Implementing E-Logging at Thames Water

Standardizing shift logs, event logs and escalation processes across all shift patterns in Water Control

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KEYWORDS

Electronic Logbook, Shift Handover, Compliance, Communication, Event Escalation, Reporting, ISO9001

ABSTRACT

This presentation will highlight how Thames Water is enhancing the Human Factors aspects of Operations Management by digitizing previously manual operational business processes.

Thames Water was using inconsistent, time-consuming tools in its Operations Control Center and for its shift handover process, including spreadsheets, paper forms, word processor documents and verbal meetings, resulting in organizational risk and inefficiency. To solve this problem, Thames Water commissioned an E-Logging (electronic logbook) project to provide greater visibility, retrievability and auditability of Water Control information. A data repository for trend analysis was also required. Thames Water wanted to standardize shift logs, event logs and escalation processes across all shift patterns in Water Control. The company also wanted a solution with excellent reporting functionality that would benefit stakeholders across Water Supply, with the aim of reports being available to support asset investment decisions and event reviews.

Electronic Logging provides wider business benefits to Thames Water, such as:

- Contributing to company-wide Outcome Delivery Incentives (ODI) in Water Quality, Energy, etc.
- Meeting the Security and Emergency Measures Direction recommendations that water companies have an electronic logging system
- Aiding demonstration to both the Environment Agency and the Drinking Water Inspectorate (DWI) that requirements can be met as a control function
- Supporting the standards required to maintain their Quality Management accreditations such as ISO9001
- Reducing the risk of compensation to external parties

INTRODUCTION

Thames Water is a private utility company, enabled by the "Water Industry Act of 1991" and is the UK's largest water and wastewater services company. Every day, Thames Water supplies approximately 2.6 billion liters (570 million imperial gallons) of tap water to 9 million customers across London and the Thames Valley and removes and treats approximately 4.4 billion liters (970 million imperial gallons) of sewage for 15 million customers, representing 27% of the UK population.

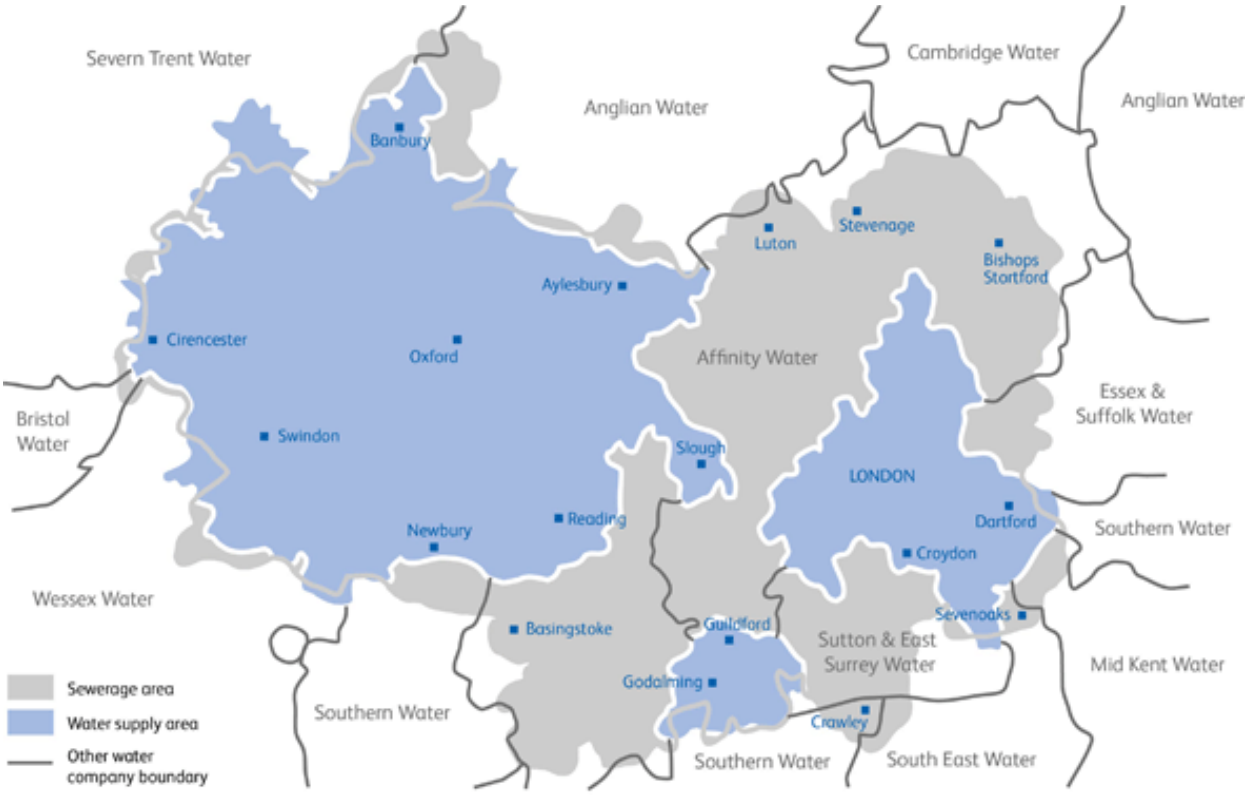


Figure 1: Thames Water Supply Area

Source: https://corporate.thameswater.co.uk/About-us/Our-business/Our-supply-area

Regulatory Governance

Regulatory Governance of the various water authorities in the United Kingdom is divided amongst the following agencies, each with their own mandates that support the Water Industry Act of 1991 and who have the ability to levy fines and regulatory oversite on companies like Thames Water.

