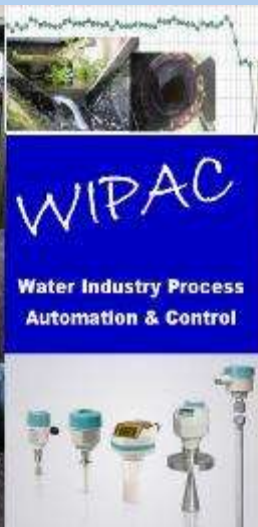# The Smart Wastewater Network.....??

Water Industry Process Automation & Control

The Smart Network Series

On the 4th December their was a CIWEM Workshop discussing the Smart Potable Water Network.

This was a very successful workshop where the opportunities for using intelligence in the potable water network were discussed. Key presenters included Syrinix, TaKaDu & I20 from the supplier side and leading key figures from the business and academic world including David Lloyd Owen, Dragan Savic & Ivan Stoianov

The follow up event was on the Wastewater Network on 18th February 2015. Key speakers included Philip Hume, David Butler, Martin Osbourne & James Harrison.

This workshop reviewed the state of the industry and where we are now and what is possible in the future

The Smart Network Series II

Learning from the potable water network showed that as an industry we are much more advanced. The key concept was of course the availability of data was key to the success of a Smart Potable Water Network

The key learning from the wastewater network workshop was

- The Wastewater Network is largely unmonitored
- AMP 6 will be key for Event Duration Monitoring and increasing monitoring
- There are a number of solutions available from a number of suppliers there seems to be two groups – instrumentation led & modelling led solutions
- The WASCs actually have a large amount of anecdotal data that they are starting to use to prevent pollution incidents. The presentation by James Harrison of Yorkshire Water demonstrated their system. Anglian Water has a similar system both are using business reports to inform likely areas of potential pollution and using preventative maintenance in these areas
- The reports produced by Mouchel through UKWIR are currently informing the UK Industry

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Event Duration Monitoring

This was a presentation by Phillip Hulme who is an Environment Agency expert

The need for EDM under the ministerial direction was pointed out as well as the evidence that formed the basis of it. It also outlined the Environment Agency's risk based approach moving forward

Key points that were pointed out:

- The combined effects of Urban Creep, Climate Change & Growth will lead to a median **increase in** 1:10 year sewer **flood volumes of 51% by about 2040** compared with current predicted flooding.
- Expectation is to prevent deterioration of permitted CSOs to protect outcomes.
- *Expectation to Improve understanding of network performance (and improve models) by using long term flow and level monitoring on sewers and CSOs.*

From the Ministerial Direction

- *"I believe that water companies need to introduce monitoring for the **vast majority** of their CSOs by 2020."*
- *"-- water company understanding **where** its CSO assets are and **how they are performing** is a basic element of sound sewerage management"*
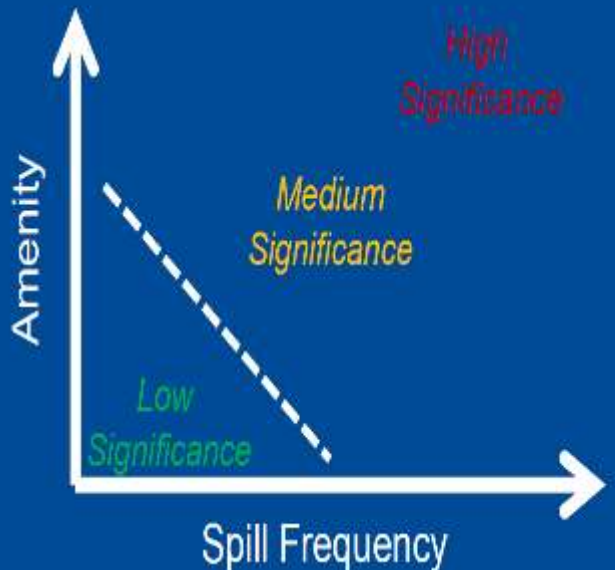
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Ministerial Direction
(Interpretation of specific messages)

