BUILDING A WORLD OF DIFFERENCE

INTEGRATED MODELLING USING DATA DRIVEN MODELS

ED GOWER
JOSS PLANT

4 September 2012

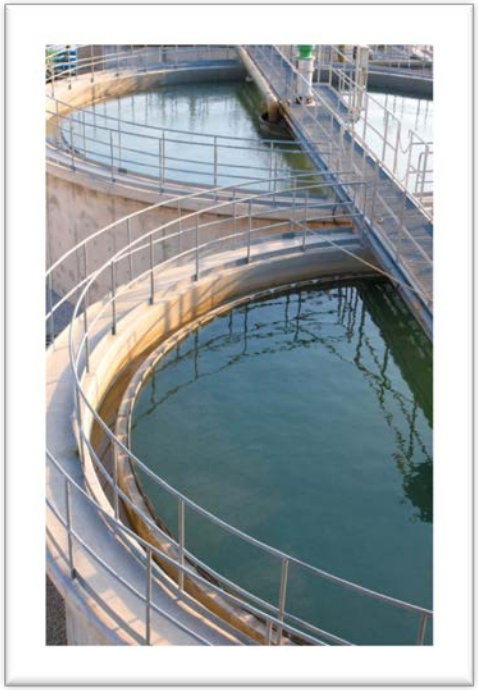
BLACK & VEATCH
Building a world of difference.®

AGENDA

- **Background**
- **Previous Modelling**
- **New Methodology**
  - Baseline performance
  - Future performance
- **Results and Discussion**
- **Conclusions and Innovation**

Water quality assessments can be carried out without full models of the catchment

BACKGROUND



Client: UK water company

Sewage Treatment Works Upgrade Project

- Improve treated effluent quality
- Minimise construction

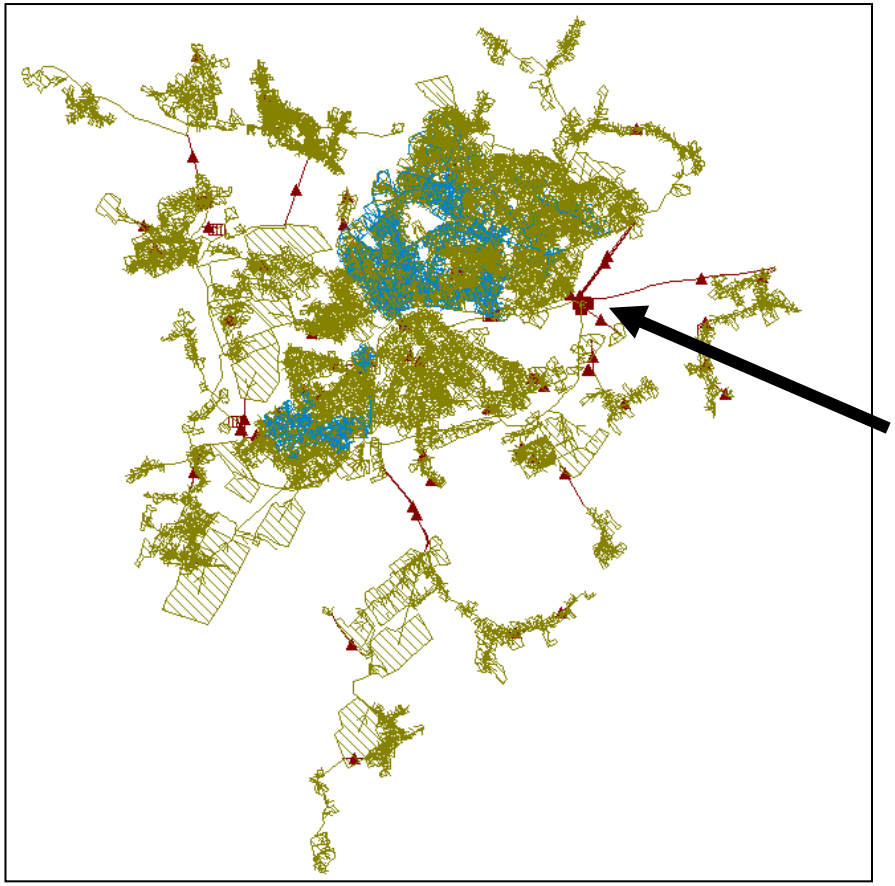
Water quality study required to justify proposals

