Teagasc Signpost Series
6th August 2021

Managing nutrient runoff from farmyards

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Northern Ireland - Ireland - Scotland
European Regional Development Fund
EUROPEAN UNION

CatchmentCARE
Community Actions for Resilient Ecosystems

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Waterford Institute of Technology
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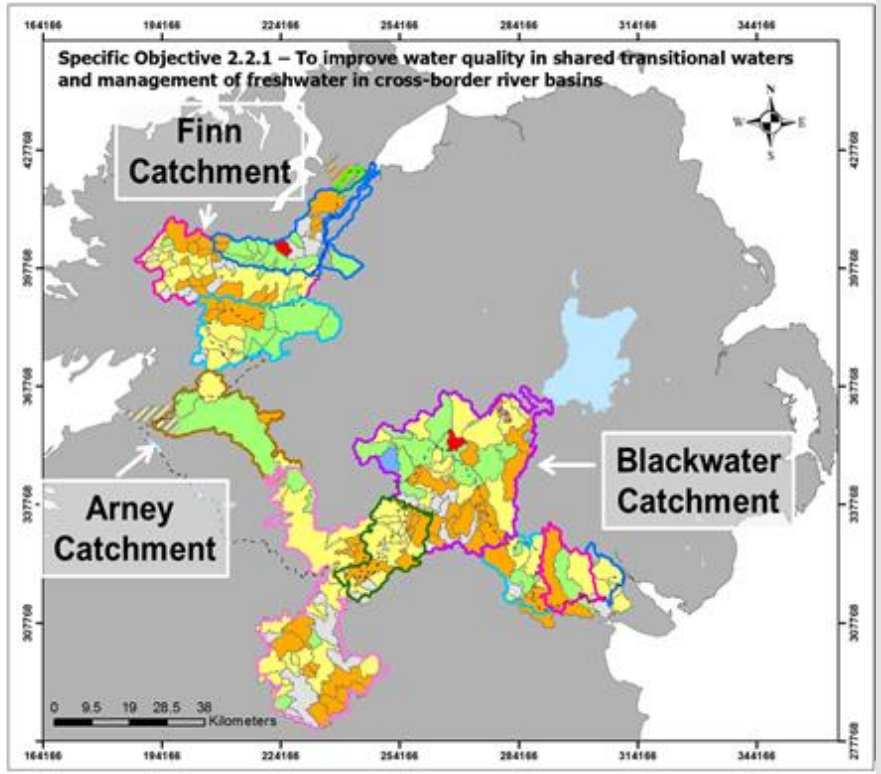
CatchmentCARE: Overview

- Hydromorphology, Diffuse & Point Sources, Lake Sediments, Behavioural Change, Knowledge Exchange, Cost Benefit Analysis
- AFBI Funding – €2.9m
  - Biofiltration
  - Nutrient Management
  - WFD Phosphorus Targets

https://www.catchmentcare.eu/



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British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Comhairle Contae Dhún na nGall
Donegal County Council

