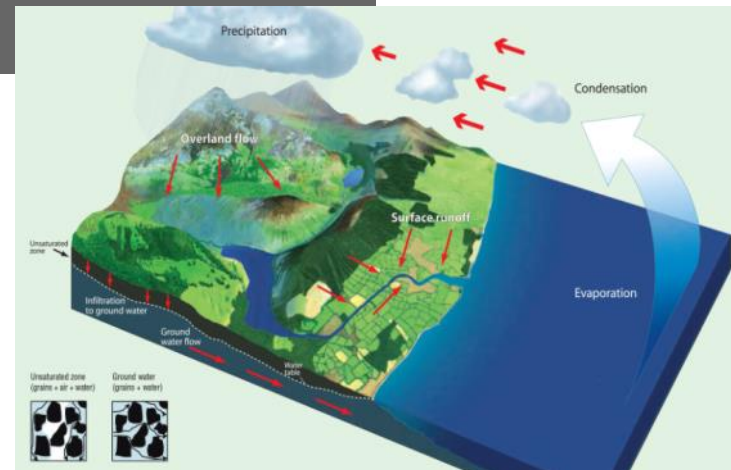
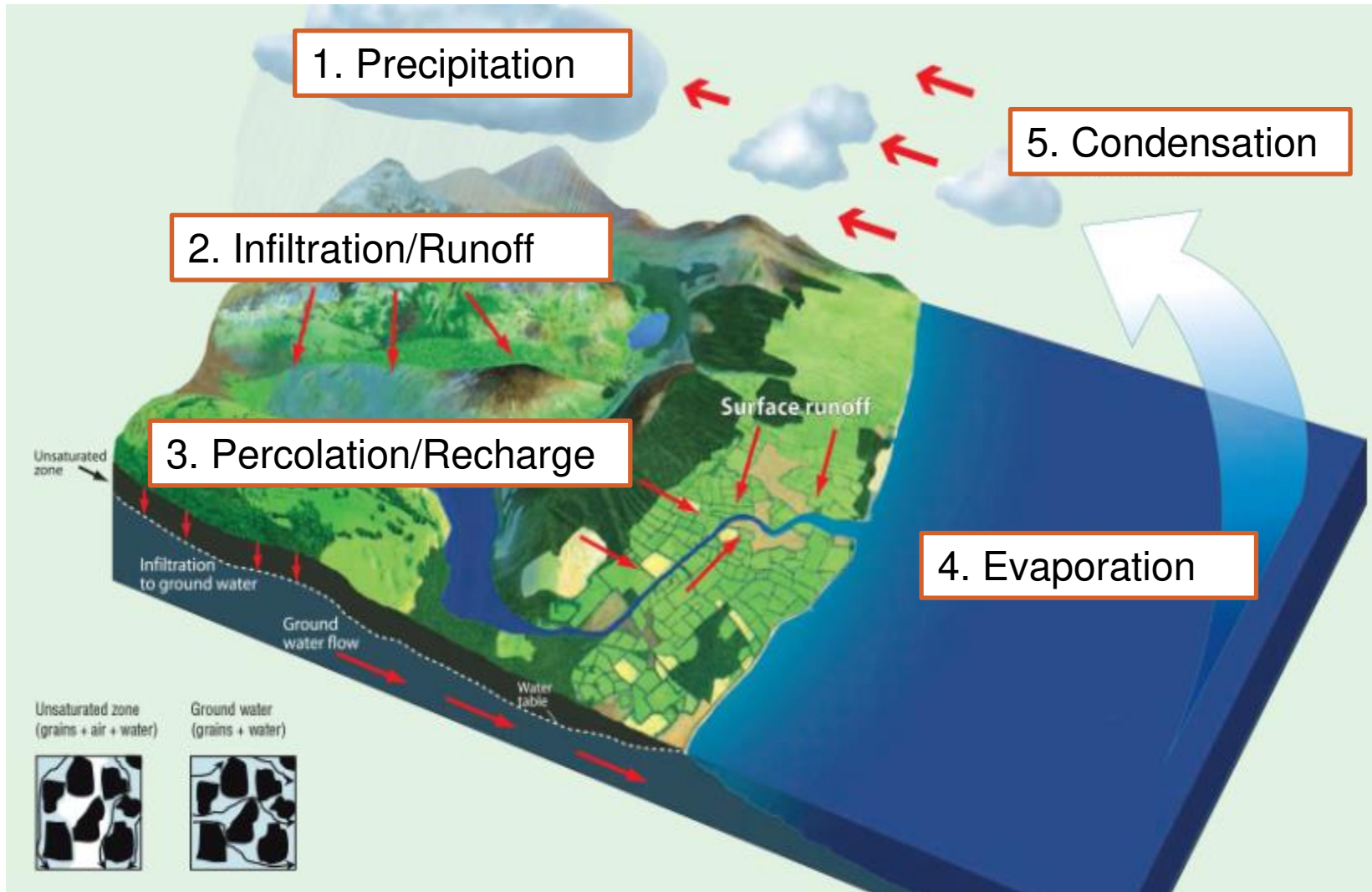


The Water Cycle: Where does all the water go?