Risks
- Future Pressures on Sewerage
- Changes in Performance
- Compliance with Legislation
- Reputational Issue
- High Frequency / Unsatisfactory CSOs

Observation
- Legitimate Safety Valve
- Previous Performance Improvements
- Existing Monitoring and Customer Engagement

Ask
- Inform Discussions with Customers
- Understanding Performance
- Monitor Vast Majority by 2020
- Monitoring approach should be risk based
- Include Monitoring in Permits
- Strategy to deal with High Frequency CSOs

Environment Agency

What does "Vast Majority" mean?

Amenity (vertical axis) vs Spill Frequency (horizontal axis)
- High Significance
- Medium Significance
- Low Significance

Environment Agency

EDM Requirements
High Significance

Event Duration Monitoring with Telemetry

- Telemetry
- Option to measure volume of the spill
- Where agreed locally provide live warnings
- Monitor the spill at 2 min intervals.
- 12/24hours procedure
- Information to be made available to the Environment Agency on request or as agreed locally plus an annually or 6 monthly (for bathing waters) reported spill summary report
- These requirements also apply to PR14 EDM1 (immersion), rB5 (bathing waters) and S8 (shellfish water) drivers.
- Early Delivery in PR14

Environment Agency

How will the data be used?

- Confirm success of Capital Schemes
- Engage with Customers
- Real Time Reactive Network Management
- Inform WaSC Strategy & Prioritise Investment
- Respond to Media
- Defend Regulatory Challenge
- Source Apportionment Inform Other's Strategy
- Real Time Informing Users Beach / Shellfish
- Inform Future Regulatory Approach
- Assess Long Term Trends
- Resilience Duty (Climate/Growth, Creep)
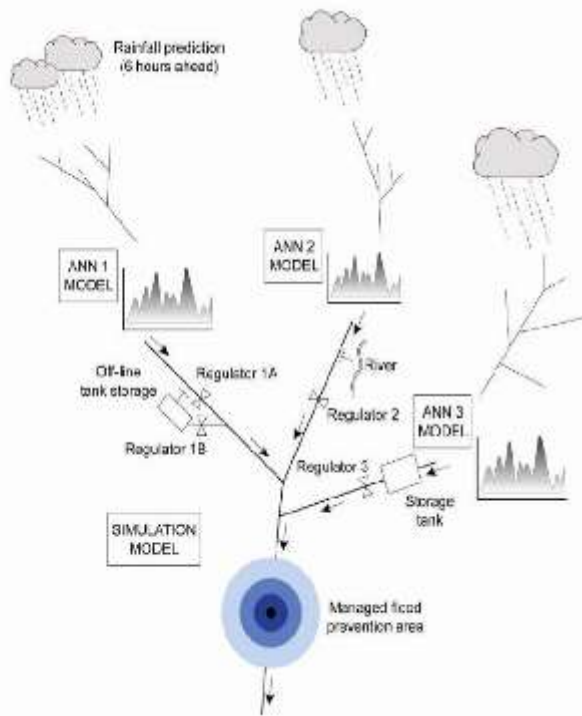- Verify Hydraulic Models

Environment Agency

Active System Control of Wastewater Networks

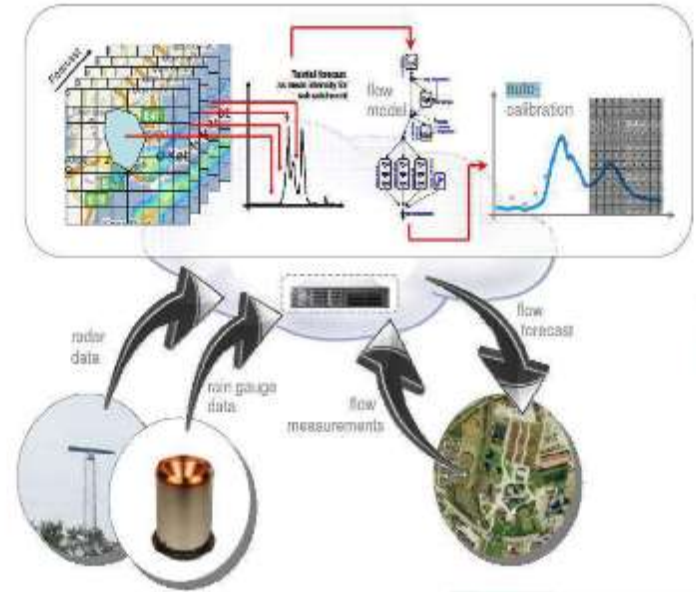Presentation by Martin Osbourne of Mouchel based upon the work they have done with UKWIR.

