

# Farm nutrient regulations; contrasting impact on water quality in different catchments

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# Irish farm nutrient regulations (National Action Programme)

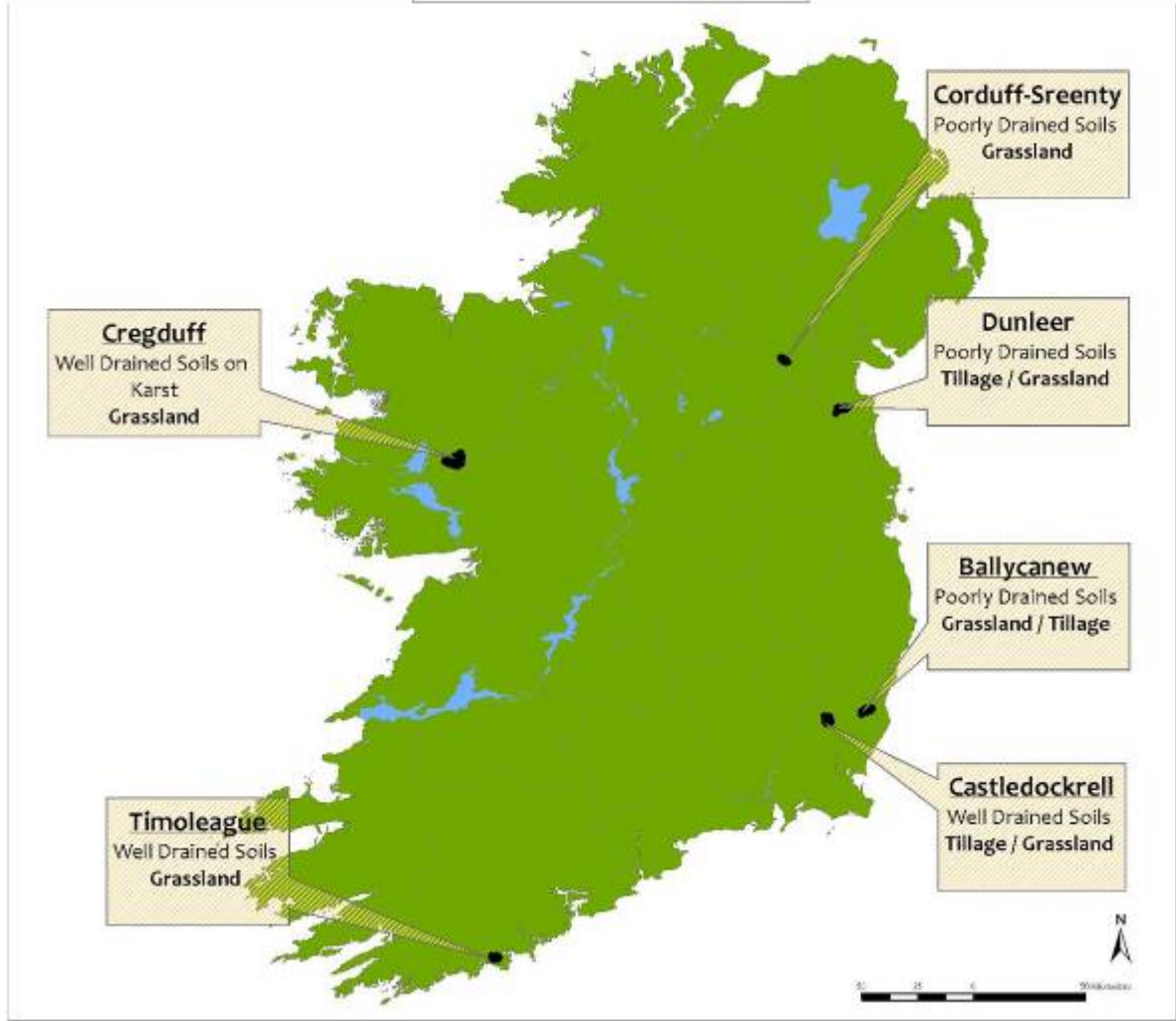
## Limits source of N and P

- Constrains N & P application rates, soil P test
- Caps livestock intensity (170kg organic N/ha)
- Supports a derogation (250kg organic N/ha)

## Minimises *temporal* and *spatial* interaction of N, P and surplus water

- Closed spreading & ploughing periods
- Manure storage requirements
- Buffers between applications and water bodies
- Separation of clean and dirty water