- **The Environmental Agency (EA) -** a non-departmental public body, established in 1995 and sponsored by the United Kingdom government's Department for Environment, Food and Rural Affairs (DEFRA), with responsibilities relating to the protection and enhancement of the environment in England

- **Ofwat -** Is the body responsible for economic regulation of the privatized water and sewerage industry in England and Wales. Ofwat is primarily responsible for setting limits on the prices charged for water and sewerage services

- **Drinking Water Inspectorate (DWI) -** is a section of DEFRA set up to regulate the public water supply companies in England and Wales.

- **SEMD - Security and Emergency Measures Direction** - a statutory document produced under the provisions of Section 208 of the Water Industry Act 1991. It places upon water companies the requirement to keep under review and revise such plans as it considers necessary to ensure the provisions of essential water supply and wastewater services at all times.

- **ISO9001 Accreditation** - While not regulatory in nature, the maintenance of ISO9001 Quality Management accreditation is seen as a significant business objective for Thames Water and achievement is complementary to meeting regulatory guidelines.

Improving Operational Performance

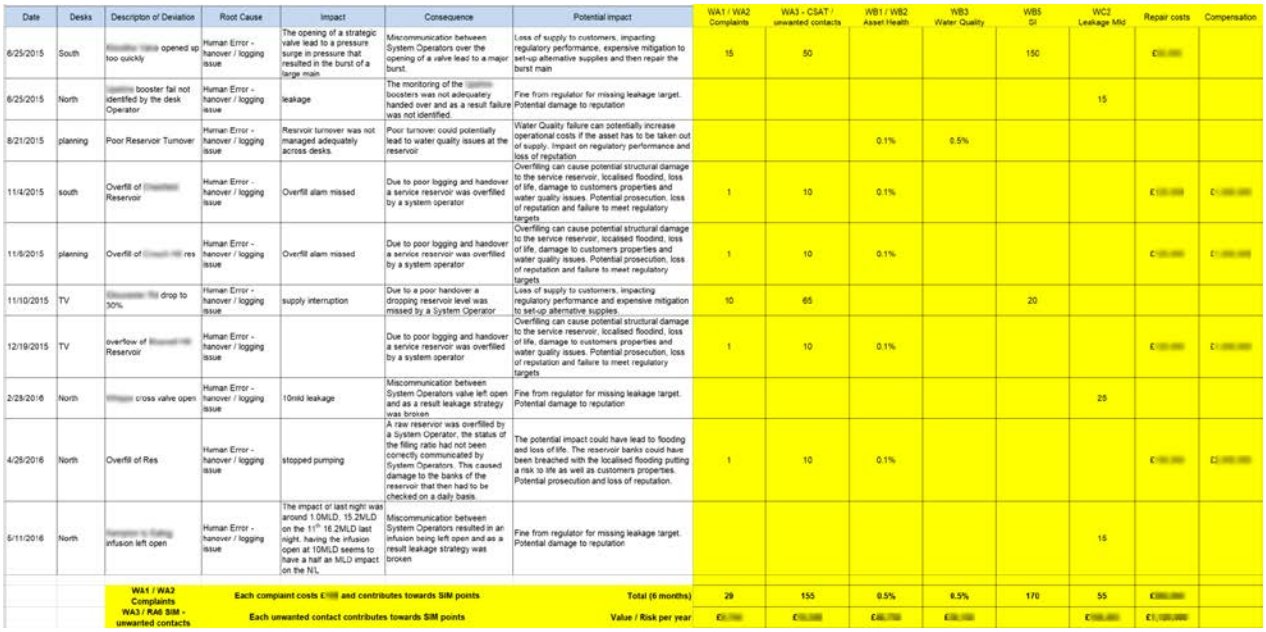
Any sustainable technology or business process improvement needs to be supported by a solid business case and so even though the regulatory environment necessitated that Thames Water digitize these Operations Logbook and Shift Handover business processes a study was conducted internally to additionally measure the impact of their current business processes against internal metrics for future evaluation of the success of the implementation of E-Logging.

Through a careful study of the Water Control Department it was identified that effective and efficient logging of Operational Activities could be improved to facilitate better communication between the shifts and to provide better visibility to asset failures.

Logging of Operational Activity - In one instance, a large storage reservoir was overfilled as the pumps had been started by one System Operator who didn't hand over to another and as a result a reservoir overfilled leading to structural damage – if the reservoir had broken their banks this could have caused severe flooding and potential injury and loss of life

Visibility of Asset Failure - Controllers and Management often only had anecdotal evidence of the number of times that water supply was reduced to a point where their customers would be affected and it was difficult to capture this information in a timely manner to influence system investment.

Below is an example of the work done to document the cost of conducting operations the old way to help guide the specifications and configuration towards the goal of reducing or eliminating problems going forward.



