Evaluating Scenarios for Achieving the Water Framework Directive (WFD) Phosphorus Targets in Small Catchments

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AIMS

1. To assess the potential of achieving WFD phosphorus target for "Moderate" and "Good" status in selected sub-catchments using modelling
2. To Investigate alternative scenarios to achieve #1 involving reducing both point and diffuse (i.e. agricultural) sources in the selected sub-catchments.

MODELS

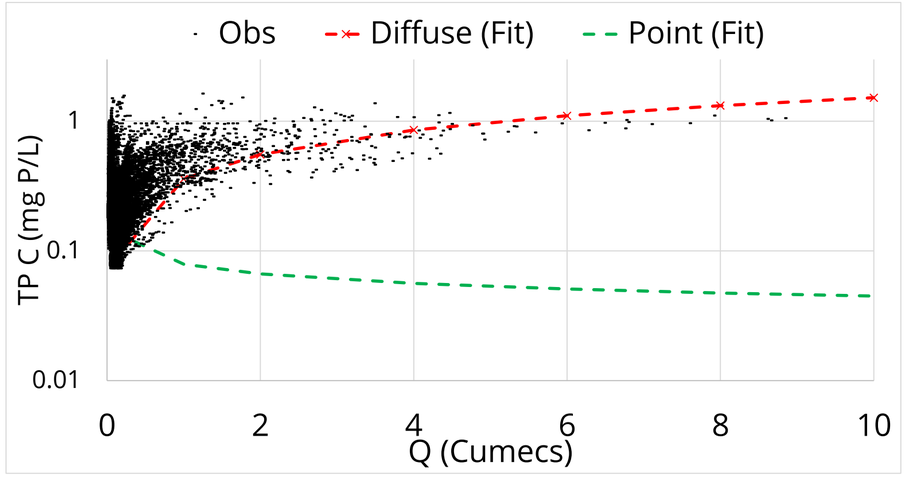
Two models are used: (i) CRAFT (Catchment Runoff Attenuation Flux Tool) models the P dynamics (concentrations and exports) under two mitigation scenarios: (1) Land Management (LM) *improved soil management* (2) Runoff Attenuation Features (RAF) (*Adams, R, et al. "The role of attenuation and land management in small catchments to remove sediment and phosphorus: a modelling study of mitigation options and impacts." Water 10.9 (2018): 1227*) (*Pow Beck Only*)

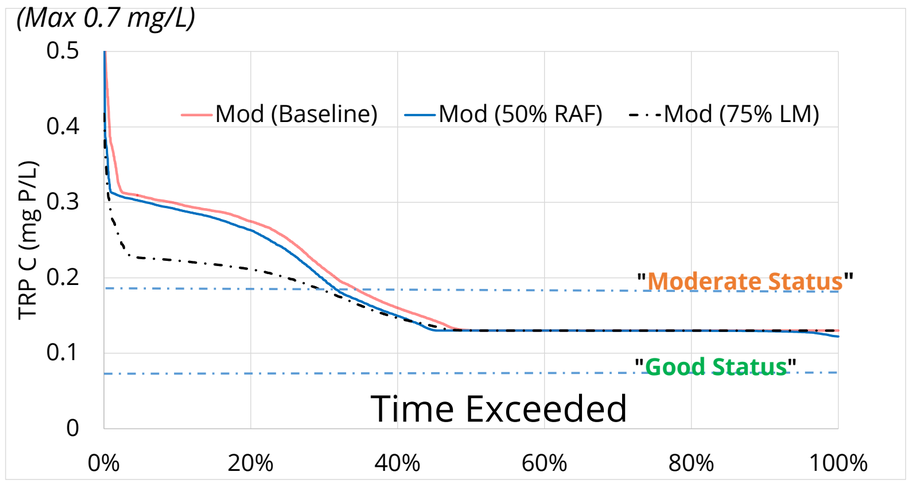
(ii) LAM (Load Apportionment Model), calculates the fractions of the TP load from point and diffuse sources using observed discharge and concentration data only. (*Bowes, M.J., et al. "Modelling of phosphorus inputs to rivers from diffuse and point sources." STOTEN 395.2-3 (2008): 125-138*) (*Both Pow Beck and Bawn*)

SITES

(i) The Pow Beck, is a 10.2 km^2 sub-catchment of the River Eden, from the EdenDTC project (http://www.edendtc.org.uk/). LAM results below (in the left pane) show that the point source load = 27%. In the two CRAFT scenarios (right pane) "LM" is applied to 75% of the catchment area) and "RAF" to 50% (RAFs assigned a 80% removal efficiency for particulate P) in an attempted to achieve "good" P WFD status, which the baseline (2012-2014 data) failed to achieve.

