

Modelling Symposium

Emotion over Evidence? The Value of Modelling Storm Overflow Impact

Presented by
Graham Moralee – Stantec New Zealand

Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

AGENDA

- **Who** am I?
- **What** are storm overflows?
- **Why** are we interested in how they perform?
- **What** have we done to get to know them?
- **When** did they become headline news in the UK?
- **How** did the UK Government respond?
- **Where** and **how** do we go from here?

Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

Graham Moralee CWEM

Senior Principal Wastewater Networks Modeller, Stantec New Zealand

- 18 years' experience in wastewater networks modelling
- Work locations: United Kingdom, India, New Zealand
- Chartered member of CIWEM
- Focus on storm overflows, catchment planning, sustainable drainage

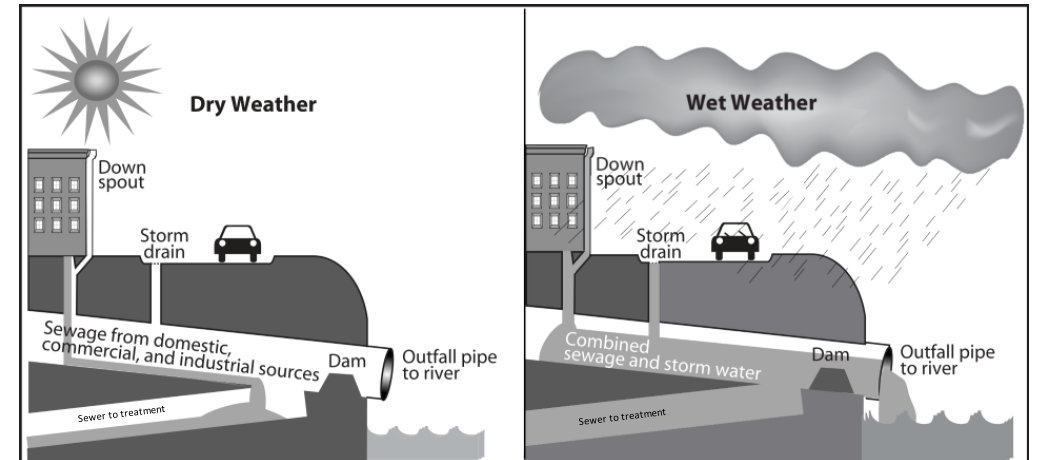
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What are storm overflows?

- ❑ Storm Overflows – SOs
- ❑ Combined Sewer Overflows – CSOs
- ❑ Type 2 Engineered Overflow Points – EOPs

- Surcharge relief points
- Used to control flows in combined sewer networks
- Help prevent incidents such as flooding

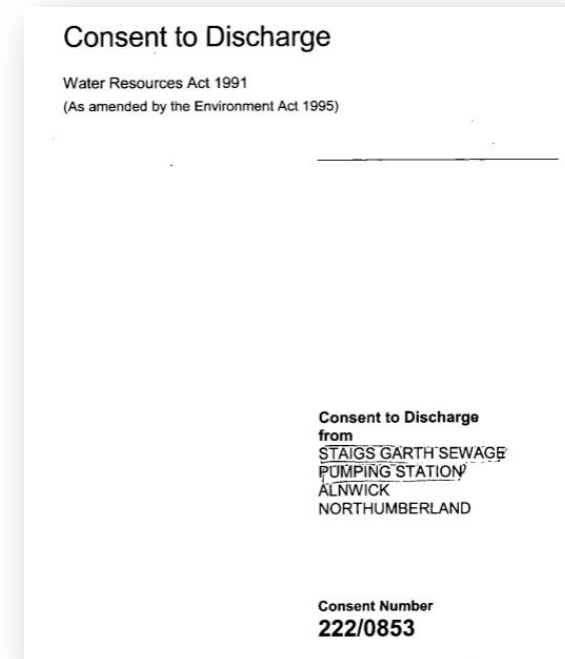


Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

Why are we interested in how they perform?

- Should operate within limits of issued consent
 - Pass-forward flow during spill
 - Location of discharge
 - Provision of screening
- Modelling has played a significant role in helping water companies understand how their overflows operate



Emotion over Evidence?

The Value of Modelling Storm Overflow Impact


What have we done to get to know and improve them?