The main conclusions were:

- There are Smart Wastewater Networks throughout Europe but the take up in the UK is low
- There is some networks in the UK but it's not mainstream
- Barriers are people based rather than technological with skills and fear of failure being cited
- There are multiple levels of control ranging from Simple Reactive Triggers creating warnings to Fast Forecast Models optimising the system
- Case studies are needed to show how it can be done and the benefits
- Latest UKWIR report is in draft to be published later this year
    - Launch seminar will be held in May – watch for announcements
    - Much more detail on the monitoring and data technology
- The next steps are Pilot Studies to demonstrate what can be done and the benefits in the UK
- We cannot afford not to go down this route and the driver in AMP 6 is the ODI surrounding pollution reduction
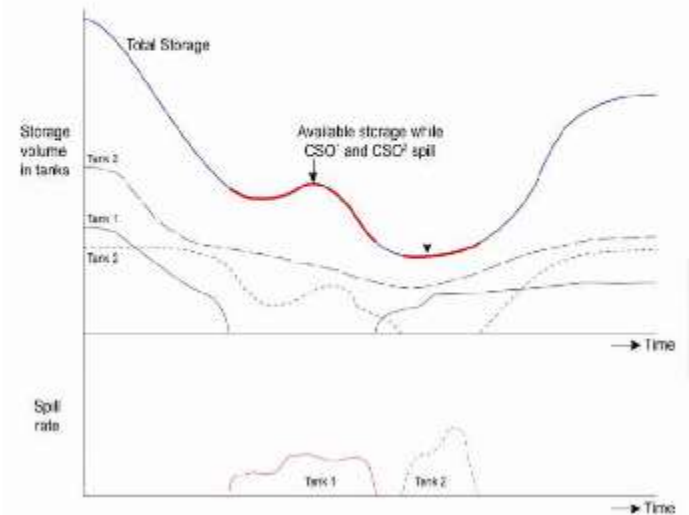
ANN models UKWIR 2012

Rainfall prediction (6 hours ahead)

ANN 1 MODEL

ANN 2 MODEL

ANN 3 MODEL

Off-line tank storage
Regulator 1A
Regulator 1B
Regulator 2
Regulator 3
River
Storage tank

SIMULATION MODEL

Managed flood prevention area

Copenhagen system

mouchel
building great relationships

auto calibration

radar data

rain gauge data

flow measurements

flow model

flow forecast

Development path

mouchel
building great relationships

	Warnings	Despatch	Operator	Local rules	Area rules	Optimiser
Fast forecast model						Copenhagen
Fast predictive model						
Forecast model	EA rivers	London	Portsmouth			
Predictive model						
Data analysis			Tyneside		Cardiff Y&P South Bend	
Predictive triggers				CENTAUR		
Reactive triggers				Pump control		