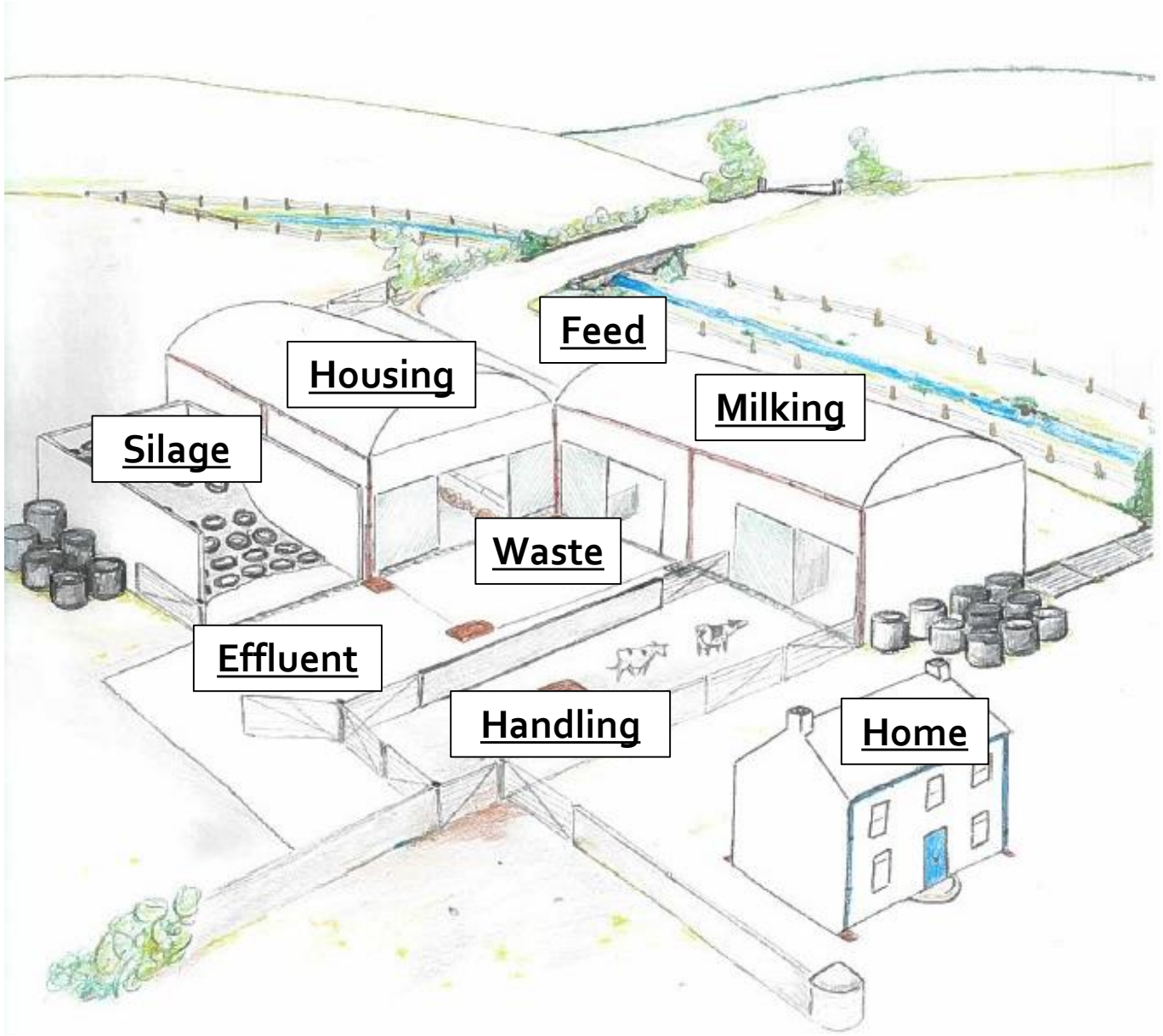
GSI

Armagh City Banbridge & Craigavon Borough Council

Iascach Intíre Éireann
Inland Fisheries Ireland

Loughs Agency

Farmyards: The hub of the farm



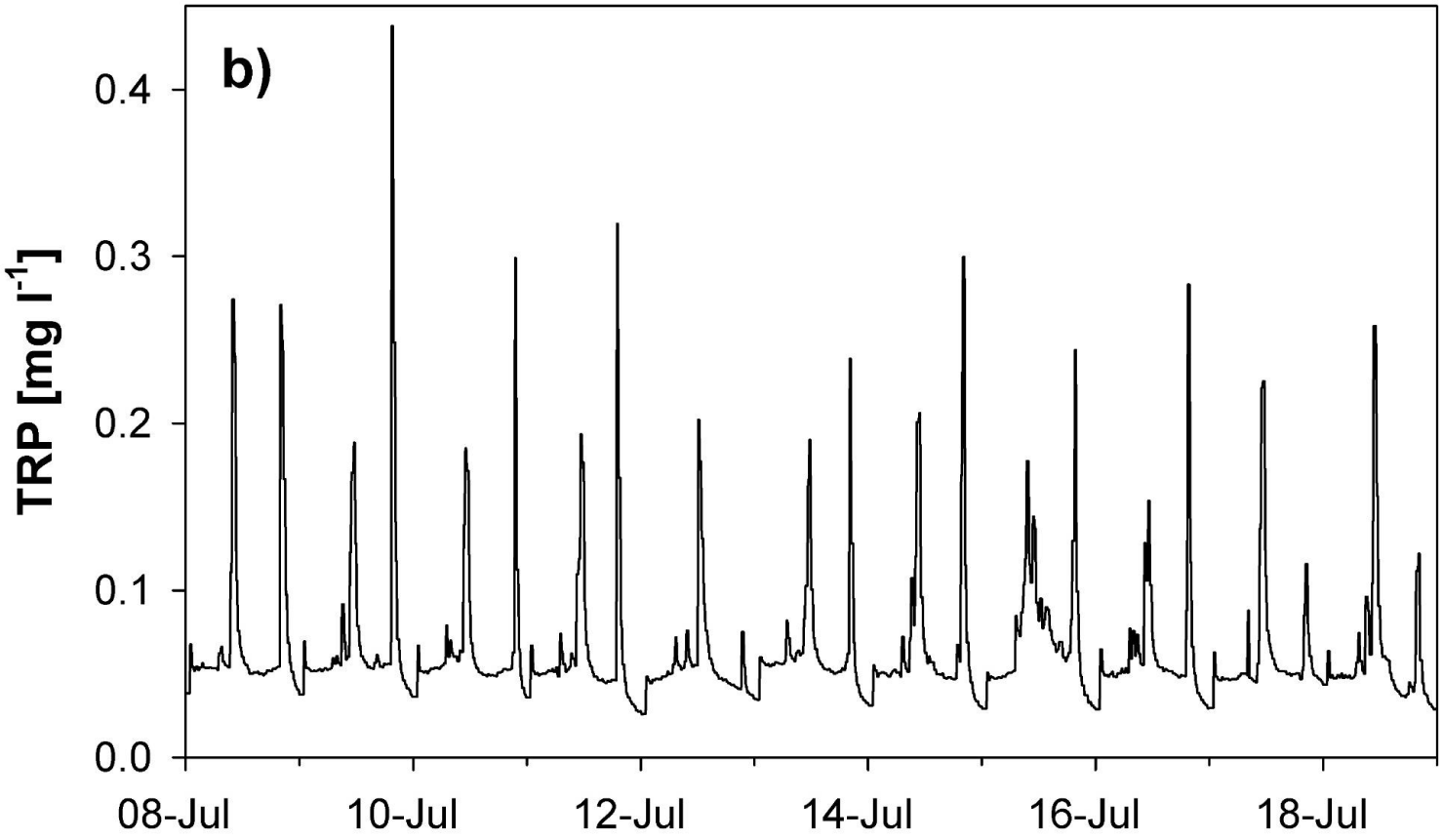
Do farmyards contribute to nutrient loss?

