

Ensuring Company Operations and Suppliers are Compliant with Existing Water Protection Legislation and Regulations

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Dear Decision-maker

Report: Ensuring that company operations and suppliers are compliant with existing water protection legislation and regulations

Fewer than a quarter of England's water environments are considered healthyⁱ, as defined by the EU Water Framework Directive. Whilst there are many factors contributing to their poor health, recent data published by the Environment Agency suggests that a third of problems can be attributed to the agricultural and rural land management sectorⁱⁱ. The causes of poor environmental health are numerous, and include fertilisers, manures and soil washing from fields when it rains, as well as problems associated with land drainage and irrigation.

To help understand the role that private sector supply chains can play in mitigating pressures from the agricultural and rural land management sector, **WWF-UK has commissioned an independent assessment of farms' compliance with water protection legislation** including the Nitrates Directive, Silage, Slurry and Agricultural Fuel Oil Regulations and Good Agricultural and Environmental Conditions under Cross Compliance. The report also investigated mechanisms to secure compliance, and how far compliance may take us towards achieving good health in our water environments.

Findings

The report, which is appended to this letter:

1. Estimates that farmer **compliance with England's water protection legislation may be between 70 and 80% on average**ⁱⁱⁱ. Consequently, WWF-UK recommends a targeted and collaborative approach to working with the remaining 20-30% of farmers to increase compliance levels;
2. Investigated the Scottish targeted enforcement model of General Binding Rules, and found that it was successful in bringing 85% of farmers inspected into compliance. Moreover, farmers and representative bodies viewed the Scottish approach favourably, regarding the process as balanced and fair;
3. Suggests that, while legal compliance with the current baseline legislation will go a long way towards improving the health of our waters, this alone will not be sufficient to address the scale of the problem. There is a clear role for industry and private sector voluntary initiatives to build on the regulatory baseline by supporting farmers (including through awareness raising and financial incentives) to implement the 'top 10' on-farm measures that can improve the water environment, as identified in this report.

The findings of this report correlate with previous work by other organisations. For example: Research by the National Farmers Union in 2011 indicated that non-compliance with Nitrates Directive requirements may be as high as 45%^{iv}; Analysis of Environment Agency catchment survey data indicated that 90% of observed diffuse pollution incidents did not trigger regulatory action^v; A 2010 National Audit Office review recommended that the Environment Agency take urgent action to raise awareness, target incentives and enforce the legal responsibilities of farmers^{vi}.



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In 2011, WWF-UK partnered with Defra and the Rivers Trusts on a Strategic Evidence Project^{vii} that explored through collaborative research with farmers, the effectiveness of current measures to tackle diffuse pollution from farms and fields. A clear conclusion of that work was that voluntary, sector-led initiatives can only be effective if built on a fair and level playing field of compliance with the statutory legislation. WWF-UK's current work with Coca-Cola to reduce freshwater impacts associated with British sugar beet production in Norfolk has also supported this conclusion.

Recommendations

The conclusion from this thorough research base must be that the solution lies in concerted efforts by government, farmers, the private sector and civil society. To make this a reality, WWF-UK makes the following recommendations:

To Government:

1. Target efforts to bring the 20-30% of non-compliant farmers in England into compliance, drawing on the successful Scottish model of General Binding Rules;
2. Ensure that water and agriculture policies reflect the 'Polluter Pays Principle' and that basic legislation is sufficient to support further achievement of good health in our waters, as defined by the Water Framework Directive;
3. Provide targeted agri-environment incentives to deliver improvements in the water environment, including through the New Environmental Land Management Scheme;
4. Continue support and resourcing for farm advice, such as Catchment Sensitive Farming, including enabling knowledge exchange with private and third sector schemes;
5. Develop the means to enable and promote matched-funding from the farming and food & drink sectors for water stewardship voluntary initiatives in order to maximise impact and promote corporate leadership.

To the food, drink and agricultural industries:

1. Better understand the impact of direct operations and supply chain agricultural operations on the freshwater environment;
2. Ensure that all operatives and suppliers comply with baseline legislation, and encourage Government to target non-compliance of the 20-30% in order to create a fair and level playing field for all;
3. Support the implementation of additional voluntary on-farm actions to reduce impact on the water environment, including by providing funding for voluntary initiatives or through participation in certification scheme, and additionally, take steps to ensure that these result in positive impacts on the ground.

We would very much welcome the opportunity to discuss the full report, and the conclusions we have drawn from it, with you. Please contact our Freshwater Project Manager, Kathy Hughes khughes@wwf.org.uk, if you would be interested in doing so.

Yours sincerely



David Nussbaum
Chief Executive

ⁱ Environment Agency. Water Framework Directive Classification 2013 progress update, October 2013.

ⁱⁱ Environment Agency. 2014. Progressing towards WFD objectives – the role of agriculture.

ⁱⁱⁱ Evidence was gathered using a survey of 45 hand-picked expert multi-sector farm advisory personnel.

^{iv} Dairy Nitrate Vulnerable Zone Survey, National Farmers Union, February 2011.

^v Catchment Walkovers; Observations of Pressures on the Water Environment, RSPB, July 2014.

^{vi} Environment Agency: Tackling diffuse water pollution in England, National Audit Office, July 2010.

^{vii} Defra Strategic Evidence and Partnership Project. Component B Report, October 2011.

Investigating Agricultural Compliance Rates



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Disclaimer:

This report has been produced under contract by Alex Inman (Consulting), an independent consultant, on behalf of WWF-UK. Whilst the author has taken all due care to interpret and collate the information presented within the report, any party relying on the results of the analysis shall do so at their own risk and neither the author or WWF-UK shall be liable for any loss or damages arising there from.

1.0 Executive Summary

- The primary objective of the study was to examine the extent of compliance with current baseline regulations by the agricultural sector. The study focussed on compliance rates in England.
- Due to a paucity of on-farm data, an expert survey involving 45 farm advisory personnel (public, private, NGO) was used to collate compliance estimates across a broad range of farming systems and regions.
- A secondary objective was to evaluate the ability of regulatory and non-regulatory measures to achieve Good Ecological Status under the Water Framework Directive. Predictive modelling was used to model various scenarios (bundles of measures) using The ECM+¹ source apportionment toolkit in the Upper Tamar catchment.
- In addition, an examination of the efficacy of the General Binding Rules (GBR) compliance model in Scotland was undertaken to establish whether this model has potential for application in England.

Compliance Rates

The primary objective of the study was to examine the extent of compliance with current baseline regulations by the agricultural sector in England. Due to a paucity of on-farm data, an expert survey involving 45 farm advisory personnel (public, private, NGO) was used to collate compliance estimates across a broad range of farming systems and regions. These individuals were hand-picked to take part in the survey, based on their proven expertise and qualifications. We examined the extent of compliance with current baseline regulations including measures required under Cross Compliance (Standards of Good Agricultural and Environmental Conditions), the Nitrates Directive and Slurry, Silage and Agricultural Fuel Oil (SSAFO) Regulations.

The study found compliance with baseline legislation to be between 70 and 80% on average. In some cases it was significantly lower, for example at 57% for the incorporation of organic manure, slurries and sewage sludge when spread to bare soil or stubble. Results demonstrate strong parity with on-farm data collected by SEPA in Scotland and also with results from a National Farmers Union Survey from February 2011 which investigated compliance rates with NVZ regulations.

Estimates of current compliance rates are outlined below:

- *GAEC 1 - Post Harvest Management*
GAEC 1 is designed to reduce the risk of soil erosion and nutrient pollution by preventing mobilisation of soil run-off from cultivated land. The expectation is that farmers do not leave finely cultivated soil exposed to rainfall over the winter months. Results indicate that **9 out of 10 farmers are complying** with this rule by adopting at least one of the prescribed measures.
- *GAEC 1 – Management of Waterlogged Land*
Waterlogged land has the potential to lead to soil damage and run-off, largely due to the destruction of soil structure from compaction by machinery and/or livestock. Ruts from wheelings can also provide a channel for run-off. **7 out of 10 farmers appear**

¹ Extended Export Coefficient Model (ECM+) developed during the RELU research programme by Dr Tobias Krueger at University of East Anglia.

to be taking actions to repair damage from accessing waterlogged land which will mainly involve some form of cultivation to break up compaction and restore soil structure.

