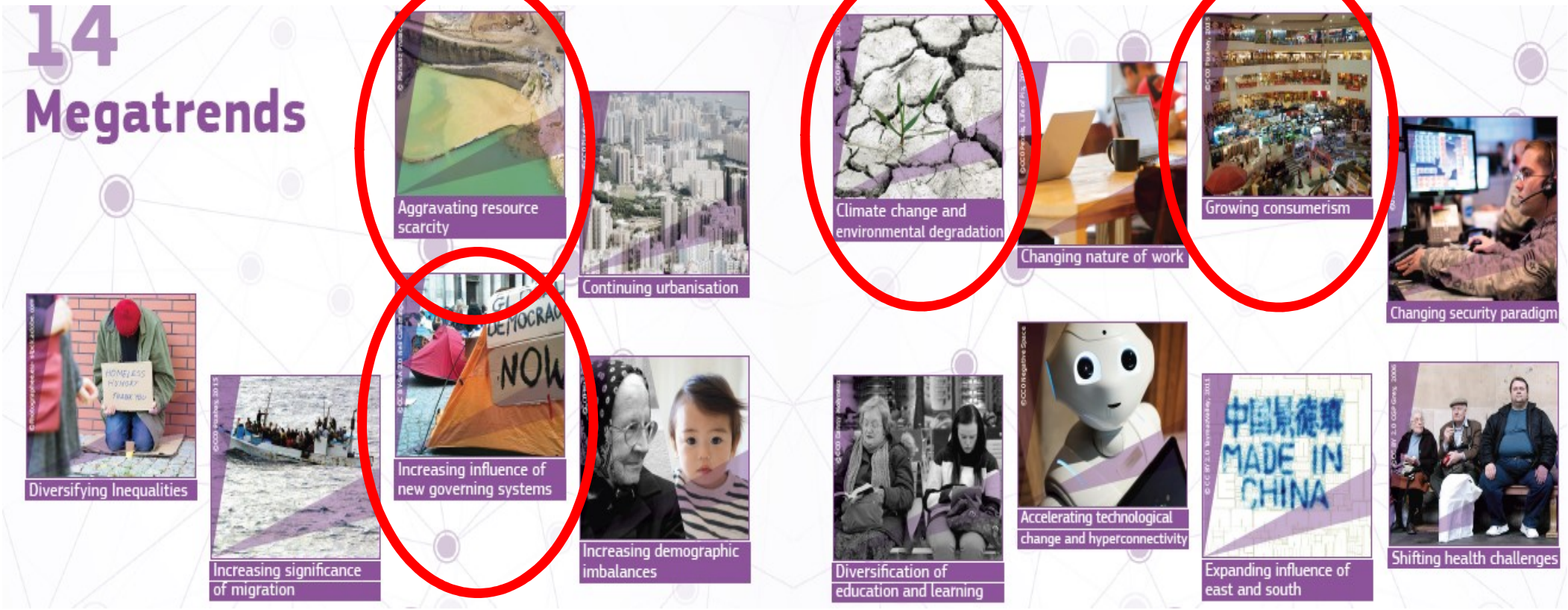
Nature Based Wastewater Treatment

Challenges and Opportunities

EU Megatrends- What's Driving Change



Megatrends- Aligning of Opportunities and Challenges

- Distributed Assets- Local Solutions
  - *Assets closer to demand*
  - *Local Resources to feed Local Demand*
  - *Commercial, legal, regulatory ,policy, planning, technical and risk constraints.*

- Multi Use Infrastructure
  - *Linear adoption model no longer appropriate*
  - *Integrated delivery of Infrastructure*
  - *Challenge of multi agency integration*

- Closed systems moving towards resource efficiency and zero waste
  - *Managing leakage of resource to waste stream*
  - *Recognising natural systems incredibly efficient.*
  - *Use of wastes as feedstock in integrated manner*
  - *Closed systems that could be carbon neutral.*

What are the Local Drivers

Decline in water quality as a driver

Pressure to increase quality of discharges, particularly from smaller WWTPS discharging into smaller and sensitive watercourses.