1. Elevated N & P in ditches connected to farmyards

	Water				Sediment	
	Mean Concentrations (mg l^{-1})				Mean Concentrations (mg kg^{-1})	
	DRP	**TP**	**NO_3^-**	**NH_4^+**	**WSP**	**Mehlich-P**
Moloney et al., 2019	0.018-342	0.084-325	0.481-380	0.051-379	1.16-175	15.51-429.5
Harrinson et al., 2019	0.019-2.43	0.053-4.68	0-8.68	0.016-14.03		
Ezzati et al., 2020*	0.047-0.61	0.031-2.29				13.81

2. Diurnal discharge in dairy catchment

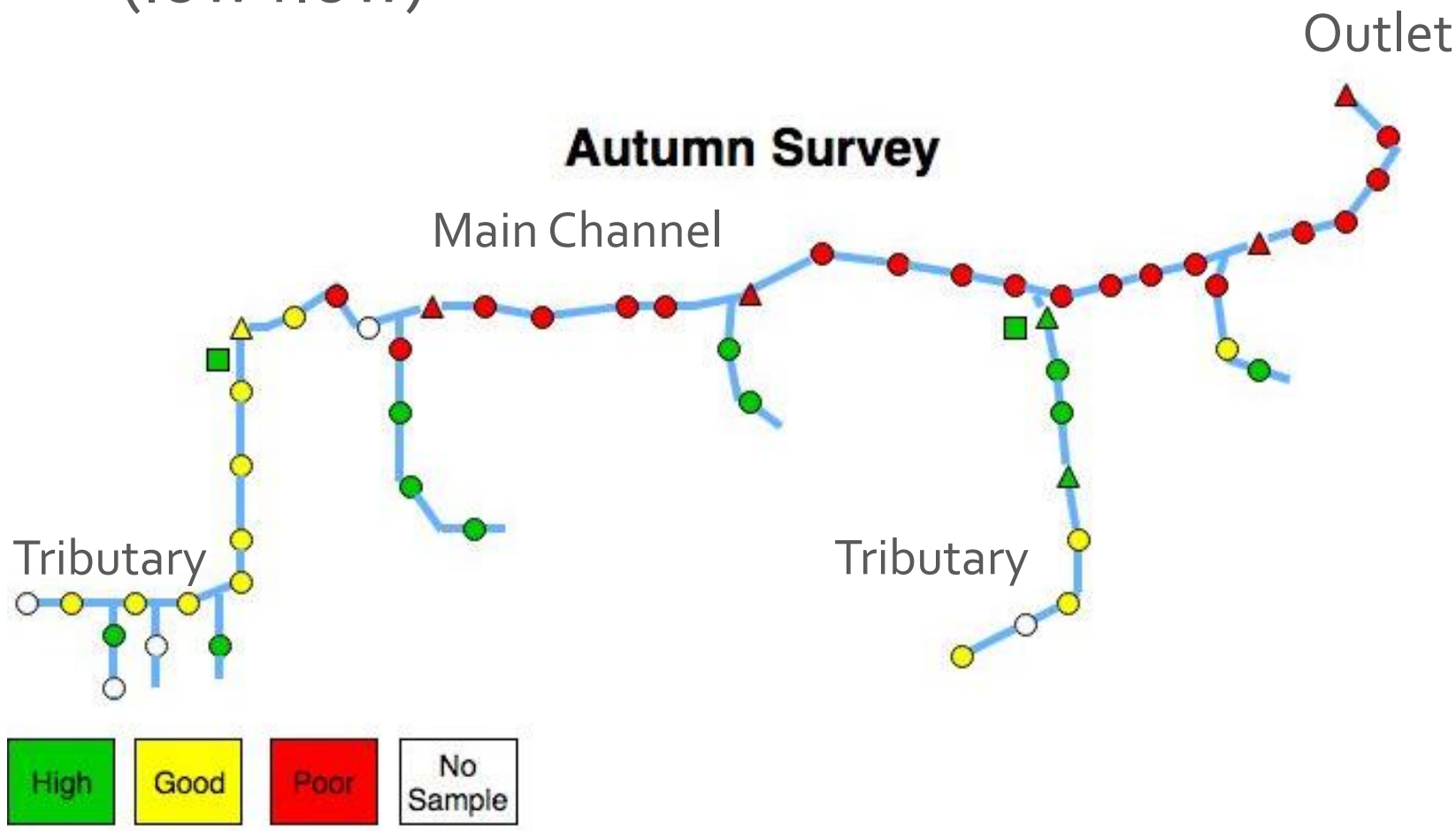
Do farmyards contribute to nutrient loss?



With permission from Mellander & Jordan, 2021. Charting a perfect storm of water quality pressures. Science of the Total Environment. 787

Do farmyards contribute to nutrient loss?