REGULATORY CONTEXT

- Urban Pollution Management study

PREVIOUS MODELLING

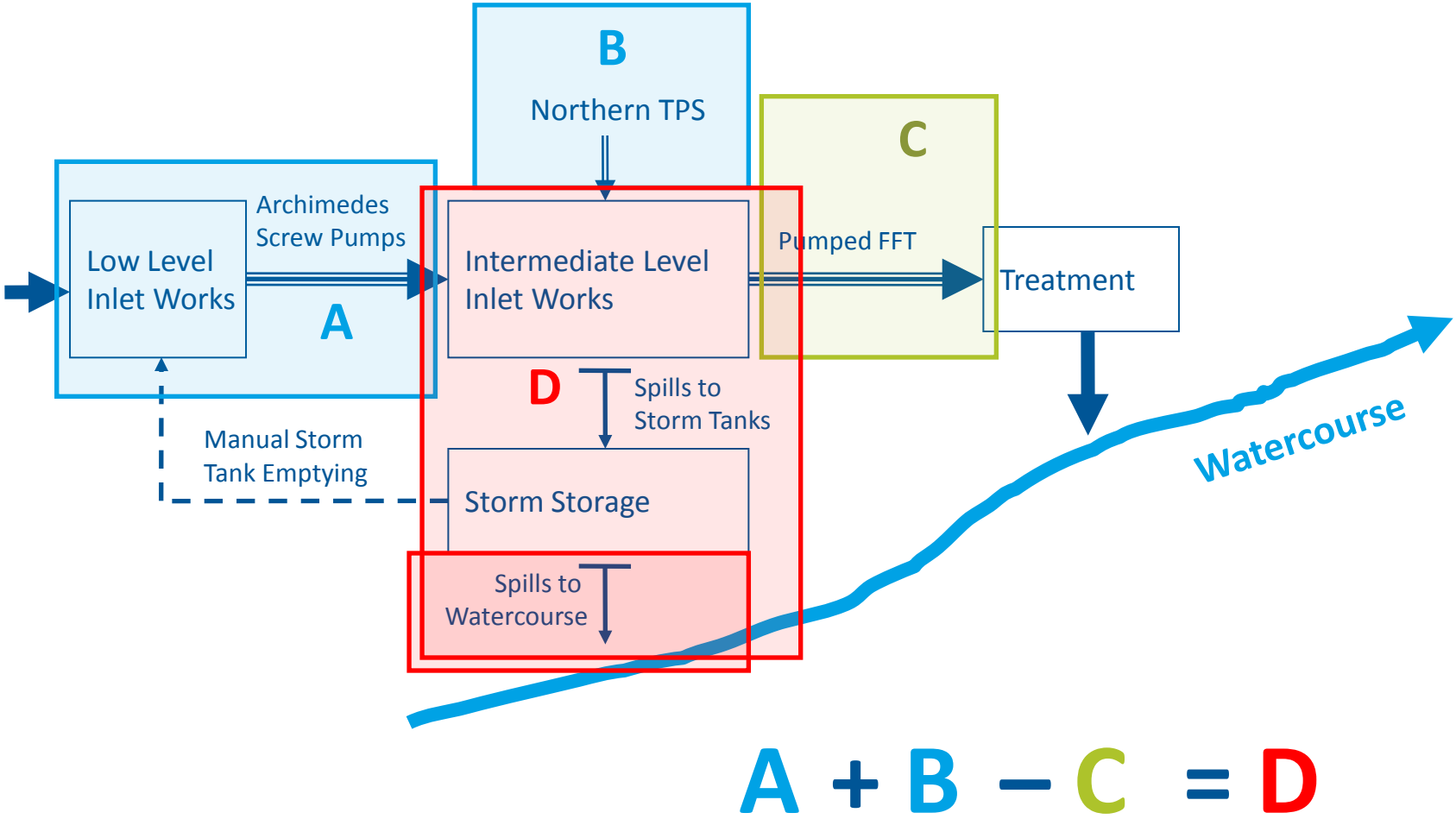
Verified network model



NEW METHODOLOGY

Baseline performance

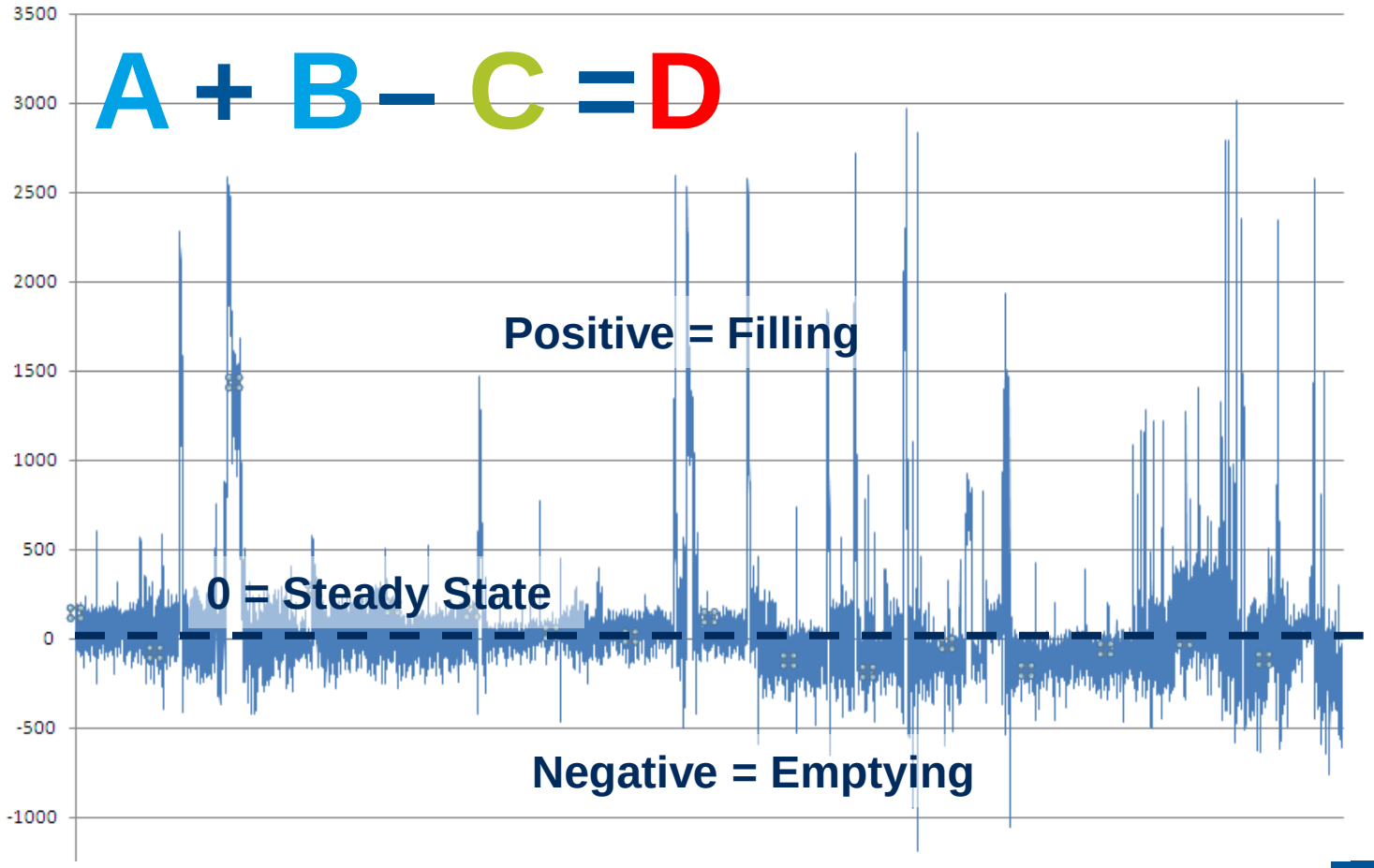
HISTORIC SPILL PERFORMANCE



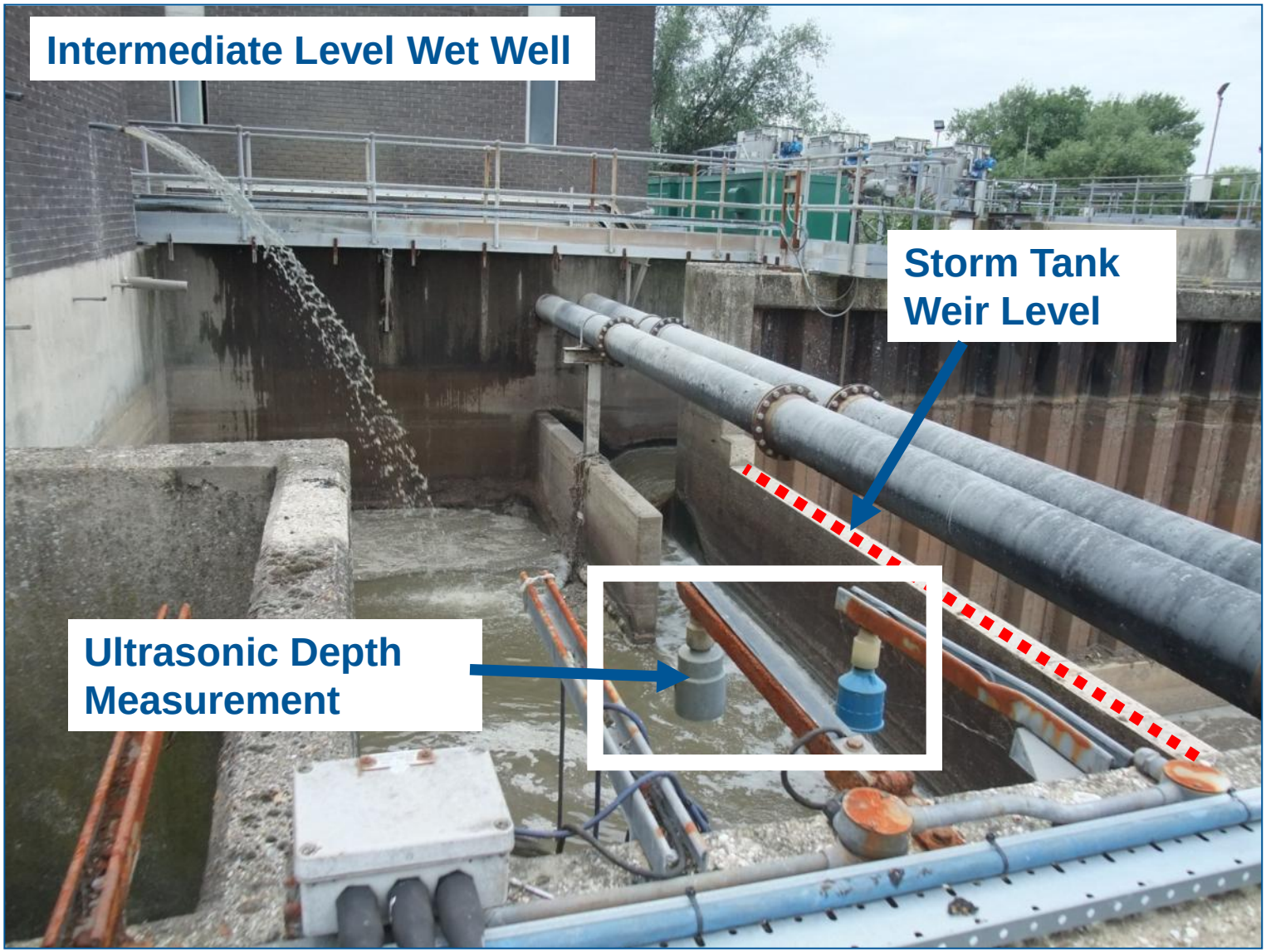
$$A + B - C = D$$

INTERMEDIATE LEVEL INLET WORKS

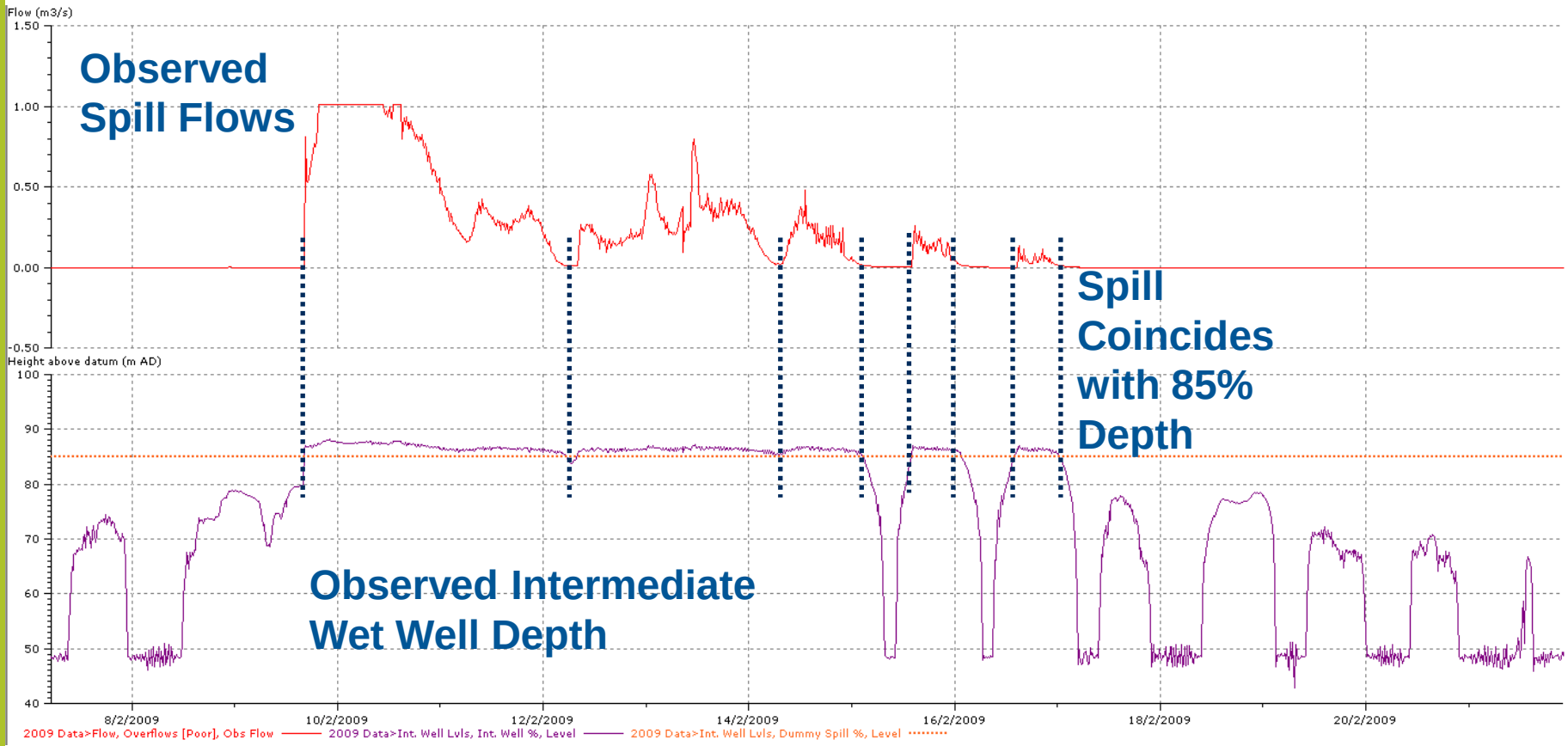