- *GAEC 9 – Managing Overgrazing/Supplementary Feeding*
GAEC 9 is designed to protect natural/semi-natural grassland from being denuded of vegetation which can be caused from poaching by livestock, particularly during the winter months. Severe soil and nutrient run-off can occur where animal density is too high. Provision of supplementary feed during the winter months (e.g. use of static ring feeders) can concentrate livestock on one area, causing a significant risk of vegetation damage and associated run-off. Results indicate that **7 out of 10 farmers are complying** with this rule by taking appropriate management actions to reduce damage.
- *GAEC 14 – Protection of hedgerows and watercourses*
GAEC 14 makes provision for basic measures to protect watercourses and hedgerows from pollution, by preventing cultivation and application of agrochemicals to land immediately adjacent to these features. Approximately **8 out of 10 farmers are currently complying** with this requirement.
- *GAEC 19 – No Spread Zones*
GAEC 19 was recently introduced to cross compliance in an attempt to provide extra protection to surface and ground waters. Survey results indicate that **8 out of 10 farmers are complying** with the 2m surface water no spread zone for inorganic fertiliser and the 50m no spread zone for springs, wells and boreholes. However, only **6 out of 10 farmers** appear to be complying with the 10(6)m surface water no spread zone for organic manure.
- *SMR3 – Application of Sewage Sludge*
With sewage sludge no longer permitted to be disposed at sea, land application remains the only viable alternative. Sewage sludge can be very high in nutrient content and if applied inappropriately can be a source of pollution. It appears **7 out of 10 farmers are complying** with most of the mandatory specifications regarding the use of sewage sludge, falling to **6 out of 10** for the requirement to take into account nutrient needs of plants when applying sewage sludge. Given the high degree of paper work and associated audit trail associated with the use of sewage sludge, it is surprising that approximately a third of farmers do not appear to be fully compliant with the legislation.
- *SMR4 and SAFFO– Management of nitrogen and controlling the risk of pollution from silage, slurry and agricultural fuel oil storage.*
Survey results indicate **compliance rates with the individual regulations vary from 6 out of 10 to 8 out of 10 farmers**. Lowest compliance rates relate to the appropriate storage of slurries and manures (farm yard and in-field) and the timely incorporation of slurries and manures when spread to land at high risk of run-off.

Efficacy of different farm management practices

Respondents to the expert opinion survey were asked to state via an open-ended question which measures (regulatory and non-regulatory) they felt had most potential to reduce water pollution. The 10 most often mentioned measures are listed in the table below.

Top 10 measures as cited by expert farm advisors (in priority order)

		Covered by regulation (Y/N)
1.	Manage soil exposure during winter months through early establishment of winter crops/leave rough surface/plant cover crops	Y
2.	Adoption of nutrient planning and precision farming	Y (NVZ only)
3.	Take steps to address and repair soil compaction	Y
4.	Introduce riparian buffer strips	N
5.	Install 5+ months slurry/manure storage facility	Y (NVZ only)
6.	Fence out livestock from water courses	N
7.	Do not grow high risk crops on sloping ground	Y
8.	Separate clean and dirty water	N
9.	Optimum maize management (early varieties, no maize stubble over winter)	Y
10.	Increase Soil Organic Matter	N

Predictive Modelling

Predictive modelling (ECM+ model) was used to estimate the contribution that full compliance with baseline regulations can make towards achieving Good Ecological Status (GES).

- Model predictions indicate that even with 100% compliance with existing requirements, there is a very high degree of probability that the test catchment (The Upper Tamar) will not reach Good Ecological Status (as measured by phosphorus concentrations).
- To explore the likely impact of increased uptake of additional non-statutory measures (going beyond current baseline requirements), a further simulation was run with 100% uptake of all 36 measures available for scenario building within the ECM+ model. Whilst the probability of reaching GES is significantly improved, model predictions suggest that, even with all 36 measures fully implemented, it is very possible that GES will still not be obtained in the Tamar test catchment.
- This is an extremely important finding from a policy perspective as, if the results hold for other catchments, it strongly suggests that achieving GES targets will not be possible by changing land management practices alone (either by enforcing current regulations, introducing new management requirements, or financially incentivising farmers to adopt given practices). Fundamental land use change may be required by farmers in specific locations, together with other options such as a reduction in livestock numbers. Further modelling work is needed to ascertain the applicability of the Tamar modelling results to other catchments.
- These findings also strongly suggest that action is needed by other sectors (including the water industry, roads and transport) if we are to meet GES.

Assessment of the General Binding Rules model in Scotland

- The main instrument deployed in Scotland to regulate diffuse pollution from agriculture is a package of Diffuse Pollution General Binding Rules (DP GBRs). A key feature of the DP GBRs is that they represent a statutory baseline of

environmental husbandry which all farmers and rural land managers must abide. No such statutory measures exist elsewhere in the UK.

- The main thrust of GBR enforcement in Scotland is undertaken at a priority catchment level, with farmer contact made exclusively by SEPA. Where breaches of GBR and/or significant pollution risks are identified, farmers are given time (usually 1 year) to address these breaches and risks before a second repeat visit is arranged by SEPA to check on progress. Secondary visits are currently underway.
- **A key point to note is that 85% of farmers have taken action to address failings identified during their initial visit from SEPA.** Evidence from the River Ayr Priority catchment demonstrates how 90% of farmers have taken action to rectify problems without any need for SEPA to take further action. This represents a significant body of targeted pro-environmental behaviour taking place, which was not being undertaken previously. Encouragingly, farmers and their representative bodies appear to have received the programme in a favourable light, regarding the enforcement process as balanced and fair.

Conclusions

- The results from this study suggest that farmer non-compliance with the regulations investigated is not an industry wide issue; rather a feature which is present on a minority of farms – between 20 and 30%. It is these farms where any future enforcement effort should be targeted to alleviate the inconvenience of compliance visits on compliant farmers.
- Defra's work to explore opportunities surrounding 'earned recognition' for farmers demonstrating high levels of environmental stewardship (when selecting farms for compliance inspections) should be supported.
- With a focus on the 'non-compliant minority', it is strongly recommended that Defra adopts the targeted enforcement policy currently operating in Scotland; specifically a process of warnings rather than immediate penalties with follow-up visits undertaken to ensure mitigation action has been adopted. The evidence suggests such a policy will be regarded as fair by the farming community and will result in appropriate actions being taken on-the-ground to deliver better water quality.
- The study has identified a 'top 10' of measures which, if implemented by farmers, are likely to make the greatest contribution to achieving improved water quality and GES under the Water Framework Directive. Many of these measures are (and will continue to be) covered by cross-compliance/other regulatory controls whilst some (particularly those involving infrastructure investment e.g. slurry stores, fencing) will require financial inducement and support.
- The modelling work undertaken for this study has highlighted that full compliance with current regulations will make a contribution to meeting GES targets under the Water Framework Directive. It is, however, very likely that targets will only be fully met through a combined response involving the water industry (management of Sewage Treatment Works) and wider society (e.g. management of septic tanks, behaviour change).

2.0 Introduction

Diffuse pollution from agriculture has been identified as a significant barrier to the UK meeting its obligations under the Water Framework Directive (WFD). Unfortunately, it is proving a complicated problem to solve. However, there is an emerging consensus amongst the policy community that compliance with a functioning baseline of basic regulatory requirements is needed (polluter pays), supplemented by financial incentives for land owners ('provider gets') to deliver interventions which go beyond this regulatory baseline. Precisely where the baseline is set and where the payments begin is a matter of considerable political debate at the current time.