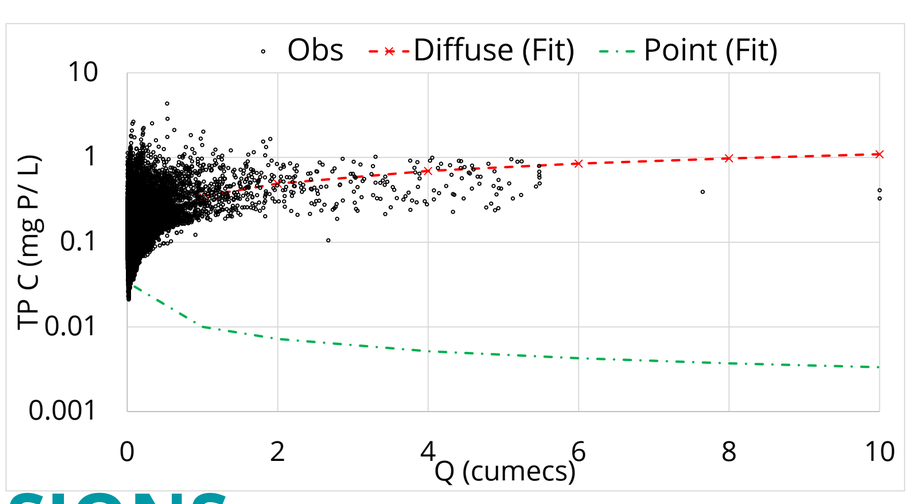
LAM Model

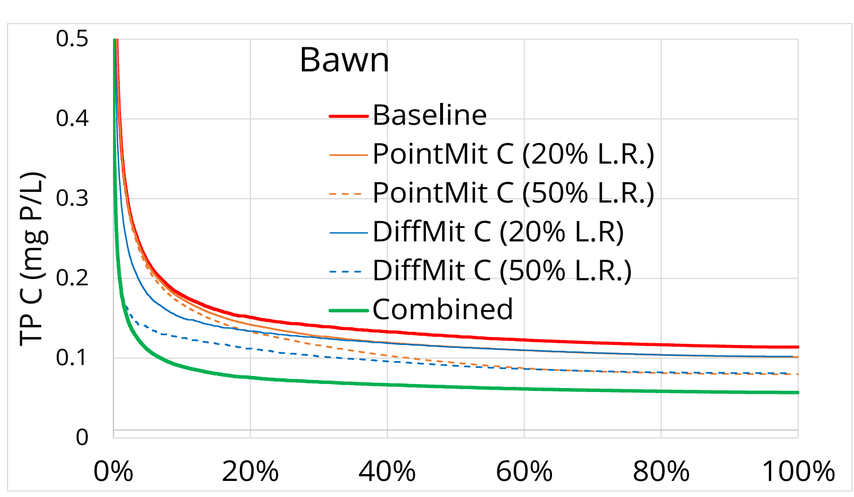




(ii) The Bawn, is a 5 km^2 sub-catchment of the Oona Water (OW), a tributary of the NI Blackwater. The 80+ km^2 OW catchment was classified as "Moderate" for P status in the last two WFD assessments. Hi-res TP and Q data were collected (2006-11) using a bankside sampler (TP="Obs") and modelled by LAM (left pane and "Baseline" in right pane). Point and Diffuse (Diff) Load reduction scenarios are shown in the right pane. The point source load = 8% of the total.

LAM Model





CONCLUSIONS

1. Combining diffuse and point source reductions is the most appropriate strategy for the Bawn according to the LAM results. This scenario reduced median TP concentration by 0.064 mg/L (50%).
2. Low-flow TRP concentrations in the Pow Beck exceed "Moderate" (0.182 mg/L) for > 50% of the time, so reducing these will require the mitigation of point sources & legacy groundwater.
3. Constructing RAFs over 50% of the Pow Beck alone will not achieve "Good" status. In part this is due to these RAFs mitigating surface runoff and reducing particulate P rather than reactive P.

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