Knowing what is happening

Decisions and actions

Look for opportunities

mouchel
building great relationships

Total Storage

Storage volume in tanks

Tank 2

Tank 1

Tank 2

Available storage while CSO¹ and CSO² spill

Time

Spill rate

Tank 1

Tank 2

Time

Predictive Analysis in the Sewerage Network

Presentation by James Harrison demonstrating what Yorkshire Water have done to reduce Pollution Incidents due to performance need that was threatening to affect financial situation of the company
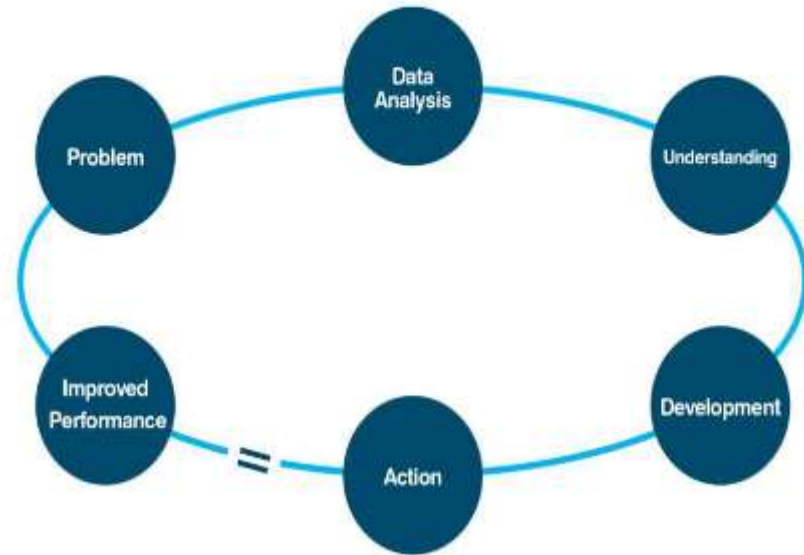
James Harrisons main points were:

- Yorkshire Water's performance was suffering and needed improvement
- They were taking a Cyclical Approach with £1.5million on cleaning and £8million on CCTV
- The data that they needed to inform their decision making was already being collected within the business and understanding the problem was what it took to discover what needed to be done
- The answer was the analysis of the "blockage timeline" where they discovered that after a prolonged dry spell blockage areas were more likely to cause pollution incidents depending upon the intensity of the rain
- Achieved a 21% reduction in pollution incidents by reorganising and working more effectively
- A quick response is no longer acceptable and predicting where problems are going to occur are key to future sucesses

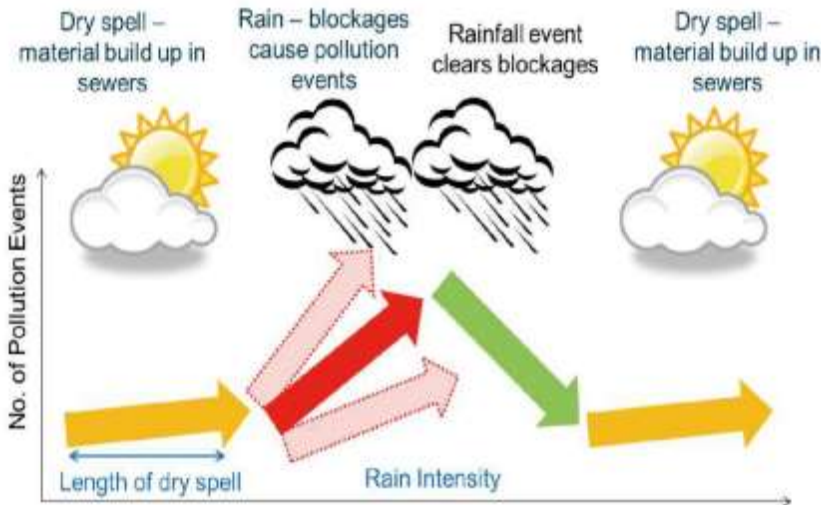Water Industry Process Automation & Control

The Problem

- 35% improvement needed across the AMP5
- We had already lost ground in the first two years
- £500k shortfall for every incident above our agreed targets
- Forecast to outturn 12 incidents above target – £6million shortfall risk
- Our improvement programme wasn't achieving targets
- Unexpected deterioration in 2013 performance

YorkshireWater

Problem → Data Analysis → Understanding → Development → Action = Improved Performance