Increasing cost of conventional approaches

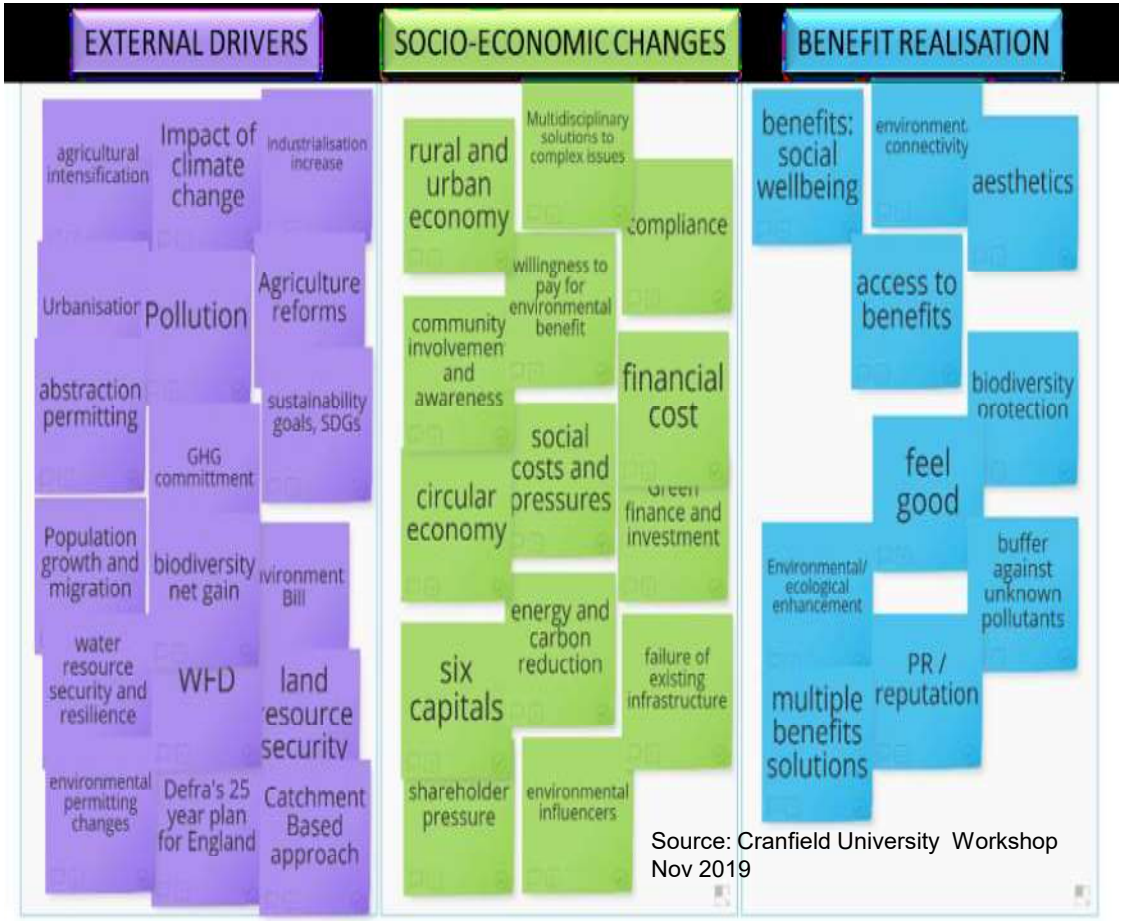
Disproportionate cost impact of increasing standards on plants discharging to smaller watercourses and need for resilient and robust solutions.

Public Sentiment

Alignment with public and institutional momentum towards, green solutions- 6 Capitals, EU Green Deal, Sustainability agenda..

Maturity as an enabler

Critical mass of NBS plants, evolved design approaches, operations experience and research capacity and activity internationally..