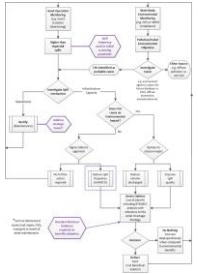

Department
for Environment
Food & Rural Affairs




JULY 2013


UK Water Industry Research

A ROADMAP FOR
SEWERAGE
INFRASTRUCTURE
DEC 2014






21st Century
Drainage
Programme

Storm Overflow Assessment Framework (SOAF) – Inland

Intermittent TaF
SEPT 2018

Benefits Valuation Framework

MWH (Stantec)
OCT 2017

Event Duration Monitoring (EDM)

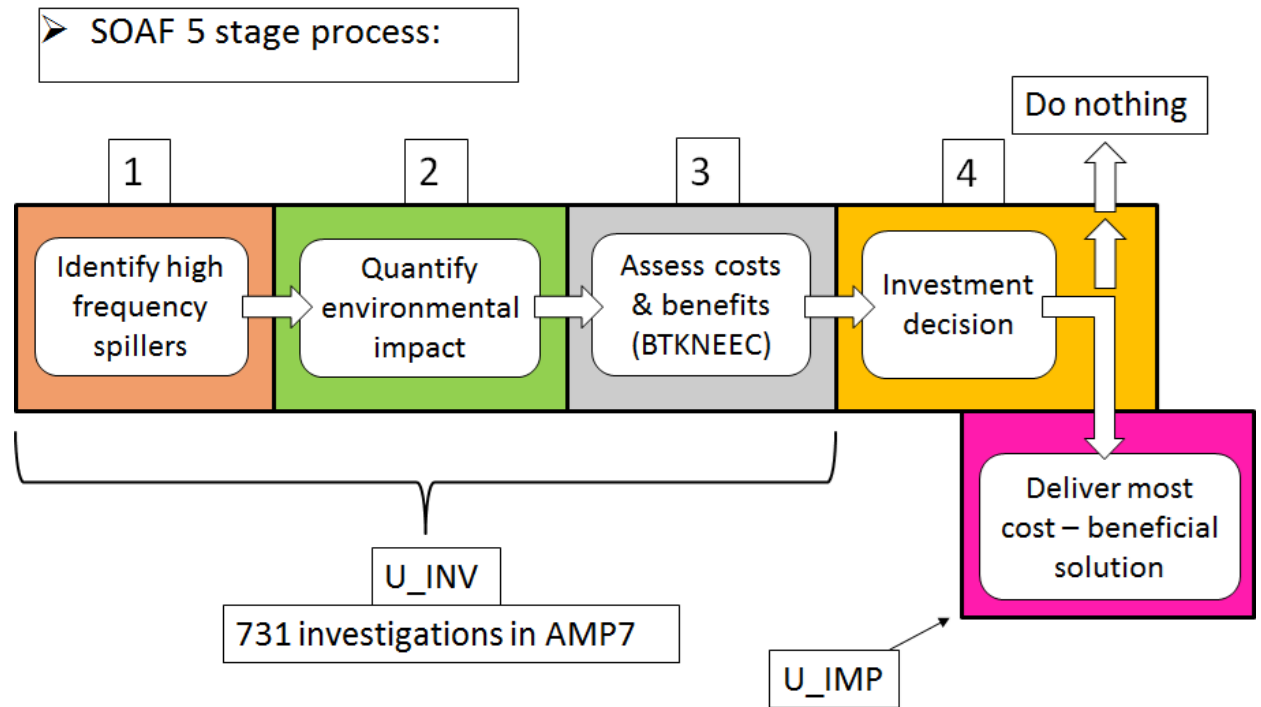
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Storm Overflow Assessment Framework (SOAF)