Date	Desks	Descripton of Deviation	Root Cause	Impact	Consequence	Potential impact	WA1 / WA2 Complaints	WA3 - CSAT / unwanted contacts	WB1 / WB2 Asset Health	WB3 Water Quality	WB5 GI	WC2 Leakage Mld	Repair costs	Compensation
6/25/2015	South	[redacted] opened up too quickly	Human Error - hanover / logging issue	The opening of a strategic valve lead to a pressure surge in pressure that resulted in the burst of a large main	Miscommunication between System Operators over the opening of a valve lead to a major burst.	Loss of supply to customers, impacting regulatory performance, expensive mitigation to set-up alternative supplies and then repair the burst main	15	50			150		[redacted]	
6/25/2015	North	[redacted] booster fail not identfied by the desk Operator	Human Error - hanover / logging issue	leakage	The monitoring of the [redacted] boosters was not adequately handed over and as a result failure was not identified.	Fine from regulator for missing leakage target. Potential damage to reputation						15		
8/21/2015	planning	Poor Reservoir Turnover	Human Error - hanover / logging issue	Resrvoir turnover was not managed adequately across desks.	Poor turnover could potentially lead to water quality issues at the reservoir	Water Quality failure can potentially increase operational costs if the asset has to be taken out of supply. Impact on regulatory performance and loss of reputation			0.1%	0.5%				
11/4/2015	south	Overfill of [redacted] Reservoir	Human Error - hanover / logging issue	Overfill alarm missed	Due to poor logging and handover a service reservoir was overfilled by a system operator	Overfilling can cause potential structural damage to the service reservoir, localised floodind, loss of life, damage to customers properties and water quality issues. Potential prosecution, loss of reputation and failure to meet regulatory targets	1	10	0.1%				[redacted]	[redacted]
11/6/2015	planning	Overfill of [redacted] res	Human Error - hanover / logging issue	Overfill alarm missed	Due to poor logging and handover a service reservoir was overfilled by a system operator	Overfilling can cause potential structural damage to the service reservoir, localised floodind, loss of life, damage to customers properties and water quality issues. Potential prosecution, loss of reputation and failure to meet regulatory targets	1	10	0.1%				[redacted]	[redacted]
11/10/2015	TV	[redacted] drop to 30%	Human Error - hanover / logging issue	supply interruption	Due to a poor handover a dropping reservoir level was missed by a System Operator	Loss of supply to customers, impacting regulatory performance and expensive mitigation to set-up alternative supplies	10	65			20			
12/19/2015	TV	overflow of [redacted] Reservoir	Human Error - hanover / logging issue		Due to poor logging and handover a service reservoir was overfilled by a system operator	Overfilling can cause potential structural damage to the service reservoir, localised floodind, loss of life, damage to customers properties and water quality issues. Potential prosecution, loss of reputation and failure to meet regulatory targets	1	10	0.1%				[redacted]	[redacted]
2/28/2016	North	[redacted] cross valve open	Human Error - hanover / logging issue	10mld leakage	Miscommunication between System Operators valve left open and as a result leakage strategy was broken	Fine from regulator for missing leakage target. Potential damage to reputation						25		
4/28/2016	North	Overfill of Res	Human Error - hanover / logging issue	stopped pumping	A raw reservoir was overfilled by a System Operator, the status of the filling ratio had not been correctly communicated by System Operators. This caused damage to the banks of the reservoir that then had to be checked on a daily basis.	The potential impact could have lead to flooding and loss of life. The reservoir banks could have been breached with the localised flooding putting a risk to life as well as customers properties. Potential prosecution and loss of reputation.	1	10	0.1%				[redacted]	[redacted]
5/11/2016	North	[redacted] infusion left open	Human Error - hanover / logging issue	The impact of last night was around 1.0MLD, 15.2MLD on the 11th 16.2MLD last night. having the infusion open at 10MLD seems to have a half an MLD impact on the N/L	Miscommunication between System Operators resulted in an infusion being left open and as a result leakage strategy was broken	Fine from regulator for missing leakage target. Potential damage to reputation						15		
		WA1 / WA2 Complaints	**Each compaint costs [redacted] and contributes towards SIM points**			**Total (6 months)**	**29**	**155**	**0.5%**	**0.5%**	**170**	**55**	**[redacted]**	
		WA3 / RA6 SIM - unwanted contacts	**Each unwanted contact contributes towards SIM points**			**Value / Risk per year**	**[redacted]**	**[redacted]**	**[redacted]**	**[redacted]**		**[redacted]**	**[redacted]**	

Figure 2: Logging Anomalies

PROJECT LANDSCAPE

To solve this problem, Thames Water commissioned an E-Logging (electronic logbook) project to provide greater visibility, retrievability and auditability of Water Control information. A data repository for trend analysis was also required. Thames Water wanted to standardize shift logs, event logs and escalation processes across all shift patterns in Water Control. The company also wanted a solution with excellent reporting functionality that would benefit stakeholders across Water Supply, with the aim of reports being available to support asset investment decisions and event wash-ups.

Key Stakeholders:

- For Water Control Operations Team- A system for shift and event logs to replace existing spreadsheets and documents with one set of logs per Operations Desk (Console) with clear and standardized processes for logging and escalation to support quicker resolution of emerging risks.
- For Compliance Teams - A system that will make it easier to identify risks and spot opportunities for further process improvements
- For Water Quality - Support standardized processes for logging and escalating water quality events, to reduce the likelihood and severity of event impacts
- For Area Operations Managers - Provide reporting data to support asset investment decisions, reduce the risk & severity of events and to support targeting planned work at Water Treatment Works
- Event Learning Team - Facilitate the visibility of logs in a single location to aid in event learning

Implementation Schedule:

The project delivery philosophy was based on implementing as much of the out-of-the-box software vendor's functionality as possible while still addressing the designated and approved operational business processes. Only after the core application capabilities were known and understood by Thames Water was system modification changes defined and implemented as part of an IT project to fill the gap between base functions and project requirements. This approach led to a significantly shortened schedule and the ability to achieve a quicker time to value.