3. Cumulative loads across catchments (low flow)



Vero et al., 2019. Sources & mechanisms of low-flow river phosphorus elevations: A repeated synoptic survey approach. Water. 11

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Farmyards as point sources

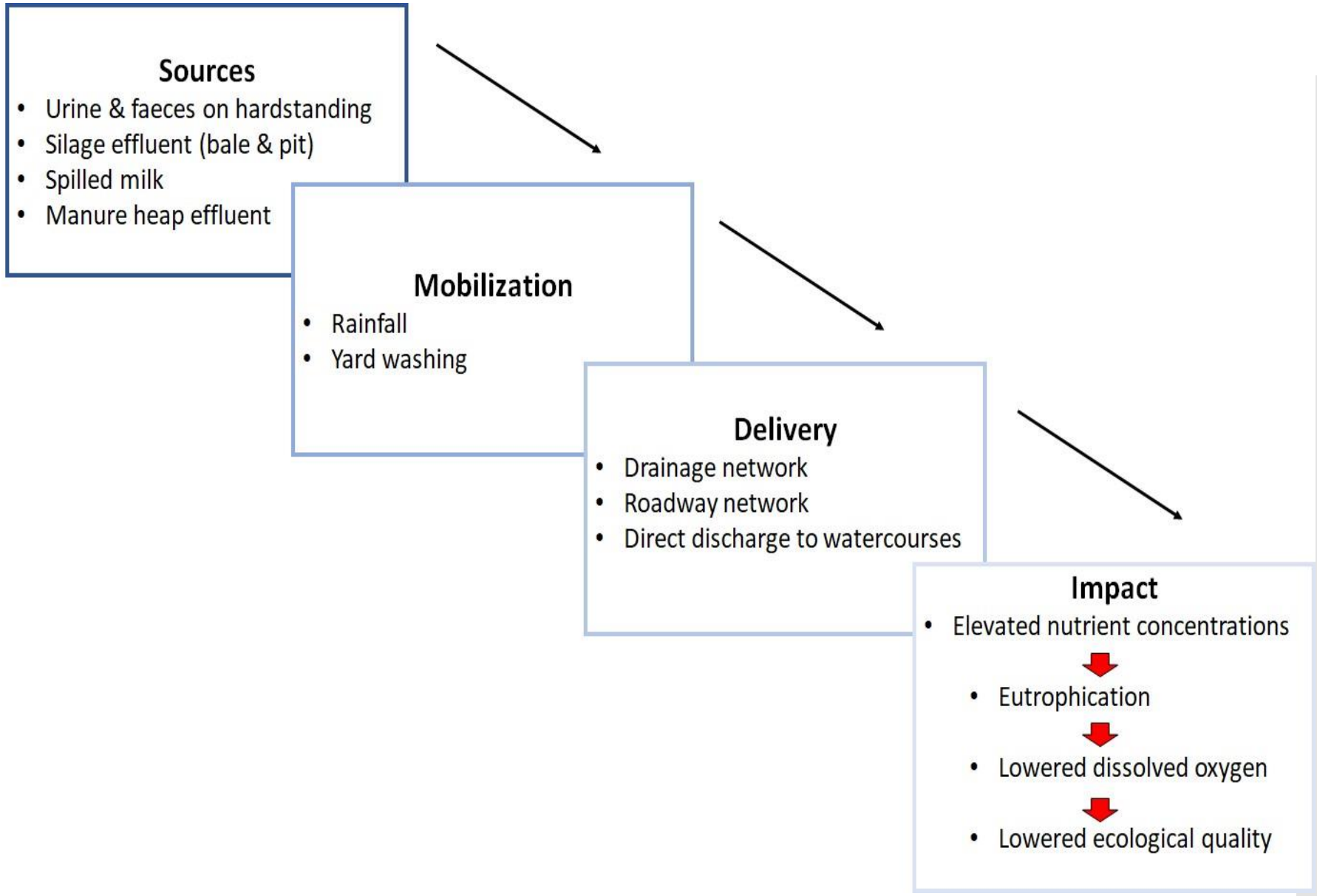
Runoff/discharge from farmyards to watercourses is prohibited

ROI: S.I. 605 2017. Code of good agricultural practice for the protection of waters
NI: Code of good practice for prevention of pollution of water, air and soil

Farmyards are ***complicated***

1. Using the nutrient transfer continuum in farmyards
2. Identifying risk factors for nutrient loss

The Nutrient Transfer Continuum



Vero and Doody. Accepted. Applying the nutrient transfer continuum framework to phosphorus and nitrogen losses from livestock farmyards to watercourses. *Journal of Environmental Quality*