No. Years EDM Data	Trigger for investigation (annual average)
1	>60
2	>50
3+	>40



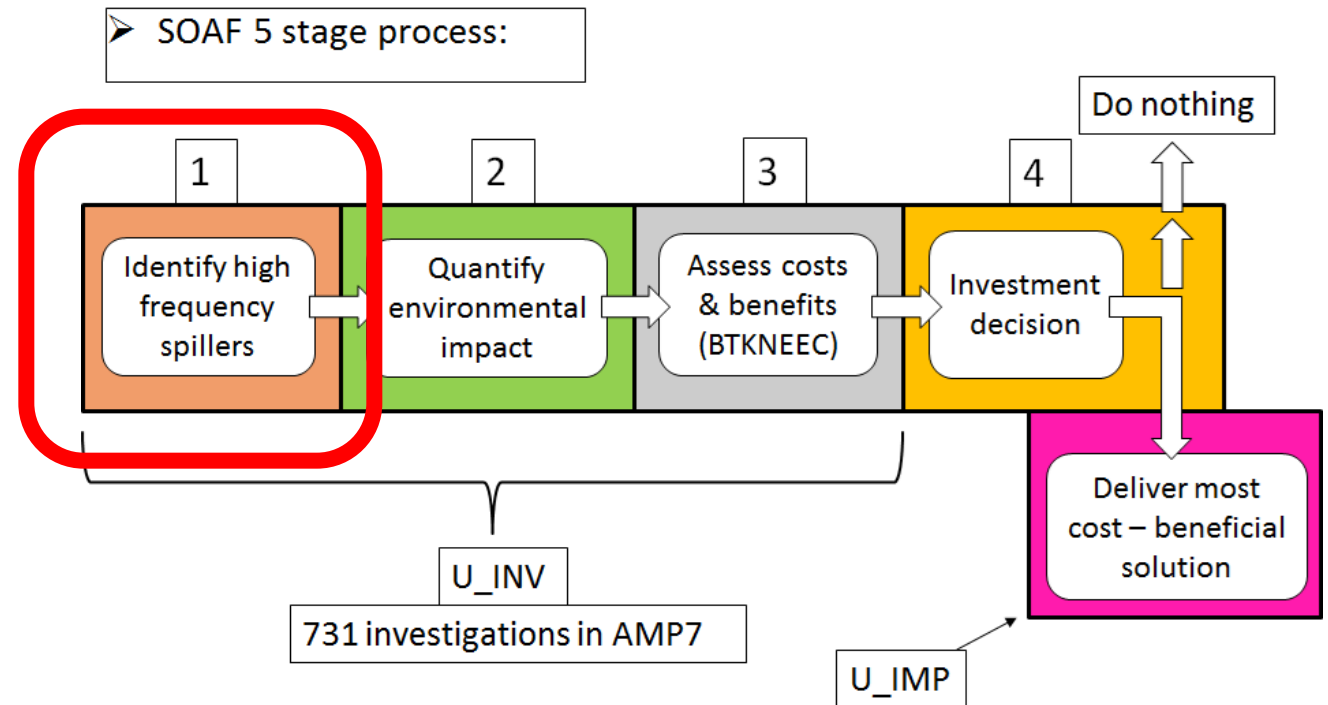
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Stage 1 – Confirm Cause of Spill Frequency

- Investigate operational issues
- Review EDM data
- Upgrade wastewater network model
- Confirm hydraulic cause



Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Stage 1 – Confirm Cause of Spill Frequency

- Investigate operational issues
- Review EDM data
- Upgrade wastewater network model
- Confirm hydraulic cause

PLR	NZ13207001
Site name	STAINDROP_WINSTONRD
WINEP Scheme Name	STAINDROP PUMPING STATION, STAINDROP, BARNARD CASTLE
Permit Reference	252/1020
WINEP Unique ID	7NW200541
WINEP Driver	U_INV
STAGE 1A - Exceptional Rainfall	
Period Covered	2012 - 2020
Exceptional Rainfall Years	None.
STAGE 1B - Asset Maintenance	
NWG Ops Feedback	No known issues.
Other Known Issues	None.
STAGE 1C - Hydraulic Assessment	
Average Annual Spill Frequency (EDM) - full years of available data	70
Average Annual Spill Frequency (EDM) - 2018-2020	47
Modelled Average Annual Spill Frequency - 2018-2020	73
Modelled Average Annual Spill Volume (m3) - 2018-2020	15,210
Modelled Average Annual Spill Duration (minutes) - 2018-2020	47,368
Dry Weather Flow (m3/s)	0.003
Other Outfalls	Single storm overflow and sewage treatment works effluent discharging at the same outfall location.
Primary Cause of High Spill Frequency	Hydraulically controlled.

