



**For how long can soil
successfully remove P from
wastewater?**

***Assessment of a 150 year
old land treatment system in
the UK***

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13th IWA
Specialized Conference on
Small Water and Wastewater
Systems

5th IWA
Specialized Conference on
Resources-Oriented Sanitation

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Land Treatment Systems- Grass plots

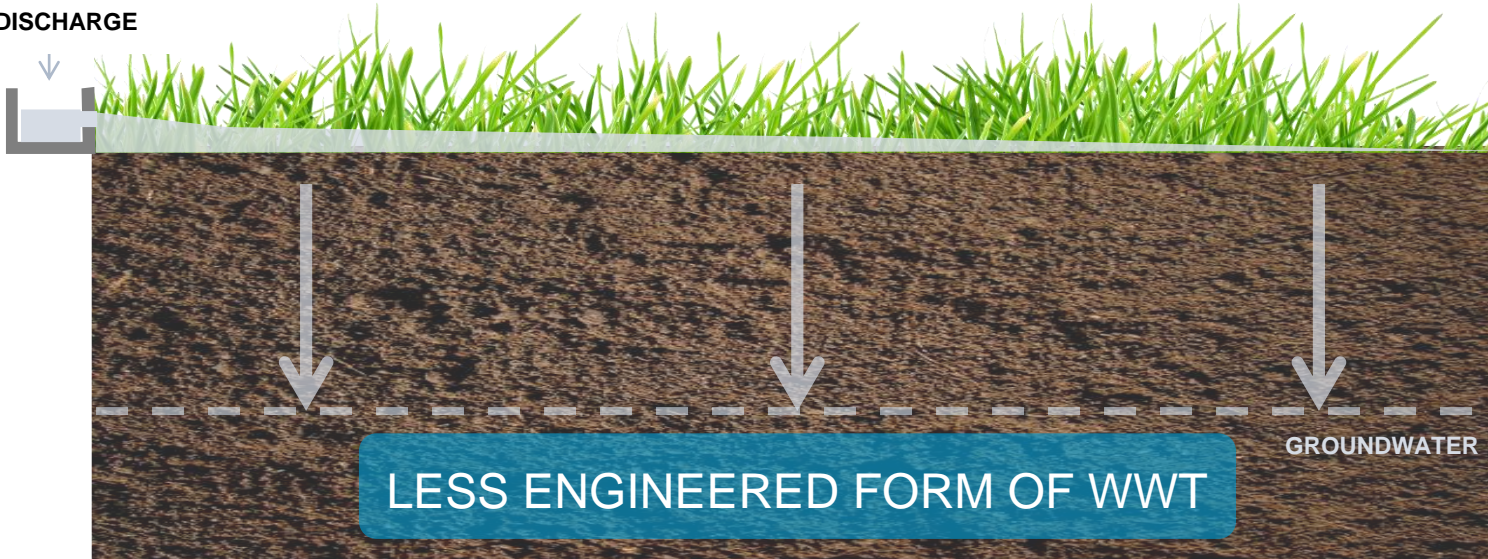
Ancient civilizations
(irrigation and sanitation)

19th century UK
(public health, cholera)