D: RATE OF EMPTYING/FILLING OF THE INTERMEDIATE LEVEL INLET WORKS



CONVERTING D (FILLING / EMPTYING) TO SPILLS



CONVERTING D (FILLING/EMPTYING) TO SPILLS

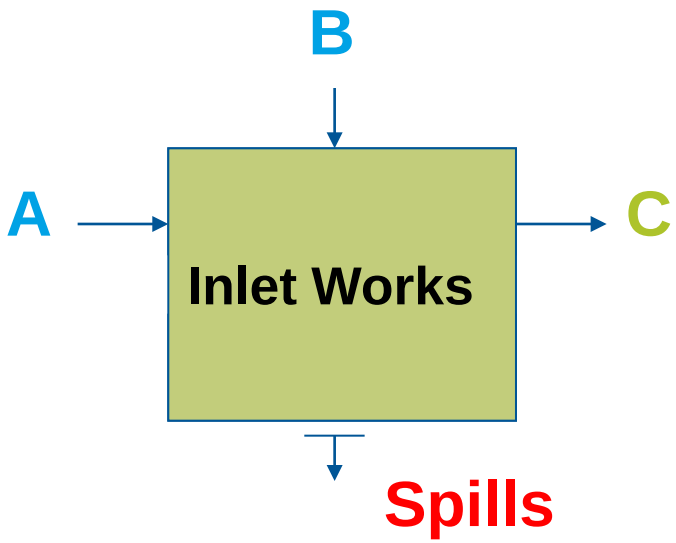


CONVERTING FROM D (FILLING/EMPTYING) TO SPILLS

$$A + B - C = D$$

- When depth ≥85%, spills to watercourse occurring
- Available storage filled and system in steady state
- For these periods:

D = Spills

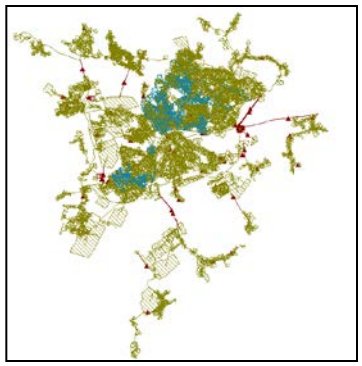


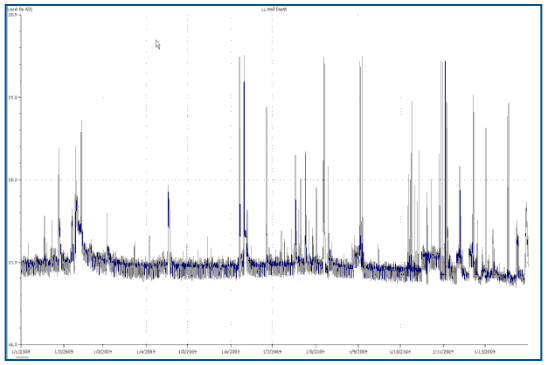
NEW METHODOLOGY

Future performance

REFINING METHODOLOGY

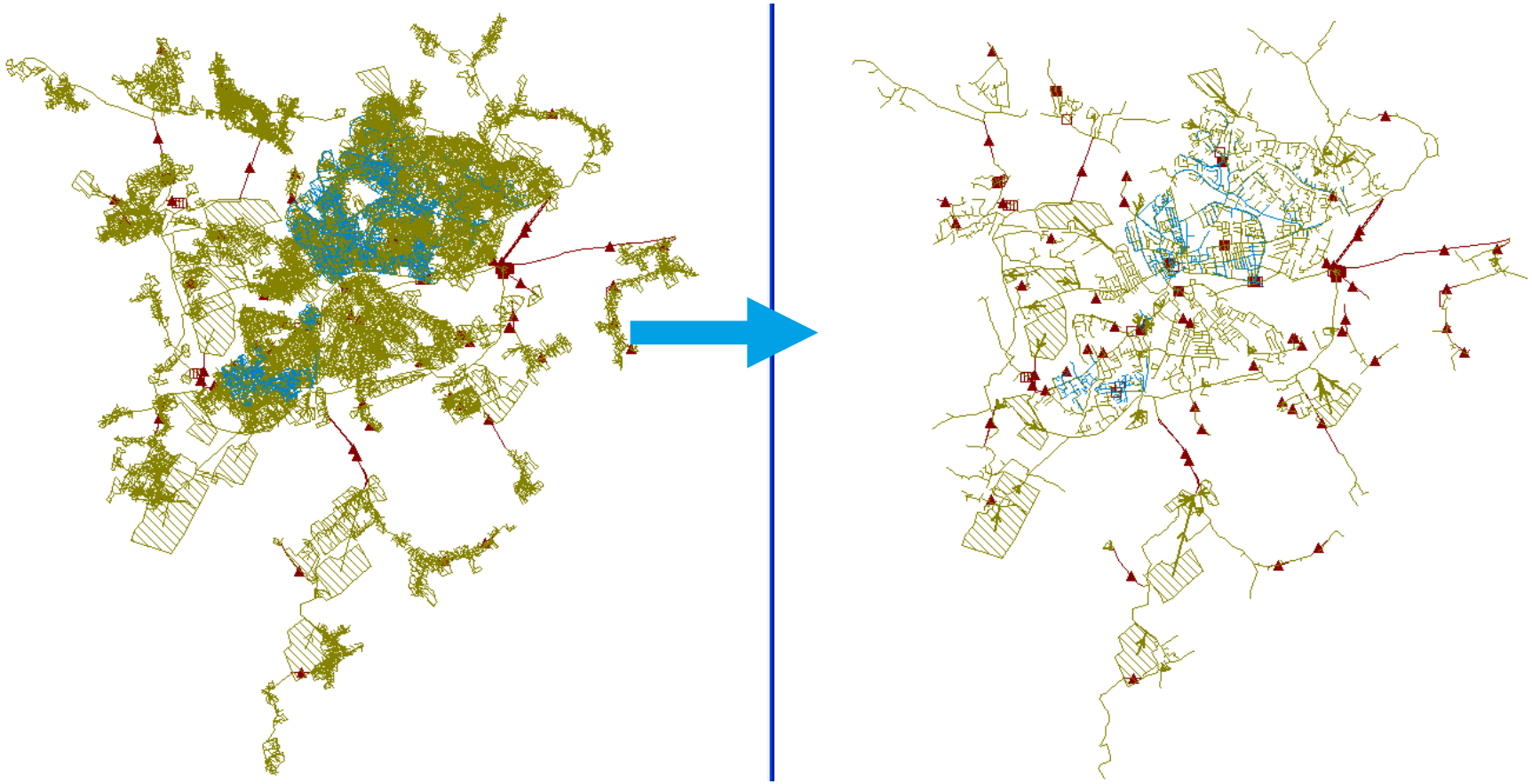
- **Future scenario includes:**
  - Growth
  - Reduced Flow to Full Treatment
  - Automatic return.
- **Methodology uses combination:**