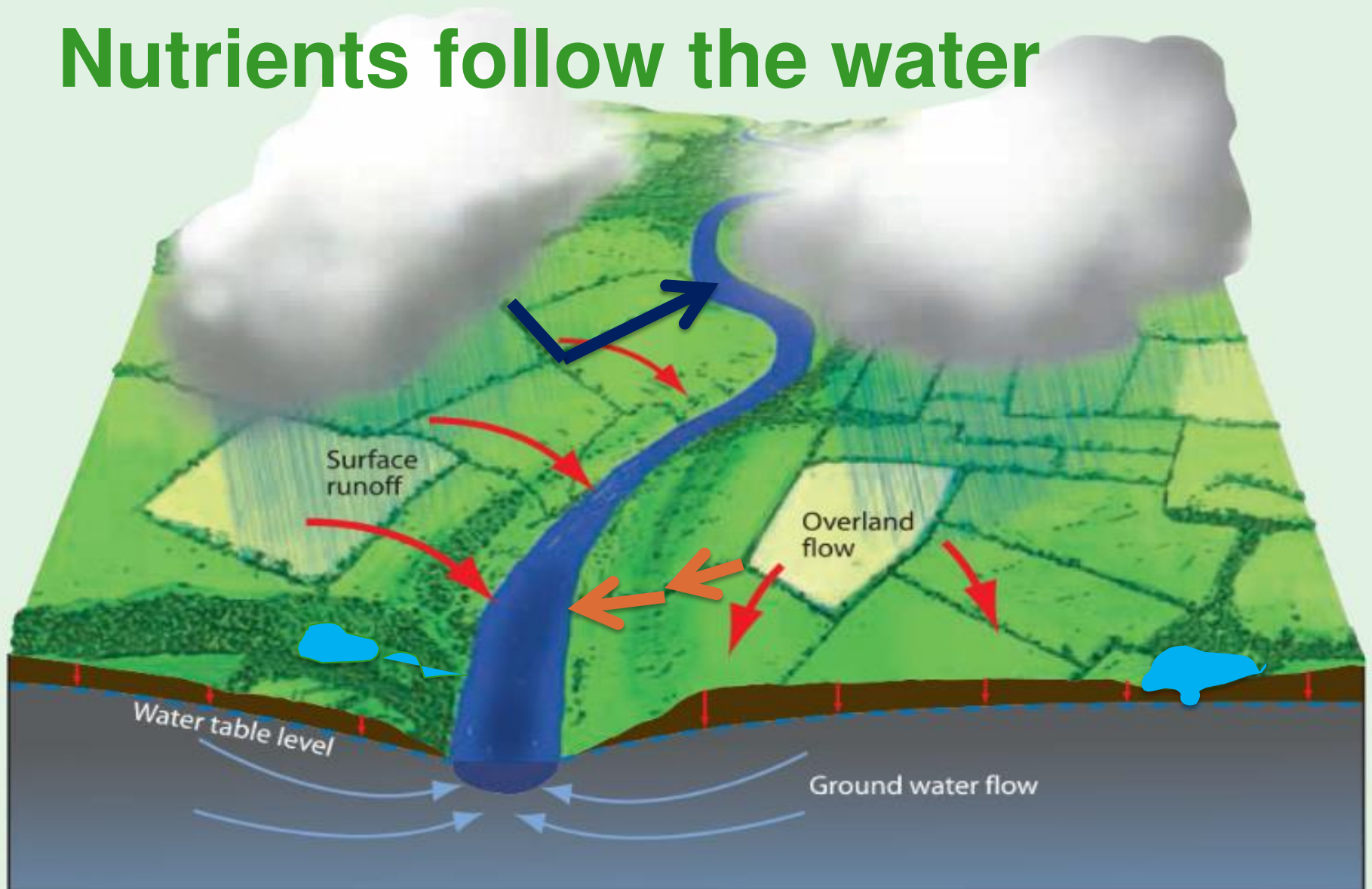
Owen Fenton
Johnstown Castle
owen.fenton@teagasc.ie
@ofenton