# 6 Catchments



Arable B

Arable A

# Two contrasting catchments



**Spring** barley 54%

11.2 km<sup>2</sup>

**well-drained soils**

**Slate and siltstone**

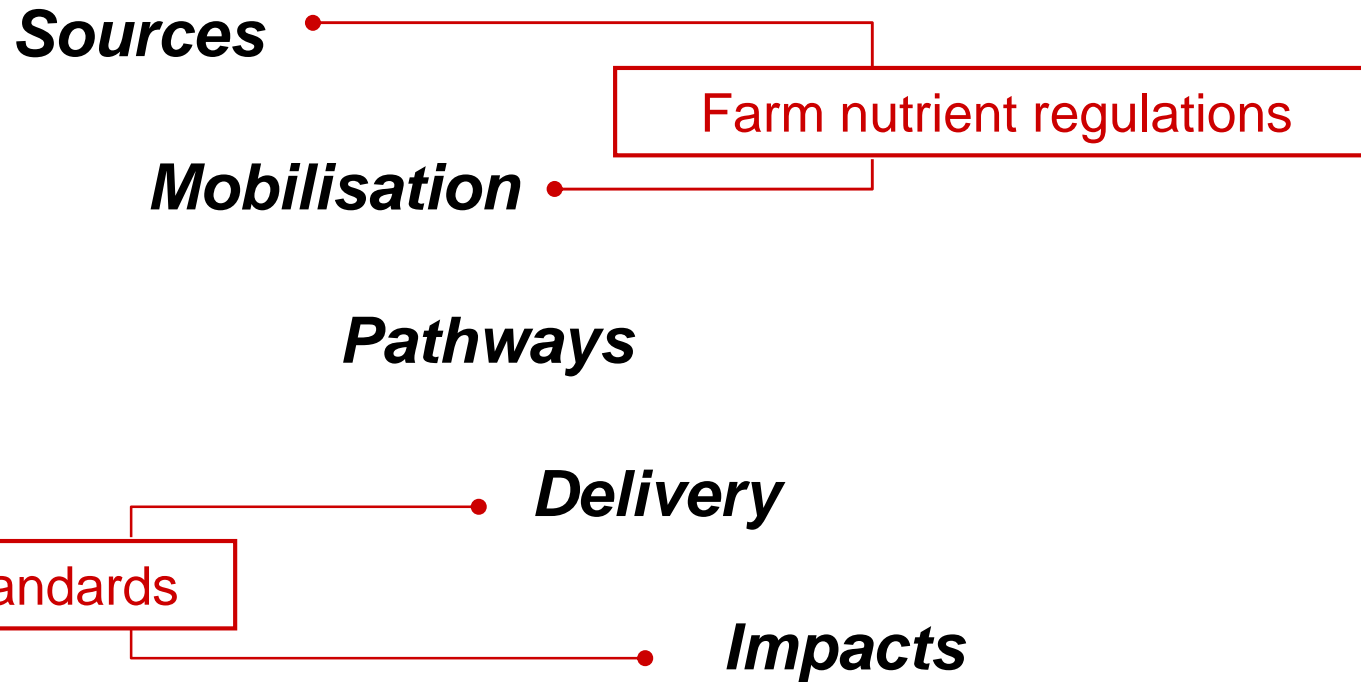
**Winter** wheat 32%

9.5 km<sup>2</sup>

**poorly-drained soils**

**Calc. greywacke & mudstone**

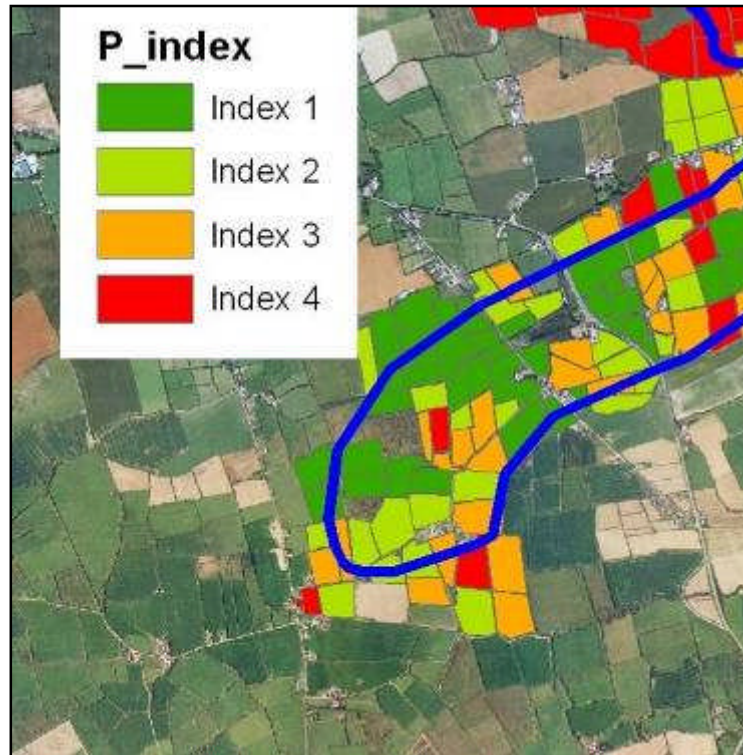
# Catchment-based experimental design



Wall et al ES&P 2011

# Methods - Sources

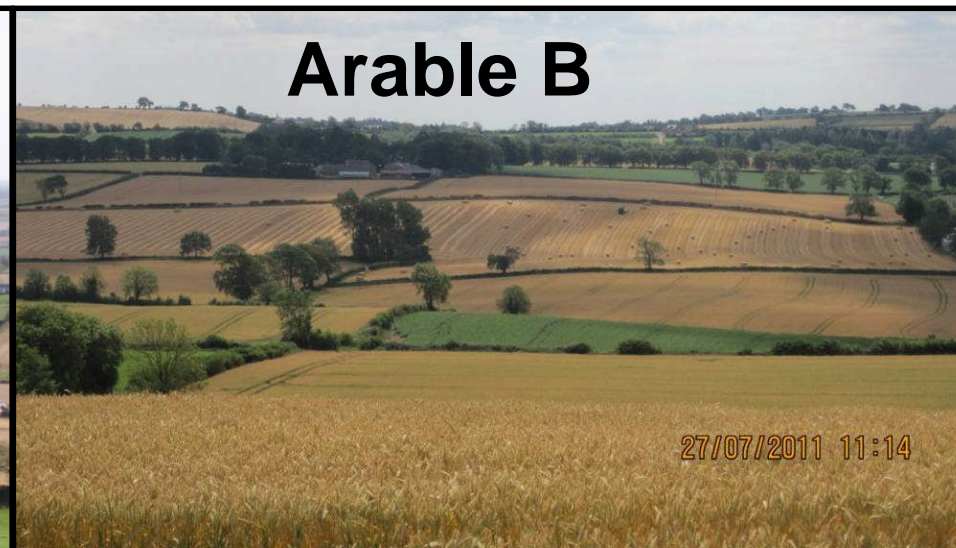
- Soil tests every 2 ha
- Farm facilities & nutrient management records