- **Historic rainfall**
- **Population and infiltration removed.**

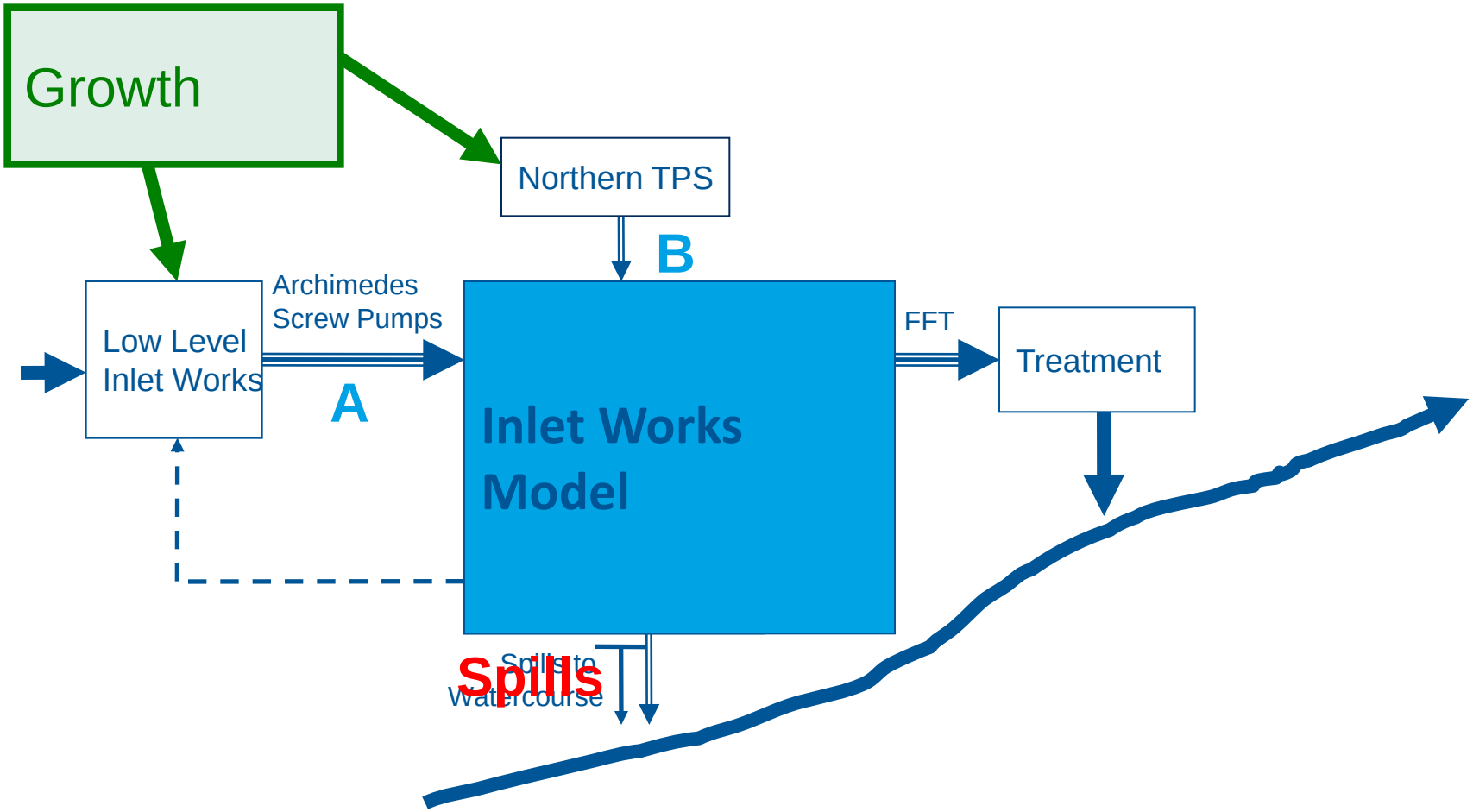
FUTURE MODELLING: GROWTH



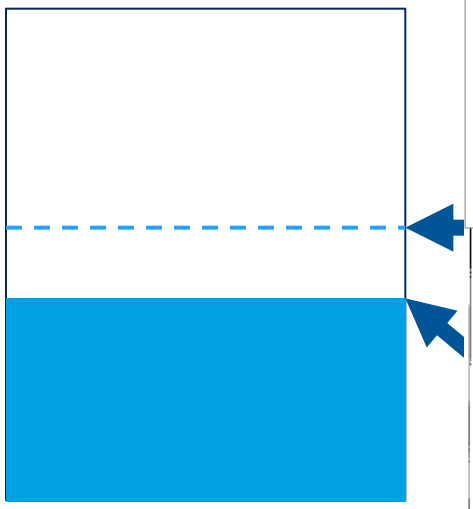
Full model inc subcatchments

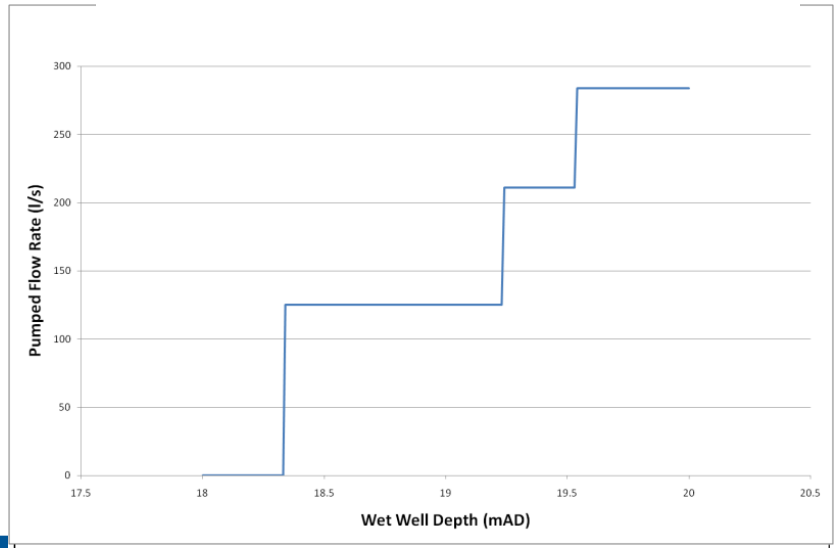
Growth catchments only

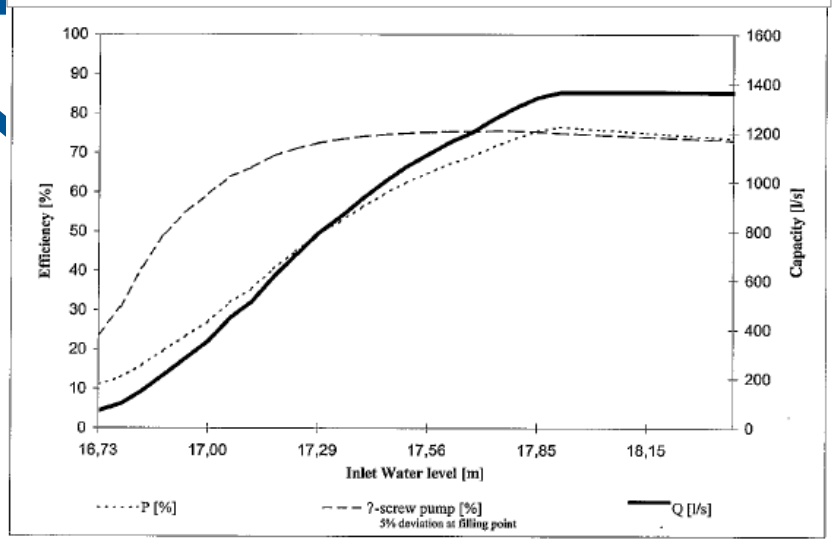
FUTURE MODELLING



FUTURE MODELLING





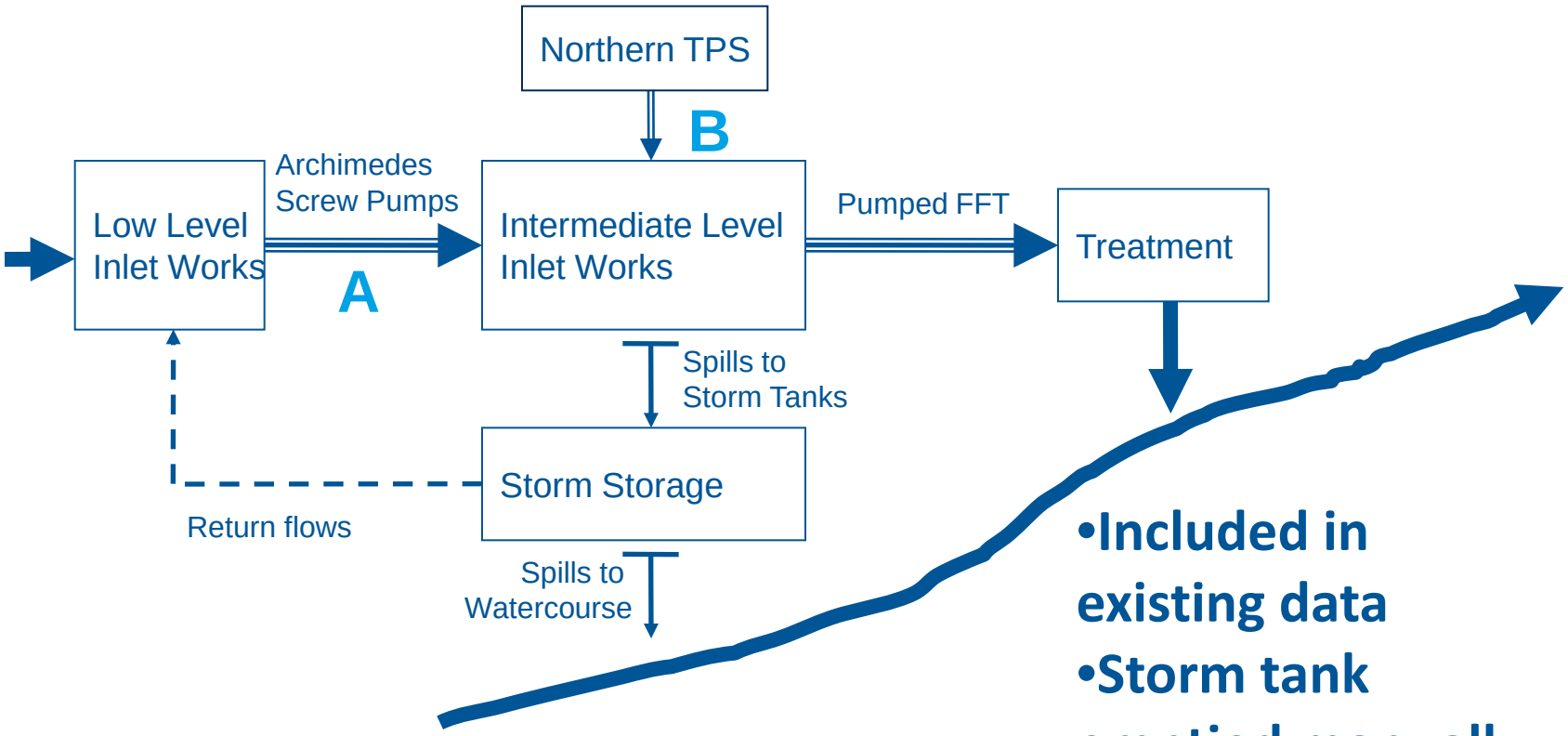