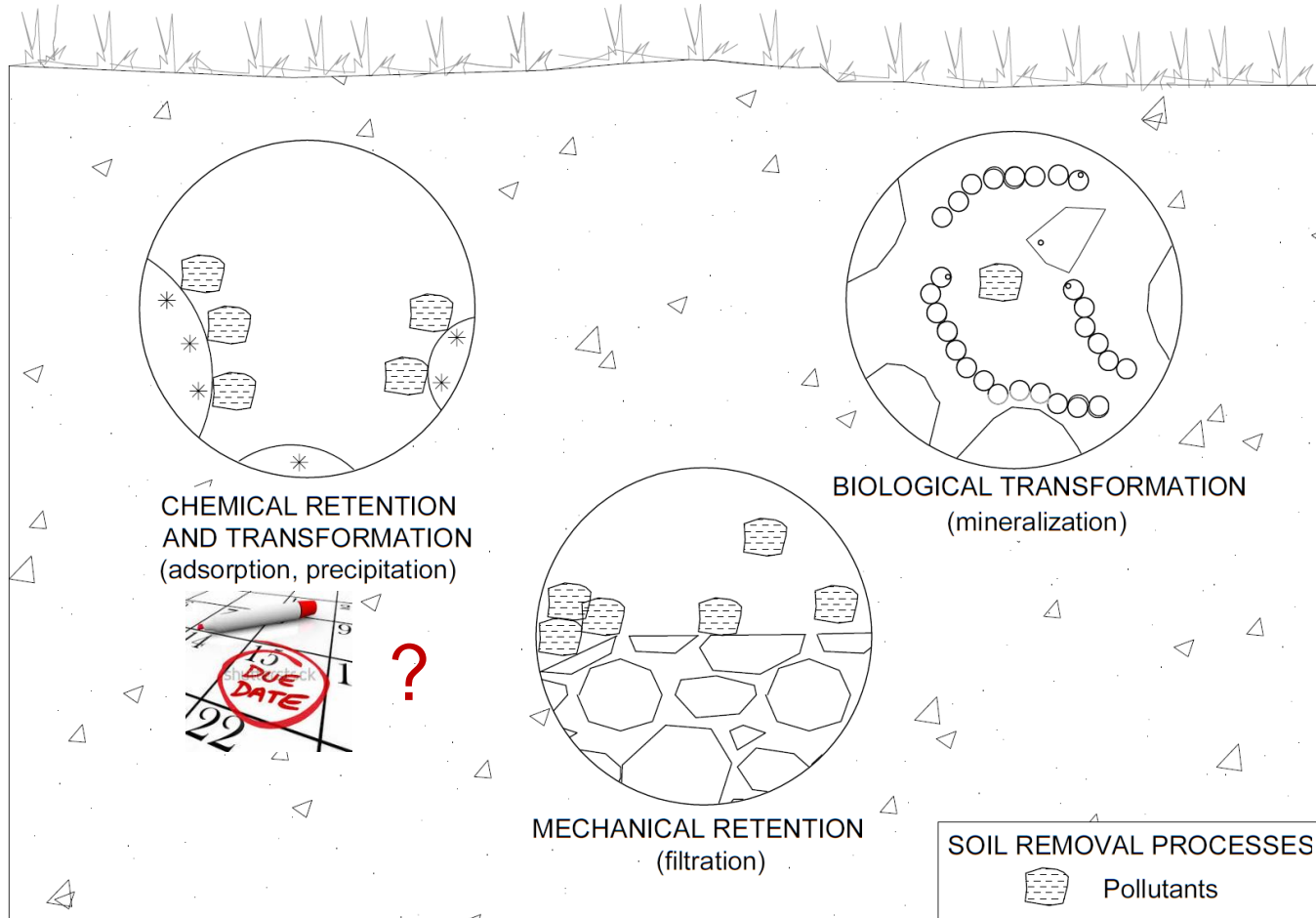
1920-1970 UK
(20:30 BOD:SS)