Source: Cranfield University Workshop Nov 2019

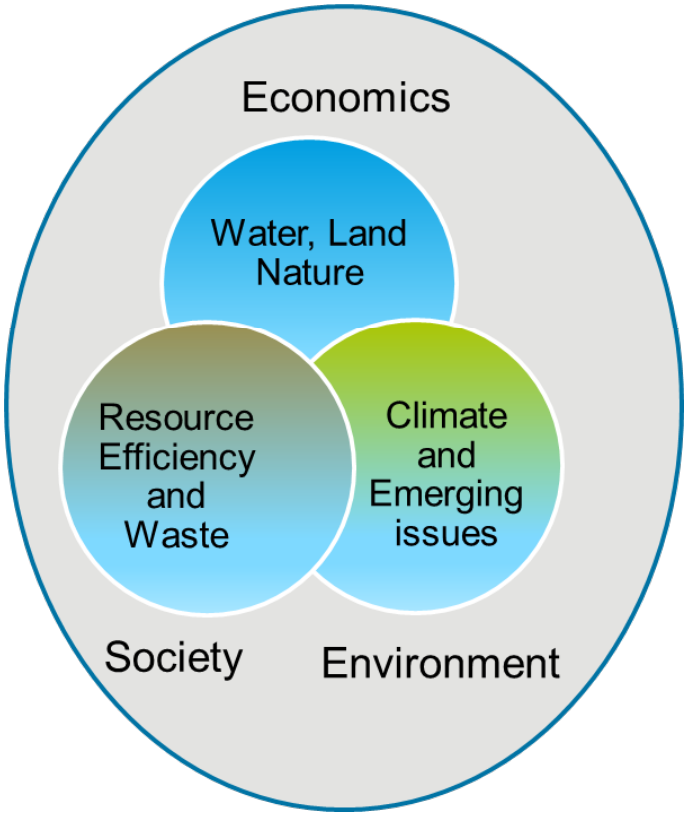
www.cranfield.ac.uk/nbs

What we might address to enable Nature Based Solutions

Living solutions inspired by, continuously supported by and using Nature designed to address various societal challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits(EU)

- *Understanding they are different, treatment levels vary in response to seasons, climate etc. but so too does receptor capacity. Regulation based on grey infrastructure focused on end of pipe constrains NBS*
- *Desirable outcomes- co-ordinating policy and legislation and tools to enable better holistic outcomes aligning with Green Agenda.*
- *Precautionary Principle - getting risk /gain balance right in accelerating delivery if it makes sense.*
- *Inertia- Learning, adaptability, co-operation and collaboration*
- *Valuing and benefits framework to account for all sectoral benefits and cross-sectoral funding mechanism to reflect this.*

- *Acknowledge that are making progress*
- *NBS is not a panacea, suitable in some locations , how do we determine where*
- *Knowledge base deficit, developing understanding across sectors, societal awareness, capacity to design and deliver.*
- *They are dynamic and roles and impacts change over time.*