This report presents findings from a recent study undertaken on behalf of WWF-UK to examine the extent of compliance with current baseline regulations in agriculture. Baseline regulations in the context of this study comprise the measures required under the Cross Compliance programme (GAEC - Standards of Good Agricultural and Environmental Condition), Nitrate Vulnerable Zone and Slurry, Silage and Agricultural Fuel Oil (SSAFO) Regulations. Predictive modelling is used to estimate the contribution that full compliance with these baseline regulations can make to achieving Good Ecological Status (GES) under the Water Framework Directive (WFD).

The study focussed on compliance in England although an examination of the situation in Scotland under the General Binding Rules (GBR) has also been undertaken (see below). It is envisaged that the assessments made within this report will help to inform WWF-UK's position regarding the development of an optimal policy mix for addressing diffuse pollution from agriculture going forward. Understanding where compliance with current regulations can make most impact on GES will also guide WWF's Water Stewardship 'asks' of corporates to reduce the impacts of their respective supply chains.

The scope of information presented in the following pages is wide ranging given the broad objectives set for the study by the client. Following an explanation of the methodology used for the study in Section 3.0, Section 4.0 outlines estimated compliance rates with baseline regulation. Having established current compliance rates, Section 5.0 provides outputs from predictive modelling in the Upper Tamar catchment in South West England to estimate the extent of GES delivery from full compliance. Modelling has also been used in Section 6.0 to estimate those current regulatory measures (and potential future measures both regulatory and non regulatory) that have the greatest potential to reach GES. Section 7.0 presents Rural Payments Agency data on non-compliance records, which provides some insights into the current regime used in England to enforce the current regulatory baseline. To inform delivery of any future environmental baseline, an assessment of the Scottish model of General Binding Rules is provided in Section 8.0, including an investigation of the appropriateness of farming practices specified in the GBR, how they are enforced and what are the levels of farmer compliance. Finally, Section 9.0 offers a set of conclusions and recommendations emanating from the report findings.

The narrative within the report is supported by a number of charts and graphs. Readers are strongly recommended to refer to the Annex 1 – 7 which contain important information necessary to interpret the report findings.

This report and the analysis contained within has been produced by Alex Inman, an independent consultant working under contract to WWF-UK. Any questions relating to this document can be emailed to the author at alex.inman@btinternet.com.

3.0 Methodology

The methodology employed for this study involved a range of data collection and analysis techniques as outlined below.

3.1 Estimating compliance with regulations

Desk research revealed a paucity of data relating to physical and quantitatively robust on-farm measurement of compliance rates in England. This is most likely due to the cost implications associated with collecting such a dataset and practical issues surrounding gaining access to farm units. Given resources to undertake on-farm measurement was not available for this study, an expert opinion survey methodology was adopted. Expert elicitation techniques have been widely applied to collect behavioural data and are recognised as offering a robust alternative to physical measurement techniques.

In order to gain an objective overview of farmer compliance across a broad range of farming systems and regions, a sample of expert farm advisors was developed incorporating public, private and third-sector individuals with extensive on-farm experience and knowledge of farming systems. These individuals were hand picked to take part in the survey, based on their proven expertise and qualifications and each had recognised technical knowledge of nutrient, soil and agro-chemical management. This selection process ensured the quality of the respondent base recruited for the study.

Survey participants were asked to estimate the uptake of a range of individual soil and nutrient management measures which correspond to specifications contained within NVZ, Cross Compliance and SSAFO requirements. These uptake figures provide de facto estimates of compliance rates with the baseline regulation. The survey questions used for the study are provided in Annex 1.

In total, 45 respondents replied to the on-line survey, which was split into different sections to encourage response rates, in that any one respondent did not have to answer the entire questionnaire. Whilst data from the survey is not a physical quantitative measurement of compliance (i.e no farms were visited), results should be interpreted as providing informed estimates of compliance rates based on expert judgement. Results demonstrate strong parity with on-farm data collected by SEPA in Scotland and also with results from an NFU Survey from February 2011 which investigated compliance rates with NVZ regulations.

3.2 Predictive Modelling

All predictive modelling undertaken for the study was undertaken using the Extended Export Coefficient Model (ECM+) developed during the RELU research programme by Dr Tobias Krueger at University of East Anglia. This tool allows phosphorus, nitrogen, suspended solids and faecal coliform concentrations (and loads) from sub-catchments to be modelled as a function of domestic septic system management, sewage treatment work management, land use, livestock numbers and farming practices. The model can apportion and quantify the sources of pollution within a catchment e.g % P coming from Arable, % from livestock, % from sewage treatment etc. Every parameter (e.g. the export coefficients) is calibrated against the estimated observed loads at multiple locations including uncertainty. The parameter uncertainty is propagated through to the model outputs which are presented as probability distributions (histograms) achieved by Monte Carlo simulation. For further background information on the model, please see Annex 2.

Given phosphorus concentrations in surface waters is a key determinant of waterbody classification status under the WFD, it is possible to use ECM+ to assess how different farming and 'non-farming' activities can impact on waterbody classification status. In practical terms, the model can be used to build hypothetical scenarios capable of delivering GES within a given sub-catchment or group of subcatchments.

Very importantly for the purposes of this study, the model allows an assessment of the impact on GES from the relative uptake of 36 farm management practices, many of which correspond to the basic regulatory measures assessed within the expert survey outlined above. Different current uptake rates for each of the 36 management practices can be entered into the model, thereby allowing an appreciation of the likely impact that increased uptake rates (increased compliance rates) will have on phosphorus export and therefore the ability to reach GES.

The 36 management practices available for scenario building within the model are derived from '*An Inventory of Mitigation Methods and Guide to their Effects on Diffuse Water Pollution, Greenhouse Gas Emissions and Ammonia Emissions from Agriculture*' (Newell Price et al 2011). This inventory was prepared as part of Defra Project WQ0106 to assess the likely impacts of a range of mitigation methods to reduce diffuse water pollution, air pollution and greenhouse gas (GHGs) emissions.

In order to populate ECM+ with current baseline compliance figures, a mapping exercise was undertaken to link the regulatory measures assessed during the expert survey with the 36 measures contained within the model. This exercise enabled nearly all the regulatory measures assessed to be linked to one or more of the 36 measures within the model, therefore allowing compliance measures to be modelled. Please see Annex 3 for the outputs of the mapping exercise.

It should be noted that some of the 36 measures in the model are not regulatory issues so it was not possible to allocate uptake figures for these from the expert opinion survey. However, it was felt current uptake of these measures would still be useful to know, so that the impact on GES of these additional measures (some currently funded through agri-environment payments) could be assessed. To this end, uptake for these measures was derived from a farm management survey undertaken by the Defra Test Catchment (DTC) programme in three catchments: the grassland dominated Eden catchment; the arable dominated Wensum catchment and the Hampshire Avon catchment which is characterised by mixed farming systems. Further details of this survey can be found in Annex 4.

3.3 Assessment of current enforcement regime

An understanding of the level of enforcement action taken against baseline regulation was achieved by obtaining data from the Rural Payments Agency which responded to the data requests as a Freedom of Information (FOI) enquiry.

3.4 Assessment of the General Binding Rules (GBR) model in Scotland

An assessment of the efficacy of the GBR model was made through an examination of relevant background literature, a review of presentations made by Scottish Environmental Protection Agency (SEPA) staff and interviews with key informed individuals involved with the design and management of Scotland's diffuse pollution strategy.

4.0 Compliance Rates

This section of the report outlines estimated compliance rates with baseline requirements. The figures in the tables correspond to the percentage of farmers estimated to undertake each measure, derived from the expert survey. The narrative that follows each table converts percentages into a 1-10 scale to summarise the data in a user-friendly format.

Readers should note that the compliance rates below have been compiled for existing cross-compliance measures. Reforms to cross-compliance will result in changes from 2015, with details of these not currently available. However, it is anticipated the reforms will not involve fundamental changes to the existing system. For example, the current Soil Protection Review (see below) will be abolished, with farmers no longer required to fill out a physical booklet. However, they will still be required to identify soil erosion risk and take adequate precautions to prevent soil erosion from happening i.e very similar to the current process less the paperwork.

It is, therefore, possible to assume that current compliance rates demonstrated by farmers within the existing system will translate into to new cross-compliance regime post 2015.