1973 UK
(inherited Water Act 20 LTS in UK)

WASTEWATER
DISCHARGE



Soil phosphorus removal processes





Knowle Wastewater Treatment Plant- case study

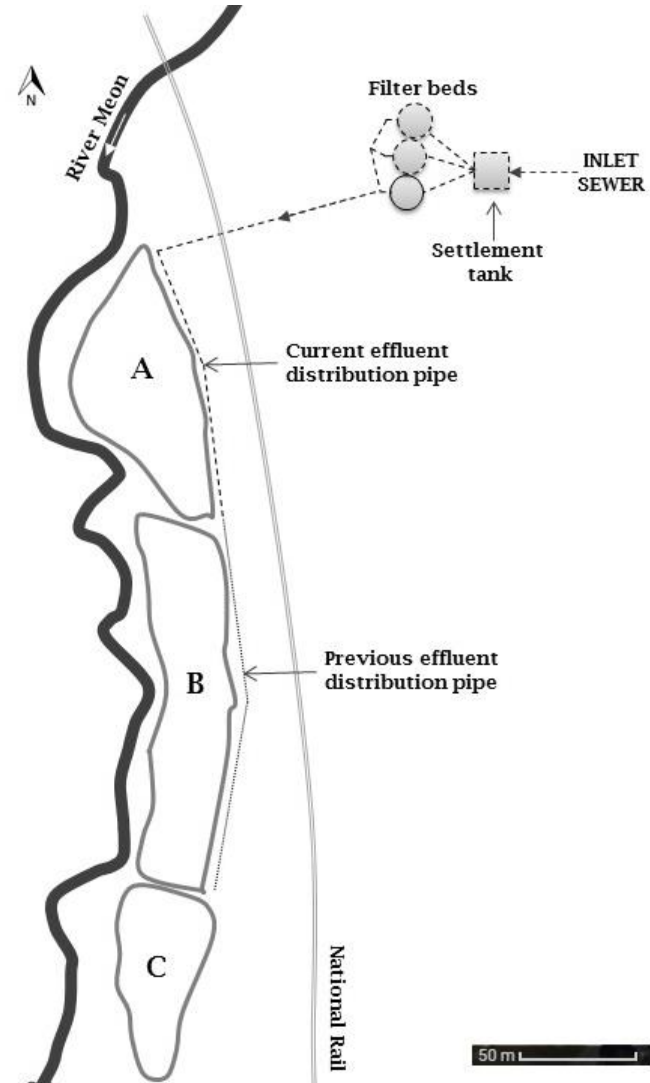


>150 years

Knowle WWTW (Hampshire, UK)



A 150 years' experience of a land infiltration system in UK



SAMPLING



Q WW discharged and phosphorus inputs 1854-2014

WWT

- Average water consumption in UK over the period
- Population data from admissions register of the hospital 1885-2000
- Redeveloped residential area population

Phosphorus

- TP load of 0.75 kg/capita/year from STW (White and Hammond, 2009)
- Faeces and urine contribution to phosphorus content in domestic wastewater of **1.4 g/capita/day until 1950** (Gilmour et al., 2008).
- 1950-2014 period, the quantified contribution of laundry machines and dishwashers of **0.66 g/capita/day** (Gilmour et al., 2008).
- 25% of P removal in the settling and at the trickling filters (Albion Water)



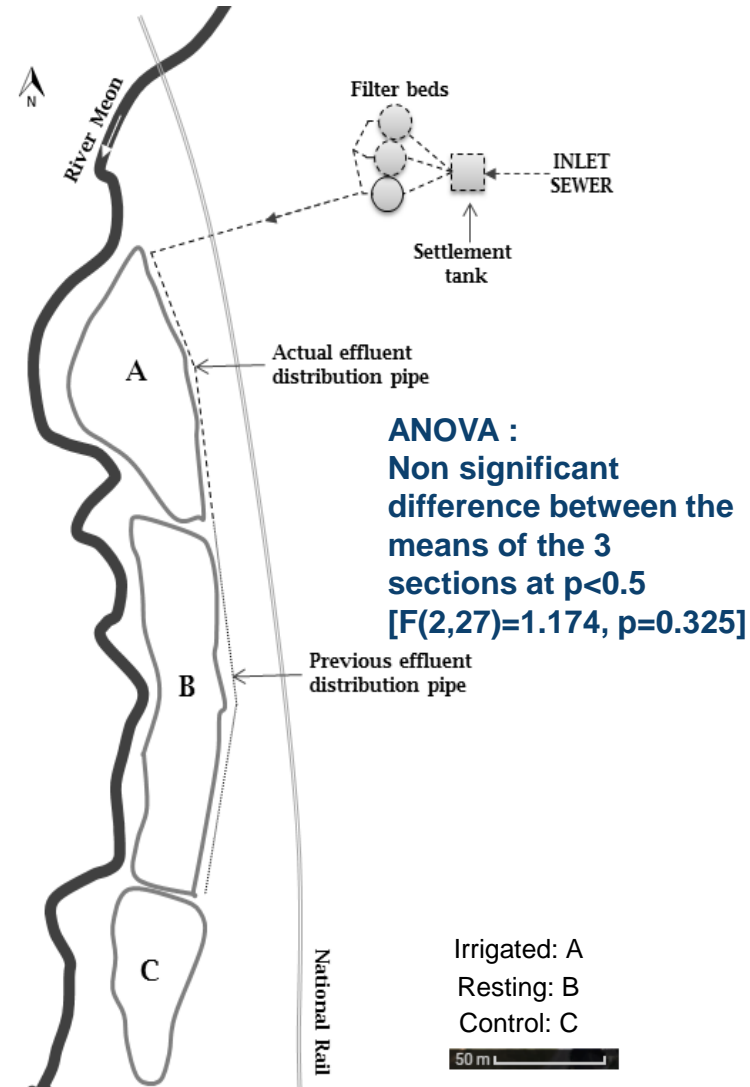
A 150 years' experience of a land infiltration system in UK