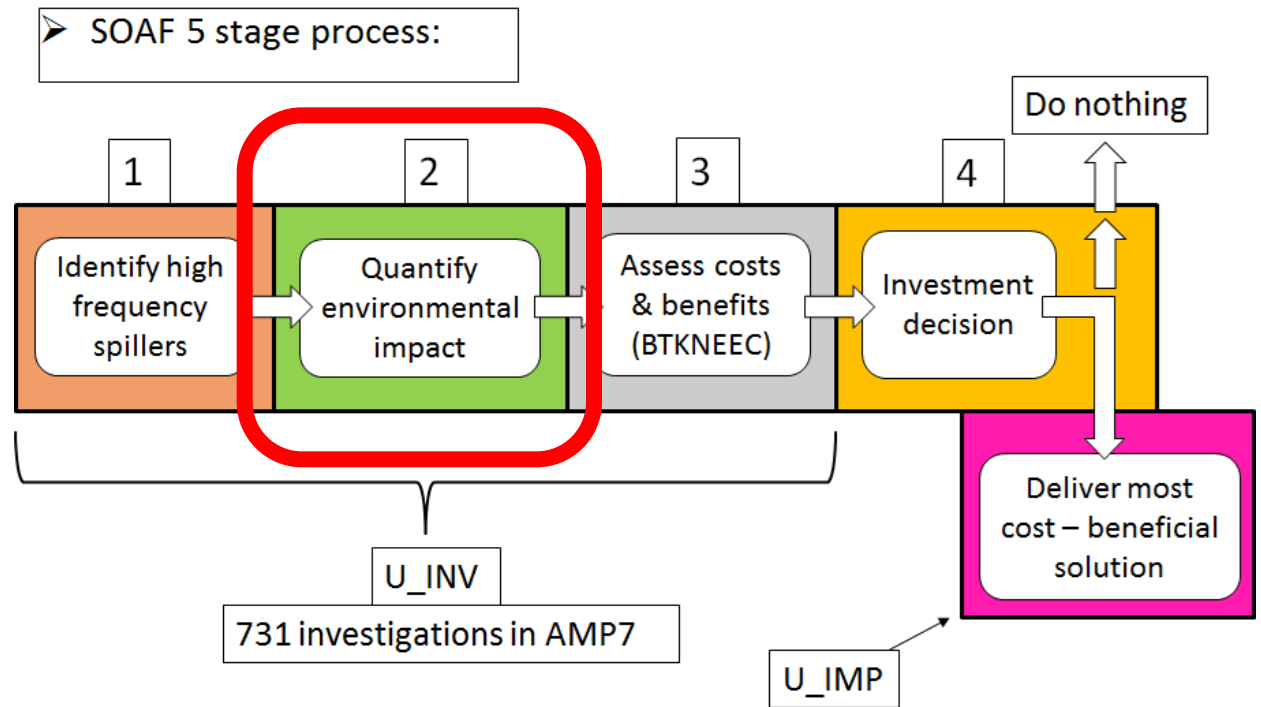
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Stage 2 – Water Quality Impact Assessment

- Assess impact of overflow discharges on water quality
- River Impact Optimisation Tool (RIOT)
- Ammonia and biological oxygen demand impacts



Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Stage 2 – Water Quality Impact Assessment

- Assess impact of overflow discharges on water quality
- River Impact Optimisation Tool (RIOT)
- Ammonia and biological oxygen demand impacts

PLR	NZ13207001	
Site name	STAINDROP_WINSTONRD	
WINEP Scheme Name	STAINDROP PUMPING STATION, STAINDROP, BARNARD CASTLE	
Permit Reference	252/1020	
WINEP Unique ID	7NW200541	
WINEP Driver	U_INV	
STAGE 2A - Aesthetics Assessment		
	Survey 1 - Autumn	Survey 2 - Spring
Sewage Litter Score	5	5
Sewage Fungus Outfall Score	5	0
Sewage Fungus Downstream Score	0	0
Amenity	None	
Amenity Score	0	
Complaints Score	0	
Pollution Incident Score	0	0
Total Aesthetic Impact Score	10	5
Aesthetic Impact Classification	Very Low	Very Low
Overall Impact Classification	Very Low	
Is CSO screened?	No	
Screen type	Not found	
Potential Aesthetic Improvement	Low	
Comments	Little sewage derived litter or fungus observed. No amenity value location.	
STAGE 2B - Invertebrate Impact		
	Survey 1 - Autumn	Survey 2 - Spring
Upstream	High	High
Downstream	Good	Good
Short-Term Impact	Low	Very high
Long-Term Impact	High	
Overall Impact Classification	Very high	
Comments	WFD classification deteriorates from 'High' to 'Good' between upstream and downstream. Variable results from the invertebrate surveys ranging from 'Low' to 'Very	