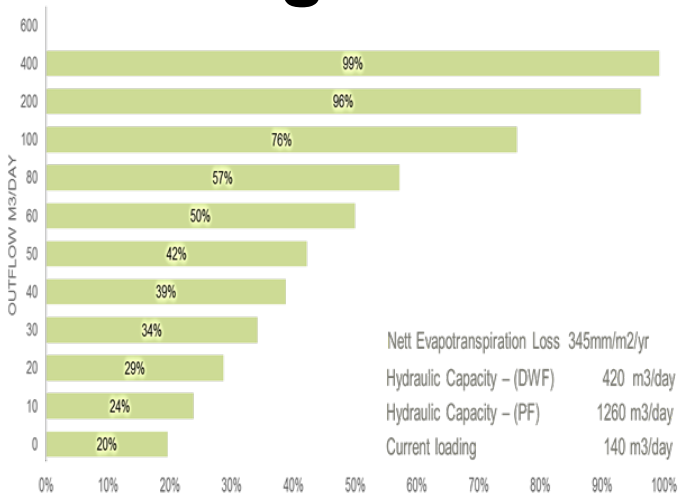


Moving from pollution prevention to opportunity perspective

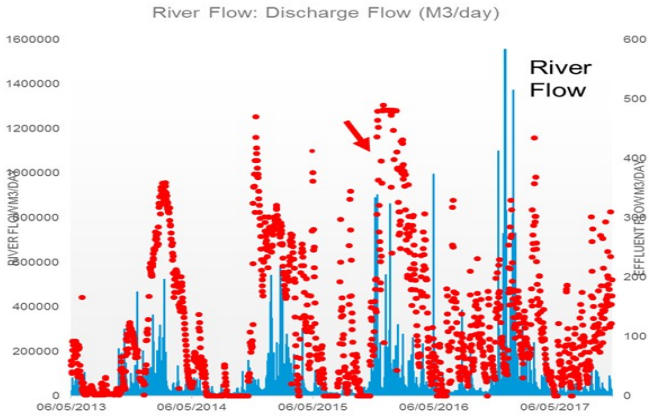
"Complex water issues are intertwined and cannot sustainably be solved by the traditional siloed water management approaches" (Ma et Al. 2015)

	Traditional	Possible
Focus	Treatment	Holistic Outcome
System Boundary	End of Pipe	Catchment/Other
Standards	Prescribed & Static	System capacity reflective - Dynamic
Regulation	Compliance	????????

