Application of integrated water quality modelling for efficient management of water quality in the River Irk with cost-effective investment

Dr. G. Manache & G. Squibbs

The wastewater and urban drainage conference
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Blackpool-UK

BUILDING A BETTER WORLD

Water pollution sources in river catchment

Urban wastewater discharges

Industrial wastewater

Receiving waters

Diffuse pollution

Water quality problems

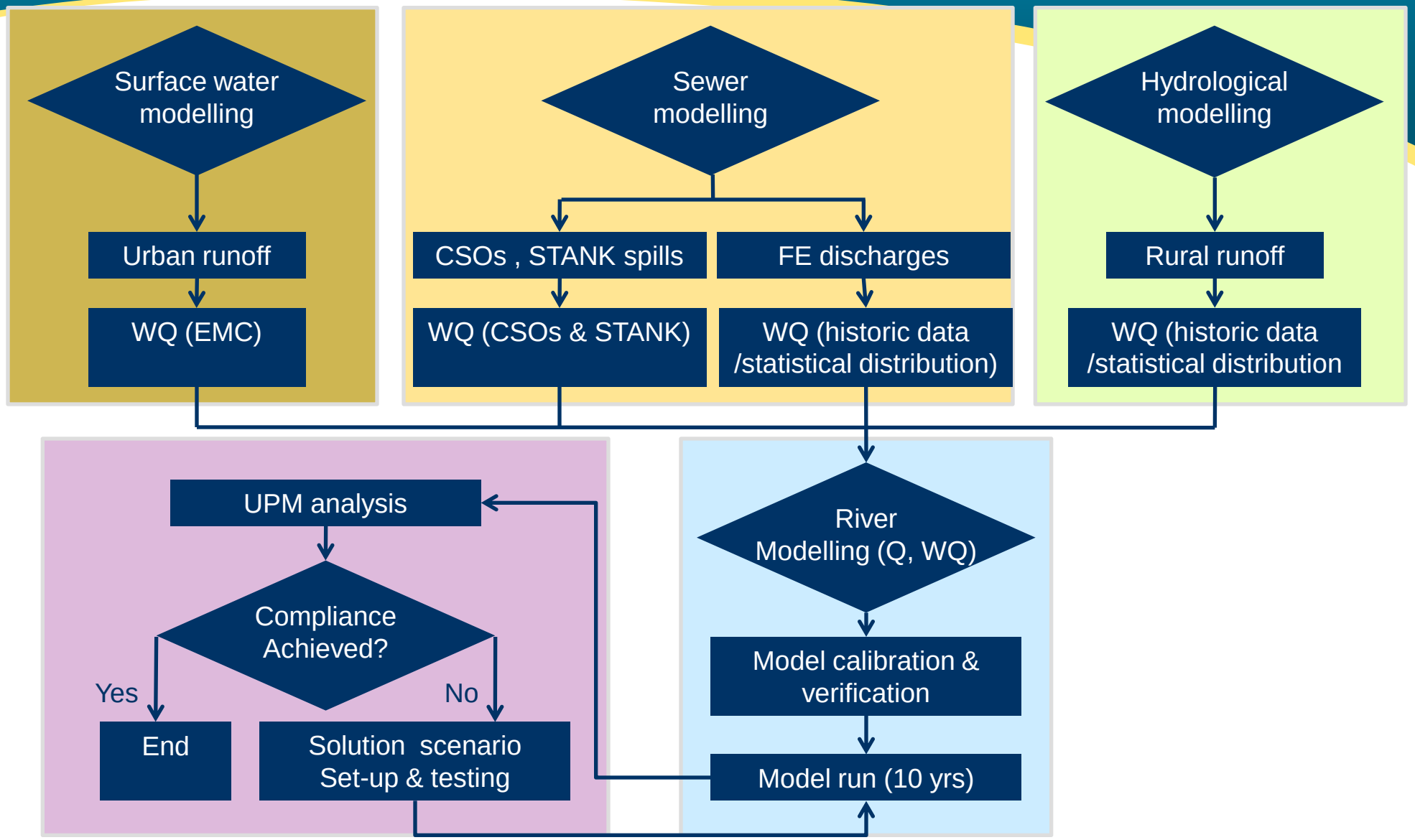
Investments in urban drainage infrastructure

Solutions of pollution problems

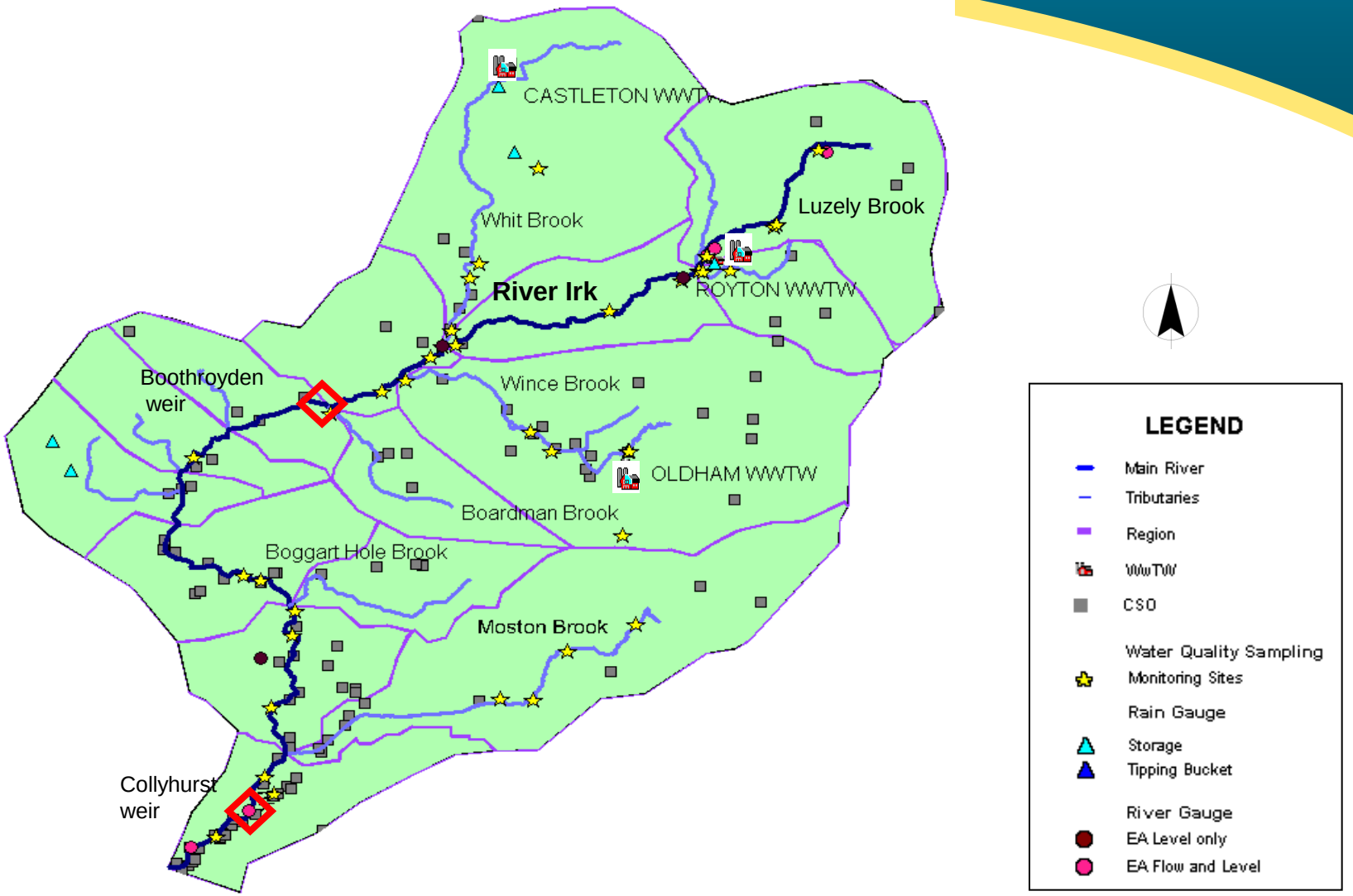
pollution control/ water quality management