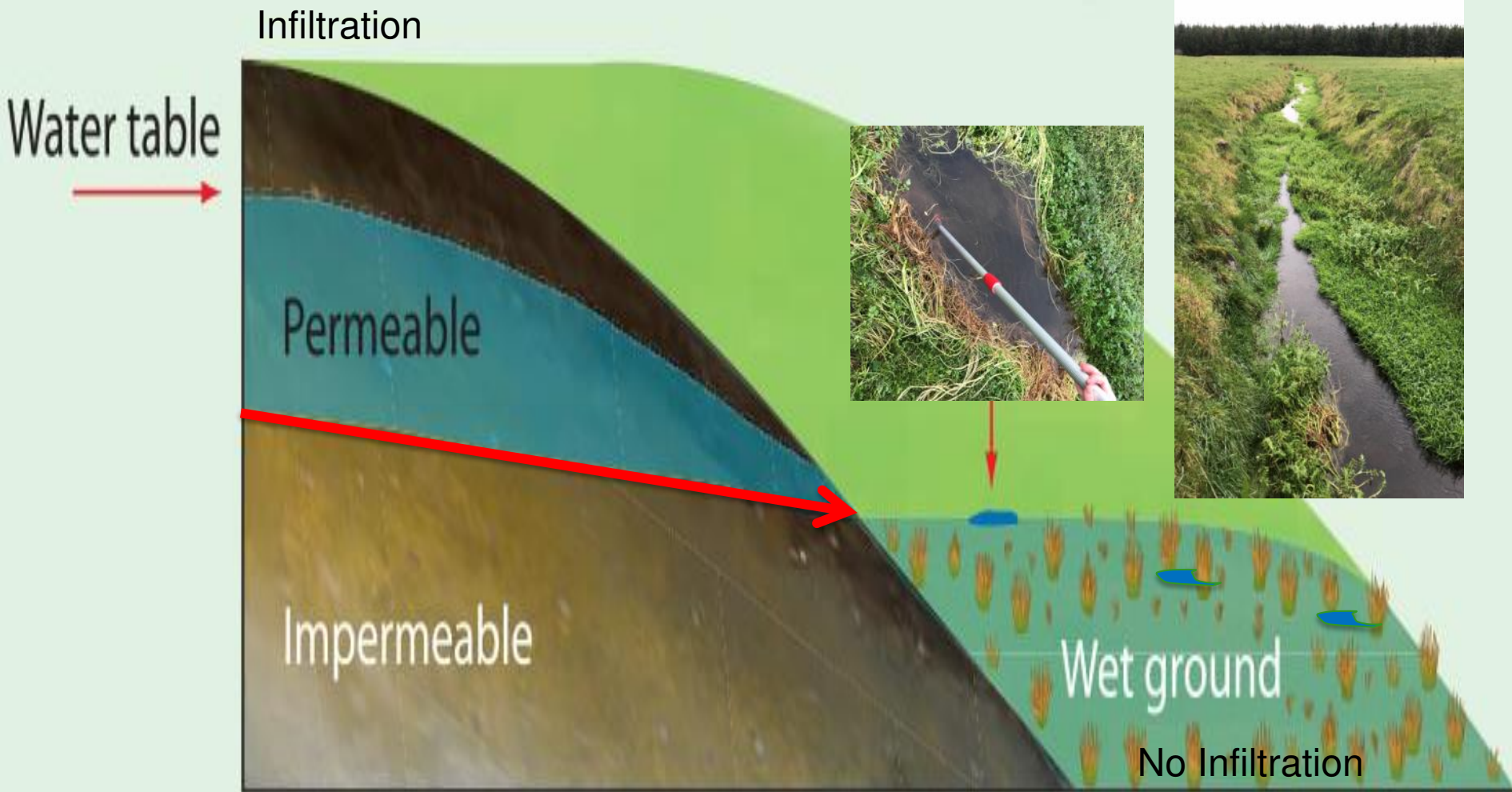
The Water Cycle – flows & temporary stores