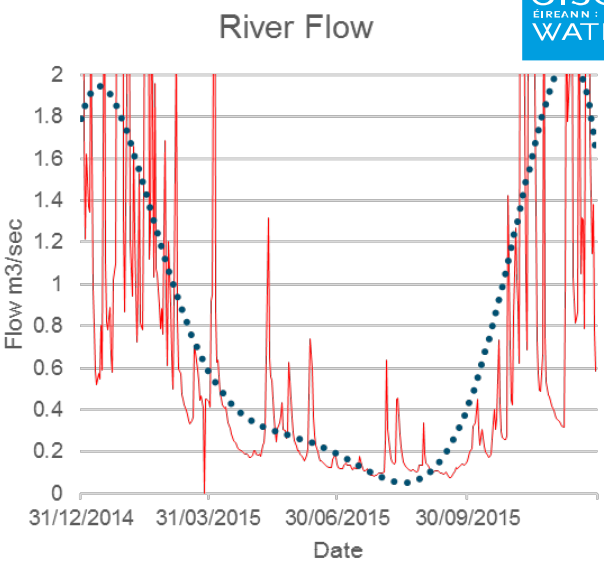
Thinking around the data



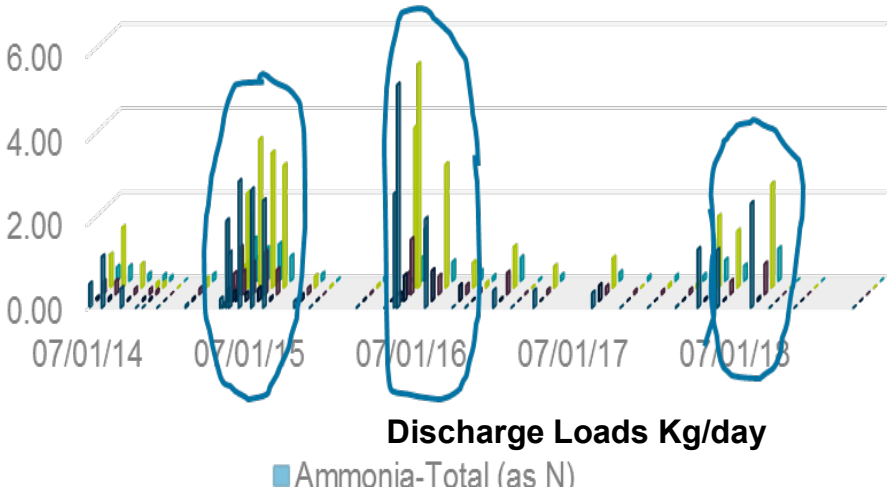
Discharge frequency analysis



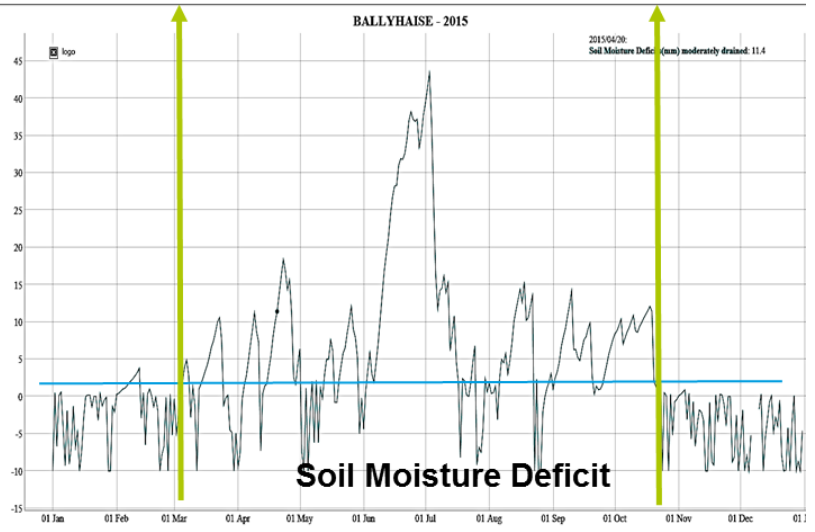
Discharge /River Flow mapping