Meeting the water quality standards of the receiving waters

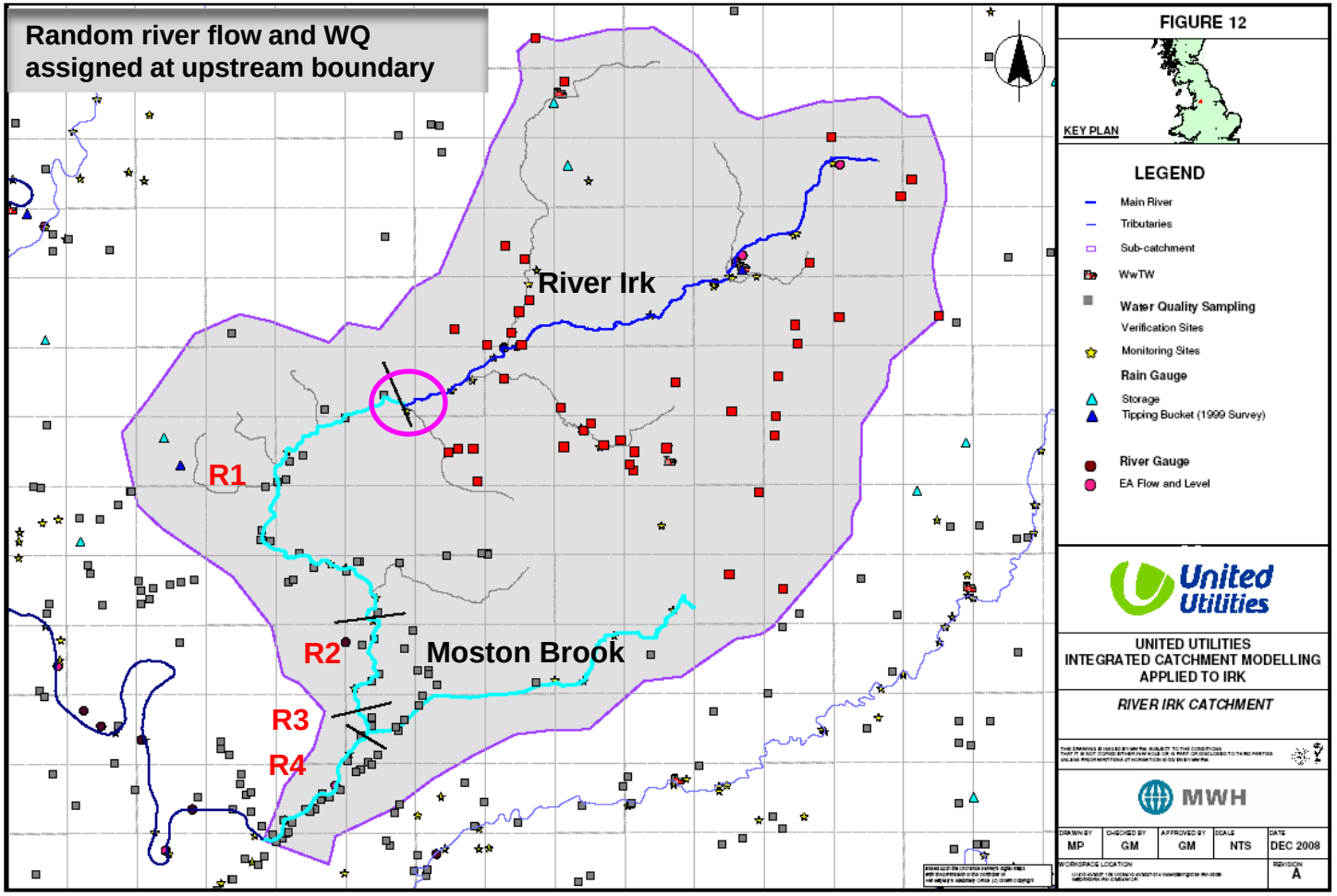
Schematic view of the ICM methodology



Integrated Catchment Modelling applied to the Irk catchment



River impact assessment : AMP3 Methodology



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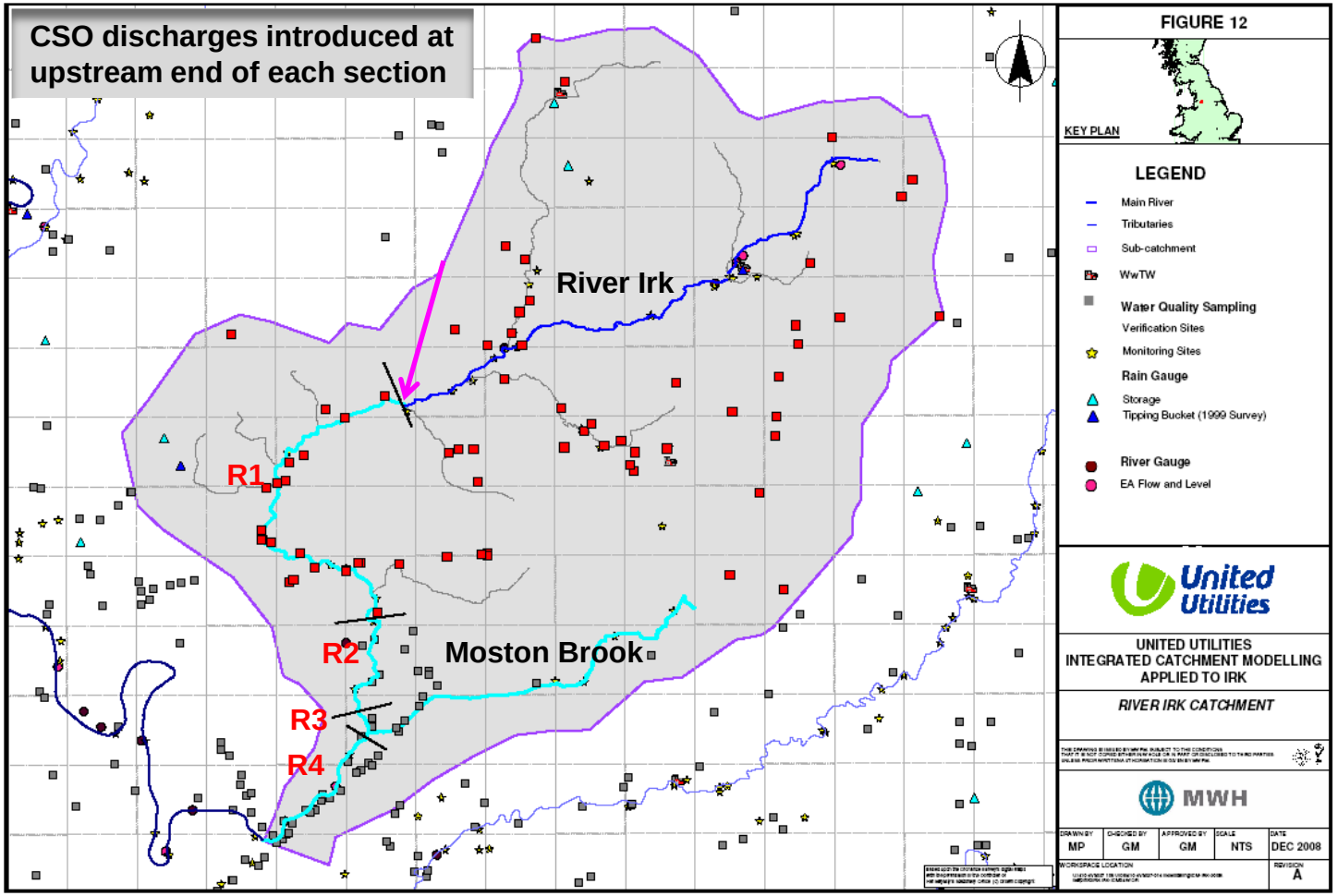

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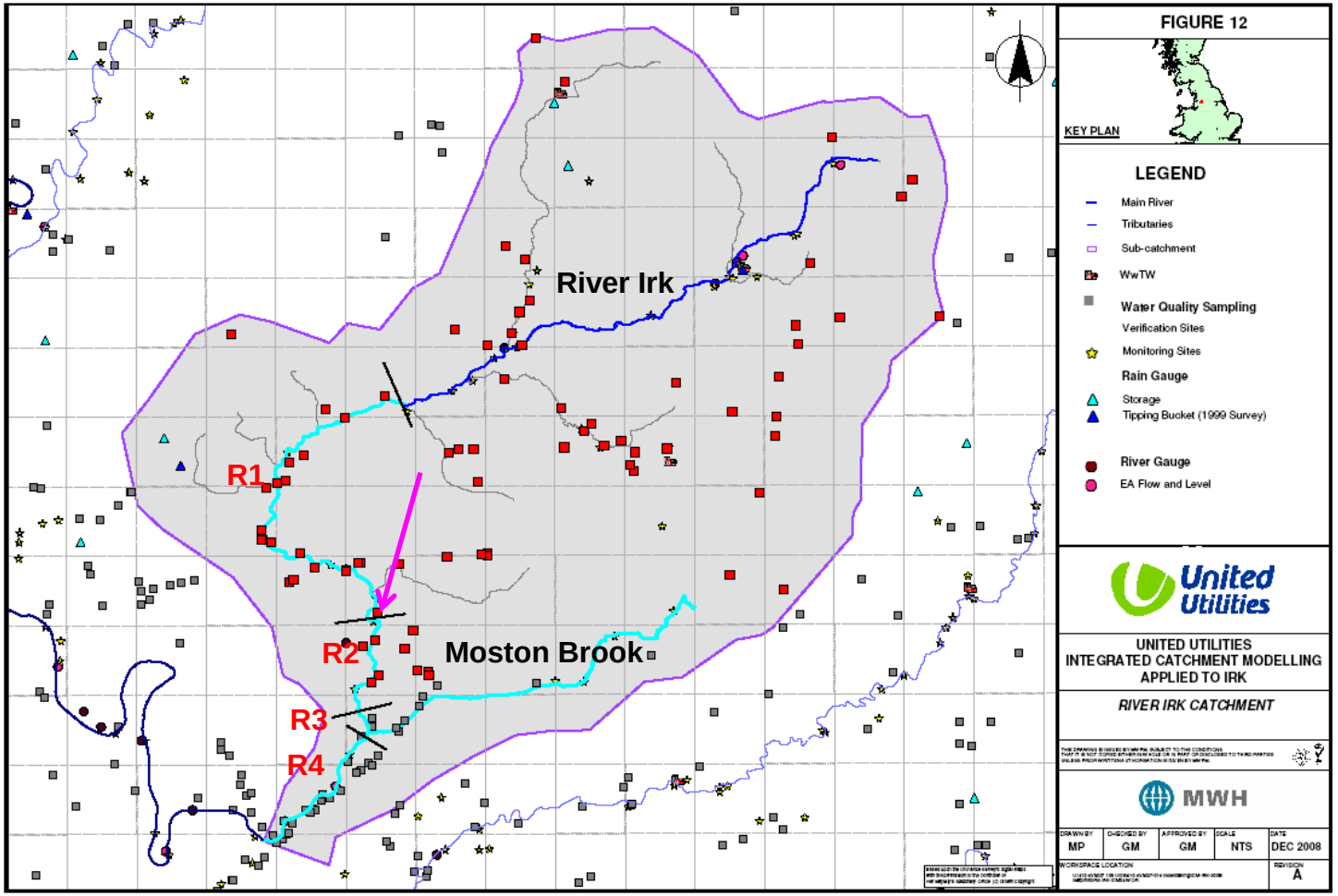