4.1 GAEC 1 - Post Harvest Management

Farmers must meet one of the conditions in the table below from the first day after harvest until the last day of February in the following year for land that has carried a crop of oil-seeds, grain legumes or cereals (other than maize) harvested by a combine harvester or a mower

Table 1. Post Harvest Management Measures

Measure	%
Keep stubble of the harvested crop in the land	45
Leave land with a rough surface over winter	28
Create stale seedbeds over winter using cultivation sequences	28
Sow a temporary cover crop over winter	15
Sow a new crop within 10 days of a seedbed being prepared	62
Percentage of farmers adopting at least one of above measures	88

GAEC 1 is designed to reduce the risk of soil erosion and nutrient pollution by preventing mobilisation of soil run-off from cultivated land. The idea is that farmers do not leave finely cultivated soil exposed to rainfall over the winter months. Results indicate that **9 out of 10** farmers are complying with this rule by adopting at least one of the prescribed measures.

4.2 GAEC 1 – Management of Waterlogged Land

Farmers must record any activity on waterlogged land when carrying out mechanical field operations such as harvesting crops, or using motorised vehicles (some exemptions exist). They should then take action to remediate any problems and note these actions in their Soil Protection Review booklet

Table 2. Management of Waterlogged Land Measures

Measure	%
Take action to remediate any damage caused by accessing waterlogged land as soon as possible within a 12 month period	67

Waterlogged land has the potential to lead to soil damage and run-off, largely due to the destruction of soil structure from compaction by machinery and/or livestock. Ruts from wheelings can also provide a channel for run-off. **7 out of 10** farmers appear to be taking actions to repair damage from accessing waterlogged land which will mainly involve some form of cultivation to brake up compaction and restore soil structure.

4.3 GAEC 9 – Managing Overgrazing/Supplementary Feeding

Farmers must meet both conditions in the table below when undertaking farming activities on natural or semi-natural habitat

Table 3. Overgrazing/Supplementary Feeding Management Measures

Measure	%
Do not allow overgrazing on natural and semi-natural vegetation	68
Do not carry out unsuitable supplementary feeding on natural and semi-natural vegetation	68

GAEC 9 is designed to protect natural/semi-natural grassland from being denuded of vegetation which can be caused from poaching by livestock, particularly during the winter months. Severe soil and nutrient run-off can occur where animal density is too high. Provision of supplementary feed during the winter months (e.g use of static ring feeders) can concentrate livestock on one area, causing a significant risk of vegetation damage and associated run-off problems.

Results indicate that **7 out of 10** farmers are complying with this rule by taking appropriate management actions to reduce damage.

4.4 GAEC 14 – Protection of hedgerows and watercourses

Farmers must meet all the conditions in the table below to protect hedgerows and watercourses on their landholdings

Table 4. Hedgerow and Watercourse Management Measures

Measure	%
Do not cultivate or apply fertilisers or pesticides to land within 2 meters of centre of a hedgerow, watercourse or field ditch	76
Do not cultivate or apply fertilisers or pesticides to land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	77
Maintain a green cover on land within 2 metres of the centre of a hedgerow, watercourse or field ditch	79
Maintain a green cover on land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	89

GAEC 14 makes provision for basic measures to protect watercourses and hedgerows from pollution, by preventing cultivation and application of agrochemicals to land immediately adjacent to these features. Approximately **8 out of 10** farmers are currently complying with this requirement.

4.5 GAEC 19 – No Spread Zones

Farmers must meet all the conditions in the table below to protect hedgerows and watercourses on their landholdings

Table 5. No Spread Zone Management Measures

Measure	%
Do not apply manufactured nitrogen (inorganic) fertiliser within 2 metres of surface water	81
Do not apply organic manure within 10 meters of surface water (6 metres if applying using precision equipment)	63
Do not apply organic manure within 50 metres of a spring, well or borehole	76

GAEC 19 was recently introduced to cross compliance in an attempt to provide extra protection to surface and ground waters. As can be seen in the above table, survey results indicate that **8 out of 10** farmers are complying with the 2m surface water no spread zone for inorganic fertiliser and the 50m no spread zone for springs, wells and boreholes. However, a lesser number of farmers – **6 out of 10** – appear to be complying with the 10(6) m surface water no spread zone for organic manure.

4.6 SMR3 – Application of Sewage Sludge

All farmers using sewage sludge on their land must meet all the conditions in the table below

Table 6. Sewage Sludge Management Measures

Measure	%
Take into account nutrient needs of plants when applying sewage sludge	63
Only use sewage sludge which has been analysed	68
Only use sewage sludge on soils that have been analysed	69
Not use sewage sludge on land where the limits for specified elements are exceeded	68
Not use sewage sludge on soil which has a pH value of less than 5	68

With sewage sludge no longer permitted to be disposed at sea, land application remains the only viable alternative. Sewage sludge can be very high in nutrient content and if applied inappropriately can be a source of pollution. It appears **7 out of 10** farmers are complying with most of the mandatory specifications regarding the use of sewage sludge, falling to **6 out of 10** for the requirement to take into account nutrient needs of plants when applying sewage sludge. Given the high degree of paper work and associated audit trail associated with the use of sewage sludge, it is surprising that approximately a third of farmers do not appear to be fully compliant with the legislation.

4.7 SMR4 and SAFFO– Management of nitrogen and controlling the risk of pollution from silage, slurry and agricultural fuel oil storage.

The aim of SMR4 (NVZ rules) is to reduce the pollution of waters caused by nitrates from agricultural sources and to prevent such pollution occurring in the future. The rules include a requirement for farmers to maintain extensive paperwork on the usage and application of fertiliser. The measures listed below refer to the tangible actions and infrastructure specifications farmers are required to adhere to.

The aim SAFFO (Silage and Agricultural Fuel Oil Regulations) is to reduce the risk of pollution from silage, slurry and agricultural fuel oil storage. Farmers must adhere to rules regarding both in-field and farm yard activity and infrastructure (mainly when making changes to their systems)

Table 7. Nitrogen/Silage/Slurry/Fuel Oil Measures

Measure	%
The average nitrogen application rate of the farm (inorganic and organic fertiliser) does not exceed the maximum nitrogen limit for each crop type	79
The rate of application of organic manure (excluding manure deposited by grazing animals) in any 12 month period to any individual field is limited to 250kg of total nitrogen per hectare (in any 2 year period 500kg of total nitrogen)	79
The rate of livestock manure applied (including manure deposited by grazing animals and any imported livestock manures) is limited to 170kg of total nitrogen per hectare in each calendar year averaged over the area of the holding	72
Slurry is only spread with low trajectory equipment (less than 4m from the ground) or other precision techniques such as band spreading or injection	71
Organic manure, slurries and sewage sludge is incorporated within 24 hours if it is spread to bare soil or stubble	57
Sufficient storage is available to house all pig and poultry manure produced between 1 October to 1 April (6 months) and all manure/slurry from all other livestock between 1 October to 1 March (5 months) ²	58
Poultry manure and other types of solid manure is stored either in a vessel, on an impermeable surface, in a roofed building or in temporary field heaps as long as they are solid enough to be stacked in a freestanding heap	63
Organic manures with a high readily available nitrogen content (e.g slurry, poultry manure) are not applied to land during the following periods: 1st September to 31st December for grassland with sandy or shallow soils; 15 October to 31 January for grassland on all other soils; 1st August to 31 December for tillage land with sandy or shallow soils (or between 1 August and 15 September if a crop is sown on or before 15 September); 1st October to 31 January for tillage land on all other soils	69
Manufactured nitrogen (inorganic) fertilisers are not applied to any soil type during the following periods - 15 September to 15 January for grassland; 1 September to 15 January for tillage land	77
No more than 30 cubic metres per hectare of slurry or 8 tonnes per hectare of poultry manure are applied to land at any one time, from the end of the above periods until the last day in February. 3 weeks are allowed between each individual application	73
Nitrogen fertiliser is not applied when the soil is waterlogged, flooded, has been frozen for 12 hours or more in the last 24 hours or is snow covered	79
Temporary field heaps are not situated in locations likely to pose a run off risk	62
New slurry and manure storage installations meet requirements for capacity, durability, maintenance and safety zones and are built in accordance with the relevant construction standards, and field silage site rules are met	73

² This result is very similar to findings from an NFU 2011 survey of NVZ compliance which found 45% of farmers surveyed did not have enough slurry storage to comply with the 5 month storage requirement

As outlined in the above table, survey results indicate compliance rates with the individual regulations vary from **6 out of 10** to **8 out of 10** farmers. Lowest compliance rates (**6 out of 10** farmers) relate to the appropriate storage of slurries and manures (farm yard and in-field) and the timely incorporation of slurries and manures when spread to land at high risk of run-off.

