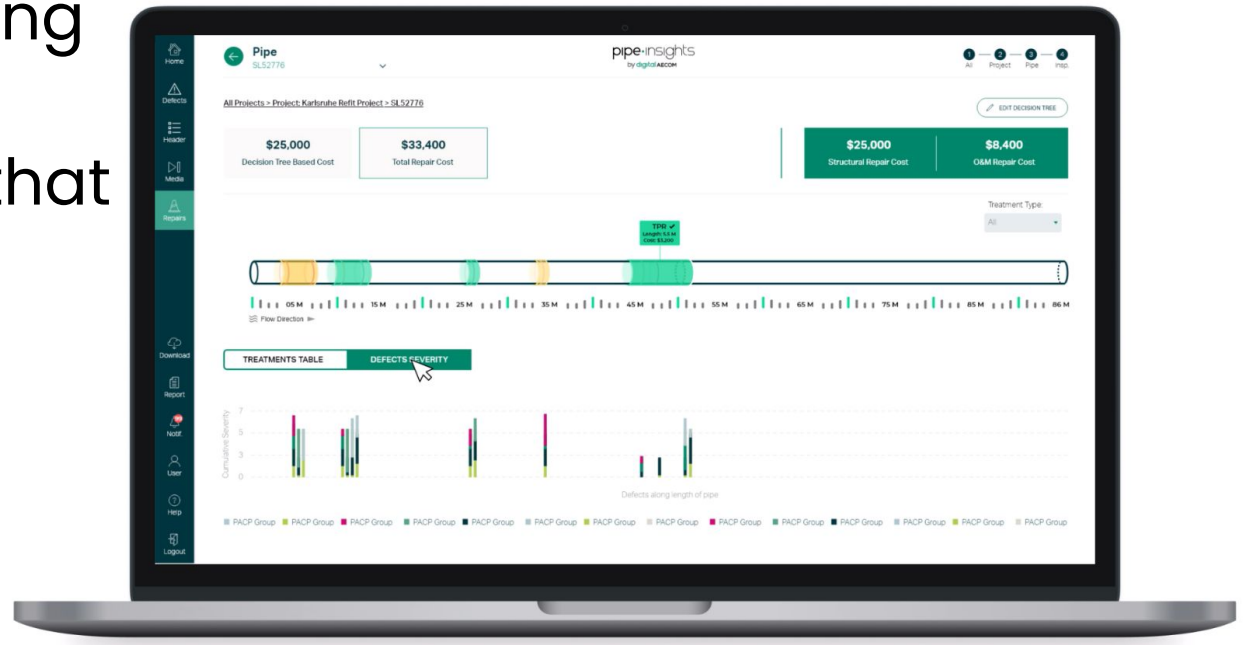


Figure 1: data applied from https://www.statista.com/chart/17966/worldwide-artificial-intelligence-funding/

Reliable Analytics for Defensible Decision-Making: AECOM – PipeInsights

- Immediate access allows contractors and operators in the field and engineers and planners in the office to access the entire inspection history, diagnose problems and make informed rehab decisions, even during emergencies.
- Greater consistency and accuracy that minimizes operator subjectivity
- A superior level of training based on AECOM's long-standing history of sewer inspections and QA/QC



Blockage and Overflow Prediction

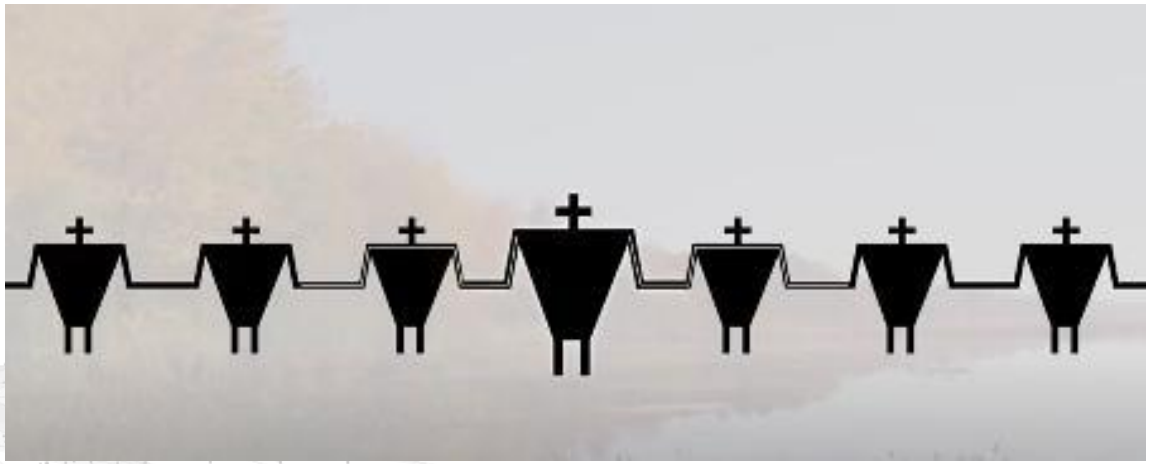
- AI systems analyze data from thousands of sensors deployed throughout a sewer network to predict developing blockages and potential overflows.
- Enables rapid intervention to prevent pollution incidents and environmental harm.

AI for Treatment Process Optimization

- Dynamic control of aeration and recycle rates lowers energy 10–30%
- Predictive control stabilizes effluent and reduces operator interventions
- Use cases: nitrification/denitrification loops, sidestreams, chemical dosing
- Path to scale: pilot → monitored rollout → continuous model governance

AI and Indigenous Stewardship: Aligning Technology with Responsibility

- Stewardship mindset: care for land and water for seven generations
- Participation & partnerships: skills, training, and shared benefits with Indigenous-led firms
- AI as a stewardship tool: anticipate issues, protect communities, reduce harm



Closing & Discussion

- AI complements engineering judgment; data + context remain critical
- Focus on stewardship, resilience, and transparency
- Next steps: pilot responsibly, measure, and scale what works

Thank you — Questions?

AI can make systems smarter — values make them wiser.