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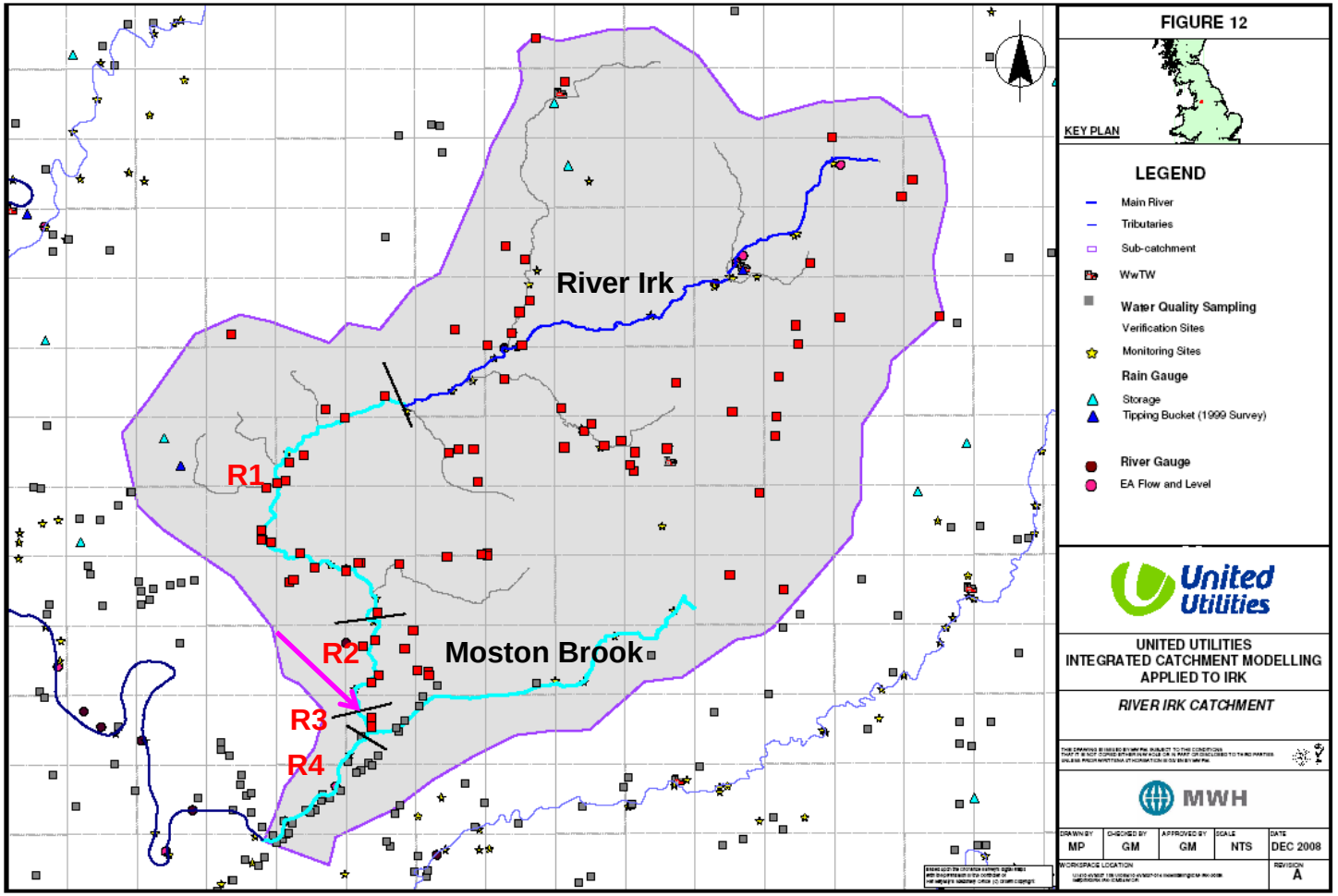

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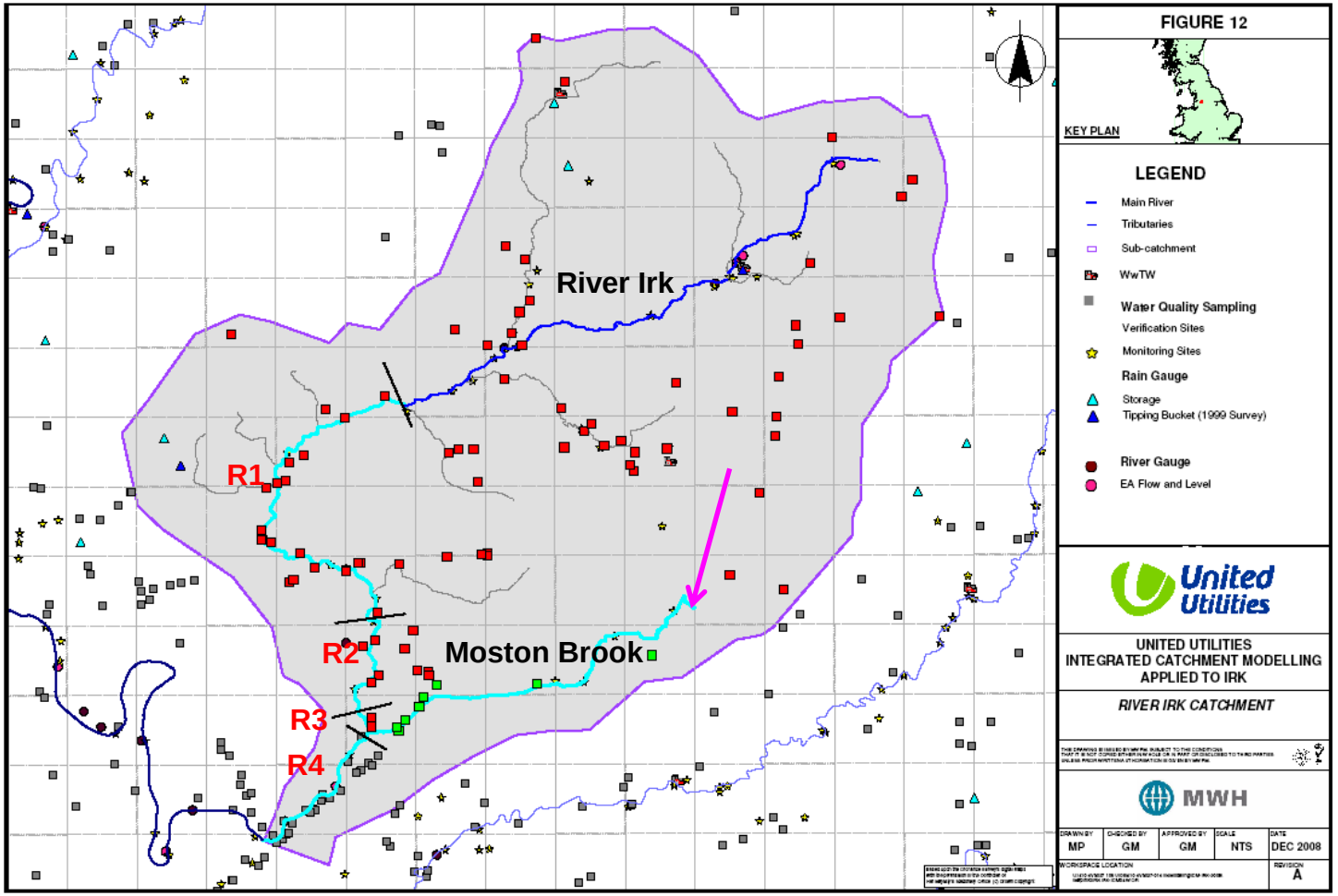

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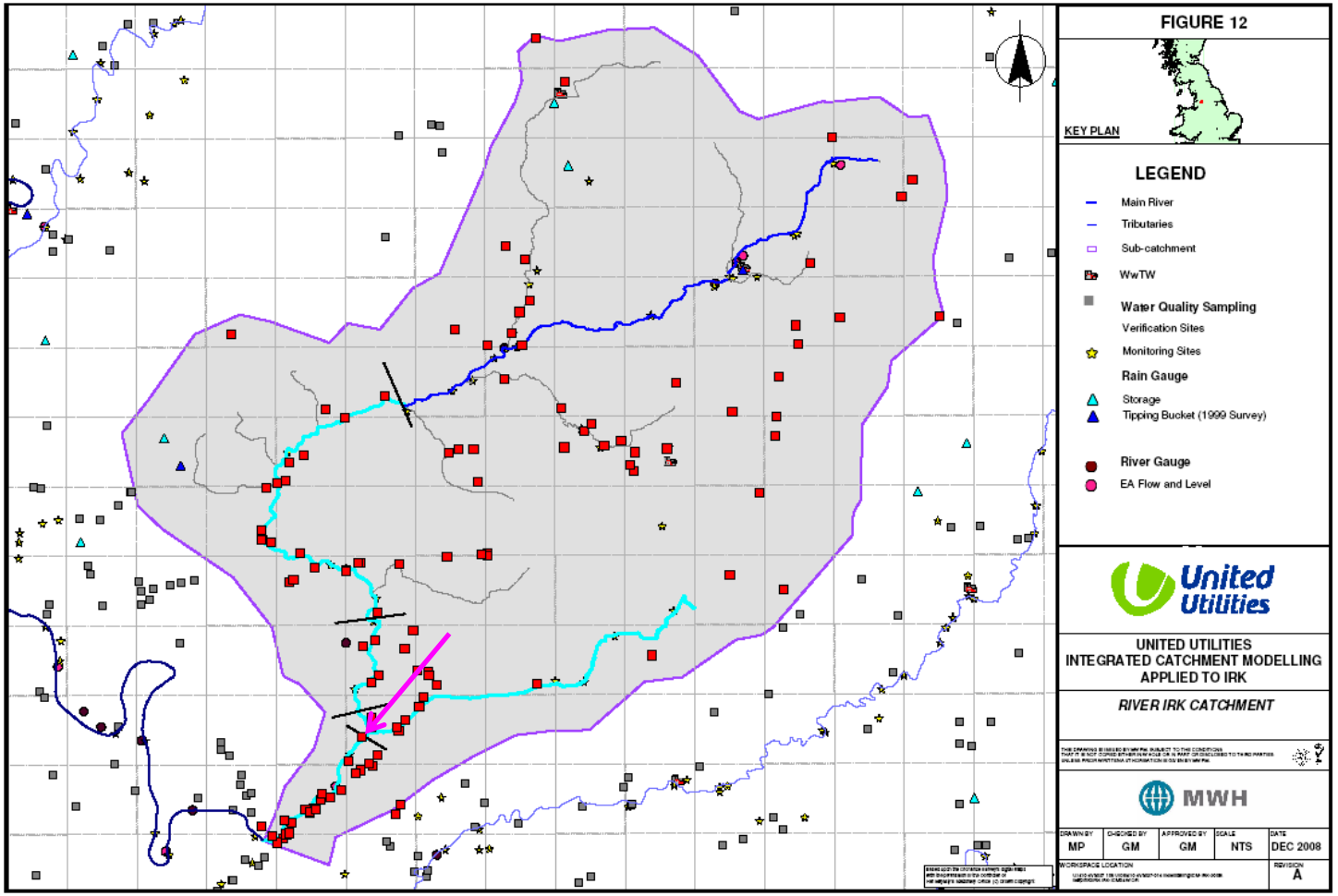