# Results - sources



**Arable A**

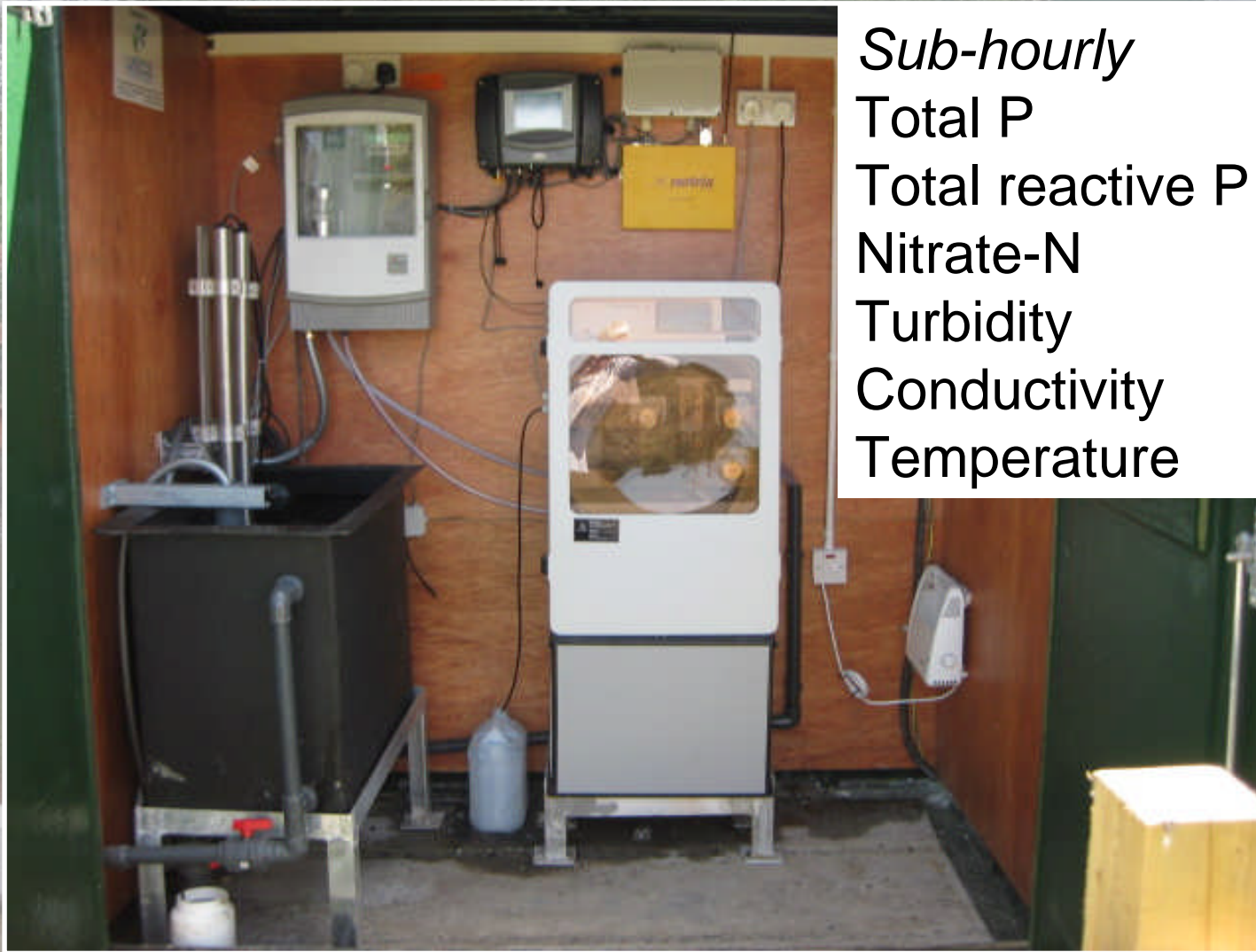


**Arable B**

**8.5** houses per km<sup>2</sup>  
0.014/ha livestock farmyards  
Closed period 15 Sep-12 Jan  
18% fields soil P > optimum

**14.0** houses per km<sup>2</sup>  
0.016/ha livestock farmyards  
Closed period 15 Sep-15 Jan  
19% fields soil P > optimum

## Methods - Delivery



*Sub-hourly*  
Total P  
Total reactive P  
Nitrate-N  
Turbidity  
Conductivity  
Temperature