It should be noted that survey respondents were asked to base their responses on the management practices of all farmers they deal with, irrespective of whether those farmers operate within NVZs or not. However, 80% of respondents noted they were basing their responses on farmers working within NVZs. It is therefore likely that the uptake figures cited above are at the upper bounds of uptake across the farming community as a whole.

4.8 GAEC1 - Soil Protection Review (SPR)

A key element within the current Cross Compliance regime is the Soil Protection Review (SPR) within which farmers must identify soil run-off risks and adopt a range of measures to mitigate these risks at a field scale. Depending on the soils and types of crops grown, farmers must adopt between one to three measures from 'Table C' in the SPR booklet. These measures have been shown to reduce soil erosion risk and are widely cited in the academic and practitioner soil management literature.

It has been possible from the expert opinion survey to collate indications of the proportion of farmers adopting each type of measure from Table C in the SPR. This information has enabled an assessment of whether current uptake of SPR measures has the potential to deliver WFD GES targets or whether greater uptake is required. This analysis forms part of a broader assessment of the contribution of the current regulatory regime to WFD delivery which is outlined in Section 5.0.

Uptake of measures included within Table C of the Soil Protection Review is outlined below in Tables 8 to 12.

The FOI request made to the RPA included a request to obtain data on the range and number of measures adopted against each identified risk level. However, the RPA was unable to provide this data due to the fact that inspection officers do not capture this information when undertaking inspections. It is, therefore, not currently possible to definitively assess how many farmers are implementing sufficient numbers of measures to *technically* comply with the SPR requirements.

Table 8. Soil Protection Review – Table C measures for land under cereals, combinable crops and grass seed

Measure	%
Maintain land drainage on heavy and medium soils	55
Where organic matter is low, apply bulky organic manures, compost or digestates	52
Where organic matter is low, introduce grass leys into the rotation	35
Where organic matter is low, introduce cover crops into the rotation	19
Drill autumn-sown cereals early to ensure a good cover	51
For winter cereals in particular, avoid a very fine, smooth seedbed	48
Sow crops and establish tramlines across the slope	40
Use Minimum tillage and direct drilling techniques	39
Where shallow cultivation is carried out, care is taken to prevent soil compaction near the soil surface	40
Before establishing a following crop, remove compaction by loosening the topsoil or subsoiling where necessary, particularly along old tramlines and on headlands	50

Table 9. Soil Protection Review – Table C measures for land under potatoes, sugar beet, salad crops, vegetables and bulbs

Measure	%
Maintain land drainage on heavy and medium soils	54
Avoid planting on slopes in a way that channels runoff and erosion and/or divide long slopes into smaller units by planting some ridges (beetlebanks) and grass strips across the slope	45
On light soils leave the seedbed as coarse as possible	47
On intensively cropped soils where organic matter is low, apply bulky organic manures, composts or digestates	40
On intensively cropped soils where organic matter is low, introduce grass leys into the rotation	30
On intensively cropped soils where organic matter is low, introduce green manures into the rotation	27
Cultivate headlands and gateways to remove compaction following planting	25
Cultivate and plant across the slope where safe to do so	35
Use tied ridges and dykes in furrow bottoms to improve infiltration and improve runoff	21
Use nurse crops or planted straw to prevent windblow on sandy and peaty soils	27
On fields that are vulnerable to compaction, runoff and soil erosion, choose early maturing varieties to allow an early harvest	36
Site plastic mulch carefully so as to avoid direct runoff into watercourses and roads	30
To prevent capping/sealing of the soil and runoff, ensure irrigation is uniform, rates are not too high and droplet sizes too big	43
Cultivate the soil as soon as conditions are suitable after harvest, to remove wheelings and compaction	48
Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow	47
Rough plough sandy and silty soils following harvest to produce a cloddy coarse surface	45

Table 10. Soil Protection Review – Table C measures for land under maize and forage crops

Measure	%
Maintain land drainage on heavy and medium soils	50
On fields that are vulnerable to compaction, runoff and soil erosion, choose early maturing varieties to allow an early harvest	44
Undersow maize	13
Manage the grazing of forage crops and crop residues to minimise poaching and runoff	37
Cultivate as soon as conditions are suitable after harvest or grazing to remove wheelings and compaction	46
Rough plough sandy and silty soils following harvest to produce a cloddy coarse surface	34
Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow	46
Sow with a temporary cover crop throughout winter	12

Table 11. Soil Protection Review – Table C measures for land under improved grassland

Measure	%
Maintain land drainage systems to reduce the risk of damaging soil structure under wet conditions (for example when cutting silage)	42
Use well drained tracks for vehicles and livestock	31
Minimise damage to riverbanks by providing managed access for livestock	37
Remove sward compaction through subsoiling with a grass subsoiler, tines or spikes	29
Regularly move ring feeders or place feeders and troughs onto a stone base	35
When re-seeding grass, sow early enough to achieve a good cover before winter. Aim to create a coarse seedbed that is less likely to form a cap that will lead to runoff	44
Remove grazing livestock from the grassland when the soil is too wet and poaching occurs	50
If it is necessary to out winter stock, locate any sacrificial fields on freely drained soils and not on fields that will lead to erosion. Cultivate and reseed in the spring to remove any compaction	37

Table 12. Soil Protection Review – Table C measures for land under semi-natural grassland and vegetation

Measure	%
Adjust stocking rates to ensure that overgrazing does not result in loss of vegetation cover	53
Shepherd the stock to prevent overgrazing in localised areas	43
Install and maintain tracks to minimise runoff	35
Minimise the need for vehicle use and use low ground pressure machinery when conditions require, keeping to established tracks and paths as far as possible	37
Undertake all supplementary feeding on ground away from sensitive vegetation and move the feeding sites as necessary to avoid breaking the soil cover, keep supplementary feeding away from watercourses	39
Avoid burning on blanket bog and deep peat where erosion can be serious	48
Avoid leaving bare soil during bracken management on sites with a risk of erosion	40
Minimise damage to riverbanks by providing managed access to water for livestock	35

5.0 Predictive Modelling

As outlined in the methodology section, predictive modelling has been used to present an indication of whether full compliance with the baseline regulations can achieve GES under the Water Framework Directive. As pointed out in Section 4.0, whilst cross-compliance regulations will be amended from 2015, there will be few if any fundamental changes to the level of environmental management practices farmers will have to implement. As such, the following analysis is considered applicable to the post 2015 situation.

The simulation depicting the outcome from 100% baseline compliance has been achieved by selecting universal uptake of a range of measures within the ECM+ model which most closely represent the key measures required by the regulation. The full profile of measures selected is presented in Annex 5.

For the purposes of the study, the Upper Tamar catchment was selected as a test case to run the predictions. This is because the Tamar catchment provides a typical example of a catchment impacted by diffuse pollution from agriculture and currently failing to reach GES across several water bodies³. From a practical standpoint, the ECM+ model was originally largely developed in the Upper Tamar which made model recalibration and set up feasible within the timeframe and resources available for the project.

Results of the before and after simulations are presented below in Chart Cluster 1 and 2. The starting point (Chart Cluster 1) assumes phosphorus stripping has been implemented at the main sewage treatment works within the catchment, in line with a balanced response to improving water quality which necessitates a response from both the water treatment industry and the agricultural sector.