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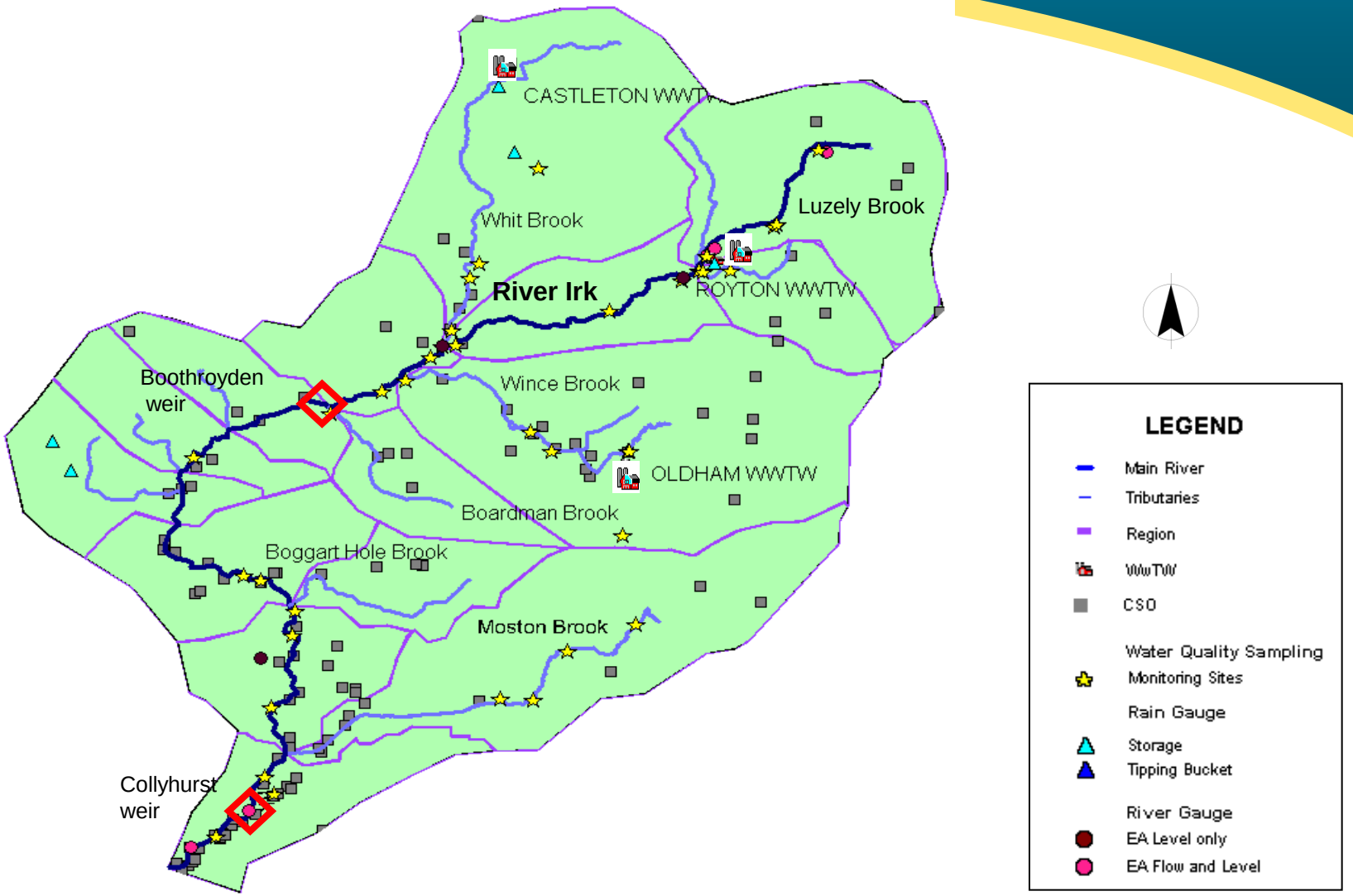
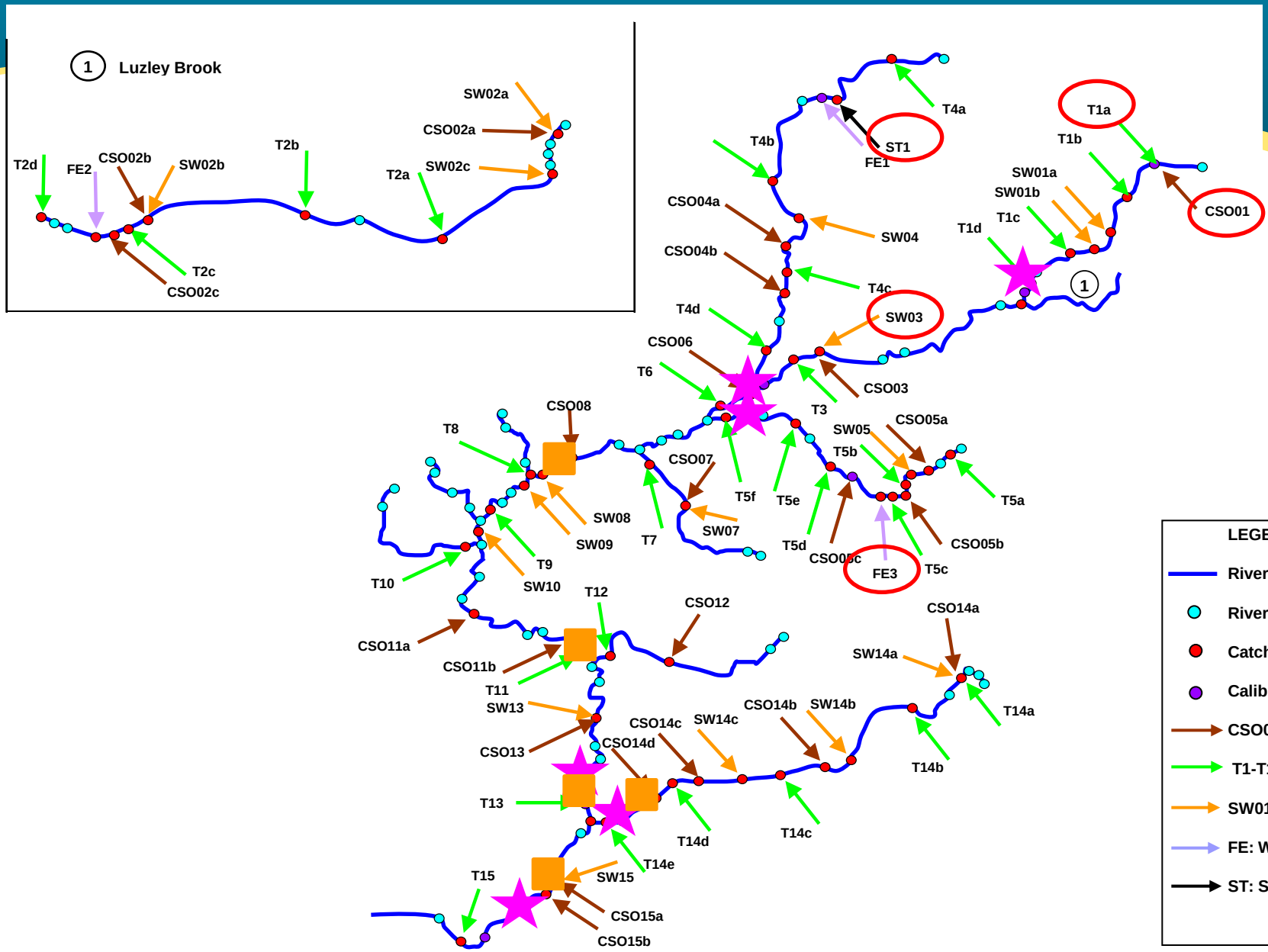
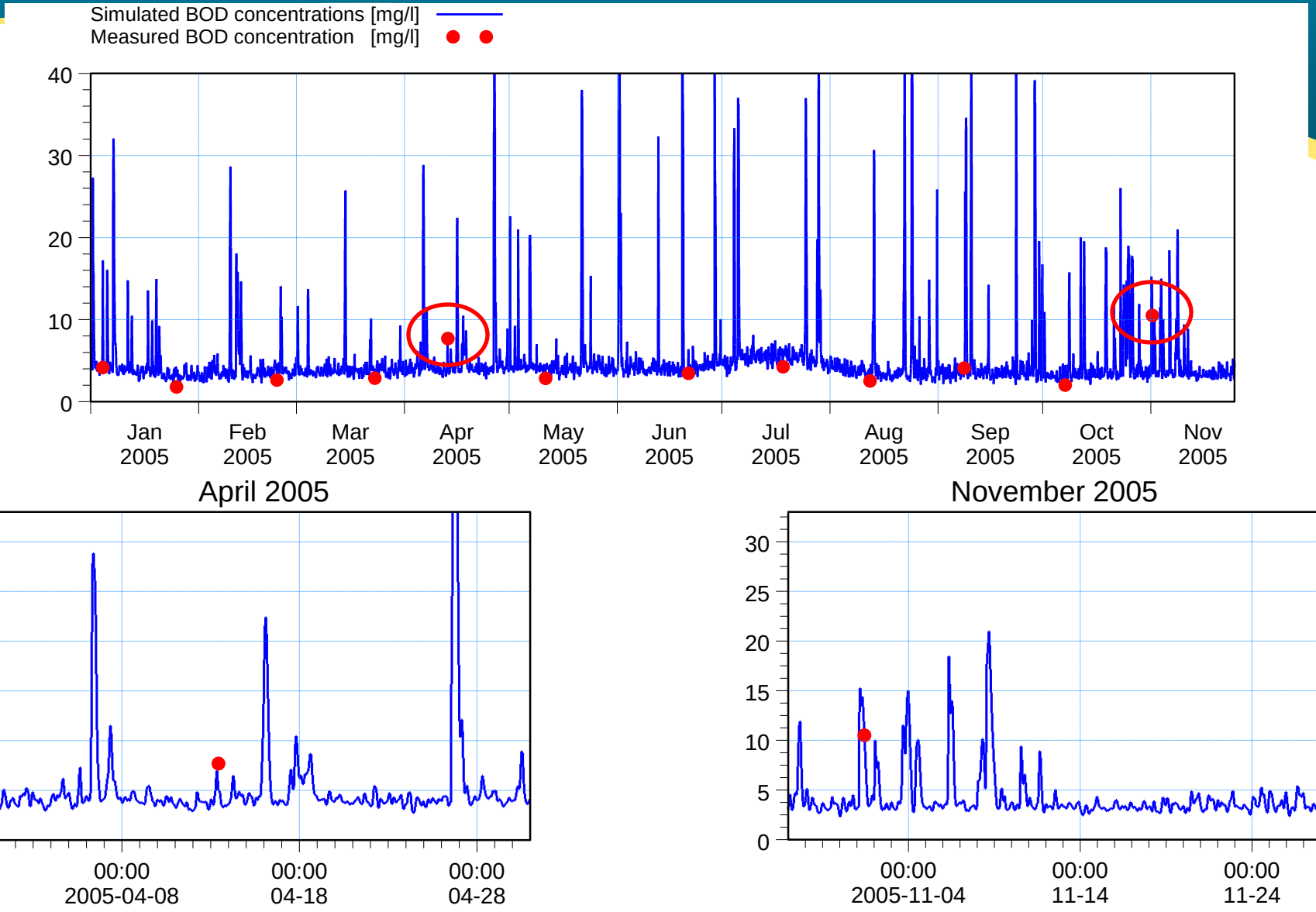