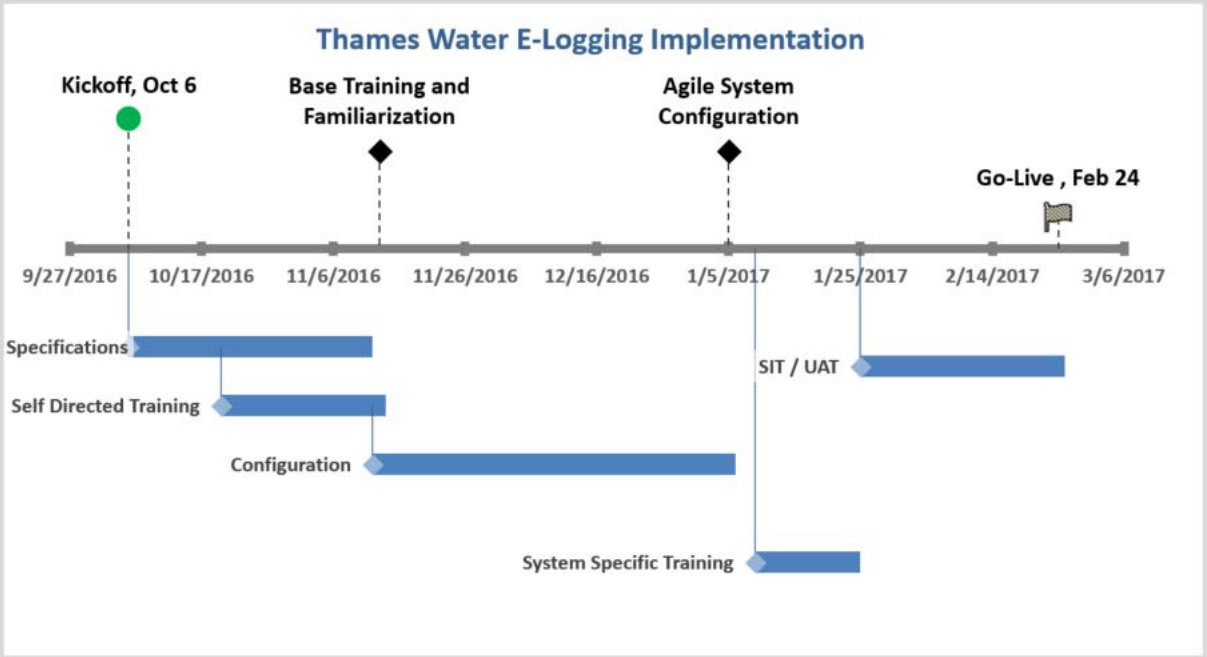
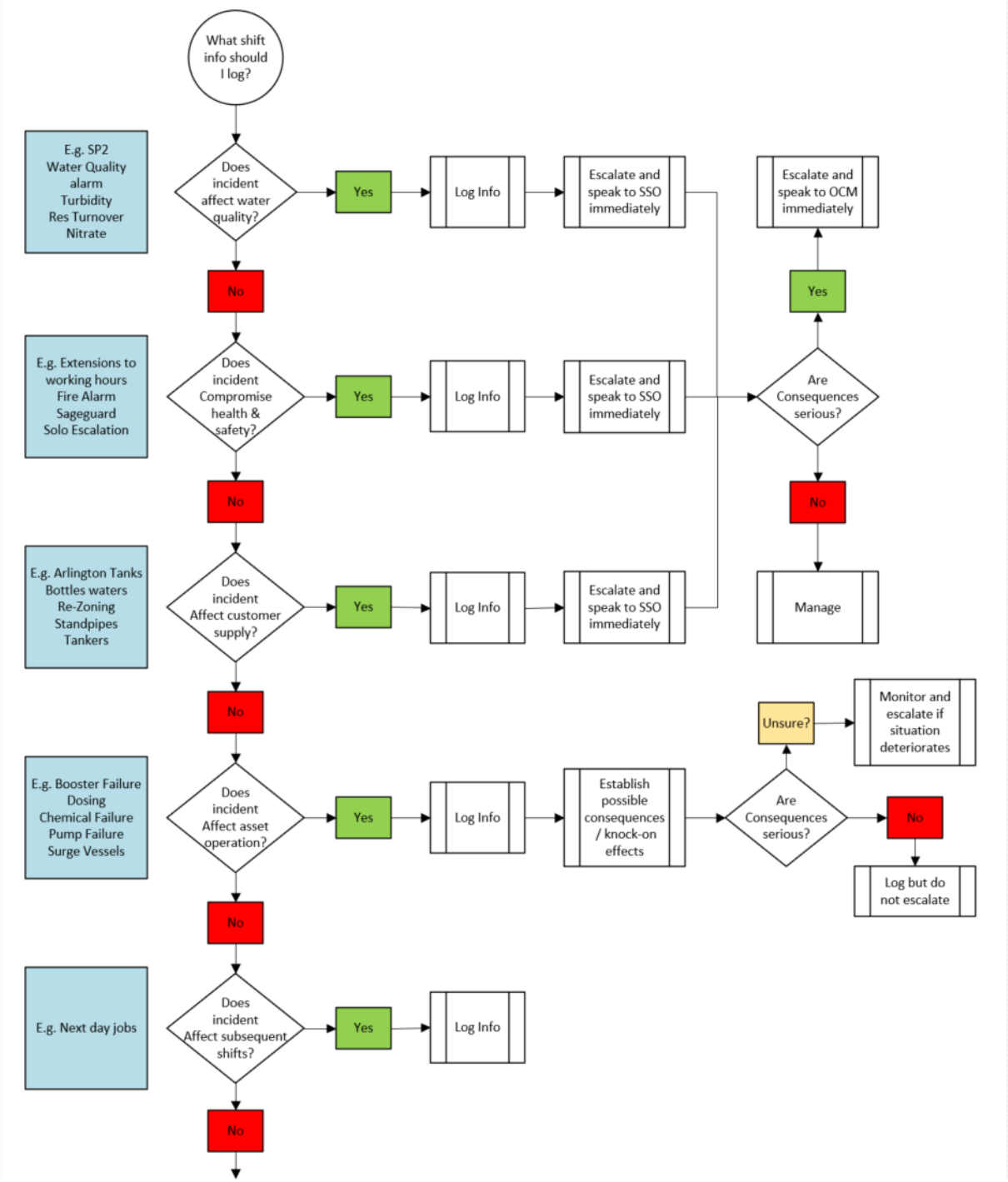