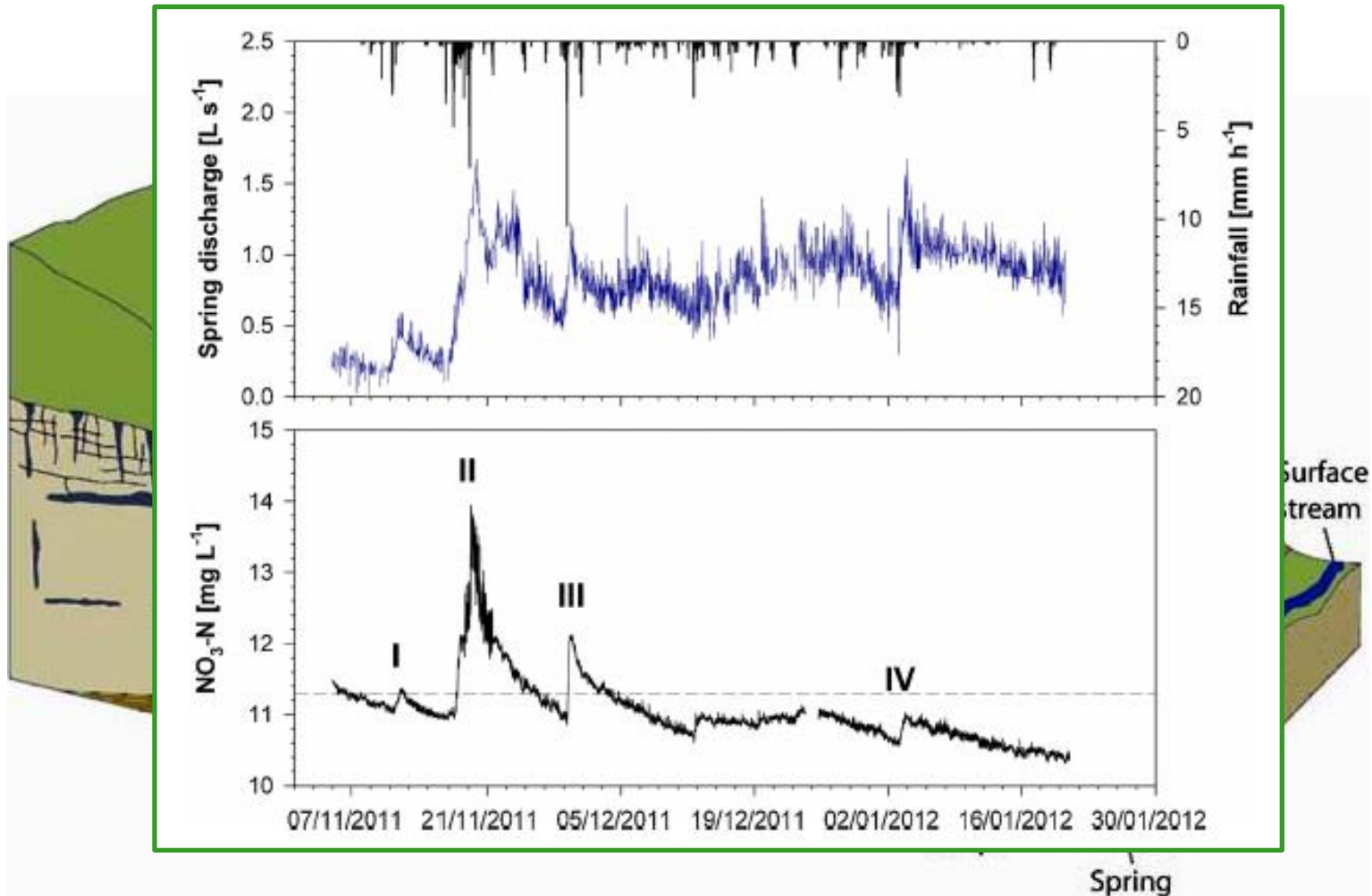
Nutrients follow the water



Springs:



Sink hole, sinking stream

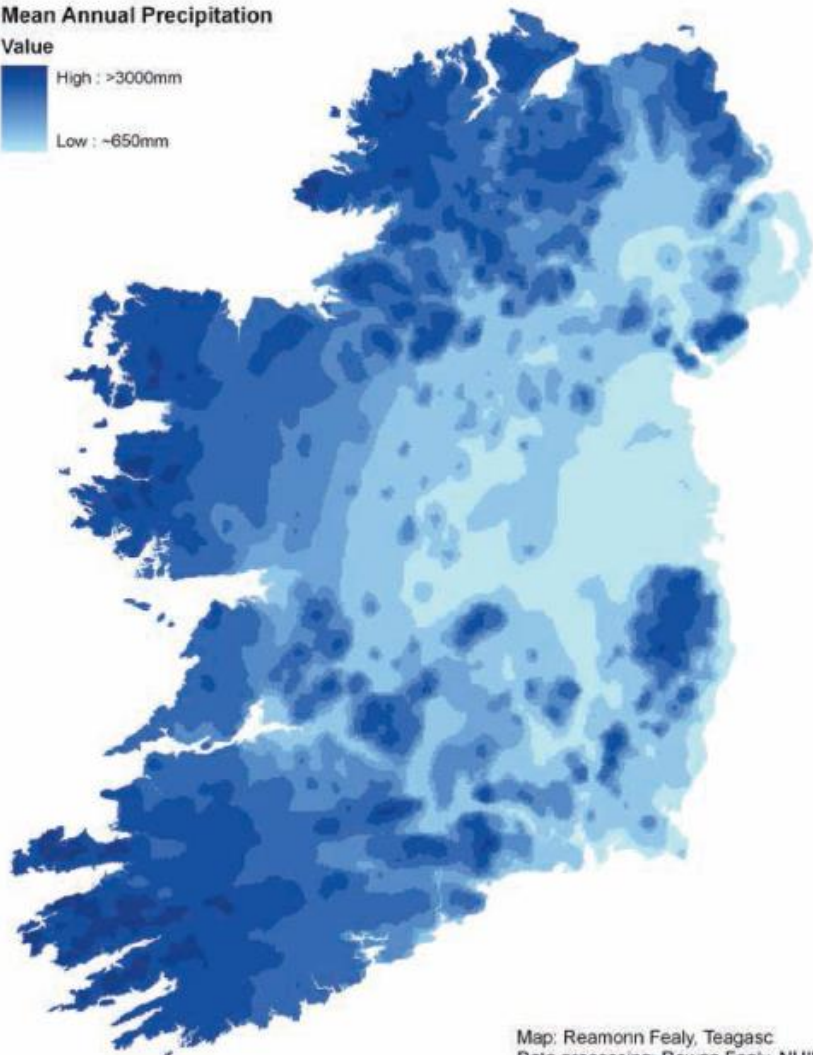


<https://www.pahasapagrotto.org/what-is-karst.html>

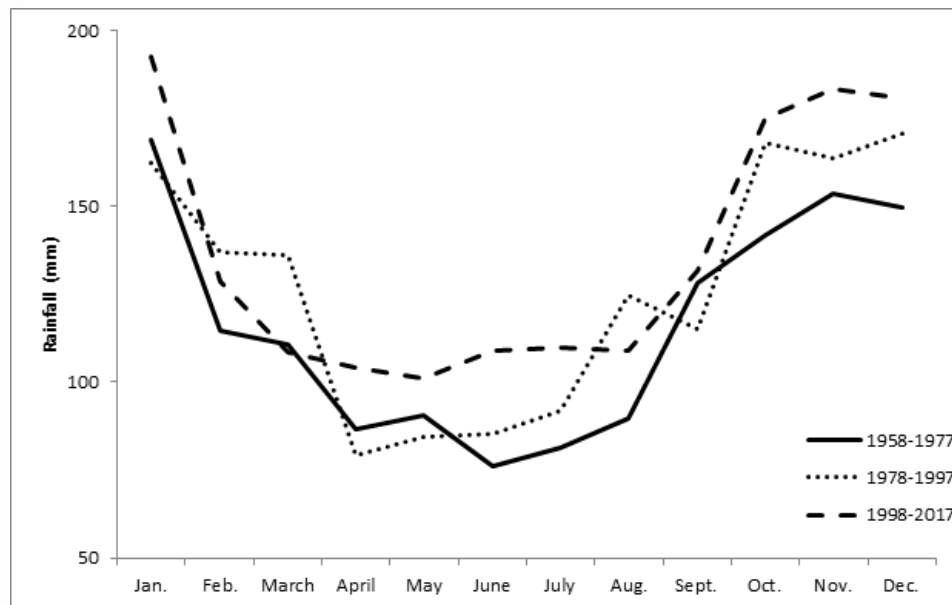
Mean Annual Precipitation (mm)