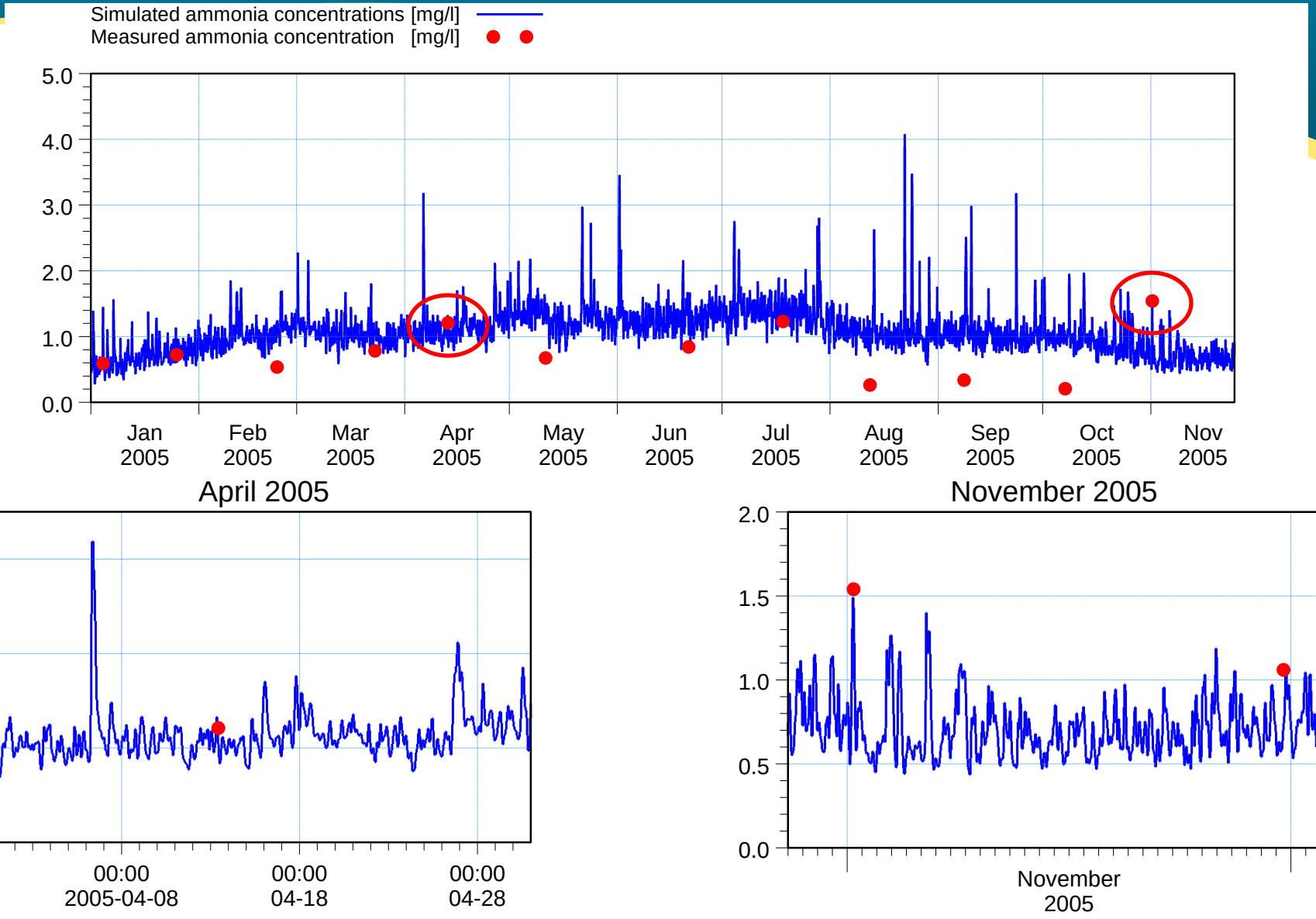
Schematic representation of the MIKE BASIN model network of the River Irk



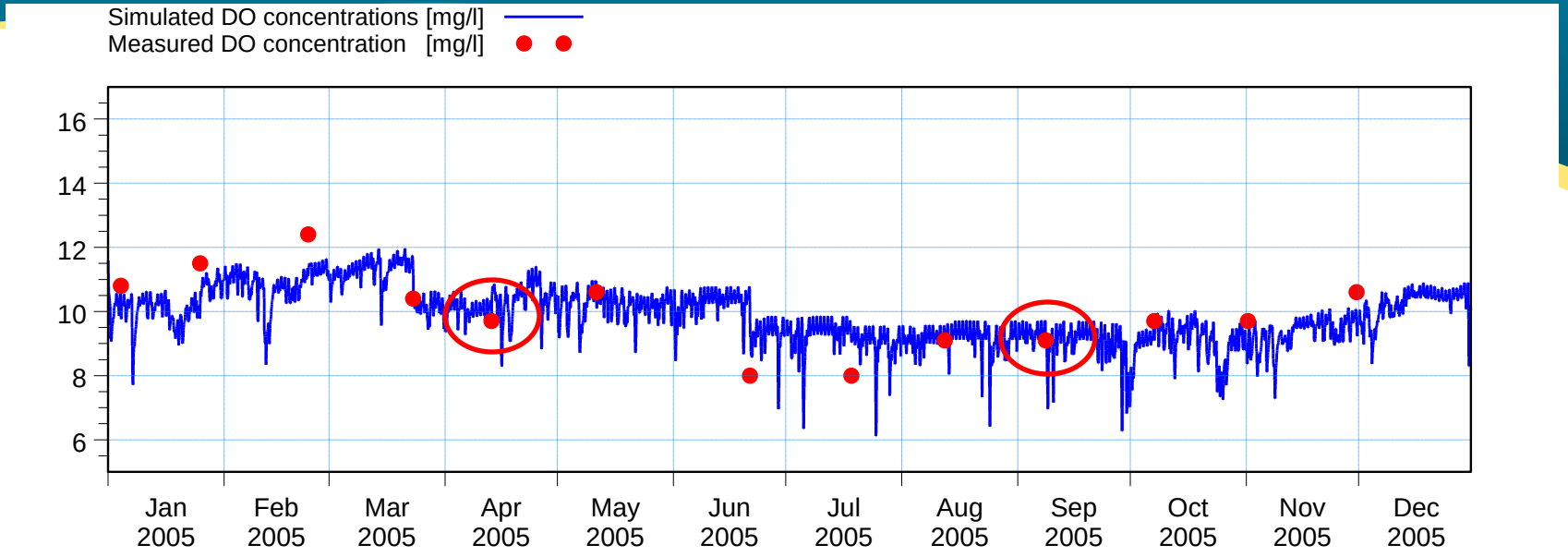
Calibration of BOD concentrations at Red Bank