Figure 3: E-Logging Implementation Timeline

- October 6, 2016 - Project Kickoff with Key Operations personnel to develop project specifications
- October 20, 2016 - Begin self-directed training to provide base-level familiarization with the software application
- November 11, 2016 - Begin Agile System Configuration
- January 9, 2017 - Begin configured system specific training
- January 25, 2017 – Begin System and User Acceptance Testing
- February 27, 2017 - Go-Live of E-Logging project

Structured Event Logging

Key requirements of implementing an E-Logging system at Thames Water was to facilitate a more structured and repeatable event logging and escalation process to support the stated quality and compliance goals of the company. The E-Logging system is therefore a tool to support the business process and so as a key factor in the deployment of the tool was the development of clear guidelines for event logging, escalation and communications which are then supported by the tool. Training with the tool went hand-in-hand with training on enhanced business processes.


What shift info should I log?
E.g. SP2 Water Quality alarm Turbidity Res Turnover Nitrate
Does incident affect water quality?
Yes
Log Info
Escalate and speak to SSO immediately
Escalate and speak to OCM immediately
No
Yes
E.g. Extensions to working hours Fire Alarm Sageguard Solo Escalation
Does incident Compromise health & safety?
Yes
Log Info
Escalate and speak to SSO immediately
Are Consequences serious?
No
No
E.g. Arlington Tanks Bottles waters Re-Zoning Standpipes Tankers
Does incident Affect customer supply?
Yes
Log Info
Escalate and speak to SSO immediately
Manage
No
Unsure?
Monitor and escalate if situation deteriorates
E.g. Booster Failure Dosing Chemical Failure Pump Failure Surge Vessels
Does incident Affect asset operation?
Yes
Log Info
Establish possible consequences / knock-on effects
Are Consequences serious?
No
Log but do not escalate
No
E.g. Next day jobs
Does incident Affect subsequent shifts?
Yes
Log Info
No