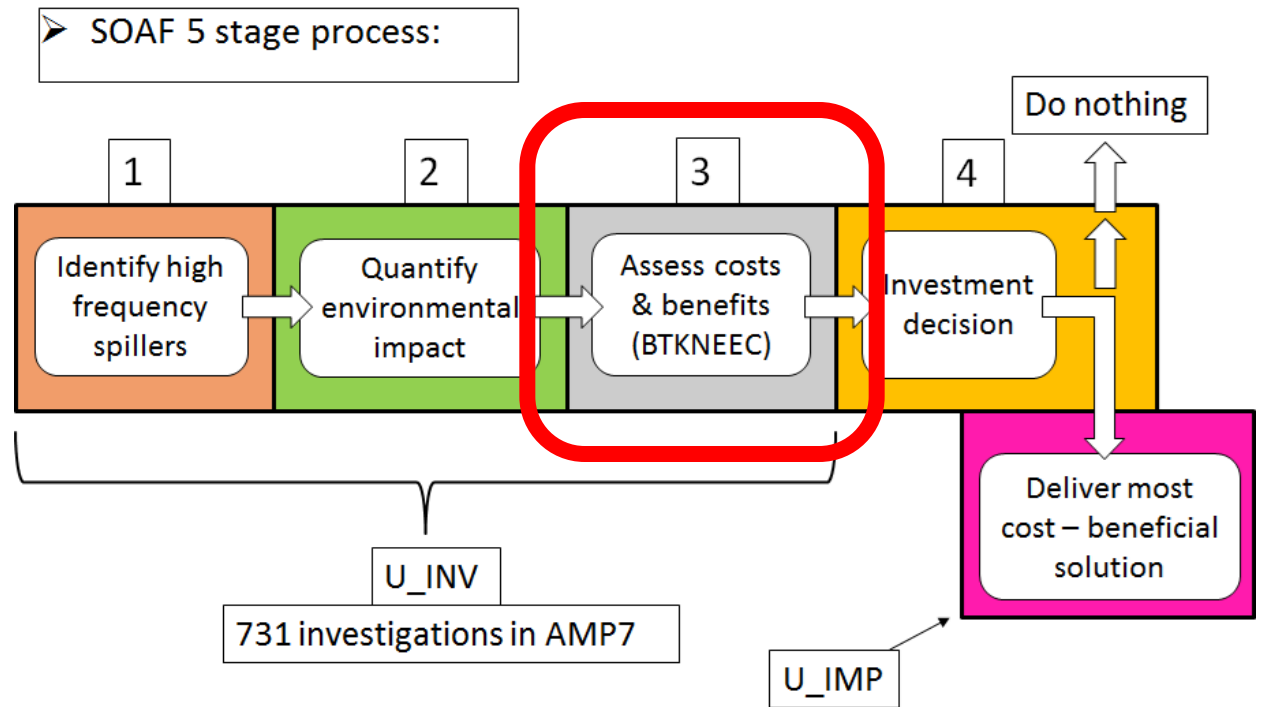
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Stage 3 – Options and Cost-Benefit Appraisal

- 10 spills per year option
- Water quality benefits
- Monetised benefits
- Calculate cost-benefit ratio



Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Stage 3 – Options and Cost-Benefit Appraisal

- 10 spills per year option
- Water quality benefits
- Monetised benefits
- Calculate cost-benefit ratio