The charts outline concentration levels for phosphorus, nitrogen, suspended solids (sediment) and faecal coliform concentrations at the outflow of the catchment. As explained in the methodology section, WFD classification status can only be derived from phosphorus concentrations at the current time, with the phosphorus concentration chart highlighted in the chart clusters below accordingly. The colours used in the chart depict the various WFD classification bands from red ('bad' status) through the blue ('high' status). Green is 'good' status (GES)⁴.

³ Readers should note however that the Tamar is characterised by predominantly livestock and mixed farming and is therefore not typical of 'arable only' catchments

⁴ The scale in the charts is based on existing phosphorus standards in rivers (Upland, low alkalinity) where 'good status' is defined as 40 µg per litre (annual mean reactive phosphorus). New and updated environmental standards have been proposed for use in the second cycle of Water Framework Directive, with these standards due to become law by September 2015. This will tighten the standard to 28 µg per litre.

Chart Cluster 1 - WFD status with current uptake of baseline measures

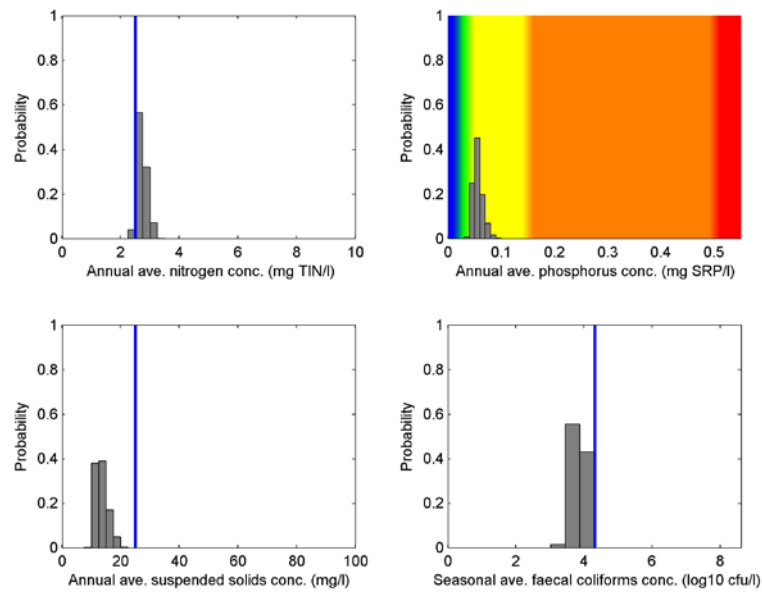
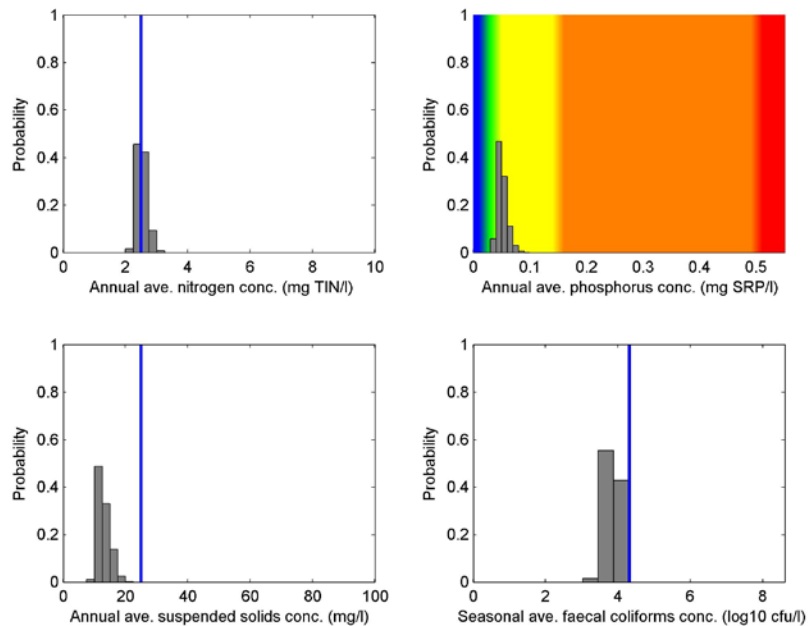
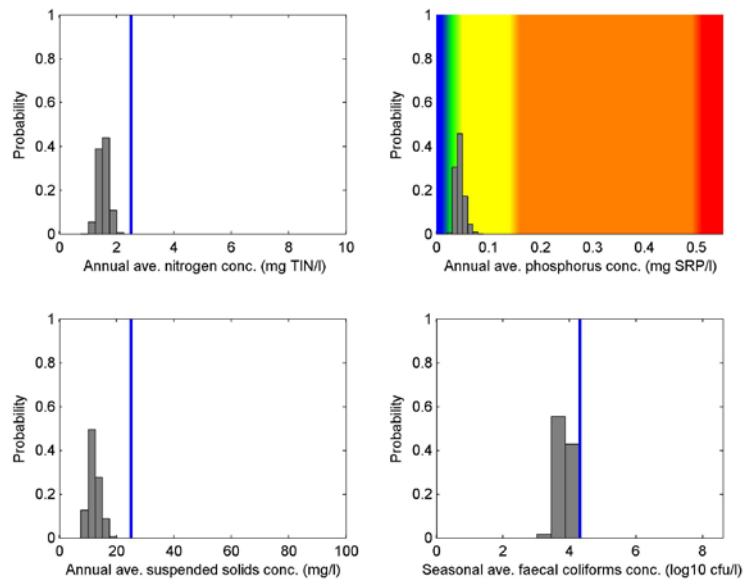


Chart Cluster 2 – Predicted WFD Status with 100% uptake of baseline measures



As can be seen in the charts above, the starting point (Chart Cluster 1) with existing measure uptake (compliance) predicts a likely WFD fail with a very small chance of achieving GES. With the 100% baseline uptake scenario (Chart Cluster 2), the situation is still a likely fail, albeit the probability of getting to good status has improved (demonstrated by the changed balance of the grey bars in the distribution profile).

To explore the likely impact of increased uptake of additional measures (going beyond current baseline requirements), a further simulation was run with 100% uptake of all 36 measures available for scenario building within the ECM+ model. The results of this simulation are outlined in Chart Cluster 3.

Chart Cluster 3 – Predicted WFD Status with 100% uptake of all 36 measures available within the ECM+ model

It is interesting to note that whilst the probability of reaching GES has significantly improved, model predictions suggest that, even with all 36 measures fully implemented, it is very possible that GES will still not be obtained. This is an extremely important finding from a policy perspective as it strongly suggests that achieving GES targets will not be possible by changing land management practices alone (either by enforcing current regulations, introducing new management requirements, or financially incentivising farmers to adopt given practices). Fundamental land use change may be required by farmers in specific locations, together with other more drastic options such as a reduction in livestock numbers. In addition, actions will be required by both the water industry (management of sewage) and householders (management of septic tanks and usage of phosphorus bearing products e.g. detergents, personal care products).

6.0 Measures with greatest potential to reach GES

In keeping with the objectives of the project, an analysis of agricultural measures was undertaken to obtain an indication of which measures (regulatory and non regulatory) offer the greatest potential to deliver diffuse pollution mitigation outcomes. This task was undertaken through a question set administered within the expert opinion survey, complemented by subsequent modelling using the ECM+ toolkit.

Respondents to the expert opinion survey were asked to state via an open-ended question which measures they felt had most importance to the water quality protection agenda. The 10 most often mentioned measures are listed in Table 13 below.

Table 13. Top 10 measures as cited by expert farm advisors (in priority order)

		Covered by regulation (Y/N)
1.	Manage soil exposure during winter months through early establishment of winter crops/leave rough surface/plant cover crops	Y
2.	Adoption of nutrient planning and precision farming	Y (NVZ only)
3.	Take steps to address and repair soil compaction	Y
4.	Introduce riparian buffer strips	N
5.	Install 5+ months slurry/manure storage facility	Y (NVZ only)
6.	Fence out livestock from water courses	N
7.	Do not grow high risk crops on sloping ground	Y
8.	Separate clean and dirty water	N
9.	Optimum maize management (early varieties, no maize stubble over winter)	Y
10.	Increase Soil Organic Matter	N

Using this list as an initial framework, relevant measures within ECM+ were individually modelled at 100% uptake to evaluate the likely impact of each measure on both phosphorous and sediment load reductions. Whilst there is no WFD target for sediment per se, a decision was taken to model this variable, given the importance respondents placed on soil pollution within their responses.