Annual River Flow Profile

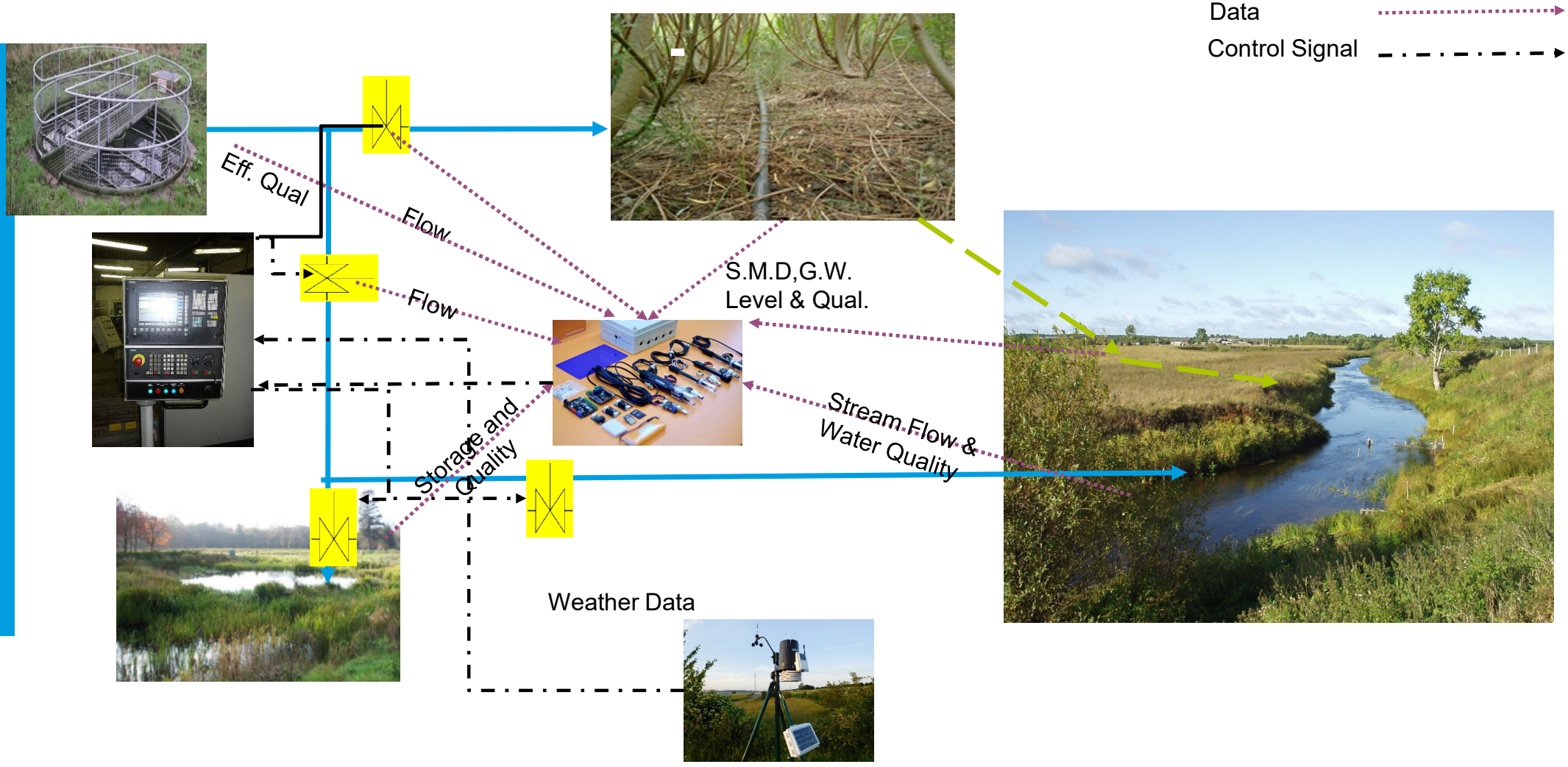


Discharge Loads Kg/day



Soil Moisture Deficit

Conceptual Hybrid NBS Model



Local Circular Model

Wetland as an amenity