PLR	NZ13207001			
Site name	STAINDROP_WINSTONRD			
WINEP Scheme Name	STAINDROP PUMPING STATION, STAINDROP, BARNARD CASTLE			
Permit Reference	252/1020			
WINEP Unique ID	7NW200541			
WINEP Driver	U_INV			
STAGE 3 OPTION IDENTIFICATION	STORAGE OPTION (30 SPILLS)	STORAGE OPTION (10 SPILLS)	HYBRID (75% SURFACE WATER SEPARATION + STORAGE)	SURFACE WATER SEPARATION
Size (m3 / ha / m3/s)	140	420	320	2.01
Average Annual Spills Achieved (204	30	10	10	66.7
Population benefitting	-	-	469	469
Cost (IMOD Express - lower)	£ 634,468	£ 774,398	£ 1,365,649	£ 632,100
Cost (upper)	£ 951,702	£ 1,161,596	£ 2,592,634	£ 1,506,000
Benefits (Water Quality)				
Water Quality (lower)	£ -	-	£ -	£ -
Water Quality (assessed)	£ 779,229	£ 779,229	£ 779,229	£ 779,229
Water Quality (upper)	£ 779,229	£ 779,229	£ 779,229	£ 779,229
Benefit / Cost Ratio				
BCR (lower)	-	-	0.090	0.154
BCR (estimated)	1.228	1.006	0.550	1.019
BCR (upper)	1.228	1.006	0.873	1.887

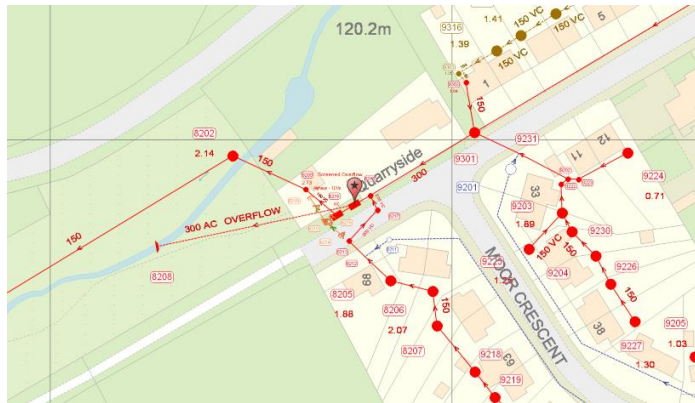
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Example of a cost-beneficial scheme

PLR	NZ35418201
Site name	LUDWORTH_MOORCR
WINEP Scheme Name	NZ35418201_LUDWORTH_MOORCR
Permit Reference	245/1256
WINEP Unique ID	N/A
WINEP Driver	U_INV



Site name	NZ35418201_LUDWORTH_MOORCR
Average Spill Frequency (all years of data)	41
Average Spill Frequency (2018-2020)	58
Stage 1 Assessment Outcome	Hydraulic Overload
Aesthetic Overall Classification	Low
Invertebrate - Worst Case Impact	-
Receiving Watercourse	Sherburn Beck from source to Pittington Beck
Dilution	1.8
WQ Model Outcome (CSO Impact)	High to Bad
30 Spills Storage BCR	1.953
30 Spills Surface Water Separation BCR	0
Option(s) with BCR > 0.5?	Yes
Next Step	Potential for scheme

STAGE 3 SCREENING SUMMARY
Model assessed maximum WQ benefit is significant
Aesthetic benefit is zero due to existing screen and low impact and low amenity
Surface water removal option would deliver some wider benefits but costs are high and uncertain and cannot achieve 30 spills per year
Overall assessment is storage option is potentially cost-beneficial
Recommendation: Consider taking forward as potential scheme

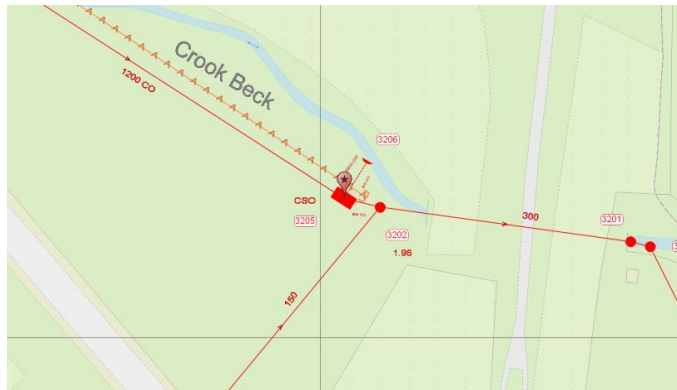
Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

What have we done to get to know and improve them?