INPUTS

Sections	A	B	C
Surface (m ²)	6700	10700	2000
P added (kg) 1854-1990	107351		-
P added (kg) 1990-2014	92	-	-

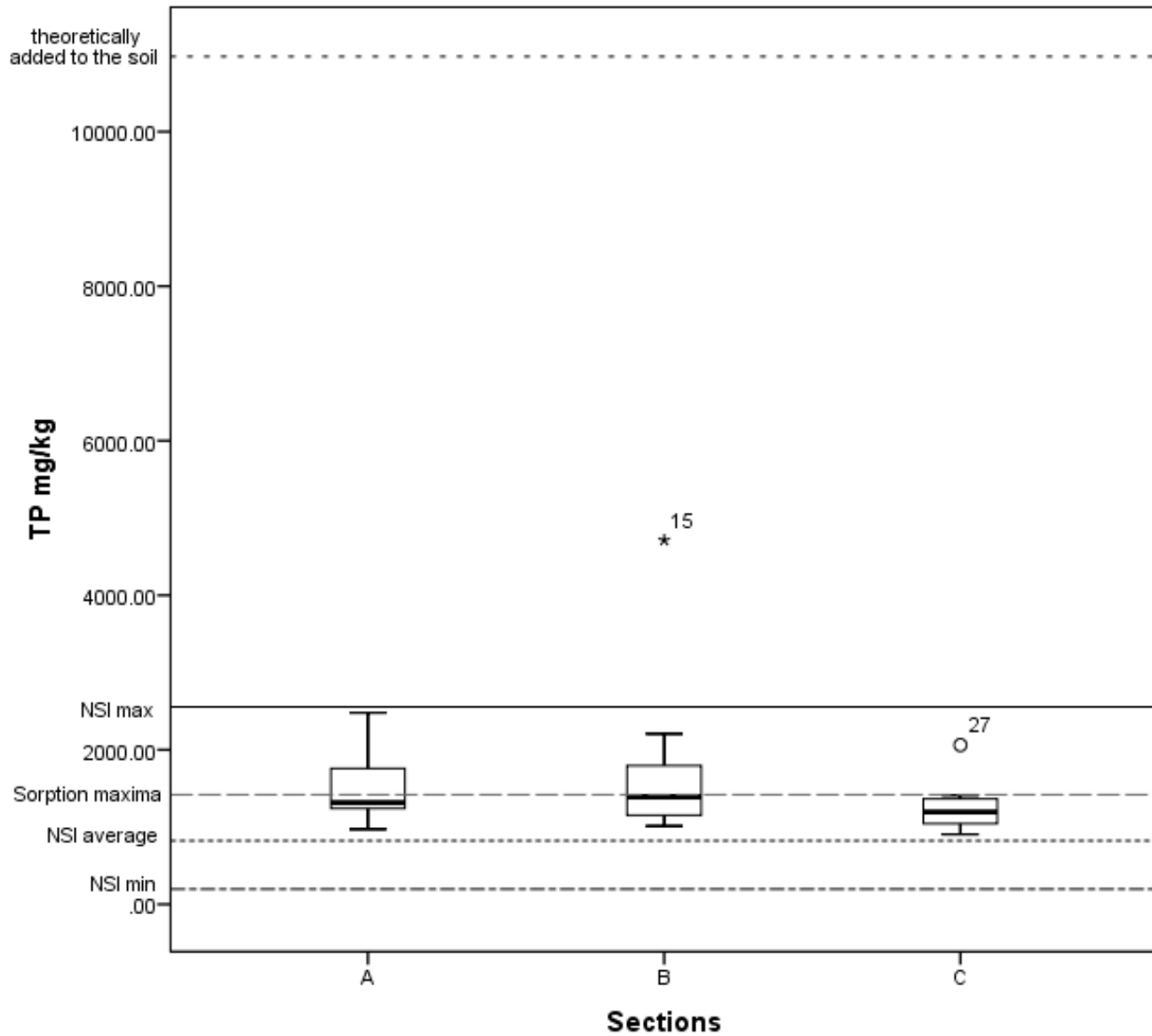
SOIL CHARACTERIZATION

Sections	A	B	C
TP average 0.40 m layer (mg P/kg)	1516	1749	1253
P storage 0.40 m layer (kg)	71.5	131.7	17.64
pH	7.2	6.4	7.7
Phosphorus sorption maxima reference sample (mg P/kg)	1440		