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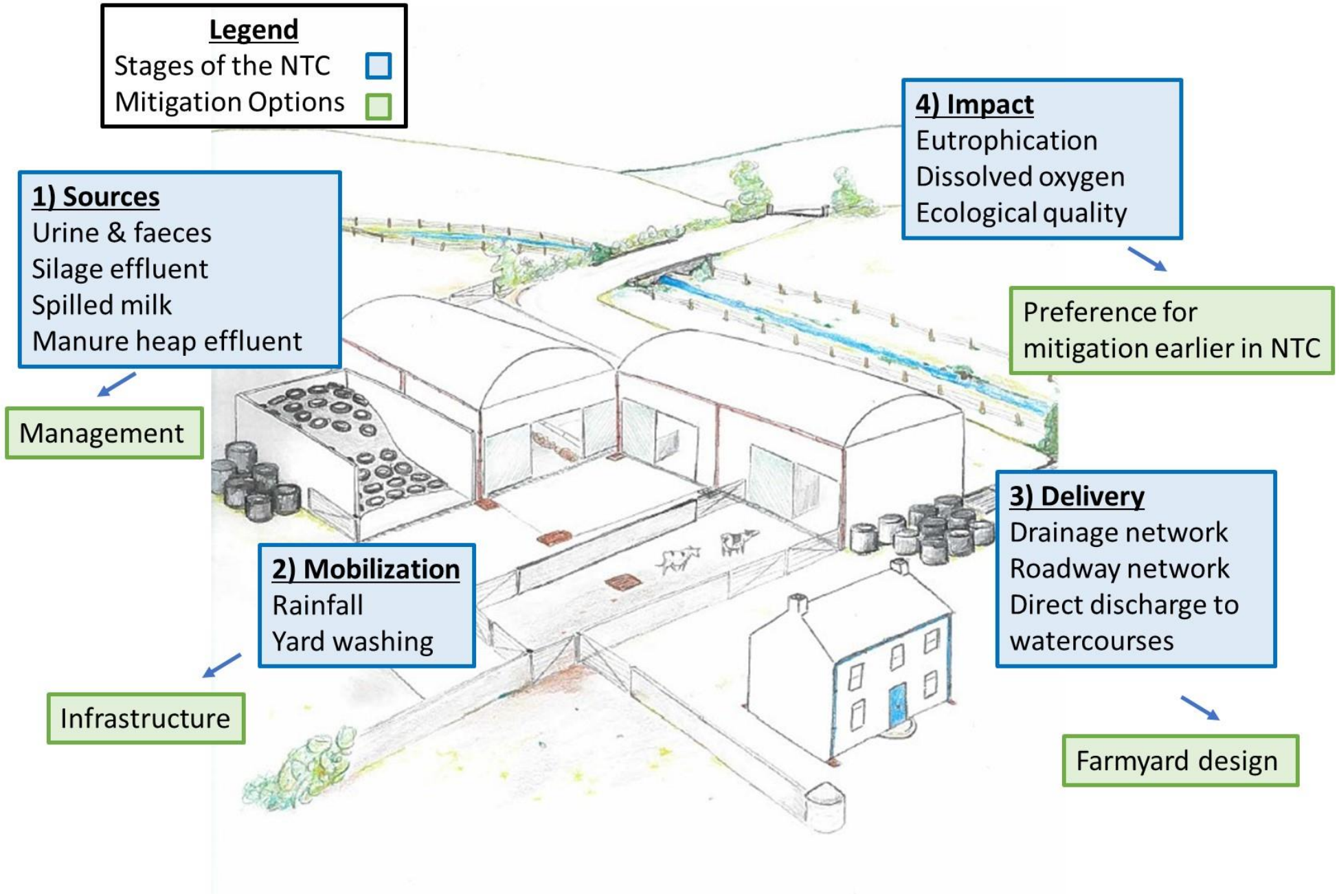
Nutrient Transport in the Farmyard



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Sources: Urine & Faeces

Stored

- Slurry
  - High N & P
  - Must be stored & spread according to regulation
  - Prevent water ingress
- Farmyard Manure
  - Effluent must be collected

Hard Standing

- Soiling during milking, handling, loading etc.
- Reduce time spent on yard
  - Good handling facilities
  - Adequate parlour size

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Sources: Silage Effluent

Silage Effluent

- Produced in 1st 21 days of ensiling
- Lower DM = Greater effluent
- Very high biochemical oxygen demand

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Sources: Soiled Wastewater

Parlour Washing

Hardstanding Runoff

Collection Yard

- **Milking**
- **Handling**
- **Other causes of soiling**

What else is in soiled water?

1. Detergents
2. Faecal bacteria
3. Trace metals (roof runoff)
4. Veterinary residues

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Mobilization

Rainfall

- 150-225 wet days per yr
- Soiled yard = soiled runoff
- Diversion of runoff from gutters = reduction in vol.

Yard Washing

- Must be collected
- Increasing frequency of cleaning reduces loading
  - Scraping
  - Sweeping
  - Hosing
- Good quality hard standing allows cleaning & collection