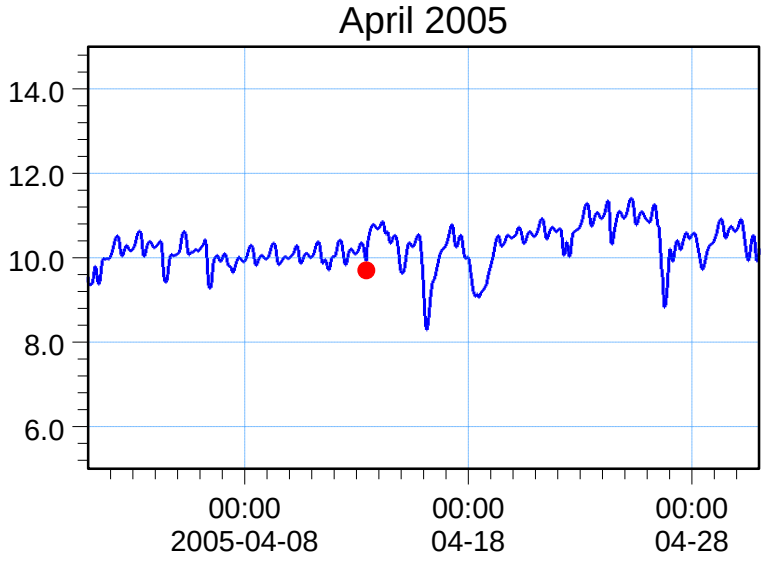


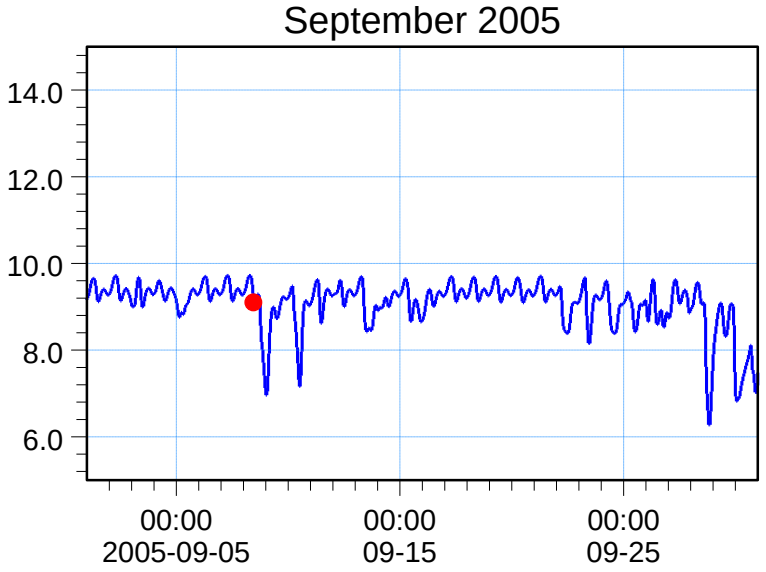
Calibration of ammonia concentrations at Red Bank



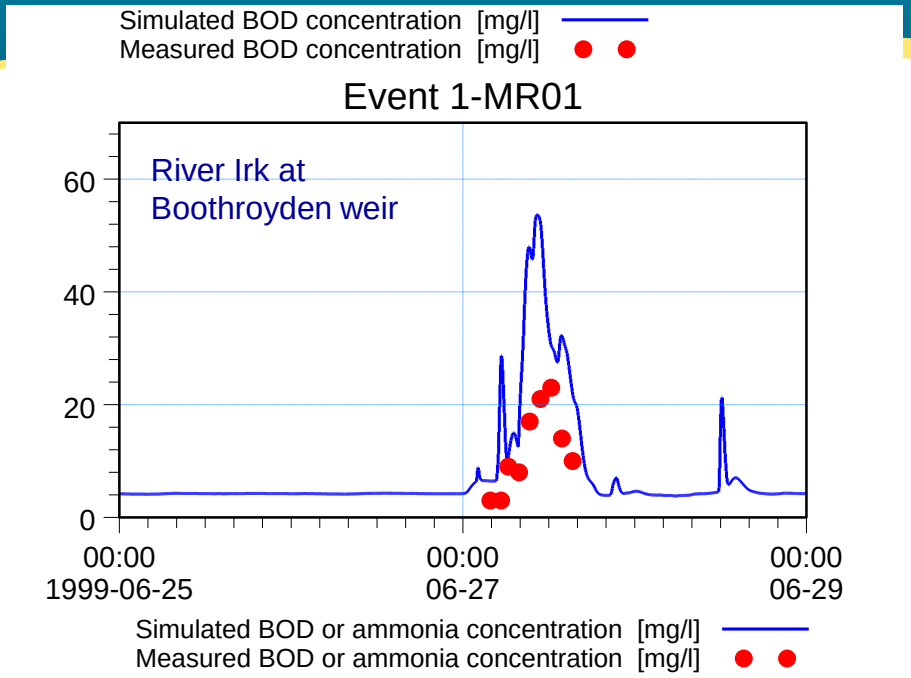
Calibration of dissolved oxygen concentrations at Red Bank

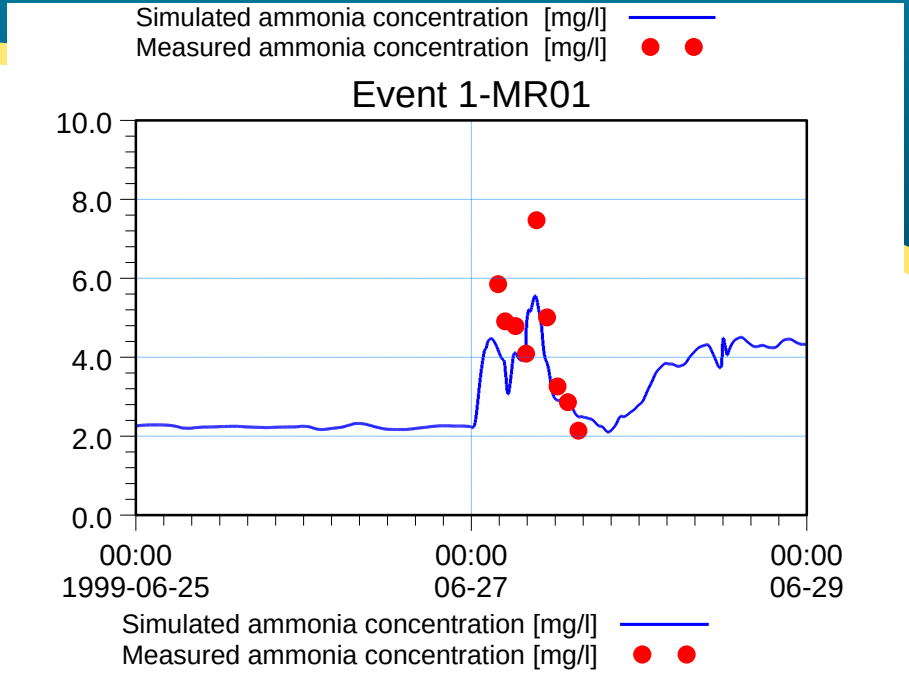


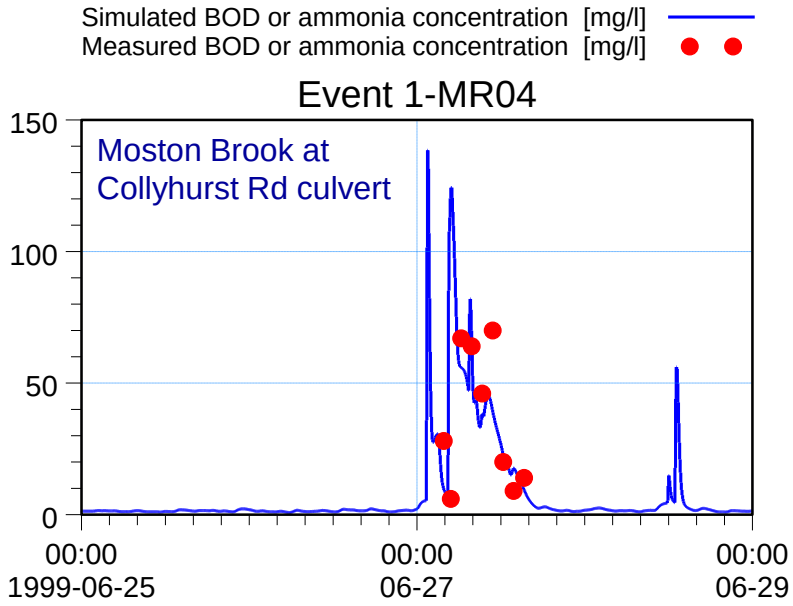


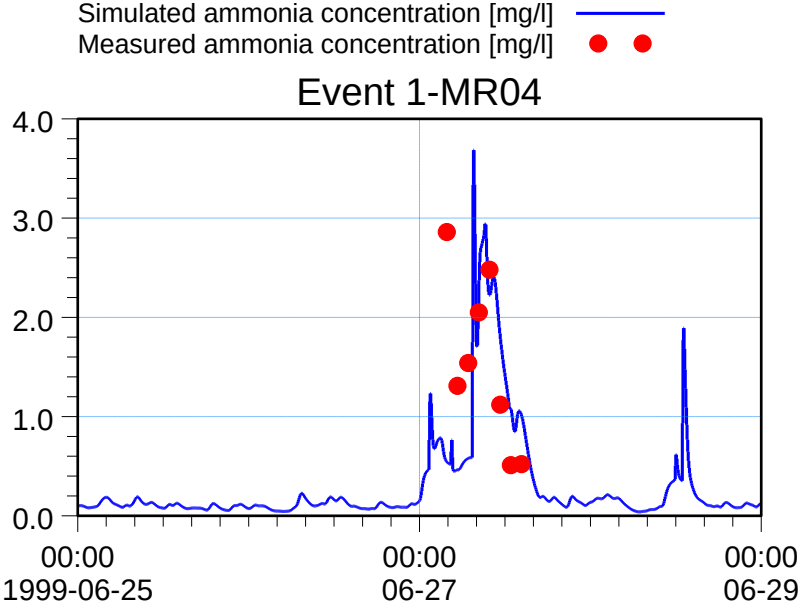


Verification of the MIKE BASIN model (wet weather events of 1999)