TP distribution in the sections





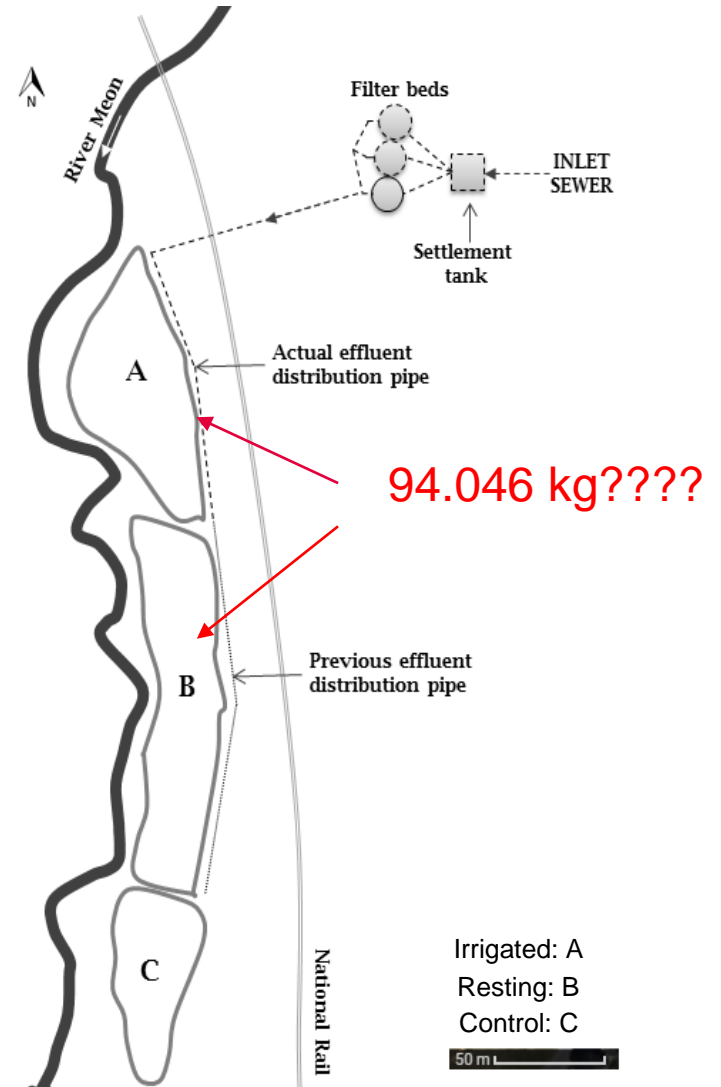
A 100 years' experience of a land infiltration system in UK

INPUTS

Sections	A	B	C
Surface (m ²)	6700	10700	2000
P added (kg) 1854-1990	107351	-	-
P added (kg) 1990-2014	92	-	-