'**Fatal Flaw**' may bypass mobilization and delivery

Magette et al., 2007

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Delivery

Roadways

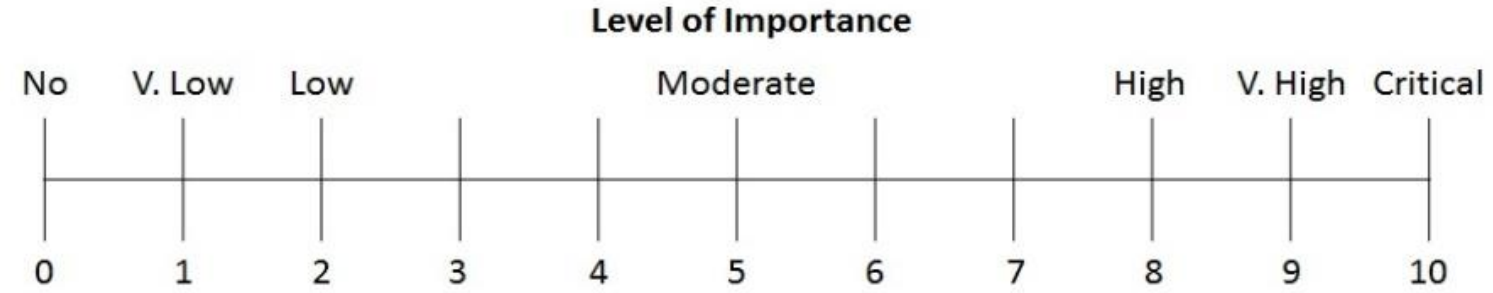
Drainage Network

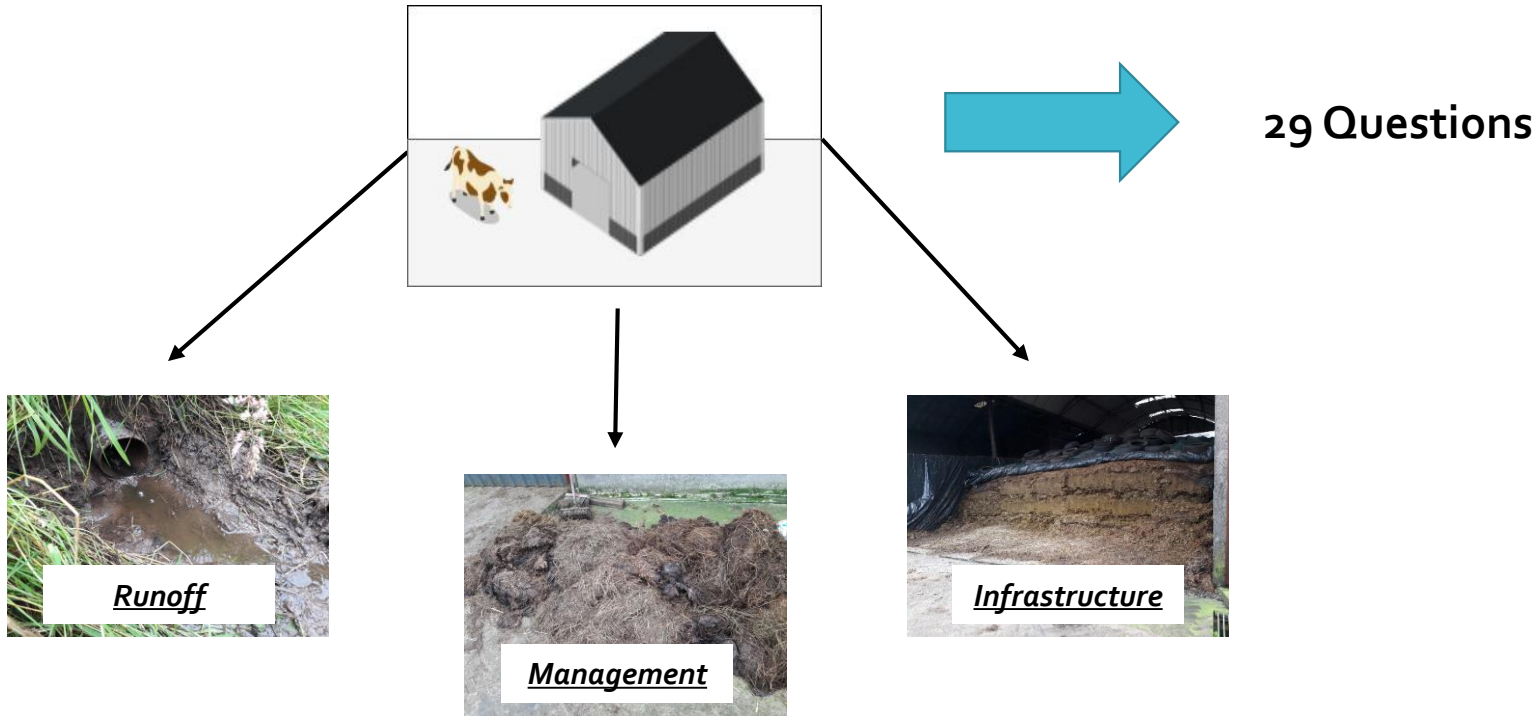
- 70% yards connected to the drainage network (Moloney et al., 2019)
- Connected ditches have high P legacy and low binding ability
- Can transport P at a later date
- Should be cleaned regularly