Synchronous discharge and chemistry monitoring

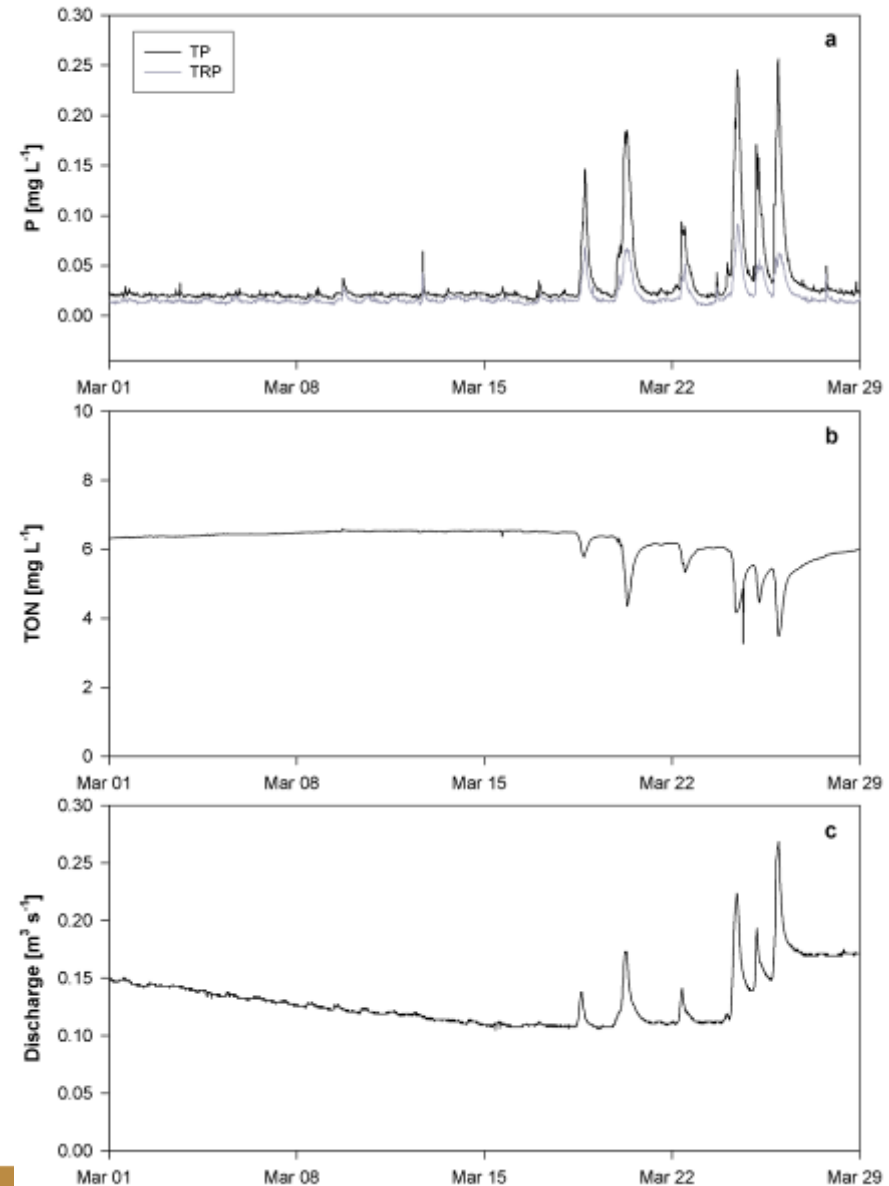


# Results - Delivery

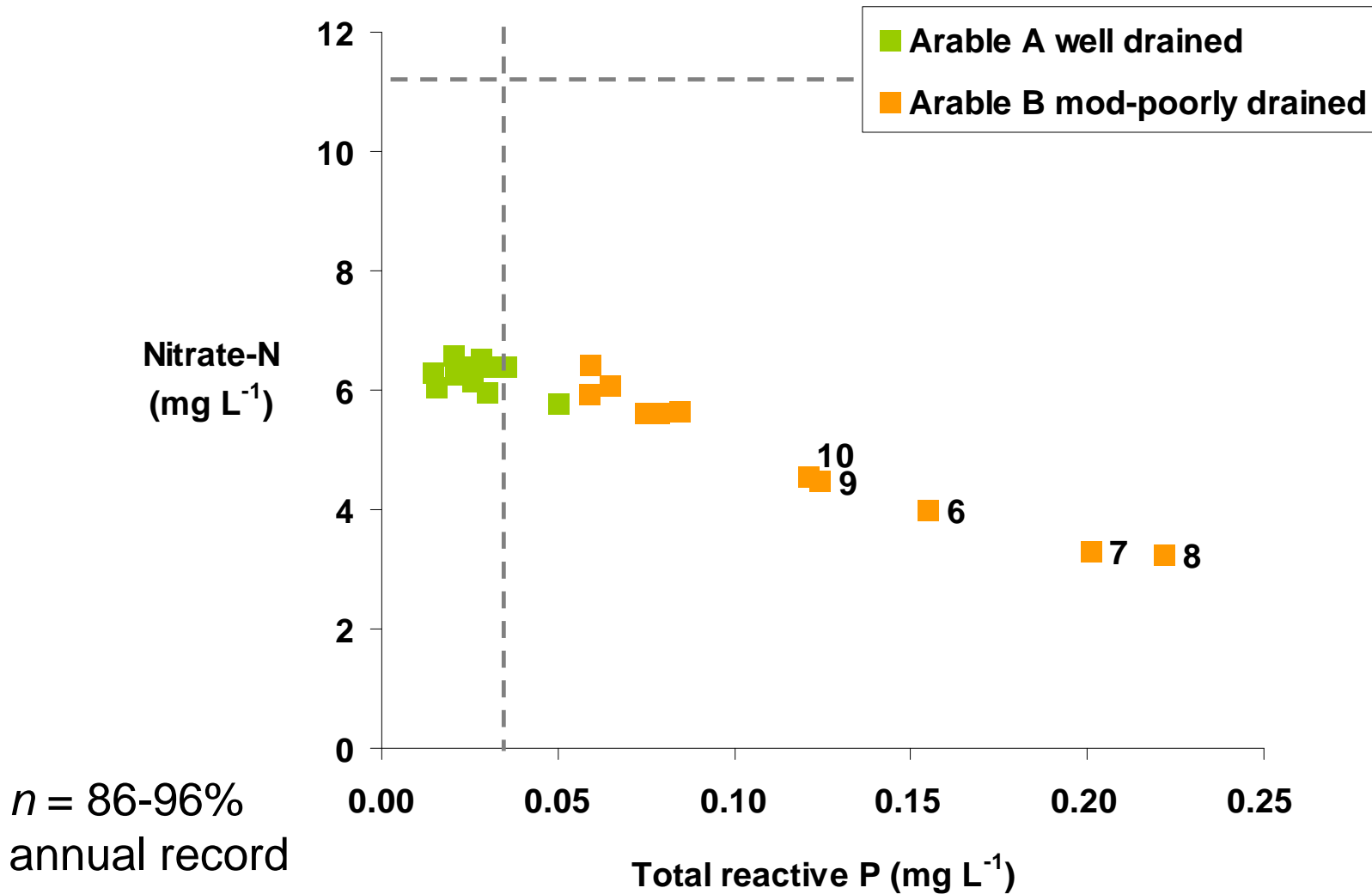
Total P & total reactive P  
 $N = 1860 \text{ mo}^{-1}$

Nitrate-N  
 $N = 4464 \text{ mo}^{-1}$

Discharge  
 $N = 4464 \text{ mo}^{-1}$



# Results - Delivery standards



# Methods - Impacts

Biannual benthic diatom  
and macro-invertebrate  
surveys



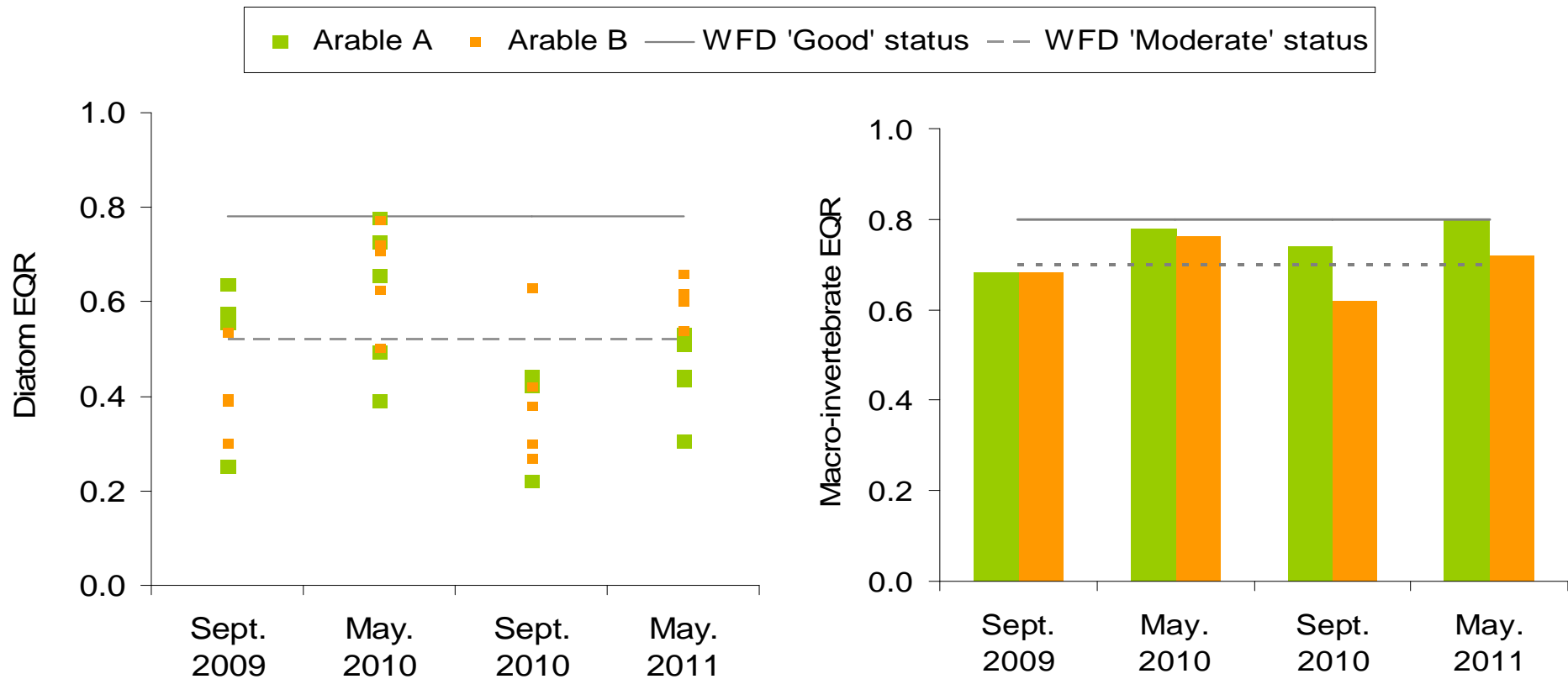
Once off fish and river  
habitat survey

# Results - Ecology standards

- 2015 'good' status target met only occasionally
- Seasonal variation larger than expected

## Benthic diatoms

## Macro-invertebrates



Two questions:

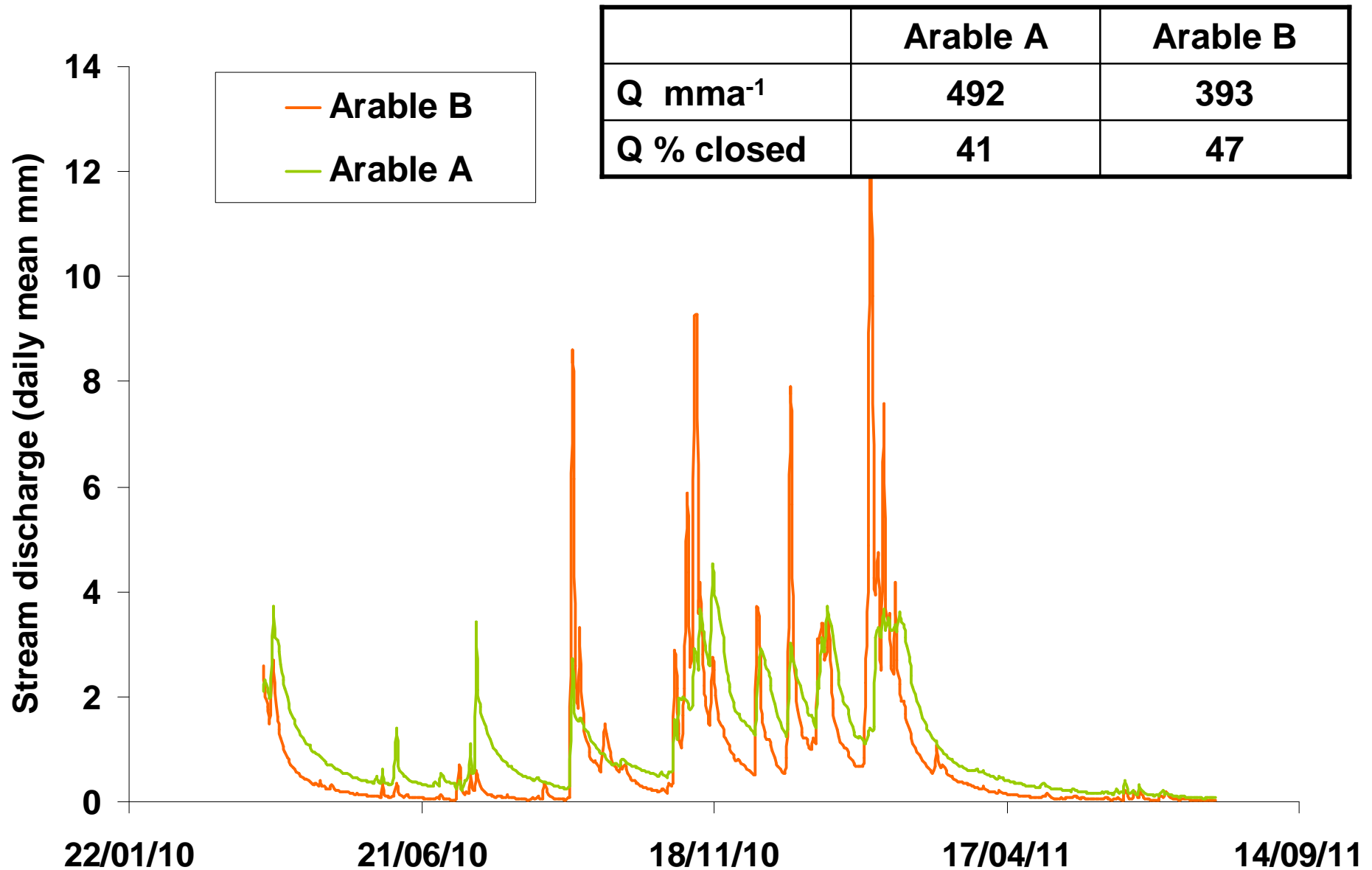
1. Why the difference in TRP response?

1. Flow volume and pathway
2. Loading

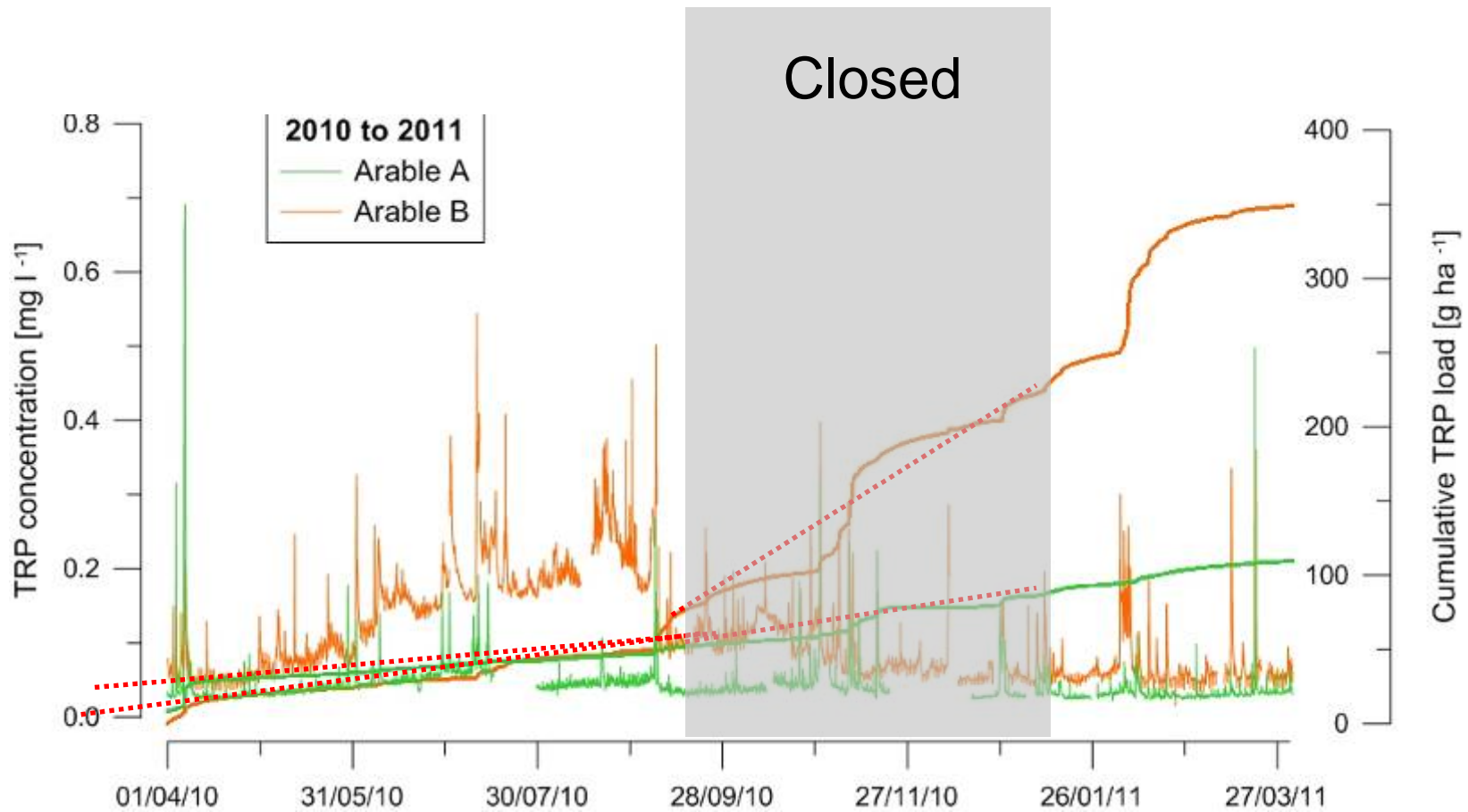
2. Are the NAP measures likely to result in WFD targets being met?