Results from this exercise are presented in Tables 14 and 15 below. The figures in the tables represent mean predicted load reductions for each measure, derived from probability distributions of potential outcomes. Histograms outlining the potential load reduction distributions are presented in Annex 6.

Table 14. Impacts of key measures on Soluble Reactive Phosphorus load reduction (tonnes yr-1 within the Upper Tamar Catchment Area)

Measures in descending order of load reduction	
Establish Riparian buffer strips (14)	0.679
Increase the capacity of farm manure storage (52)	0.649
Loosen compacted soil layers in grassland fields (15)	0.591
Move feeders at regular intervals (38)	0.348
Install covers on slurry stores (54)	0.309
Fence off rivers and streams from livestock (76)	0.289
Reduce field stocking rates when soils are wet (37)	0.260
Do not apply P fertiliser to high P index soils (32)	0.225
Minimise volume of dirty water and slurry produced (57)	0.129
Cultivate compacted tillage soils (8)	0.074
Do not apply manure to high risk areas (68)	0.050
Use a fertiliser recommendation system (22)	0.049
Do not apply fertiliser to high-risk areas (25)	0.045
Establish cover crops in Autumn (4)	0.027
Early harvesting and establishment of crops in Autumn (5)	0.021
Leave Autumn seedbed rough (10)	0.016

Table 15. Impacts of key measures on sediment load reduction (tonnes yr-1 within the Upper Tamar Catchment Area)

Measures in descending order of load reduction	
Loosen compacted soil layers in grassland fields (15)	194.682
Fence off rivers and streams from livestock (76)	124.102
Establish Riparian buffer strips (14)	119.816
Cultivate compacted tillage soils (8)	43.913
Move feeders at regular intervals (38)	14.452
Establish cover crops in Autumn (4)	12.551
Early harvesting and establishment of crops in Autumn (5)	10.096
Reduce field stocking rates when soils are wet (37)	7.053
Leave Autumn seedbed rough (10)	7.010
Use a fertiliser recommendation system (22)	n/a
Do not apply P fertiliser to high P index soils (32)	n/a
Increase the capacity of farm manure storage (52)	n/a
Install covers on slurry stores (54)	n/a
Do not apply manure to high risk areas (68)	n/a

As would be expected, some measures are more relevant to reducing phosphorus loads than sediment and visa versa. However, there are some measures that appear to be key to managing loads of both pollutants; the most noticeable being (1) the establishment of buffer strips (2) the loosening of compacted grassland fields and (3) the fencing of livestock out of watercourses.

In essence, the measures in the top half of each of the above tables provide guidance on which measures policy makers might wish to focus on when developing any future action plan to tackle diffuse pollution from agriculture.

7.0 Enforcement of Regulations

The baseline regulations outlined in Section 4.0 are enforced by a combination of the Rural Payments Agency and The Environment Agency. The Environment Agency has responsibility for statutory items – SMR 3 Management of Sewage Sludge, SMR 4 Use and Storage of fertiliser and manure in NVZs and SAFFO– although in practice, compliance with these regulations is largely checked by the RPA under the cross compliance inspection process which also checks compliance with the other regulations listed.

Under EU regulations, 1% of farms claiming the Single Farm Payment (i.e most farms in the UK) receive an RPA cross-compliance inspection each year. Selection of farms for inspection is undertaken using both a random and risk-based methodology. The number of inspections per year for the period 2010 – 2013 is outlined in Table 16:

Table 16. Cross-Compliance Inspections 2010 - 2013

Year	2010	2011	2012	2013
Inspections	1071	1072	1066	2900

For the purposes of this project, an Information Request was made to obtain data on the number and type of regulation breaches registered by the RPA. Data provided by the RPA is reproduced in Annex 7. Having reviewed this information, two key observations can be made which have relevance to the project objectives.

Firstly, it appears that the percentage of farmers registered by the RPA as failing to undertake appropriate management practices does not correlate with the estimates of farmer (non)compliance provided by respondents to the expert survey undertaken for this survey. By way of an example, comparisons for GAEC 1, 14 and 19 are outlined in Table 17 below:

Table 17. Comparison of non-compliance rates derived from survey and RPA data

Regulation	Approximations of non-compliance (estimates from expert survey)	Registered non-compliance (RPA inspection data 2013)
GAEC 1 – Management of waterlogged land	30%	<1%
GAEC 14 – Do not cultivate or apply fertilisers or pesticides to land within 2 meters of centre of a hedgerow, watercourse or field ditch	20%	2%
GAEC 14 – Do not cultivate or apply fertilisers or pesticides to land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	20%	1%
GAEC 14 – Maintain a green cover on land within 2 metres of the centre of a hedgerow, watercourse or field ditch	20%	1%

GAEC 14 – Maintain a green cover on land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	10%	1%
GAEC 19 – Do not apply manufactured nitrogen (inorganic) fertiliser within 2 metres of surface water	20%	0%
GAEC 19 – Do not apply organic manure within 10 meters of surface water (6 metres if applying using precision equipment)	40%	<1%
GAEC 19 – Do not apply organic manure within 50 metres of a spring, well or borehole	20%	0%

The above data would tend to corroborate extensive anecdotal evidence that the RPA inspection process currently fails to identify the full extent of breaches with the regulations and that the process is largely a 'desk based' exercise rather than a physical and objective assessment of land management practice⁵. This observation is strongly supported by evidence from walkover surveys undertaken by SEPA in Scotland where 5000 non-compliances with General Binding Rules (very similar to cross-compliance measures – see Section 8.0) were found on farmland during a survey of 5000 km of water courses (1 non-compliance per km). 75% of the issues related to livestock poaching and 22% concerned cultivation too close to watercourses⁶.

A second observation made from the supplied RPA data is that by far the majority of non-compliances registered by the RPA relate to farmers failing to provide sufficient and/or accurate paperwork, rather than tangible failures to carry out appropriate on-farm management practices. To illustrate this point, the percentage of paperwork failures for SMR 4, GAEC 1 and GAEC 19 as a percentage of all failures registered for these measures by the RPA in 2013 are outlined in Table 18.

Table 18. Percentage of paper based non-compliances

Regulation	Total number of non-compliances	Non compliances associated with paperwork	Paperwork non-compliances as percentage of all non-compliances
SMR4 – Management of fertiliser in NVZs	621	565	91%
GAEC 1 – Soil Protection Review	585	573	98%
GAEC 19 – No Spread Zones	99	92	93%

⁵ See Component B of the report

<http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectD=17412&FromSearch=Y&Publisher=1&SearchText=RiversTrust&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

⁶ Source: The Rural Diffuse Pollution Plan for Scotland. Presentation by Jannette MacDonald and Stephen Field, Land Unit, Scottish Environment Protection Agency (SEPA)
http://www.sepa.org.uk/water/river_basin_planning/diffuse_pollution_mag.aspx

The emphasis on paperwork based non-compliances rather than 'actual' non-compliances suggest the current inspection process may be failing to deliver the changes in management practice the cross-compliance legislation is designed to deliver. The volume of paperwork involved must also be a significant burden to the farming community and calls into question whether their time might be better spent on other activities. Ministers have made a decision to remove the paperwork associated with the Soil Protection Review GAEC 1 which represents a positive move forward if the new rules demonstrate impact. A system based on no paperwork has been adopted in Scotland under the General Binding Rules (GBR) system which forms the subject of Section 8.0 of this report.

8.0 Assessment of General Binding Rules Model in Scotland

8.1 Background to Diffuse Pollution regulation in Scotland

The framework for regulating pollution in Scotland is provided under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) and the Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2013. The framework is designed to provide a tiered system of regulation based on the relative risk an activity poses to the environment. Three levels of regulation exist within CAR: (1) General Binding Rules (GBRs); (2) Registrations; and (3) Licenses.