Direct Discharge to Watercourses

Prohibited

Risk Factors for Nutrient Loss

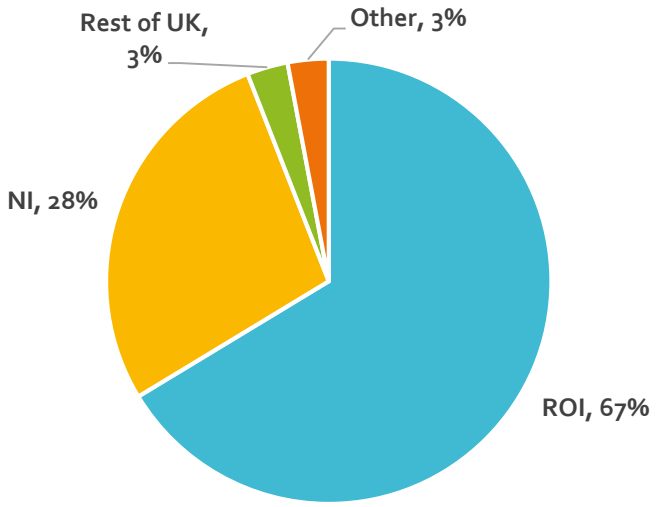




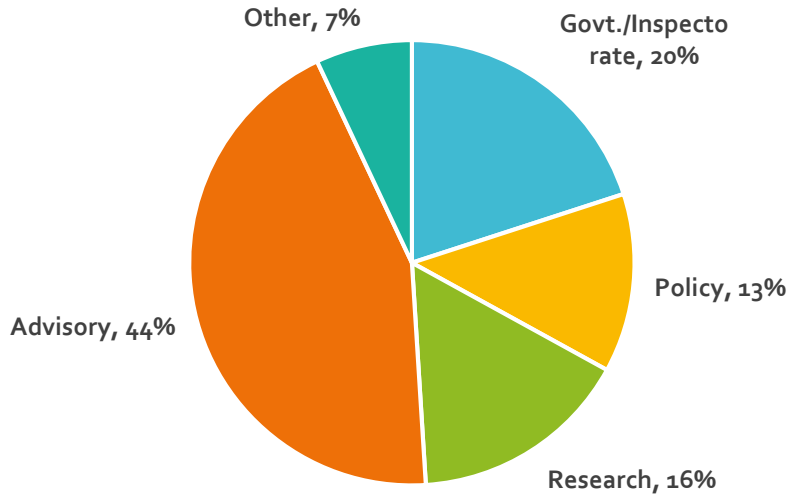
Fish *et al.*, 2009 Unruly pathogens: eliciting values for environmental risk in the context of hetereogeneous expert knowledge.
Oliver *et al.*, 2009. A cross-disciplinary toolkit to assess the risk of faecal indicator loss from grassland farm systems to surface waters.

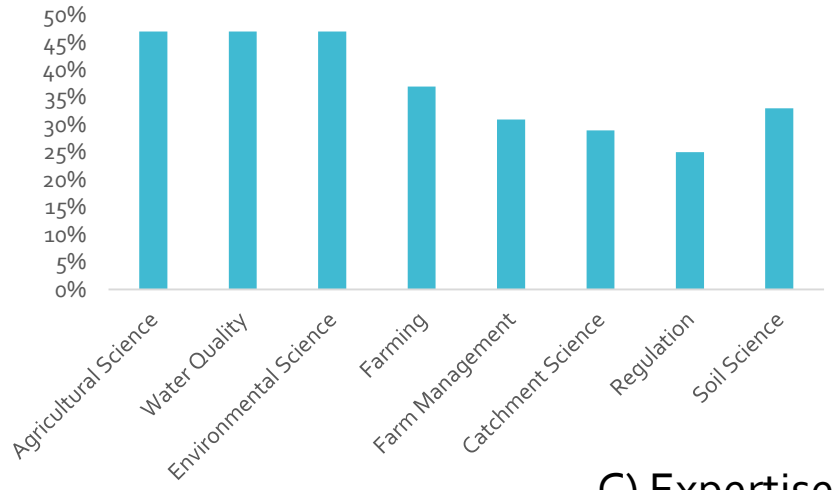
Results - Respondents

A) Geographic location



B) Primary employment





C) Expertise

Infrastructure Factors

Infrastructure Factors > Runoff Factors > Management Factors

Risk Factor	Mean	Within Category Ranking
Collection of silage pit effluent	8.97	1
Slurry storage capacity	8.91	1
Condition of silage pit	8.71	1
FYM storage capacity	8.52	2
Soiled water storage capacity	8.44	2
Cracks in hard standing	7.76	3
Collection of silage bale effluent	7.63	3
Roofing of silage pit/slurry tank/manure heap	7.34	3
Area of hard standing	7.32	4
Layout of farmyard	7.14	4
Quality of livestock handling facilities	5.86	5

Runoff Factors

Infrastructure Factors > Runoff Factors > Management Factors

Risk Factor	Mean	Within Category Ranking
Direct discharge to watercourse	8.74	1
Direct discharge to open drain/ditch	8.38	2
Runoff from paved area to watercourse	7.53	3
Slope of farmyard to watercourse	7.30	3
Runoff from paved area to open drain/ditch	7.20	3
Distance of farmyard to watercourse	7.04	4
Number of rainfall days per year	6.35	5
Average annual rainfall	6.26	5

Management Factors

Infrastructure Factors > **Runoff Factors** > **Management Factors**

Risk Factor	Mean	Within Category Ranking
Frequency of yard cleaning	7.63	1
Level of education of farmer	7.22	1
Membership of environmental schemes	6.90	2
Receipt of advisory services	6.79	2
Age of farmer	6.19	3
Duration of livestock housing	6.12	3
Membership of quality assurance schemes	5.81	3
Receipt of basic payment	5.76	4
Participation in off-farm employment	5.02	5
Compactness of calving/lambing	4.29	6

How do we manage these risk factors?

Infrastructure

- Engineered solutions
- Financial investment

Runoff

- Less control
- Break the pathway

Management

- Simple and cheap
- Requires time

Vero et al., 2020 Evidence and perception of phosphorus loss risk factors in farmyards. *Environmental Science & Policy*.