New inflow into inlet works

KEY ASSUMPTIONS IN FUTURE MODELLING

- Future flows not throttled
- Double counting

CALCULATION OF RETURN FLOWS

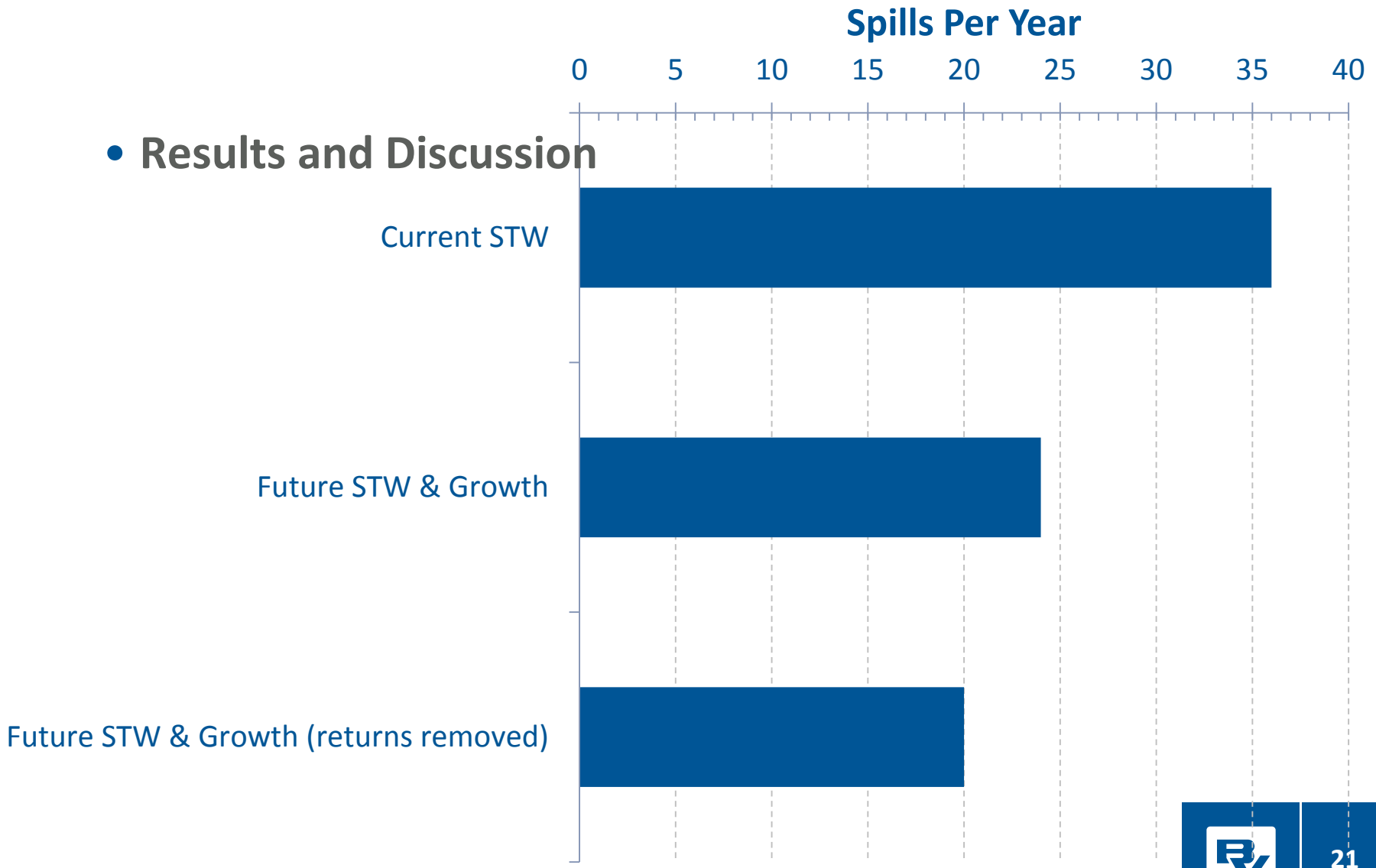


- **Included in existing data**
- **Storm tank emptied manually**

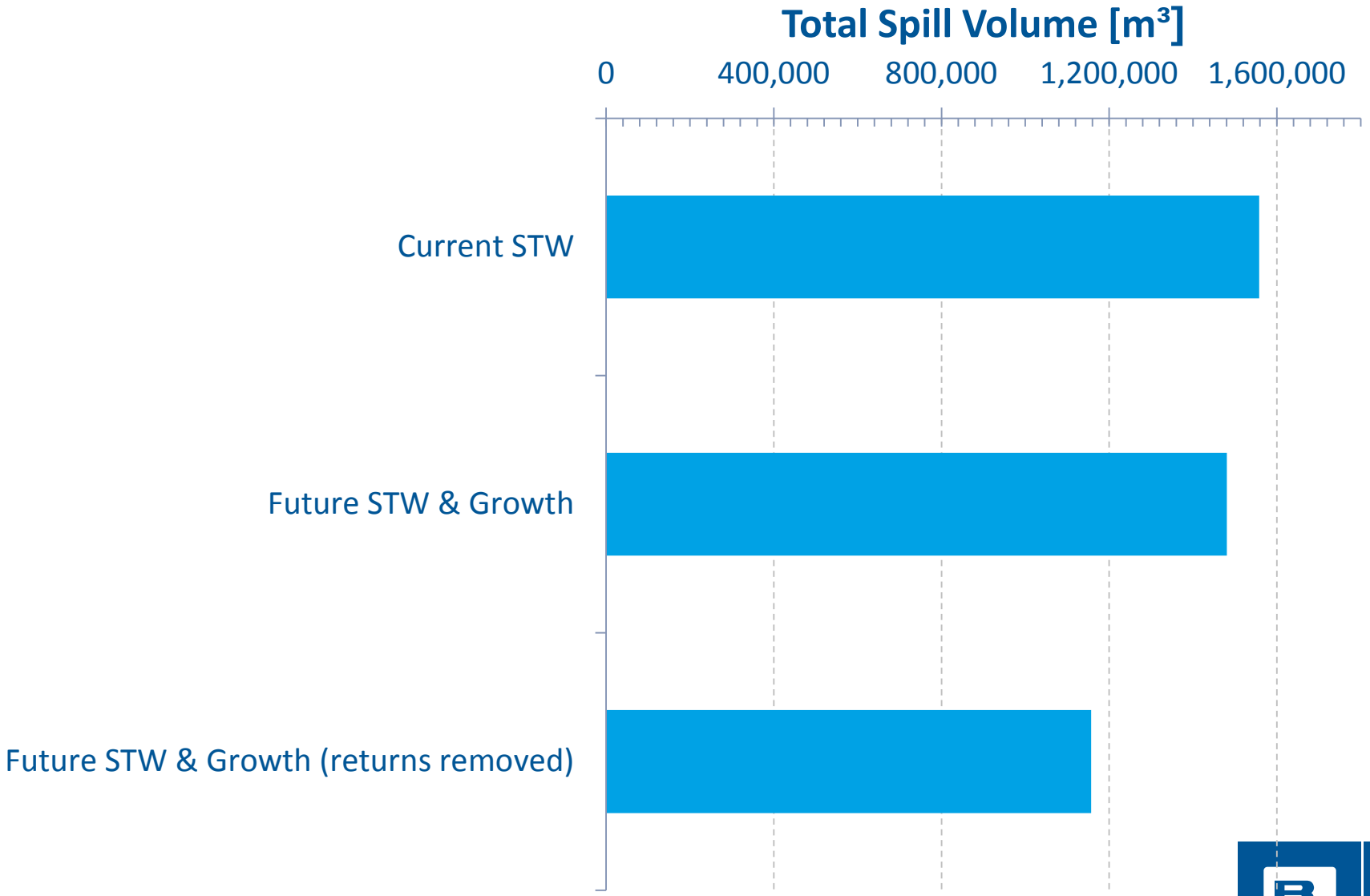
RESULTS AND DISCUSSION

RESULTS OF THE UPM: SPILL COUNT

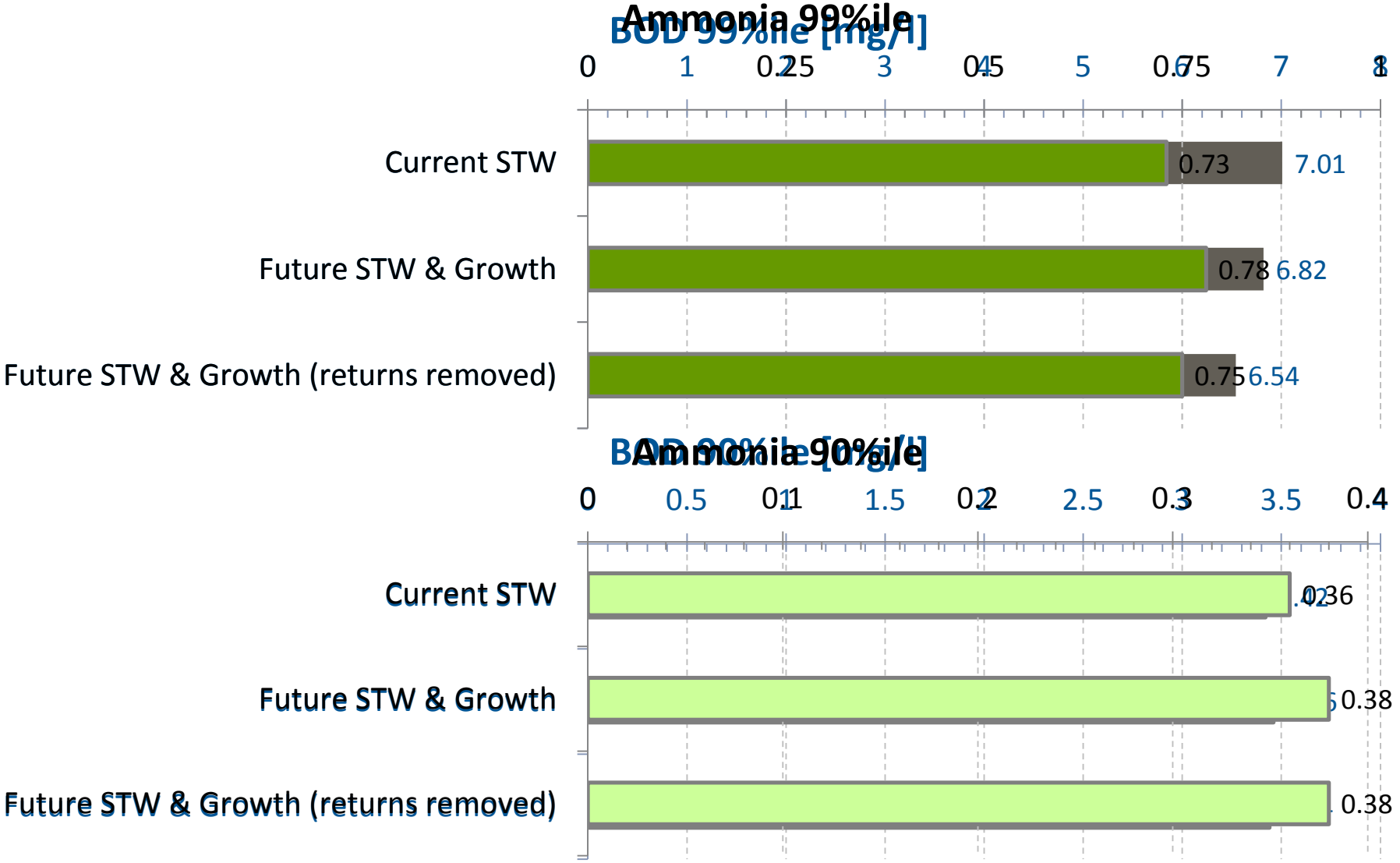
- Results and Discussion



RESULTS OF THE UPM: SPILL VOLUME



RESULTS OF THE UPM



CONCLUSIONS AND INNOVATION

CONCLUSIONS

- Using a network model not always possible.
- Network model under predicts the existing spills.
- Manual operation difficult to represent in network model
- Data driven methodology matches actual performance.
- Methodology relies on telemetry data