1. Requires temporal and spatial connectivity (mobilisation) of sources with stream response

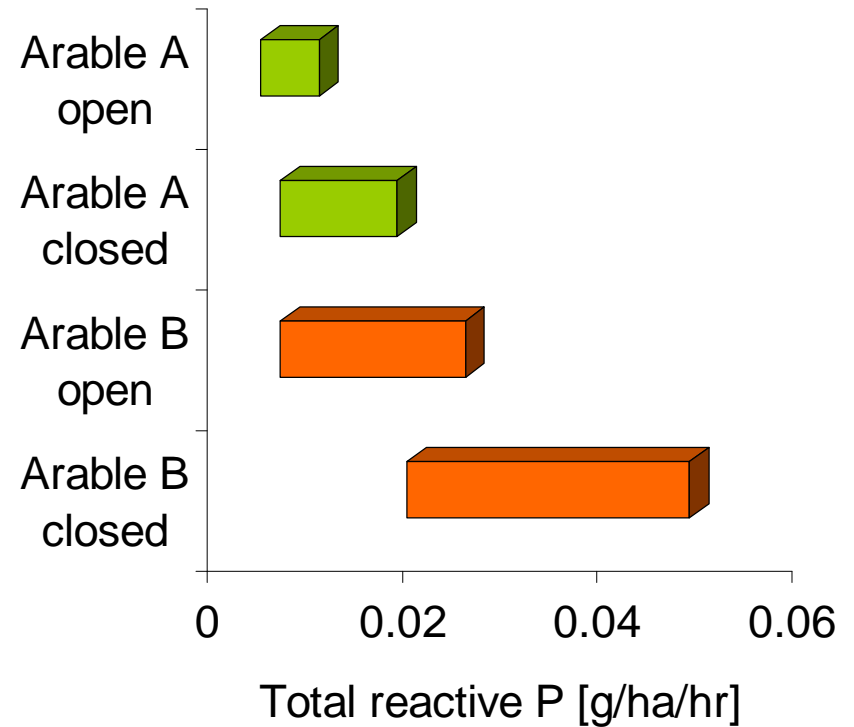
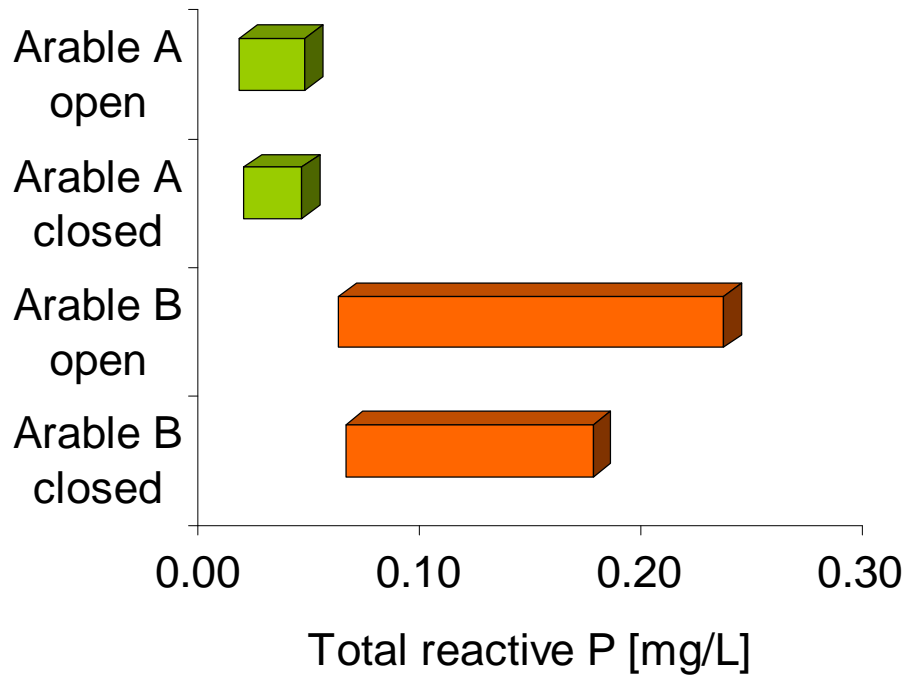
# 1.1 Delivery - discharge comparison