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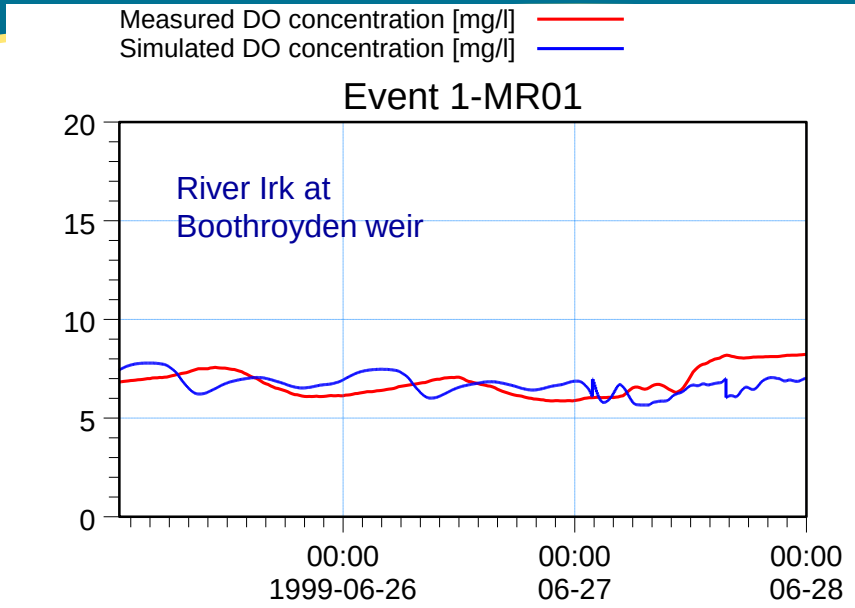
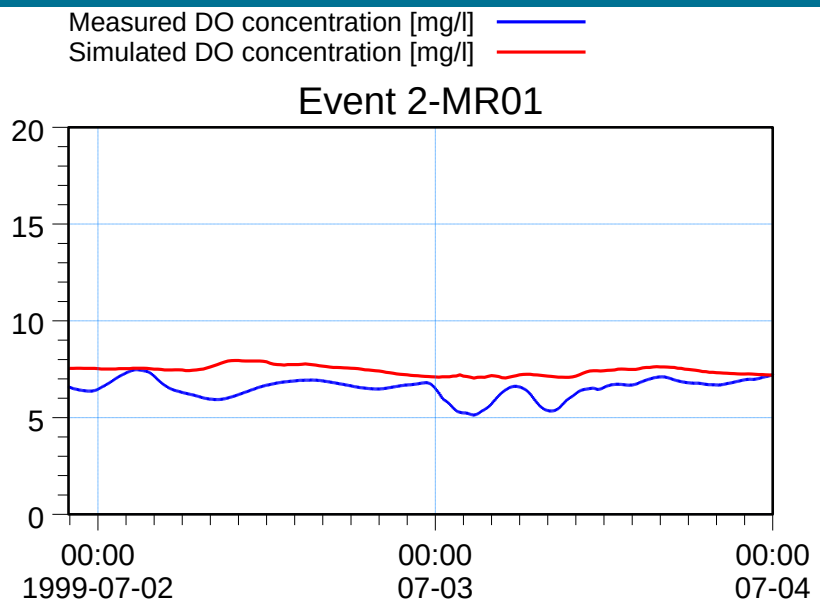
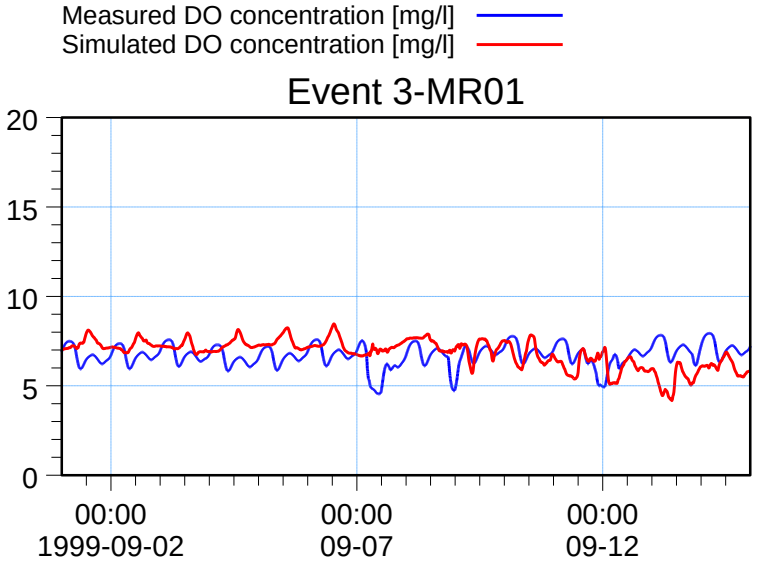
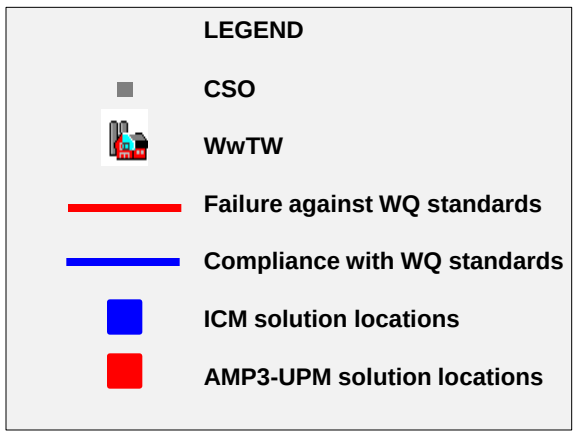