Habitat, carbon sink

Algae as a bio economy feedstock

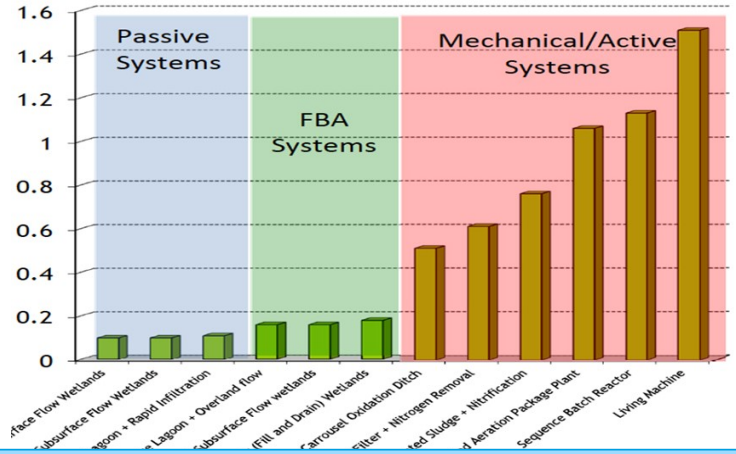
Nutrient substitution

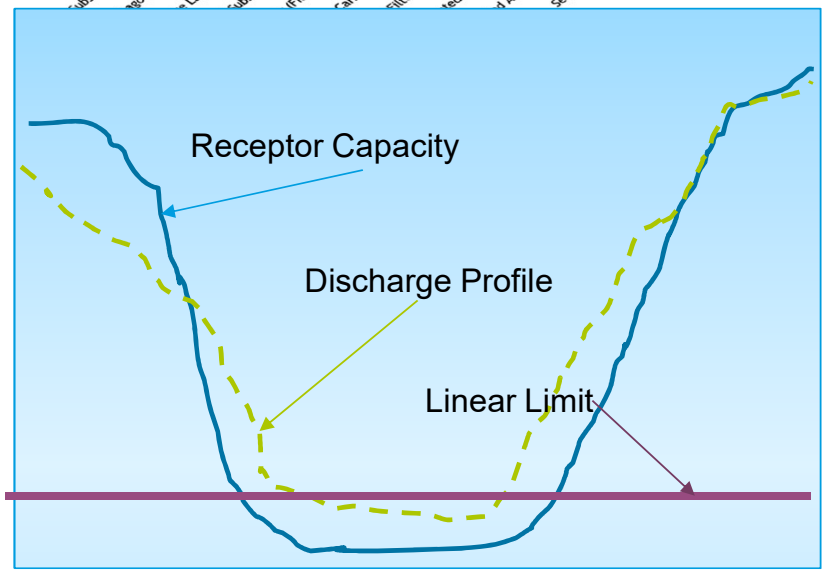
Effluent as an input -35% increase in crop output