# 1.2 Delivery – Seasonality of loads



# Delivery – seasonality and loads

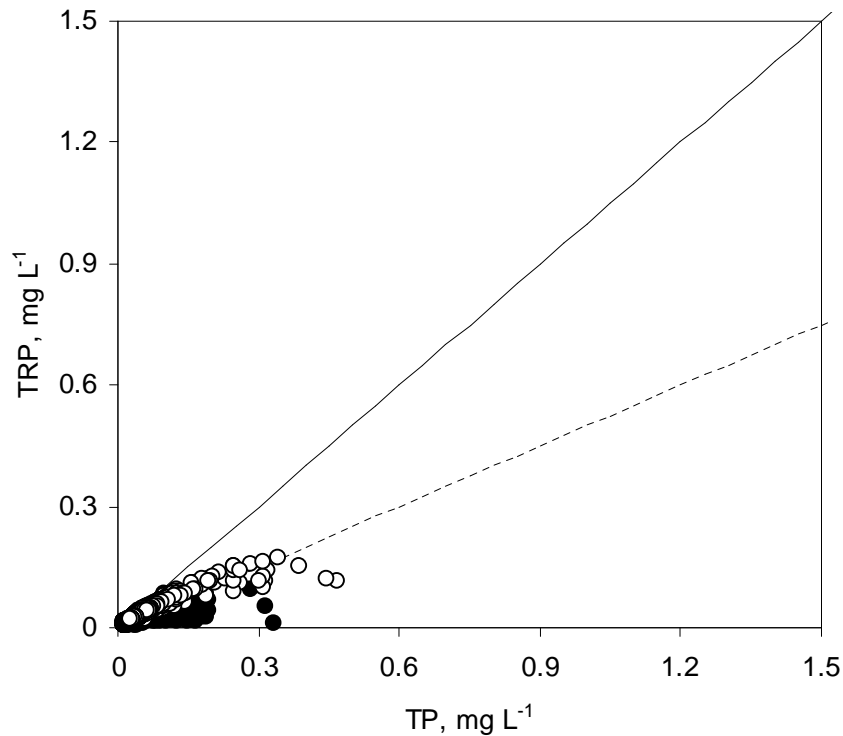




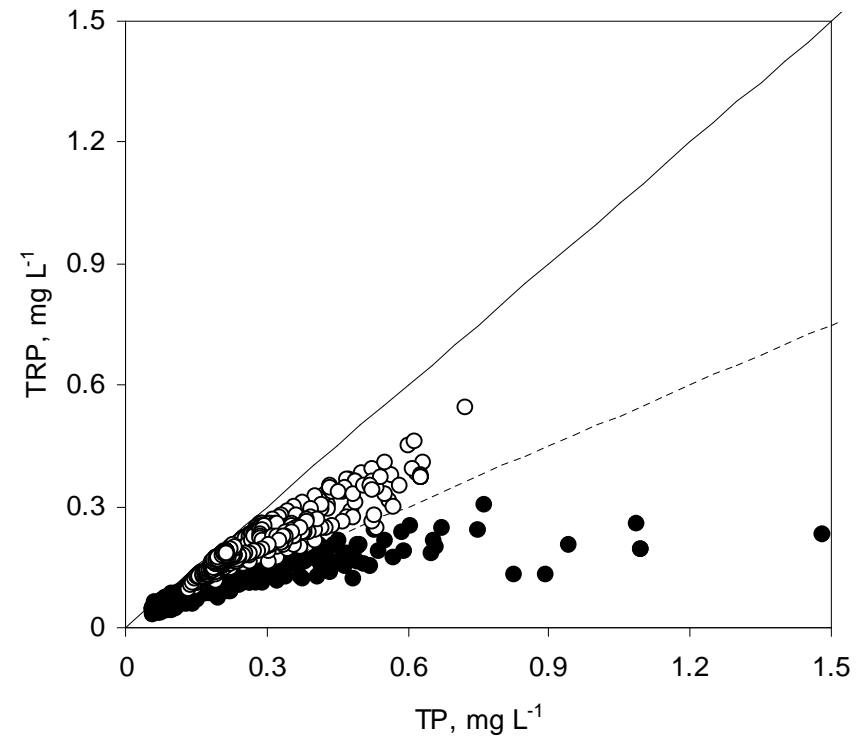
# Delivery – seasonal connectivity with sources

Higher particulate fractions in winter cf summer –  
evidence of connectivity of diffuse sources higher in  
winter than summer