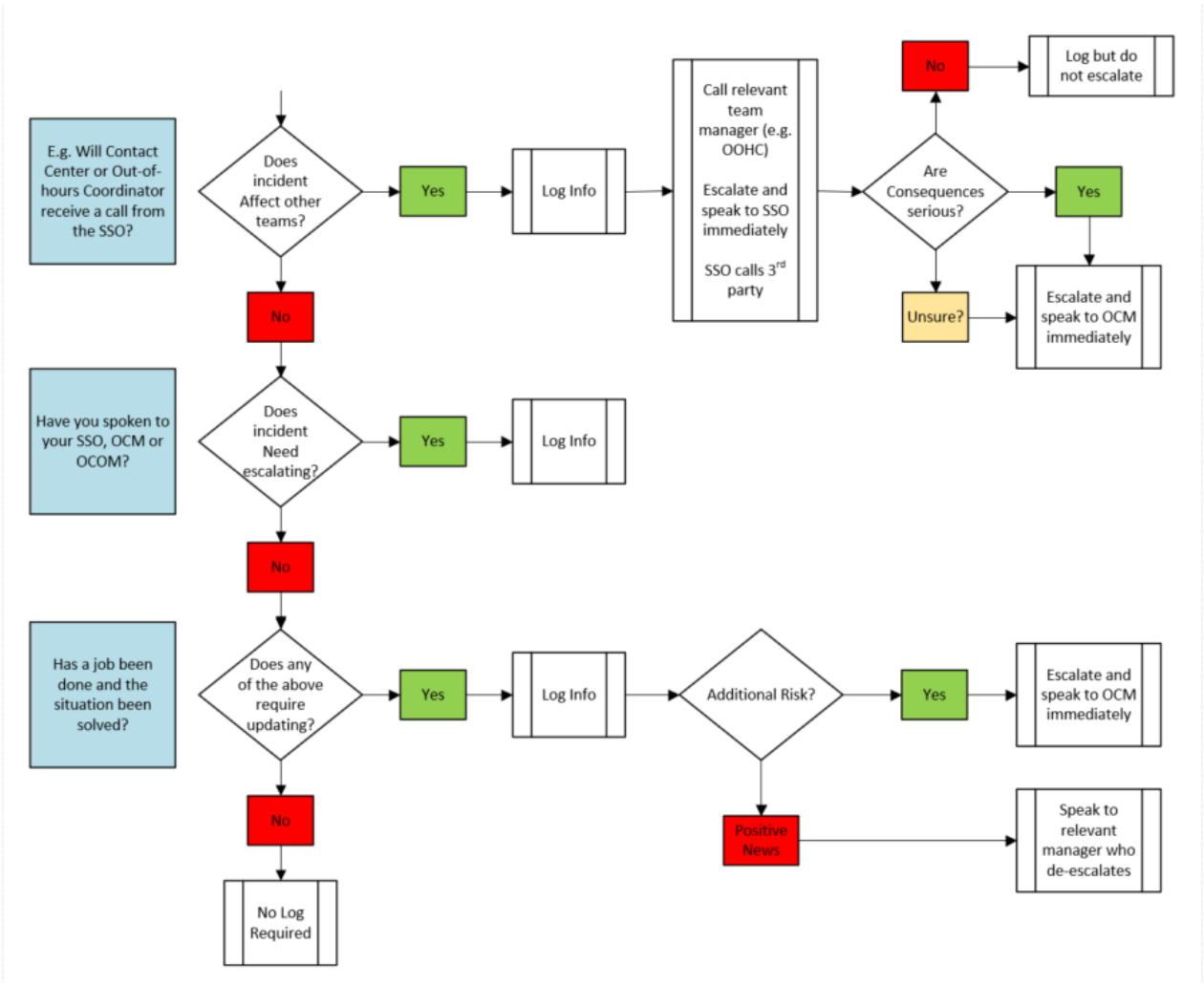


Figure 4: Escalation Decision Tree

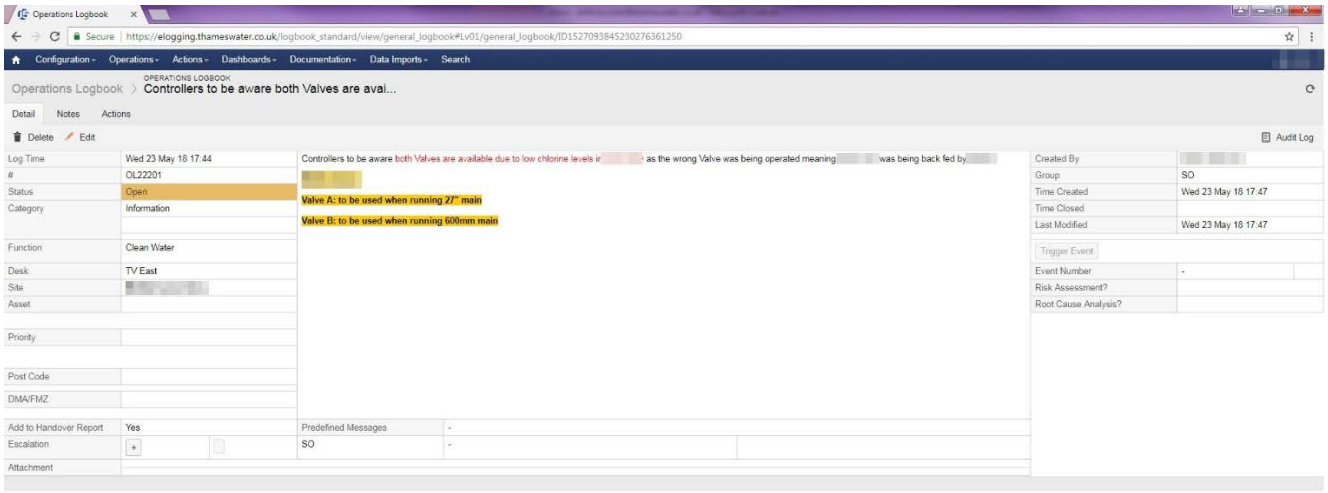


Figure 5: Logbook Entry Screen Shot

Event Escalation and Reporting in Water Control

Escalation within Water Control is accomplished through proactive conversations which take place in Water Control. Is it not the goal of implementing the E-Logging technology to compromise or restrict that conversation but rather to standardize the way logging is done and to facilitate escalation and better communications using the E-Logging tool.

The Shift Handover application within the E-Logging tool helps to facilitate a roll-up of critical information from the DESK level to SENIOR SYSTEM OPERATOR level and then up to MANAGEMENT.