SOIL CHARACTERIZATION

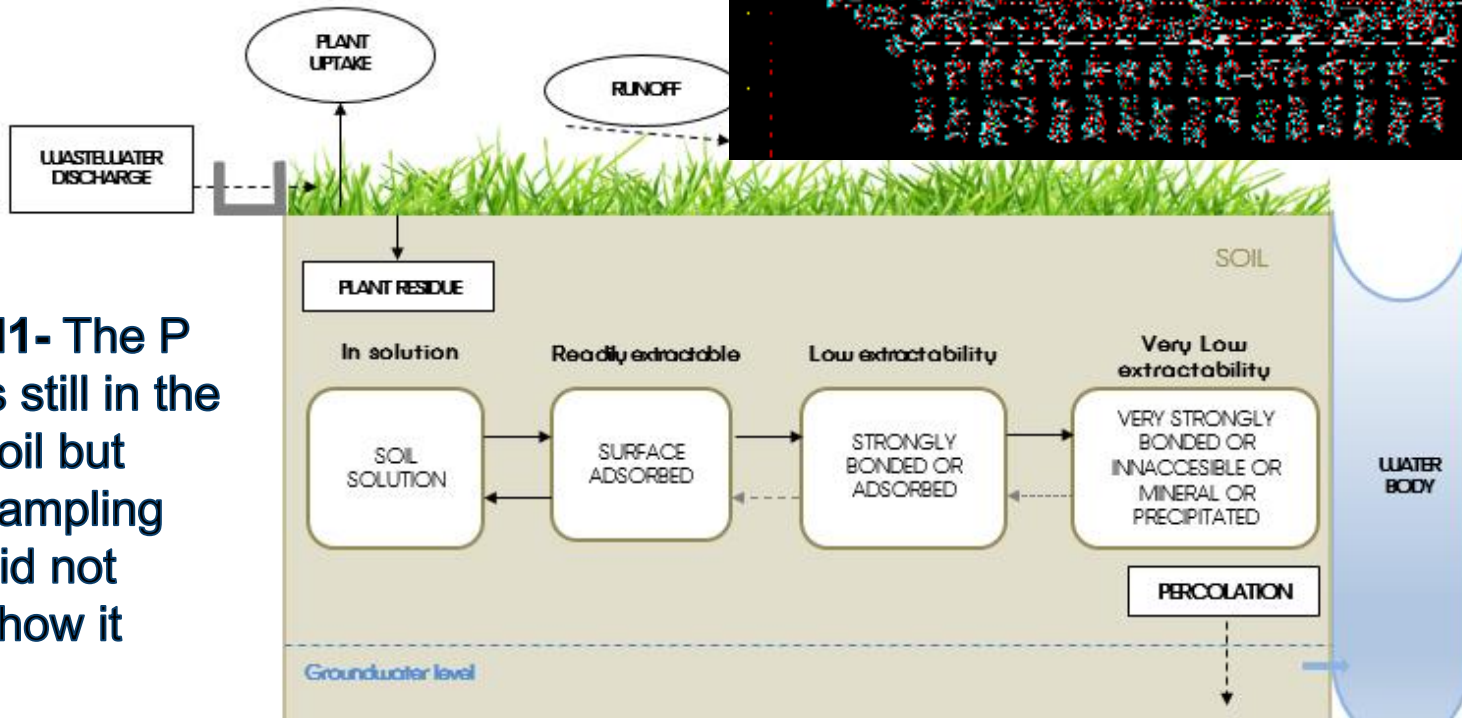
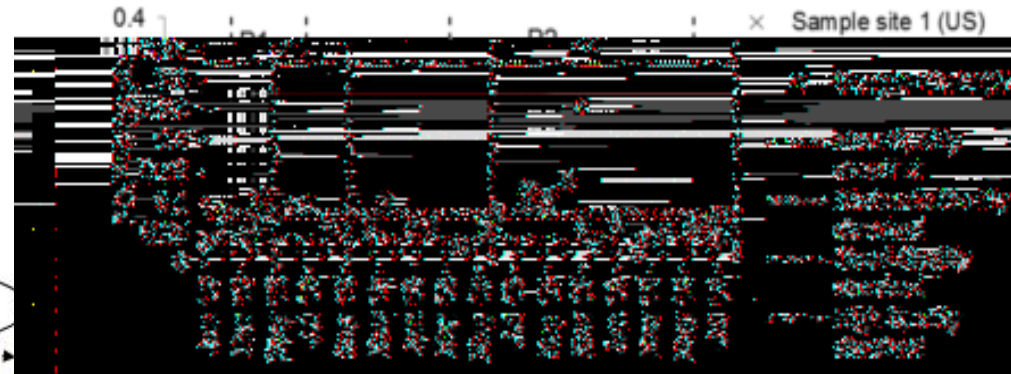
Sections	A	B	C
TP average 0.40 m layer (mg P/kg)	1516	1749	1253
P storage 0.40 m layer (kg)	4712	8683	1162
pH	7.2	6.4	7.7
Phosphorus sorption maxima reference sample (mg P/kg)		1440	
			9





A 100 years' experience of a land infiltration system in UK

River quality



H1- The P is still in the soil but sampling did not show it

H2- Percolated and transferred to the water bodies



CONCLUSIONS AND FURTHER WORK

- Finite removal capacity in soil infiltration systems is a major concern
- Lifetime estimations is an important management and decision tool for on-site wastewater treatments
- Max sorption capacity might be underestimated under traditionally batch test for long-term predictions
- Further efforts should be done to combine empirical data with modeling tools to forecast longevity of LTS