c) Arable A

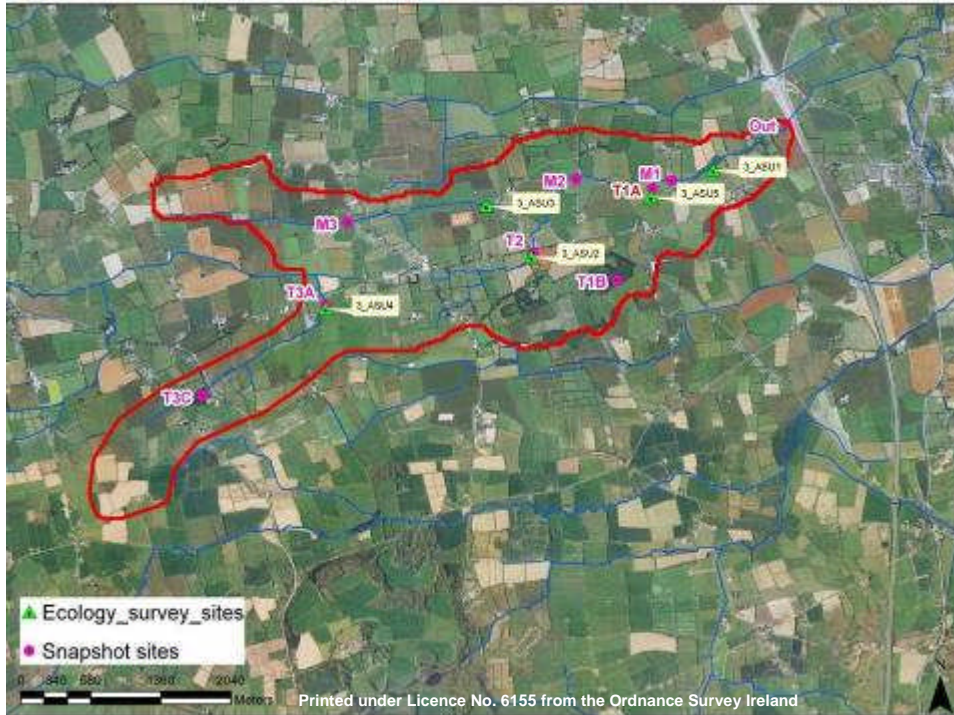


d) Arable B



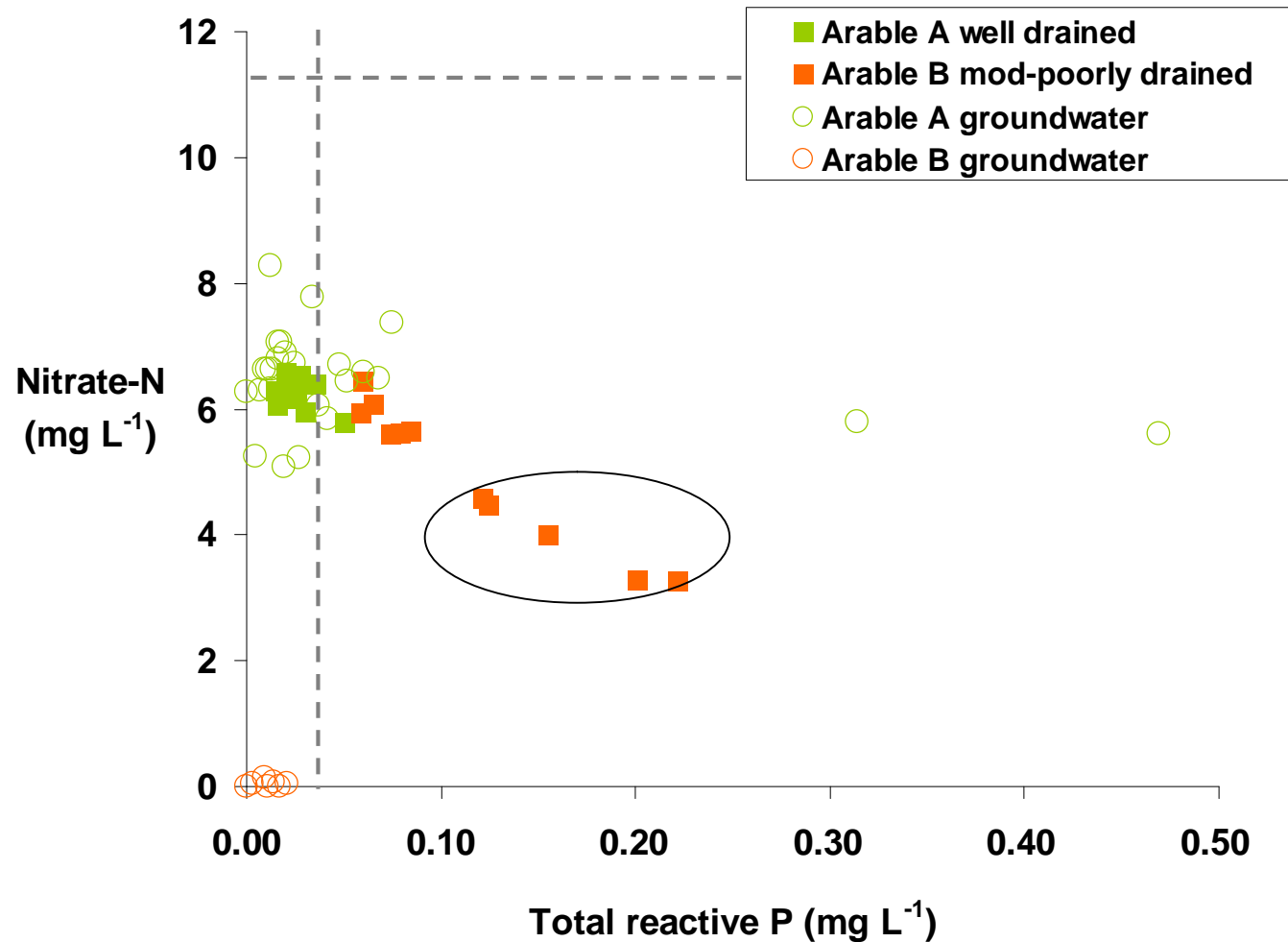
# Methods - Pathways

## Surface water snapshots



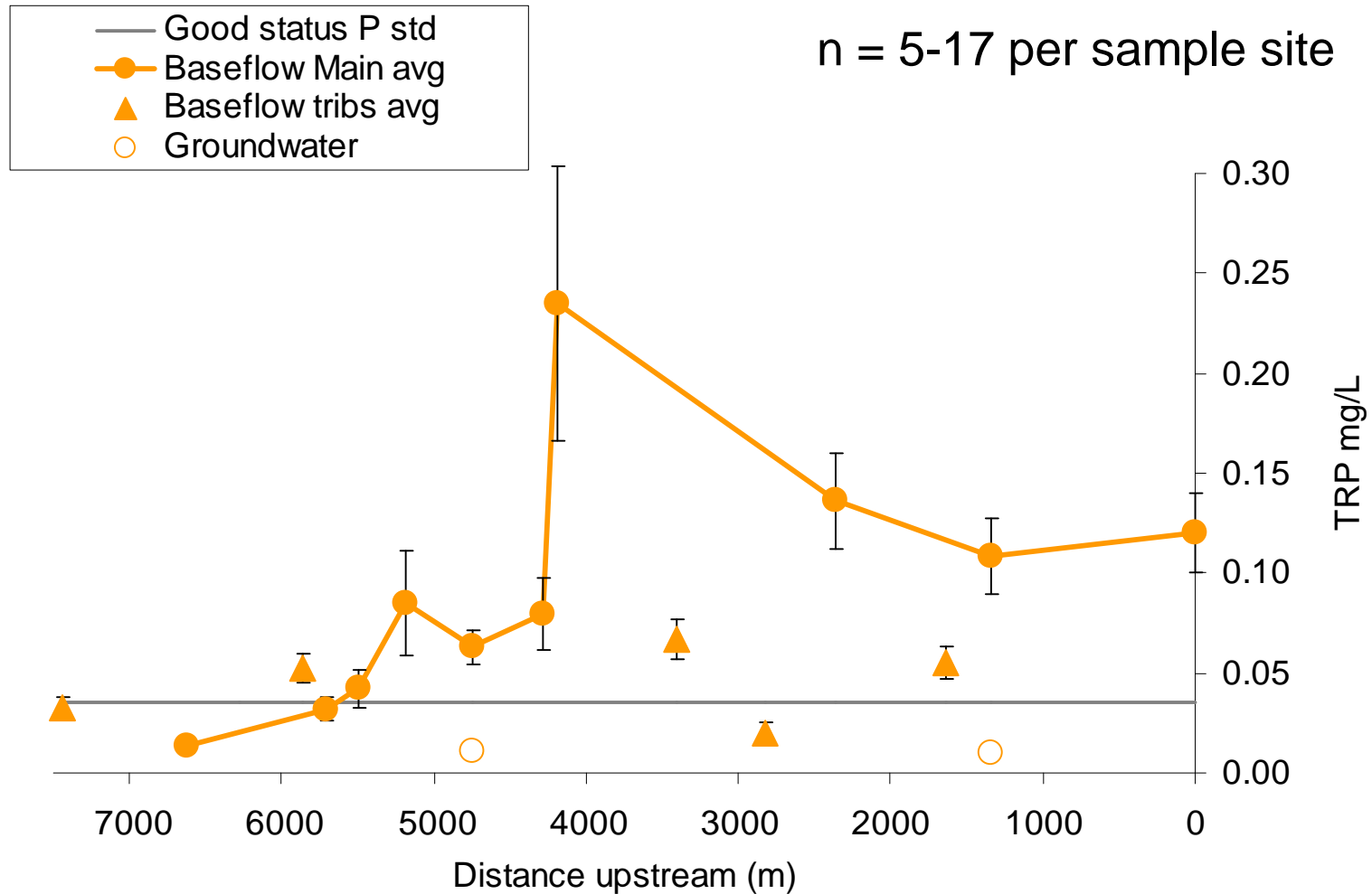
Groundwater monitoring

## 2.1 Source connectivity



Arable A - close stream and groundwater quality link  
Arable B - no stream and groundwater quality link

# Source connectivity – Arable B baseflow



# Conclusions - Efficacy of measures

Same measures – different catchment responses

Moderate-poorly drained Arable B showed:

- lack of hydrological buffering of nutrient pressures during summer
- exacerbation of nutrient pressures during storms

Lotic ecology poor-good despite Arable A TRP standard met

Lotic ecology better following (winter) period of higher nutrient load rate

Pathways analysis helps identify which and when sources are most connected to stream response

# Future challenges

Further (targeted and long term) research into

- seasonal lag effects of storm (diffuse) loads on the range of receiving water body types and
- historical near/in-stream (point) sources on summer concentrations and ecological response

Thank you

[www.teagasc.ie/agcatchments](http://www.teagasc.ie/agcatchments)



Catchment farmers N = 301

Colleagues N = 24

Funder (DAFM) N = 1

Catchment Science 2011 participants N = c. 200