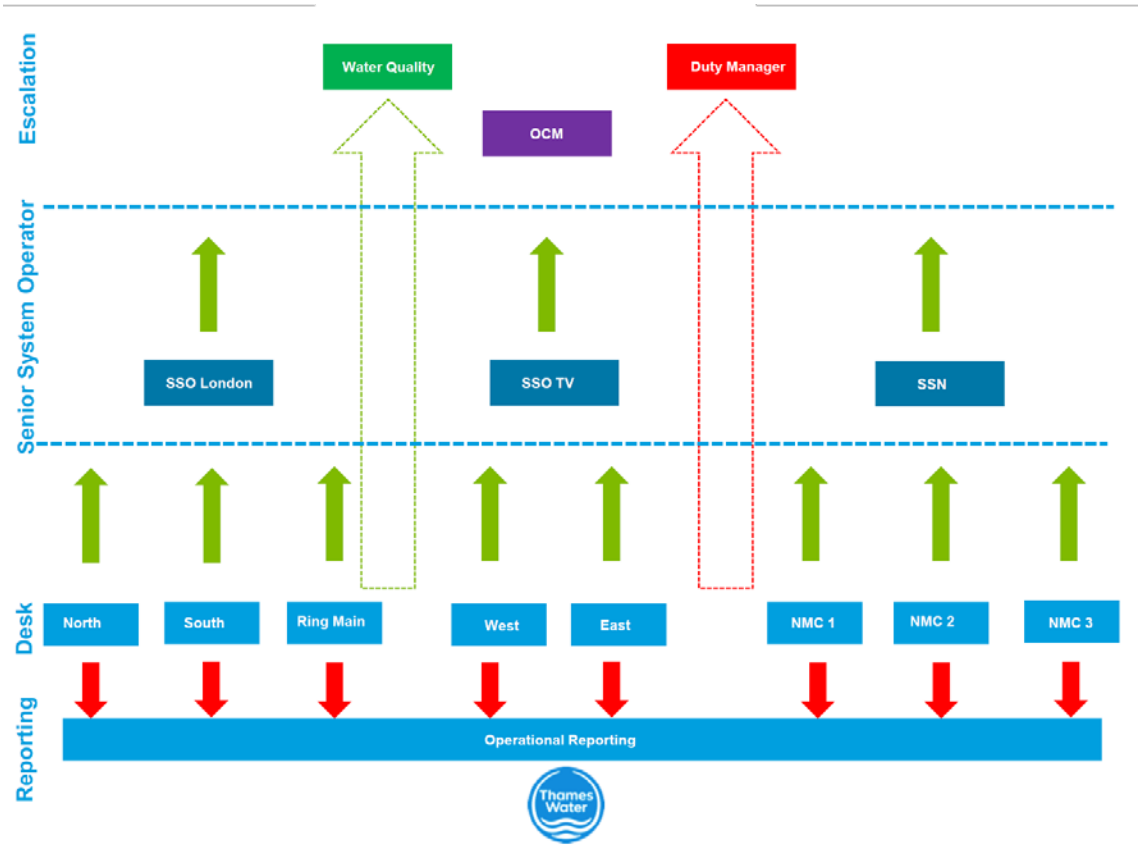


Figure 6: Hierarchical Escalation

Shift Report May 23, 2018

Clean Water

Shift Start:	May 23, 2018, 6:04 PM	**Shift End:**	May 24, 2018, 5:37 AM
Status:	Complete		
Outgoing Approval:	Approved	[redacted]	May 24, 2018, 5:37 AM
Incoming Approval:	Acknowledged	[redacted]	May 24, 2018, 6:20 AM
Handover IndustraForms:	Pending		
	OCM Checklist		

Burst reported [redacted]

Electrical storm now affecting multiple sites i[redacted]

Electrical storm in south London tripped multiple sites

[redacted]

Resources in area are all out on jobs, VM left for OOH[redacted]

E936 [redacted] **urst on** [redacted] **36" or 1000mm**
Flooding contained and under control.
Res storage not enough to do trial shut to prove which main the burst is on.
Plan is to increase storage until Monday and then prove burst and repair the main.
South desk to maximise pumping into[redacted]
Cell 2 inspection at [redacted] res suspended.

Brasenose:
SR likely to be in low level, work ongoing in network is restricting flow to SR. Days to escalate to network to reverse

[redacted]

24" burst or [redacted] circular now shut in [redacted] was shut in at 0.27 cell 1 & 0.39 in cell 2, 12" main has been used to supplement main feed to SR and there is now a positive flow into[redacted], if flow into SR reverses then it must be shut back in as no WQ testing has been done, this can be completed once sample pumps are available, only filling cell 2 at this time. WQ must be consulted prior to the SR being reintroduced to supply. List of properties for sampling has been forwarded to [redacted]. Bottled water and tankers have been deployed to the area and are awaiting further instructions. NMC have areas listed by property height and bottled water locations ready should they be required.

Figure 7: Shift Handover Report

Current Open Events – 08/01/17			Next Event No 7378
Total open events	Clean Production = 16	Waste Process = 17	I.T. Event = 3
61	Clean Network = 13	Waste Network = 11	Other = 1

Start / Update		Event Controller	DEFRA	DWI	EA	EHO	PHE	Ops Man	WQ	KA	Event Number
05/01 06/01	15:50 14:41	OCDM	No	No	No	Yes	No	Yes	Yes	No	7377 L2

8" Burst

Burst reported at 12:50, confirmed as 8" outside . The school was still in supply but closed due to water flooding the car park for H&S concerns. 144 props in the shut but tanker on site reduces to 62 without water.

+ Called on , he confirmed flushed main and then checked with headmaster he confirmed now running clear. 3 props next to school confirmed no WQ issues. Job last night was on connection past the schools service pipe. WQT is on site to take samples now.

Closure Criteria	Main repaired road reinstated. , network returned to normal configuration,
Event Strategy	Locate burst & isolate main, manage network to maintain customer supply.

Start / Update		Event Controller	DEFRA	DWI	EA	EHO	PHE	Ops Man	WQ	KA	Event Number
03/01 06/01	04:30 10:09		No	No	No	No	No	Yes	No	No	7375 L2

900mm Burst Main

pumps have tripped and flow has increased indicating a burst on the 900mm main. Currently is running. res levels are No.1 – 67%, No.2 – 67%, No.3 – 76%, expected to drop at 7% an hour.