INNOVATION

- Uses telemetry
- Spreadsheet based
- Matches anecdotal evidence
- Accounts for manual operation

QUESTIONS?

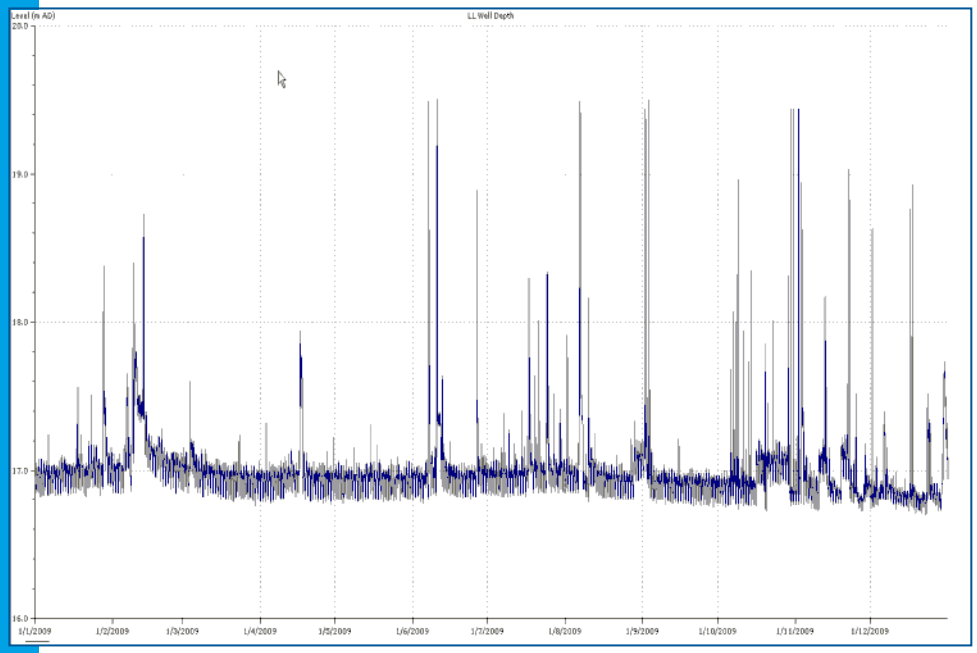
Building a world of difference.®

Together

BLACK & VEATCH

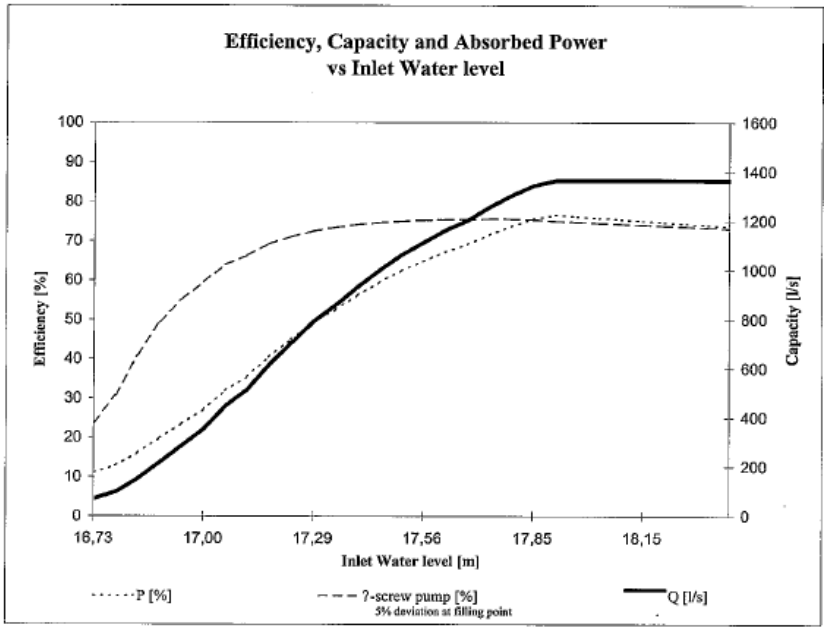
A: INFLOW FROM THE SCREW PUMPS

Historic Telemetry Depth



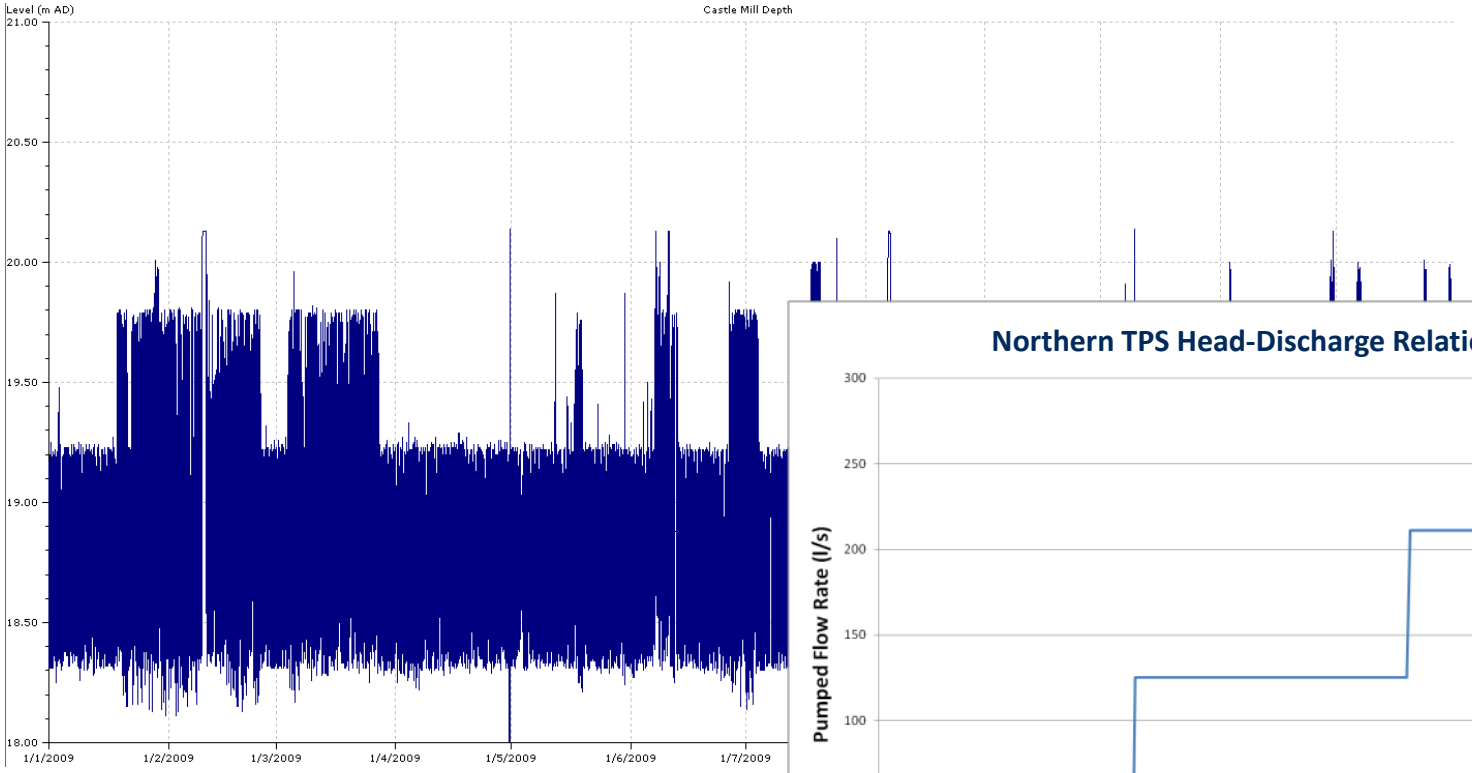
+

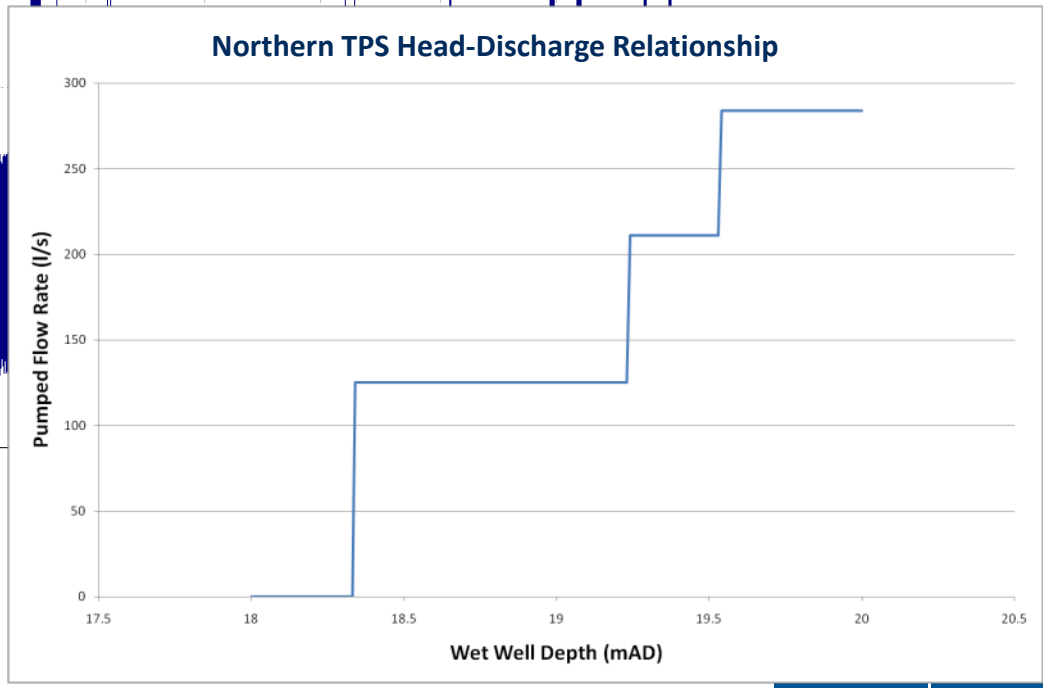
Head-Discharge



0-1350 l/s

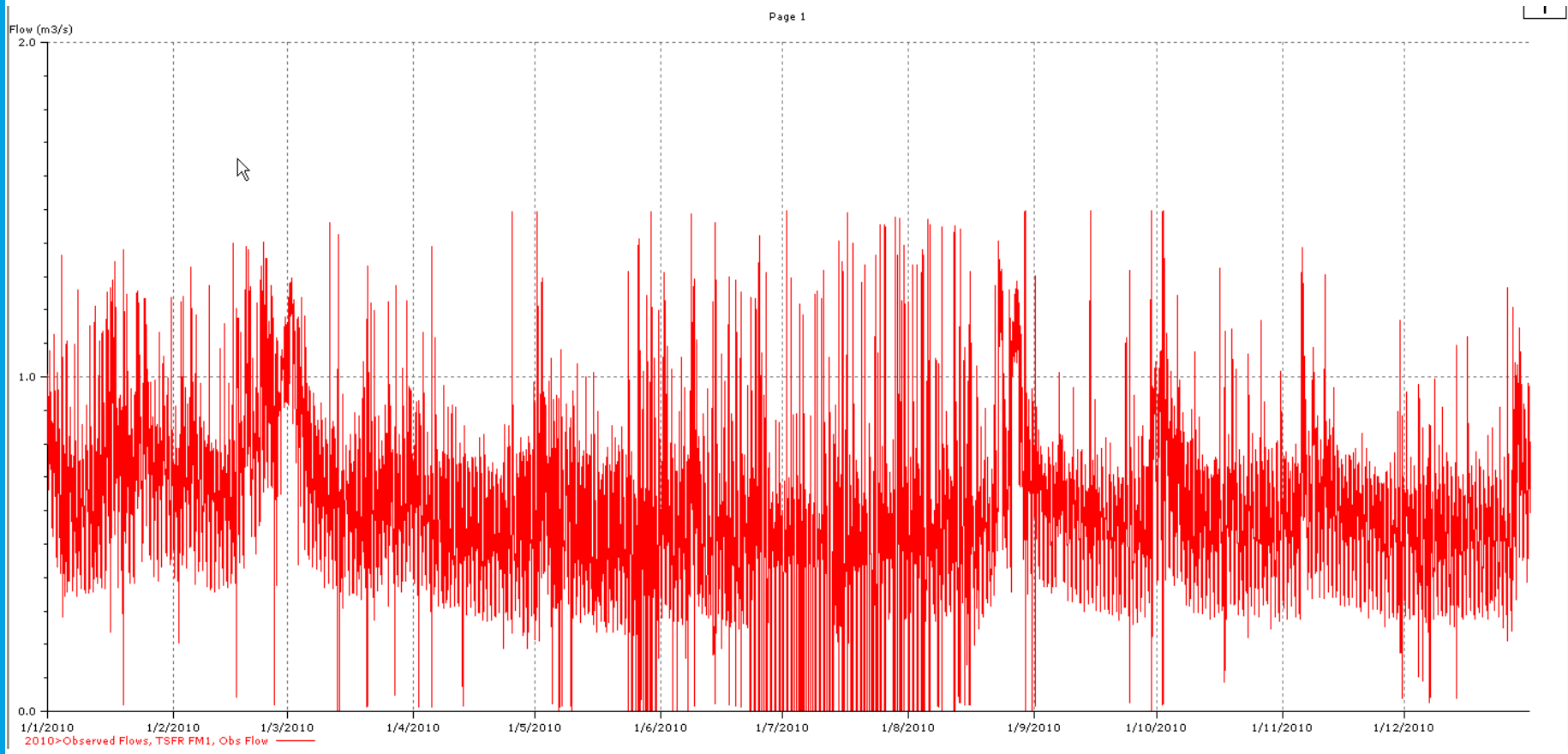
B: INFLOW FROM NORTHERN TERMINAL PUMPING STATION





0-284 l/s

C: FLOW TO FULL TREATMENT FROM TELEMETRY DATA



RESULTS OF THE UPM

Scenario No.	Description	Total Spill Volume (m3)	Spills Per Year	90%ile concentration BOD	90%ile concentration Amm	99%ile Concentration BOD	99%ile Concentration Amm
1	River Only	N/A	N/A	2.78	0.09	5.5	0.38
2	River & STW (Current)	N/A	N/A	3.28	0.34	5.54	0.65
3	2006-2008 (Current)	1,557,879	36	3.42	0.36	7.01	0.73
4	River & STW (Future)	N/A	N/A	3.35	0.37	5.61	0.69
5	2006-2008 with growth (return flows included)	1,480,713	24	3.46	0.38	6.82	0.78
6	2006-2008 with growth (return flows removed)	1,157,296	20	3.44	0.38	6.54	0.75
			(WFD High) RE1	(4.0) 2.5	(0.3) 0.3	5.0	0.6
			(WFD Good) RE2	(5.0) 4.0	(0.6) 0.6	9.0	1.5
			(WFD Moderate) RE3	(6.5) 6.0	(1.1) 1.3	14.0	3.0
			(WFD Poor) RE4	(9.0) 8.0	(2.5) 2.5	19.0	6.0