Mean Annual Precipitation

Value



Map: Reamonn Fealy, Teagasc
Data processing: Rowan Fealy, NUIM
Data: Met Eireann



**More rainfall over time
in summer months**

Infiltration into soil

Gravel

Sand

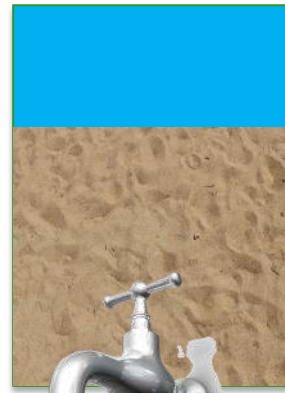
Silt

Clay

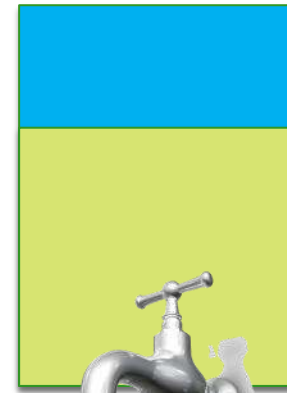
1 metre



2 minutes



2 hours



200 days

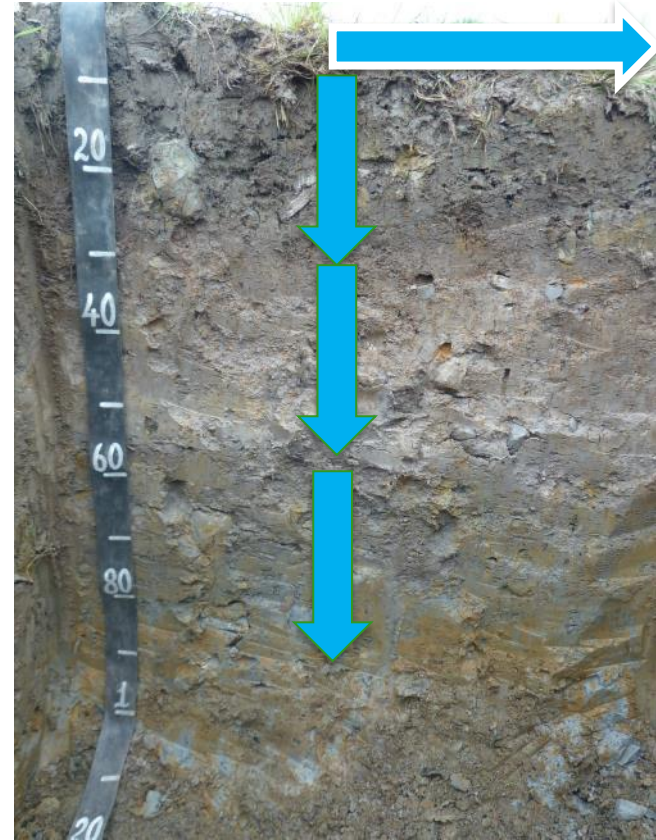


200 years

Infiltration vs. Runoff



Well drained



Poorly Drained

Fast Infiltration System?



Soil & Subsoil:
Well drained

Rock:
Karst Limestone or
productive bedrock

Runoff: Low, no in-field drains, no ditches

Dominant pathway: Groundwater

Roadway Network Density: Low

Nutrients Lost: Nitrate, Phosphorus

Mitigation:
Source and mobilisation control important

Slow Infiltration System?



Soil & Subsoil:

Poorly drained mineral or peaty soils

Rock:

Underlain by a poorly productive bedrock

Runoff: High, in-field drains, ditches

Dominant pathway: surface

Roadway Network Density: High

Surface Nutrient: Phosphorus
(particulate and dissolved)

Subsurface nutrient: Ammonium

Mitigation:

Need to break the pathway

Practice change and water quality response

How long does it take for the mitigation measures to have an effect on water quality?

At meso-catchment scale (up to 100 km²) – 25 studies found worldwide

- Positive effects were found in 17 of the 25 studies
- It took 1-10 years for positive response to show up in monitoring
- Longer times were connected with scale
- Response time increased as the transport pathway increased