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Take Home Messages

Nutrient Transfer Continuum

Sources
- Slurry & FYM stores
- Silage effluent
- Soiled hard standing
- Soiled wastewater

Mobilization
- Rainfall
- Yard washing

Delivery
- Drainage network
- Roadway network
- Direct discharge

Impacts
- Elevated N & P – Eutrophication
- Depleted O2 – Fish kills

Risk Factors

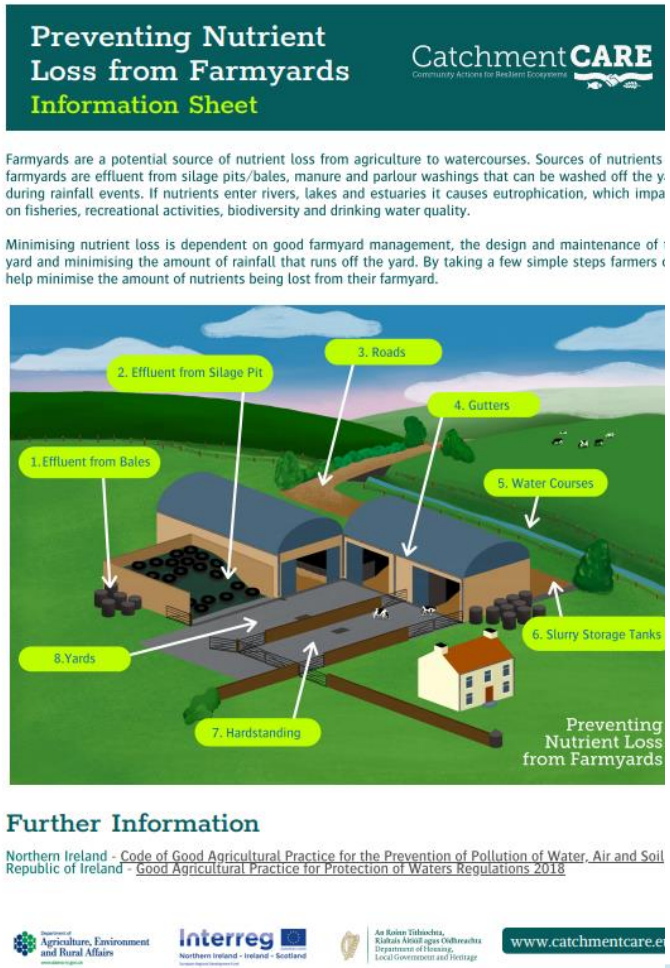
Infrastructure
- Sufficient slurry storage
- Sufficient & sound silage storage

Runoff
- Prevent direct discharge
- Intercept runoff

Management
- Frequency of yard cleaning
- Keep gutters clean
- Empty tanks
- Education – think about your yard

Where can I get advice on my farmyard?

- Managing Farmyards to Reduce Soiled Water Losses (Teagasc Website)
- Farmyards and Water Quality (Teagasc Website)
- Preventing Nutrient Loss from Farmyards (CatchmentCARE)



Preventing Nutrient Loss from Farmyards
Information Sheet

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Farmyards are a potential source of nutrient loss from agriculture to watercourses. Sources of nutrients
farmyards are effluent from silage pits/bales, manure and parlour washings that can be washed off the y
during rainfall events. If nutrients enter rivers, lakes and estuaries it causes eutrophication, which impa
on fisheries, recreational activities, biodiversity and drinking water quality.

Minimising nutrient loss is dependent on good farmyard management, the design and maintenance of
yard and minimising the amount of rainfall that runs off the yard. By taking a few simple steps farmers
help minimise the amount of nutrients being lost from their farmyard.

Further Information

Northern Ireland - Code of Good Agricultural Practice for the Prevention of Pollution of Water, Air and Soil
Republic of Ireland - Good Agricultural Practice for Protection of Waters Regulations 2018

Preventing Nutrient Loss from Farmyards - Key

1. EFFLUENT FROM BALES
Effluent from bales stored in the farmyard must be collected. Stacking bales in a single layer produces less effluent than multiple layers and should be preferred if you have sufficient space. Bales stored in fields should be kept more than 10m from a watercourse and the location moved each year.

2. EFFLUENT FROM SILAGE PIT
All effluent from the silage pit must be collected in a gully/pipe and routed to a storage tank.

3. ROADS
Roads should be cambered to direct runoff to the adjoining field.

4. GUTTERS
Gutters of farmyard houses should be intact and kept clear. Gutters and downpipes should direct rain water away from hard standing areas on the farmyard.

5. WATER COURSES
Regularly check any water courses adjacent to your farmyard.

6. SLURRY STORAGE TANKS
Ensure that slurry storage tanks are in good condition, with no cracks or faults. Manage and monitor regularly to ensure no overflow occurs.

7. HARDSTANDING
The hardstanding may become soiled by livestock. Rainfall that comes in contact with manure/urine is considered either dirty/soiled water or slurry so must be directed to the appropriate storage tank. To reduce this, scrape or sweep the hardstanding to remove manure before rainfall. On dairy farms, covered waiting areas in yards are recommended.

8. YARDS
Minimise soiled yard areas. Keep clean and dirty yards separate and don't let water from clean yards or surrounding fields flow onto dirty yards. Manholes and gullies should be kept clear.

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Thank you!

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