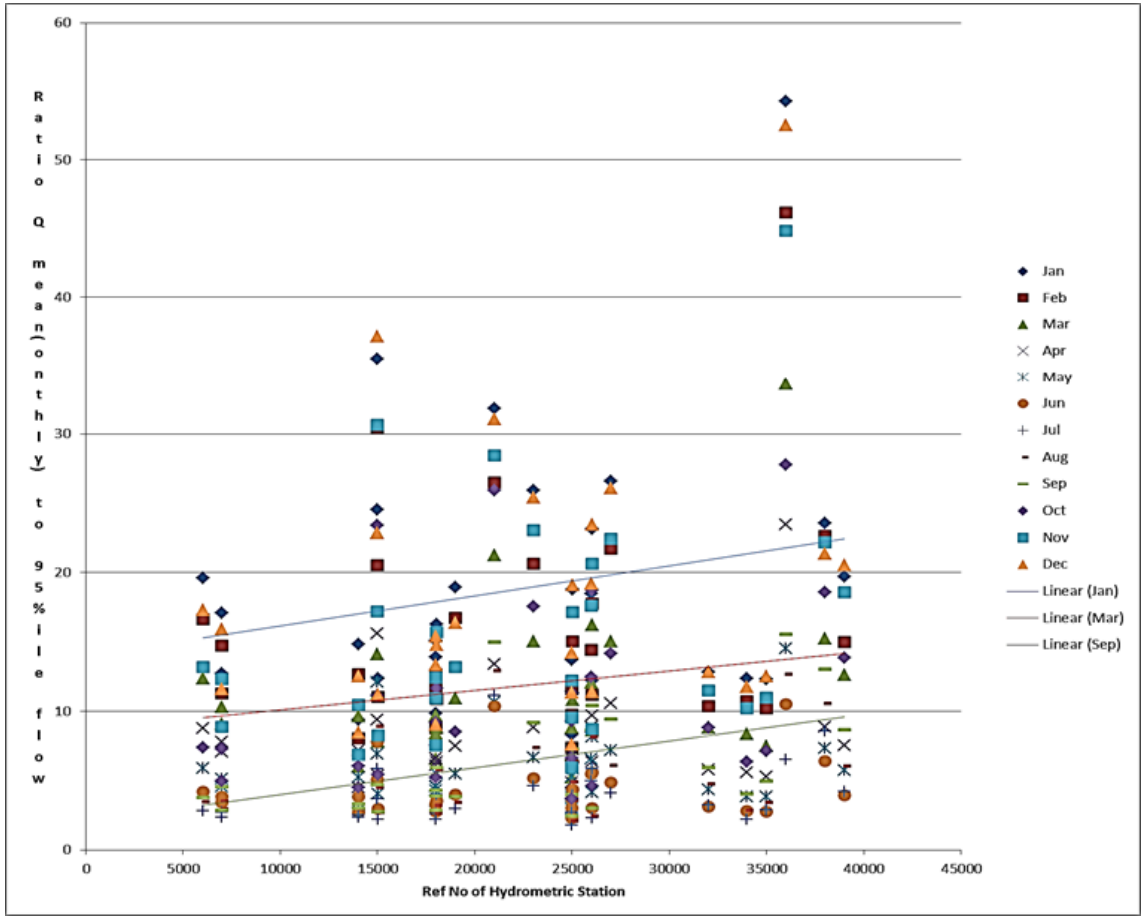
Biodiversity/ Alternative Crop/Income

Heating/School/Community

First Step - Seasonal Discharge Consents

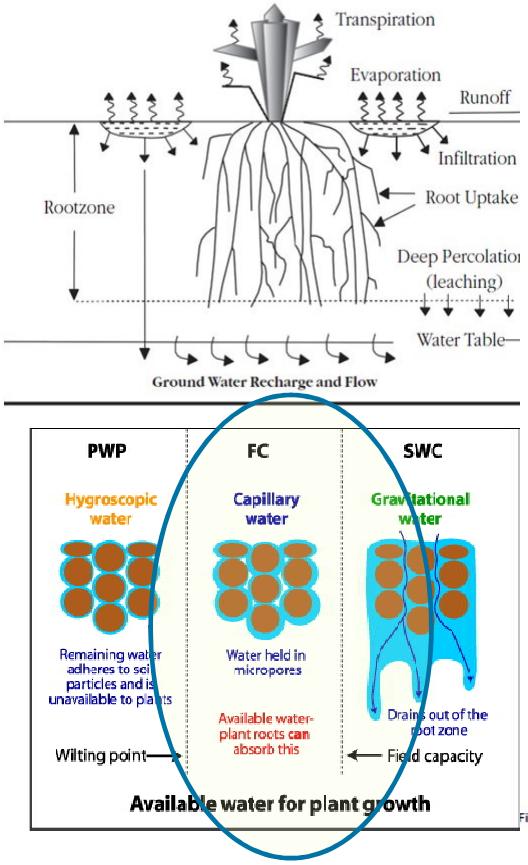






Ratio Mean to Q95 on selection of rivers over 25 years- monthly

Soil Moisture, Monitoring and Management



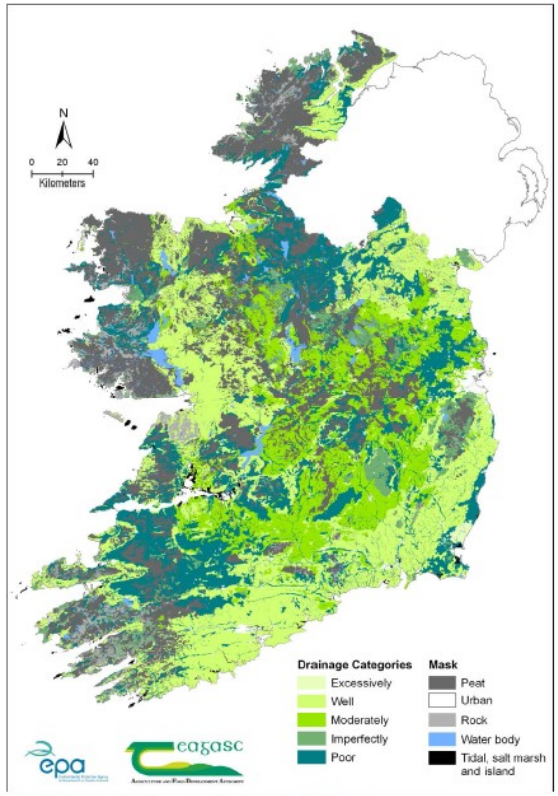


Figure 2.1. Indicative soil drainage map of agricultural soils in Ireland.

Effective capacity for irrigation will depend on soil characteristics and SMD(Measured).

Evapotranspiration rates will relate to type vegetation cover daylight, wind and solar intensity. (Measureable).

Operating principle effectively managing the capillary water storage to maintain equilibrium between applied effluent, rainfall and evapotranspiration.

Discharge to groundwater where treated effluent migrates to surface water..

Water Table levels (hydraulic gradient), and groundwater quality will be directly monitored.