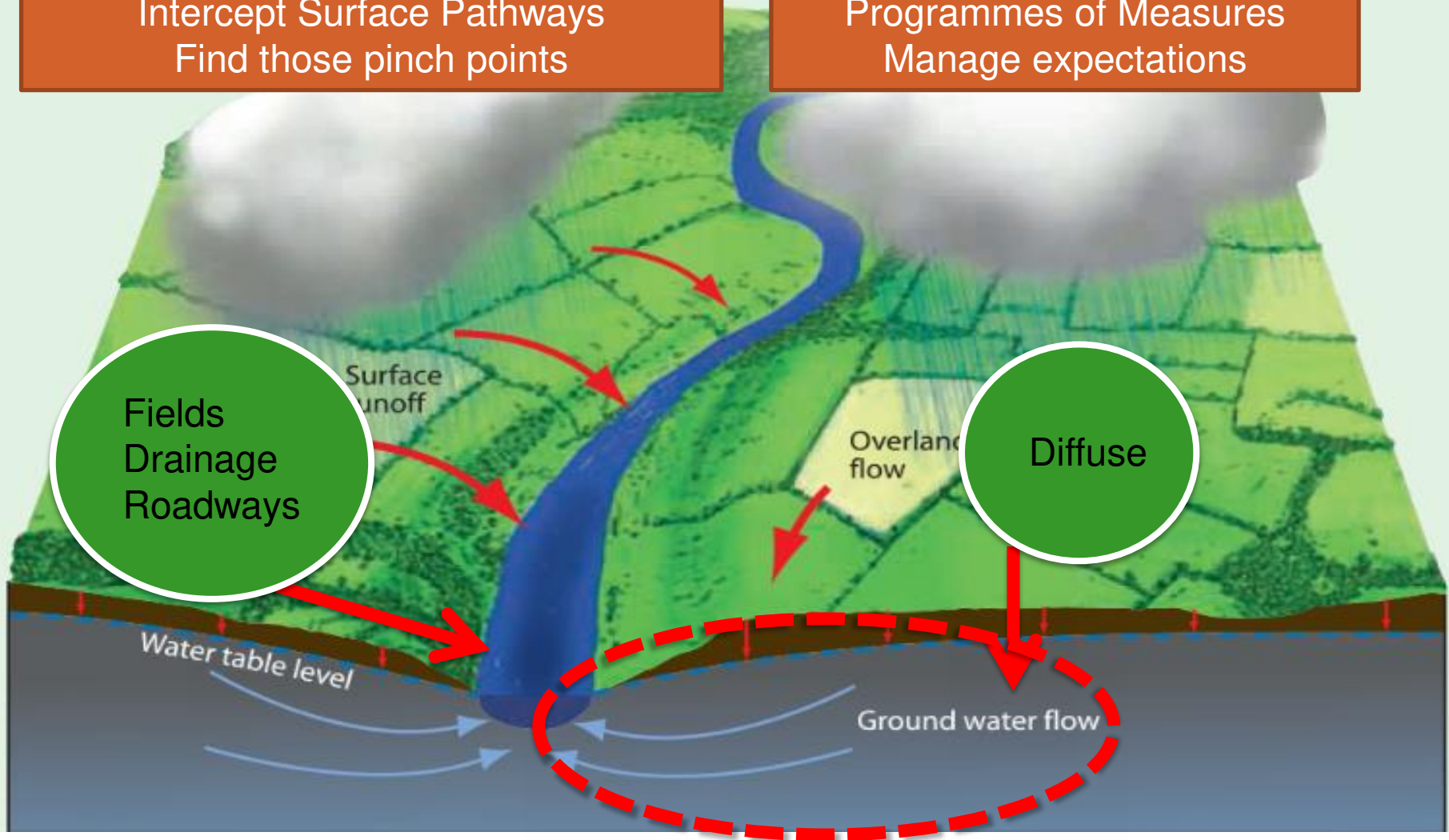
Also time lags associated with implementation of measures (0.5 – 14 years)

SLOW INFILTRATION

Time Lag: weeks to months
Intercept Surface Pathways
Find those pinch points

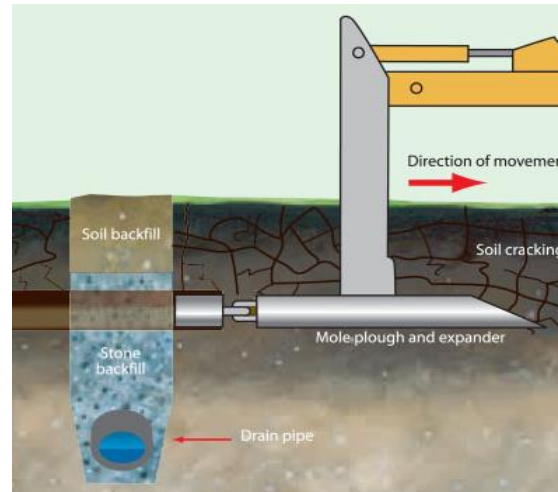
FAST INFILTRATION:

Time Lag: months to decades
Programmes of Measures
Manage expectations

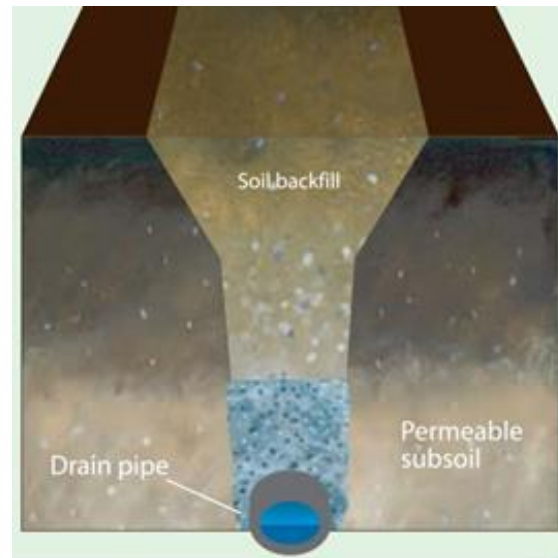


Biogeochemical
time lags

On Farm Land Drainage -

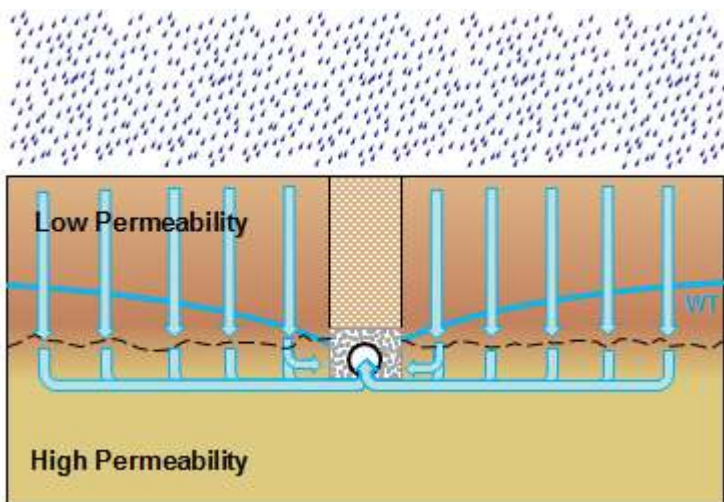
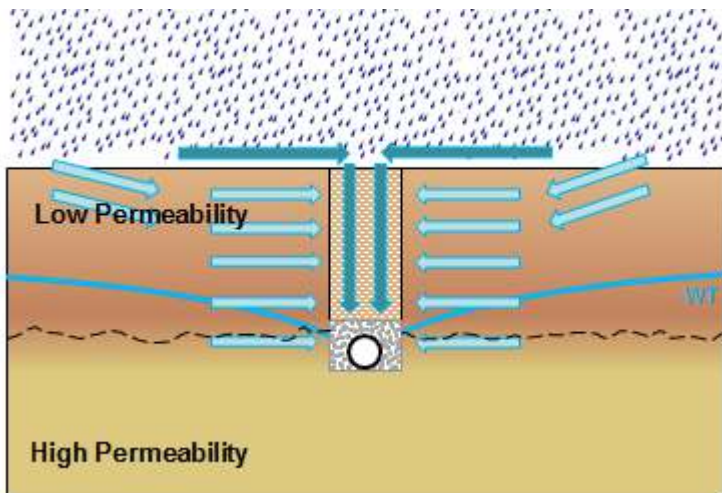


Shallow high intensity systems
-target rainfall



Deep groundwater systems
-target groundwater & rainfall

We need to avoid land drainage mistakes..... Need to slow the flow



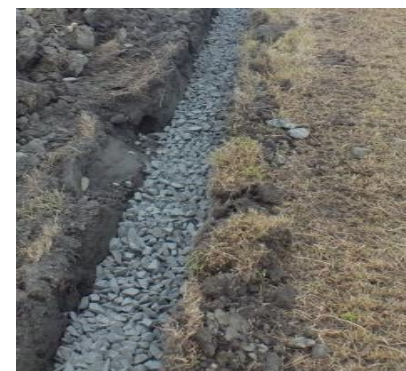
Going forward:

- Focus on mineral and not peat soils
- Avoid floodplains

Break connectivity of drainage network with:

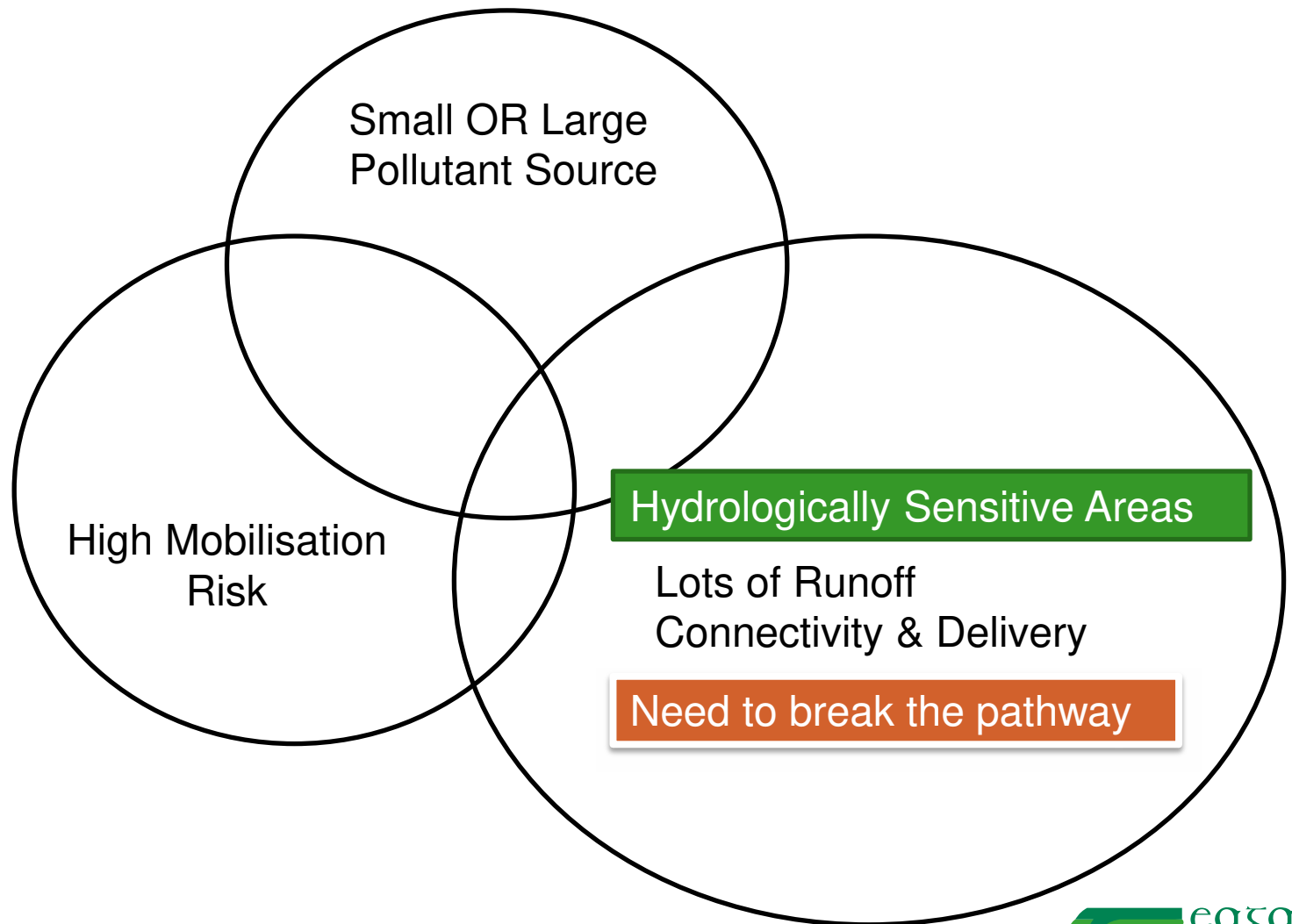
- Farmyards
- Roadways
- Surface Water

Always back fill top soil on top of stone



Diffuse Critical Source Areas

Slow Infiltration Systems



New Pathway - Farm Roadways



ROADRUNNER

*Research shows annual load of phosphorus and sediment are low:

Farm Scale: ~1% of all losses

Catchment Scale: ~10 % of all losses

But, but, but.....

Compared with field runoff, roadway runoff occurs all year round

Reacts quicker (hard surfaces, less infiltration)

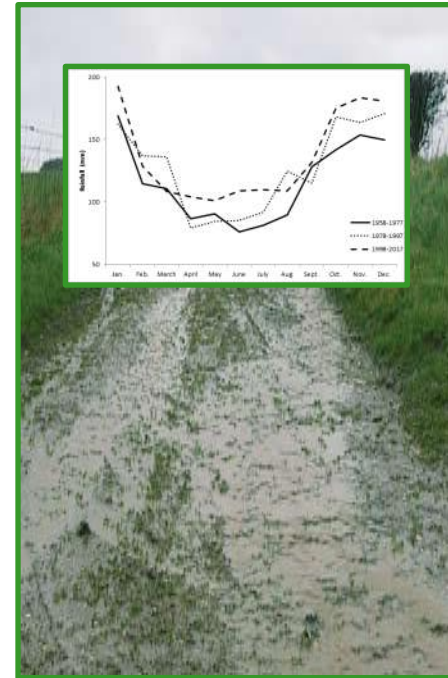
Can connect directly to ditches and surface water

Especially in Summer months:

Contributes much higher proportions to catchment load (**4-76%**)

Find sections

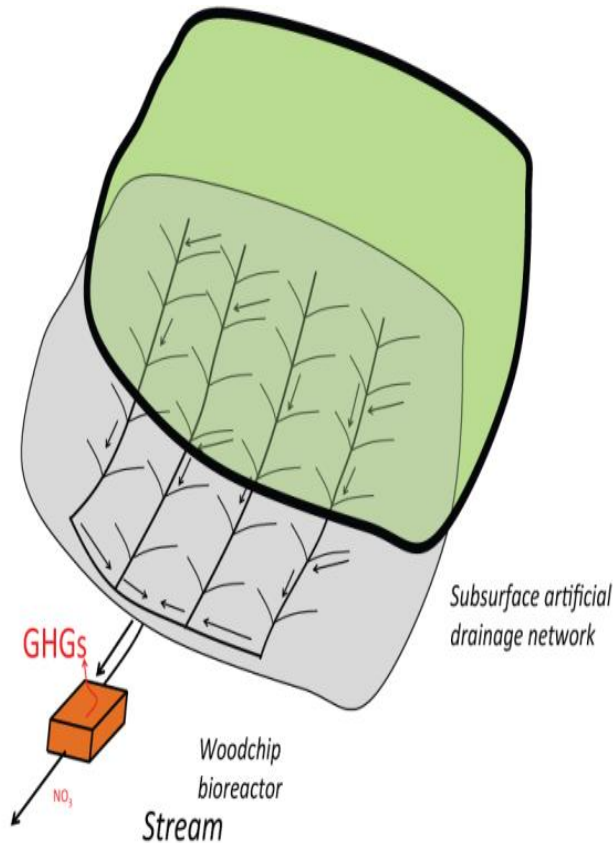
Intercept Pathway



@ROADRUN_project

Break the pathway

Roadway, open ditch and in-field options must be explored



(B)



(C)