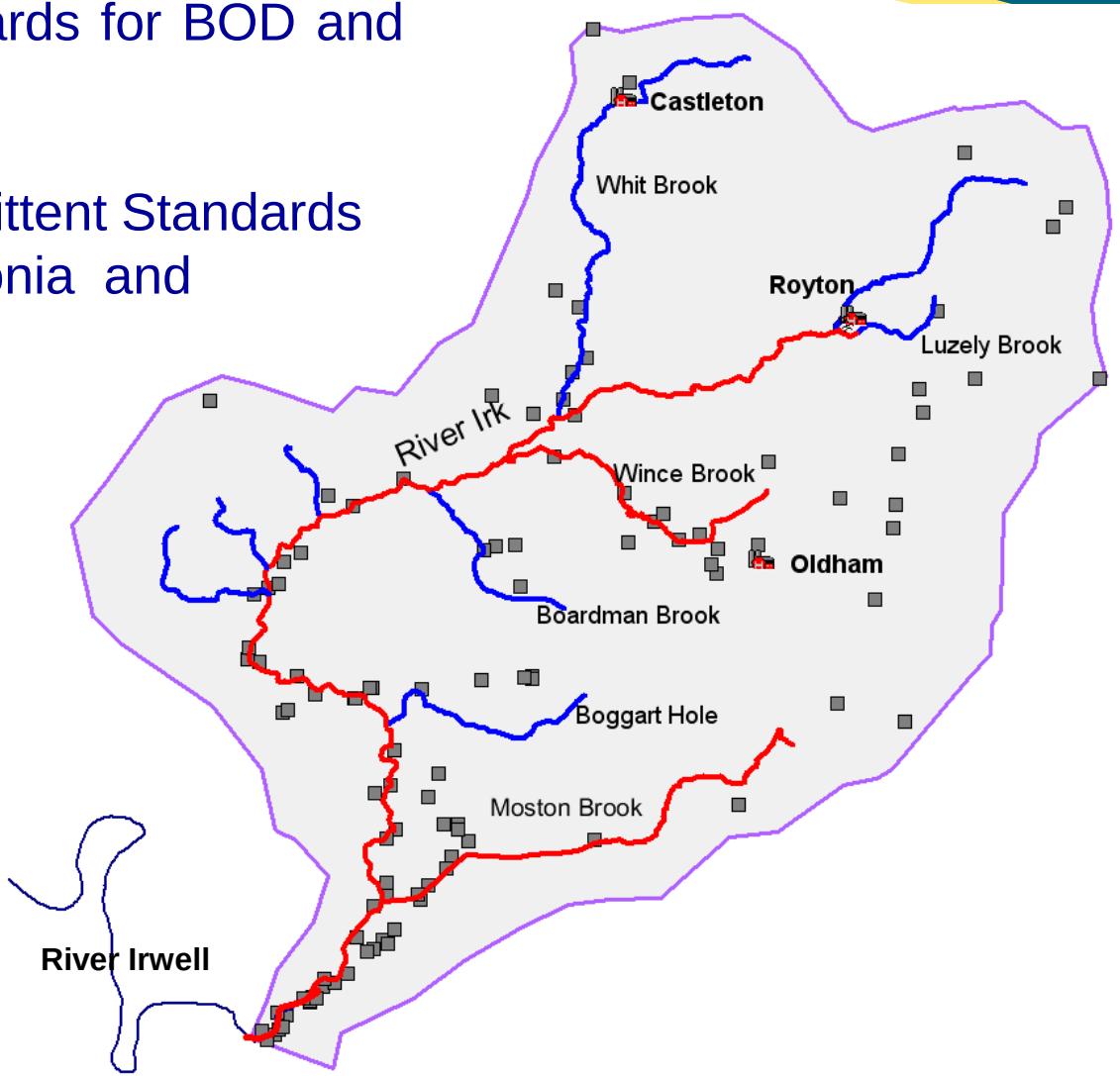




River impact analysis based on High percentile standards for BOD

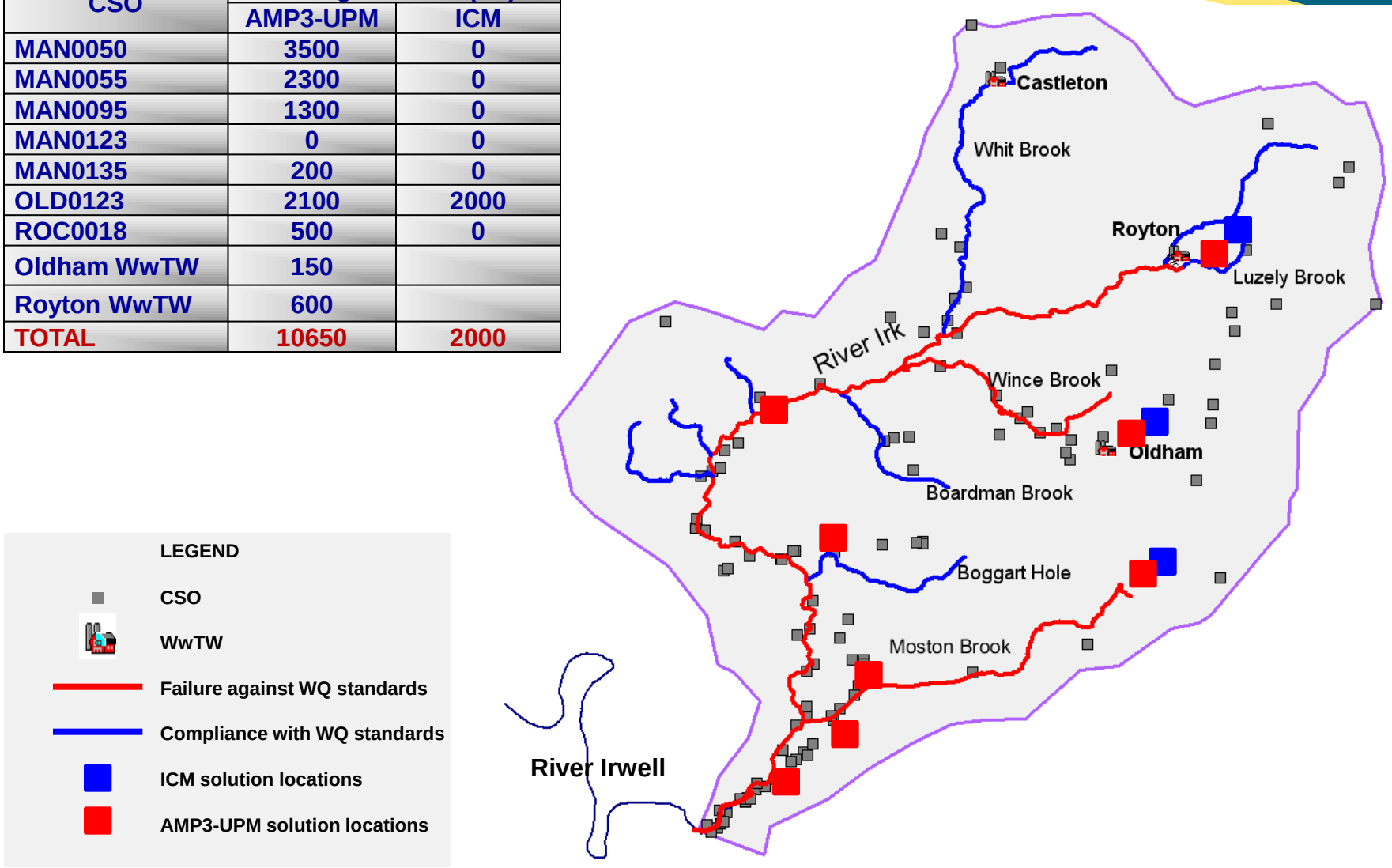
- 99-percentile standards for BOD and ammonia
- Fundamental intermittent Standards for un-ionised ammonia and dissolved oxygen





Location of the identified solutions

CSO	Storage volume (m^3)	
	AMP3-UPM	ICM
MAN0050	3500	0
MAN0055	2300	0
MAN0095	1300	0
MAN0123	0	0
MAN0135	200	0
OLD0123	2100	2000
ROC0018	500	0
Oldham WwTW	150	
Royton WwTW	600	
TOTAL	10650	2000



Conclusions

- The use of hydrological modelling to derive flows at river boundaries and ungauged tributaries resulted in more realistic representation of river flows than those applied in AMP3 UPM study (i.e. randomly generated from available statistics.
- By accounting for the spatial distribution of pollution sources, the impact of individual sources on the river water-quality could be identified. This allowed better identification of the locations where solutions are required.
- The use of continuous simulation and historical rainfall to derive all discharges allowed a more representative analysis to be made.
- With the detailed modelling approach, more locations along the river can be considered in the river impact analysis.
- The application of the ICM approach allowed a better understanding of water quality issues within the watercourse, leading to:

more focused solutions, efficient management, and cost-effective investment.

UU ICM Studies in AMP4 and AMP5

- UU have implemented an extensive programme of ICM studies in AMP4 / AMP5.

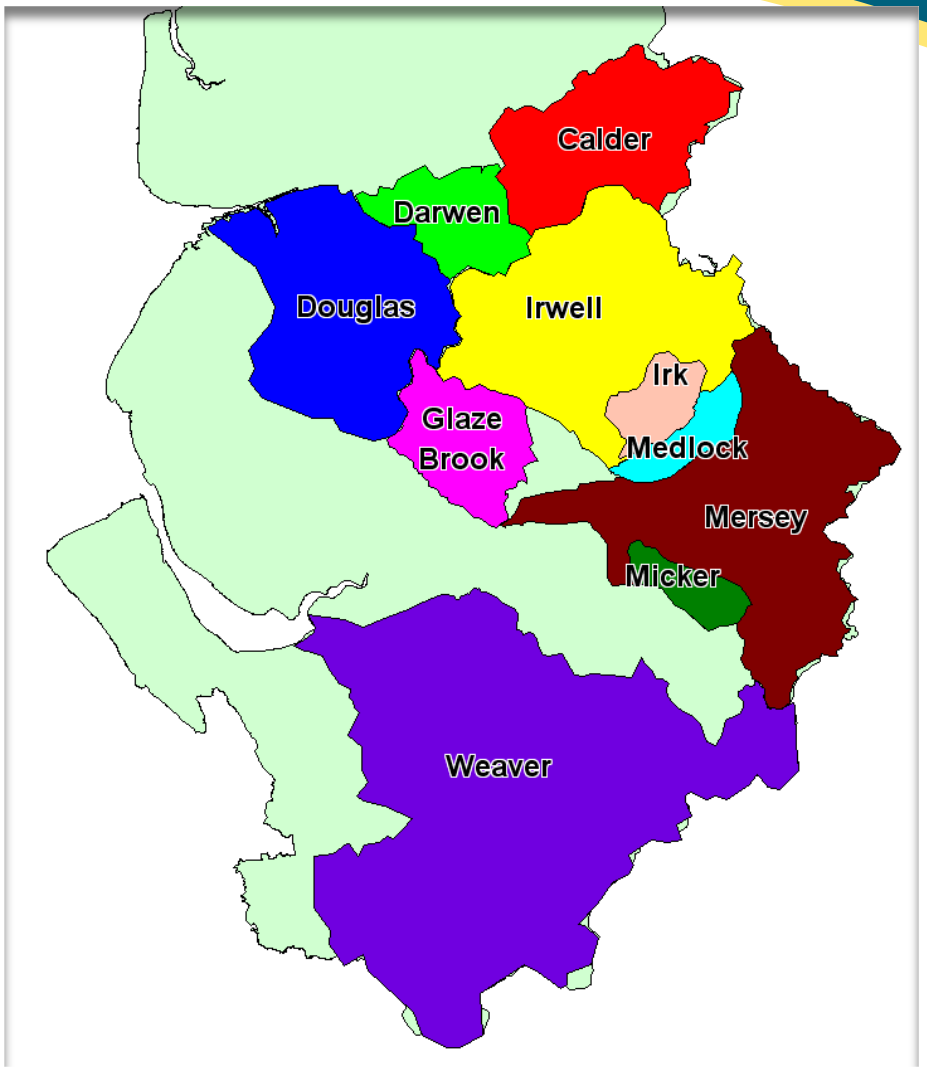
- AMP4 Investigations (undertaken by MWH).
  - Irk ICM
  - Rossendale ICM
  - Rochdale ICM
  - Manchester Ship Canal Water Quality Investigation

- AMP5 Planning Studies (UU studies).
  - Irwell, Irk, Medlock, Mersey, Calder, Darwen, Douglas, Glaze, Weaver

UU AMP5 ICM Studies

- 9 Studies

  Output March 2012
- Planning tools
  - PR14
- Major catchments
  - Pop 4M
- Sampling programme
  - WQ, summer 2010 (& 2011)



Outputs

- Flow and water quality analysis tool with 10 years river.
- Assessment against FIS, 99%ile and WFD standards.

Use of the tools

- Part of the tool kit for UU's integrated asset planning process.
- PR14 development.
- Climate change impact assessment
  - Changes in temperatures, rainfall, and evaporation.
  - Both effects of changes in discharges and background river flows.
- Potential transfer of data and results into improvements of SIMCAT models.

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