Figure 8: Operational Event Report

OCM Checklist May 24, 2018, 6:21 AM

OCM Checklist					
Task	Completed	Comments	Task	Completed	Comments
Leakage Report	Yes		North Desk Abstraction Report	No	
Extension of working hours	No		Daily Production Call	No	
Lone Alert Escalations	No		Thursday Planning Call	No	
WIS Report	Yes		WQ Turnover Call (every two weeks)	N/A	
Demand Prediction Tool	No		WQ Turnover Commentray	Yes	
PPPR	Yes		Outage Calendar Management	Yes	
South Area Abstraction Report	Yes		PTW Sign Off	Yes	
Trunk Scheduler Creation	No		DRA Validation	Yes	
Trunk Scheduler Compliance	Yes		DRA Report Publication	No	
Pumping Stategy Commentary	Yes				
SUBMISSION STATUS					
Not Submitted					

Figure 9: OCM Checklist

Critical Success Factor - E-Logging Ambassadors

It was recognized early on that in order to achieve the goals of a successful deployment of the E-Logging system, a group of Ambassadors would act to facilitate the training and adoption throughout the Water Control Group. These Ambassadors were chosen from the ranks Senior System Operators. The Roles and Responsibilities of these Ambassadors are as follows:

- Act as the first point of contact on shift if my team has a query and redirect them if it is required. e.g. A System Operator has a query on how to log an event on the desk. The Ambassador will spend five minutes running through logging within the system and point to the training materials for future reference.

- Understand and communicate the capabilities of E-Logging and the wider business benefits of what we're aiming to achieve. e.g. The Ambassador will pick up on comments like 'it would be easier to go back to spreadsheet logs.' The Ambassador will remind teams of the benefits and previous events which may have been avoided if E-Logging had existed at that point.

- Support E-Logging by driving compliance and celebrating success. e.g. The Ambassador will identify success stories of reduced impact from water quality events through using the escalation process and share these across Water Control.

- Think strategically about E-Logging and generate more ideas on how E-Logging can be improved further. e.g. The Ambassador will use Team Hubs to collate ideas on how the E-logging tool can be improved and feed these into the Business Lead.

- Communicate when future phases of E-Logging have gone live. e.g. Technical briefings have now been made available on E-Logging. The Ambassador will remind teams when arriving on shift that this functionality is now available and communicate how it impacts the team.
- Support the onboarding of new team members. e.g. A new starter in Water Control joins. As part of their induction, the Ambassador will run through E-Logging and what it's aiming to achieve. The Ambassador will ensure new starters have passed the proficiency test.

SUMMARY

Many teams across Water Supply have benefitted from E-Logging and the improved business processes which are being aligned to making best use of the tool. In particular, anyone who carries out shift or event logs are benefitting from quicker, smarter processes and users find it quicker and clearer than the older processes (spreadsheets, paper, word processing documents, etc.), providing enhanced visibility to returning shift workers.

- Since Go-Live in February 2017 there have been over 21,000 logs entered into the system.
- Thames Water has extended the functionality of the system to additionally manage tasks that in the past were not executed consistently, examples include:
  - Solo Escalation - people working alone in the field must report back every so often. If they don't a form is required to be filled out stating whether contact with the person was made and where they are (previously an email)
  - Extension of Working Hours - If someone is working in the field longer than the shift time a checklist needs to be completed to make sure it is safe for them to continue doing so, (previously an email)
  - Sample Failure Investigation - If a water sample comes back with a failed result then they complete a form with details of the sample failure (previously an email)
  - Risk Assessments - for asset failures and events Risk Assessments can be completed at different times (previously a Work Document)
  - Alternative Waters - If they must provide alternative water supply to an area (bottled water, tankers etc.) they complete forms with the details of the supply.

The E-Logging tool has added to the good work achieved through the company's iHub, acting as the tool to escalate emerging risks identified on the schematic and through alarms in SCADA. The E-Logging tool forms an important piece of the Thames Water Systems Operations Vision, allowing the company to move further towards being a business in control.

The E-logging tool contributes to a company-wide Outcome Delivery Incentives (ODI) in Water Quality, Energy, etc.

- Meeting the Security and Emergency Measures Direction Recommendations that water companies have an electronic logging system
- Aiding demonstration to both the Environment Agency (EA) and the Drinking Water Inspectorate (DWI) that requirements can be met as a control function
- Supporting the standards required to maintain their Quality Management accreditations such as ISO9001
- Reducing the risk of compensation to external parties

And finally, the successful implementation of the E-Logging tool for events and shift-to-shift communications has provided a digitization platform that will allow for enhancing other peripheral business processes and integration with other Thames Water systems of record. The additional operational processes being considered include:

- Electronic Permit to Work
- Electronic Work Authorization for Contractors

LIST OF ACRONYMS

ODI ……. Outcome Delivery Incentives (Thames Water terminology)
UK……. United Kingdom
DWI……. Drinking Water Inspectorate (UK Government Agency, department of DEFRA)
EA……. Environmental Agency (non-departmental public body)
DEFRA…... Department for Environment, Food and Rural Affairs (UK Government Agency)
Ofwat……. Water Services Regulatory Authority (Non-ministerial government department)
SEMD……. Security and Emergency Measures Direction
CCA…….Civil Contingencies Act (Act of Parliament)
OCM…….. Operations Customer Manager (Thames Water Operations Position)
SSO……. Senior Systems Operator (Thames Water Operations Position)
SSN……. Senior Network Operator (Thames Water Operations Position)
iHUB…….. Third Party application used by Thames Water for conditional awareness

ABOUT THE AUTHORS

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