The blockage timeline

YorkshireWater

Dry spell – material build up in sewers

Rain – blockages cause pollution events

Rainfall event clears blockages

Dry spell – material build up in sewers

No. of Pollution Events

Length of dry spell

Rain Intensity

The Operational response

YorkshireWater

Weather Report Analysis in the control room

Trigger Alert

Technical Team Prioritise Sites

Operational Response

Technical Team Review Job Feedback

Case Study of the Eastney Project

Presentation was given by Jody Cockroft of MWH, the project was for Southern Water down in the Eastney Catchment of Portsmouth

Key points were

- Driver was a 104 year event in 2000 with 300 properties flooded internally, 530 properties externally affected and Portsmouth Navy Yard
- Drove investment in AMPS 4, 5 and 6 with the Smart Wastewater Network Solution being an Early Warning System
- The System was based on Innovyze's ICM Live and uses forecast models to inform the operators at the pumping station.
- Uses Rainfall Monitoring and Nowcast Radar, Four pumping stations and 9 Sewer Level Monitors

Benefits include

- Allows SW operations to have a simple automated tool to act as their eyes and ears
- Advance warning of pump operation
- System can alert on forecasted operations not being carried out
- System can alert on system problems
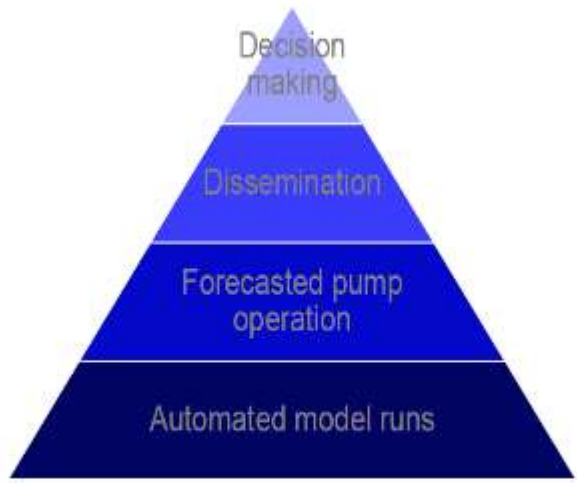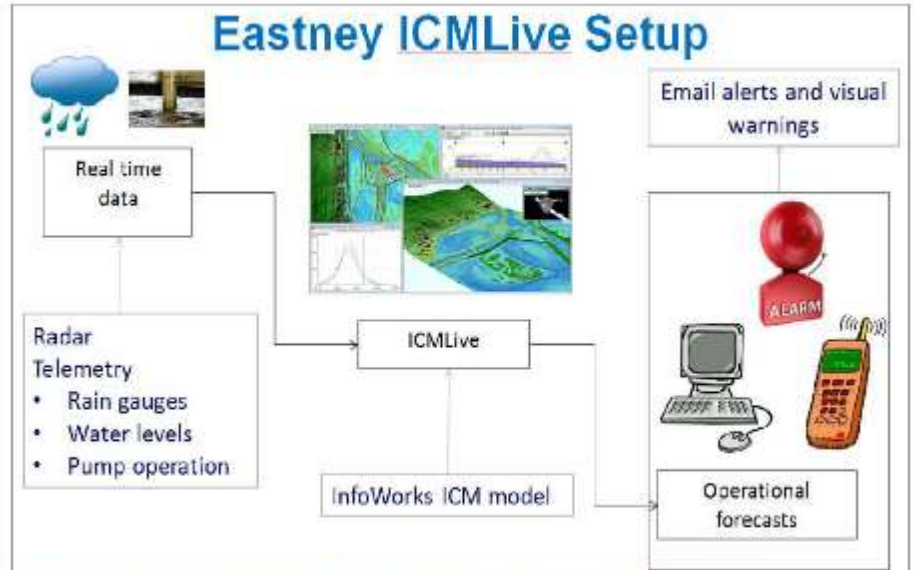- Improved system calibration
- Protection of Portsmouth

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