Example of a non cost-beneficial scheme

PLR	NZ16363205
Site name	RODDYMOOR_FARRERSARMS_5
WINEP Scheme Name	PEASES WEST CSO, CROOK, CO.DURHAM
Permit Reference	241/1083
WINEP Unique ID	7NW200501
WINEP Driver	U_INV



Site name	NZ16363205_RODDYMOOR_FARRERSARMS_5
Average Spill Frequency (all years of data)	47
Average Spill Frequency (2018-2020)	55
Stage 1 Assessment Outcome	Hydraulic Overload
Aesthetic Overall Classification	Moderate
Invertebrate - Worst Case Impact	No impact
Receiving Watercourse	Beechburn Beck (Trib of Wear)
Dilution	1.2
WQ Model Outcome (CSO Impact)	High to Good
30 Spills Storage BCR	0.089
30 Spills Surface Water Separation BCR	0.319
Option(s) with BCR > 0.5?	No
Next Step	No further action

STAGE 3 SCREENING SUMMARY
Model assessed maximum WQ benefit is zero for Good to High
Aesthetic benefit is zero due to existing screen and low impact and low amenity
Surface water removal option would deliver some wider benefits but costs are high and uncertain and cannot achieve 30 spills per year
Overall assessment is options are non cost-beneficial
Recommendation: No further action under SOAF

Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

When did they become headline news?

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | York & North Yorkshire

'Disgusting' raw sewage spotted in the River Foss in York

© 4 September 2023

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | London

Thames Water: 72 billion litres of sewage pumped into river in two years

© 10 November 2023

The Guardian

Water bosses in England and Wales face bonus bans for illegal sewage discharges

Senior executives got £26m in extra payments over the past four years despite public outrage at extent and frequency of overflows.

Faulty monitors leave hundreds of rivers with sewage spill blindspots

The water industry boasts it monitors all outlets pumping raw sewage into rivers and the sea, but figures seen by The Times show hundreds of monitors don't work



NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
UK | England | Ireland | Scotland | Wales | Isle of Man | Guernsey | Jersey | Local News

Drone captures sewage pumped into sea for days



Overflows: 'There is raw sewage going into the river'

Data shows that the number of recorded sewage spills in Scotland has increased by 40% over the last five years.

2 August 2021 • News • Scotland

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | Gloucestershire

Sewage pumped into Cotswold river for more than 1,000 hours

© 17 January

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | Cornwall

Raw sewage at Porthleven beach 'making surfers ill'

© 3 March 2020

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | Cornwall

Raw sewage 'discharged at Cornwall and Devon beaches'

© 28 July 2015

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | Kent

Whitstable campaigners call for action over raw sewage

© 26 August 2022

The Guardian

Ministers may have broken law over sewage dumping in England, says watchdog

Government may be letting firms discharge raw sewage more often than law allows, says Office for Environmental Protection.

NEWS
Home | Israel-Gaza war | War in Ukraine | Climate | Video | World | Asia | UK | Business | Tech
England | Regions | Gloucestershire

Scale of raw sewage released into Gloucestershire's rivers 'staggering'

© 21 April 2022

POLITICS SHOW
bbc.co.uk/politicsshow
Sundays
Page last updated at 14:29 GMT, Sunday, 6 December 2009

Raw sewage 'pumped into Thames'



Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

How did Government respond?



Storm Overflows Discharge Reduction Plan

Headline Targets

- 10 spills per year at **all** inland storm overflow locations by 2050
- 2 or 3 spills per bathing season at **all** bathing storm overflow locations by 2035
- Less than 10 spills per year at locations where ecological harm is caused by 2050

Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

How did Government respond?



Storm Overflows Discharge Reduction Plan

What is the impact?

- Largest ever investment profile in wastewater infrastructure
- Increase in customer rates to pay for required works
- Innovation in delivery is now a must-do, not a should-do

Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

Where and **how** do we go from here?

- Continued water quality impact assessments at lower dilution overflow locations to determine 'harm' and scale of option
- Water companies targeting model maintenance programmes to improve confidence in wastewater network models needed for solution development
- 'Low hanging fruit' overflows being identified for fast-track delivery of 'no regret' schemes

Emotion over Evidence?

The Value of Modelling Storm Overflow Impact

Could a SOAF programme be applied in New Zealand?

- In short... yes!
- Work already ongoing by some water authorities to look at water quality impact from storm overflows
- Methodology has been developed and with some regional updates to water quality parameters, could be applied
- Cultural considerations must be taken into account

Modelling Symposium

Thank you!
Questions? Patai?