- General Binding Rules (GBRs) - are a set of mandatory rules which cover specific low risk activities. A business does not have to apply for permission to undertake these activities provided it complies with a set of regulations regarding how these activities are carried out. There is no paperwork involved for the business community
- Registrations - activities that individually pose low environmental risk but, cumulatively, can result in greater environmental risk must be registered with SEPA. Details of the location and scale of the activity must be submitted and the operator will usually have to comply with a set of conditions associated with carrying out the activity
- Licenses - these involve site-specific conditions to be set for higher risk activities with the applicant required to nominate a 'responsible person' to be responsible for compliance with the terms of the licence

8.2 Regulating Diffuse Pollution from Agriculture

The main instrument deployed in Scotland to regulate diffuse pollution from agriculture is a package of Diffuse Pollution General Binding Rules (DP GBRs). A key feature of the DP GBRs is that they represent a statutory baseline of environmental husbandry which all farmers and rural land managers must abide by. No such statutory measures exist elsewhere in the UK. Importantly, GBRs are in line with the polluter pays principle. If farmers choose to adopt measures that go beyond GBR requirements, they have the opportunity to derive payments for these undertakings ('provider gets').

There are five key DP GBRs focussing on rural land use activities (nb there are several other GBRs which are relevant to non-agricultural activities):

- DP GBR 18: Storage and application of fertilisers
- DP GBR 19: Keeping of livestock
- DP GBR 20: Cultivation of land
- DP GBR 23: Application of pesticide
- DP GBR 24: Operation of sheep dipping facilities

Details of each DP GBR are provided below, reproduced from SEPA's *The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) - A Practical Guide*.

GBR 18 - The storage and application of fertiliser

- a) Fertiliser must not be stored on land that: is within 10m of any river, burn, ditch, wetland, loch, transitional water or coastal water; is within 50m of any spring that supplies water for human consumption, or any well or borehole that is not capped to prevent the ingress of water; is waterlogged; has an average soil depth of less than 40cm and overlies gravel or fissured rock, except where the fertiliser is stored in an impermeable container; or is sloping, unless the fertiliser is inorganic or it is ensured that any run-off of fertiliser is intercepted (by means of a sufficient sized buffer or otherwise) to prevent it entering any river, burn, ditch, wetland, loch, transitional water or coastal water towards which the land slopes.
- b) Rule (a) does not apply where the fertiliser is being stored in a building that is constructed and maintained to a standard that prevents run-off or seepage of fertiliser from the building.
- c) Organic fertiliser must not be applied to land that: is within 10m of any river, burn, ditch, wetland, loch, transitional water or coastal water; is within 50m of any spring that supplies water for human consumption or any well or borehole that is not capped to prevent water ingress; has an average soil depth of less than 40cm and overlies gravel or fissured rock, except where the application is for forestry operations; is frozen (except where the fertiliser is farmyard manure) waterlogged, or covered with snow; or is sloping, unless it is ensured that any run-off of fertiliser is intercepted (by means of a sufficient buffer zone or otherwise) to prevent it from entering any river, burn, ditch, wetland, loch, transitional water or coastal water towards which the land slopes.
- d) Inorganic fertiliser must not be applied to land that: is within 2m of any river, burn, ditch, wetland, loch, transitional water or coastal water; is within 5m of any spring that supplies water for human consumption or any well or borehole that is not capped to prevent water ingress; has an average soil depth of less than 40cm and overlies gravel or fissured rock, except where the application is for forestry operations; is frozen, waterlogged, or covered with snow; or is sloping, unless it is ensured that any run-off of fertiliser is intercepted (by means of a sufficient buffer zone or otherwise) to prevent it from entering any river, burn, ditch, wetland, loch, transitional water or coastal water towards which the land slopes.
- e) Fertilisers must not be applied to land in excess of the nutrient needs of the crop.
- f) Any equipment used to apply fertiliser must be maintained in a good state of repair.
- g) Fertiliser must be applied on land in such a way and at such times that the risk of pollution to any river, burn, ditch, wetland, loch, transitional water or coastal water is minimised

GBR 19 - Keeping of livestock.

- a) Significant erosion or poaching of any land that is within 5m of any river, burn, ditch, wetland, loch, transitional water or coastal water must be prevented
- b) Livestock must be prevented from entering any land that is within 5m of a spring that supplies water for human consumption or any well or borehole that is not capped to prevent water ingress
- c) Livestock feeders must not be positioned where run-off from around the feeders could enter any river, burn, ditch, wetland, loch, transitional water or coastal water, and in any case, positioned no closer than 10m from any river, burn, ditch, wetland, loch, transitional water or coastal water

GBR 20 - Cultivation of land

- a) Land must not be cultivated for crops if it is: within 2m of any river, burn, ditch, wetland or loch, as measured from the top of the bank, or within 2m of any transitional water or coastal water as measured from the shoreline; within 5m of any spring that supplies water for human consumption or any well or borehole that is not capped to prevent water ingress; or waterlogged.
- b) Land sloping to any river, burn, ditch, wetland, loch, transitional water or coastal water with an overall gradient in excess of 4.5° must not be moled.
- c) Land must be cultivated in a way that minimises the risk of pollution to any river, burn, ditch, wetland, loch, transitional water or coastal water.

GBR 23 - The storage and application of pesticide

- a) The preparation of pesticide for application and the cleaning or maintenance of pesticide sprayers must not be undertaken within 10m of any river, burn, ditch, wetland, loch, transitional water or coastal water, and done in a manner that prevents any spillages, run-off or washings from entering any river, burn, ditch, wetland, loch, transitional water or coastal water.
- b) Pesticide spraying equipment must be maintained in a good state of repair such that there is no leakage and the sprayer is accurately calibrated to deliver the required application rate.
- c) Pesticide sprayers must not be filled with water taken from any river, burn, ditch, wetland or loch unless: a device preventing back siphoning is fitted to the system; or the water is first placed in an intermediate container.
- d) Pesticide-treated plants must not be stored or soaked in any river, burn, ditch, wetland, or loch.
- e) Pesticide must be applied in accordance with the terms and instructions of the relevant product approval.
- f) Pesticide must not be applied in, onto or over ground or allowed to drift onto or over ground that: is frozen, snow covered or waterlogged, except where the application in, onto or over waterlogged ground is necessary for the purpose of controlling fungal disease and all precautions are taken to minimise the risk of pesticide entering any river, burn, ditch, wetland, loch, transitional water or coastal water; is within 1m of any river, burn, ditch, wetland or loch, as

measured from the top of the bank, or within 1m of any transitional water or coastal water as measured from the shoreline; is sloping, unless it is ensured that any run-off of pesticide is intercepted (by means of a sufficient buffer zone or otherwise) to prevent it from entering any river, burn, ditch, wetland, loch, transitional water or coastal water towards which the land slopes; is within 50m of any spring that supplies water for human consumption or any well or borehole that is not capped to prevent ingress of the pesticide; has an impermeable surface which drains directly to a surface water drainage system, unless measures are taken to minimise the risk of pesticides entering the drainage system; or along roads, railway lines, permeable surfaces or other infrastructure, unless measures are taken to minimise the risk of pollution of any river, burn, ditch, wetland, loch, transitional water, coastal water or surface water drainage system

- g) Application of pesticide must be carried out in such a way that the risk of pollution of any river, burn, ditch, wetland, loch, transitional water or coastal water is minimised, in particular, pesticide must not be applied during rainfall during conditions when there is a risk that spray will drift or be blown outwith the target area.
- h) Pesticide, including packaging, must not be stored: within 10m of any river, burn, ditch, wetland, loch, transitional water or coastal water; within 50m of any spring that supplies water for human consumption or any well or borehole that is not capped to prevent ingress of the pesticide; on an impermeable surface draining to a surface water drainage system. Rule h) does not apply when pesticide leakage and spillage cannot reach any river, burn, ditch, wetland, loch, transitional water, coastal water or a surface water drainage system.

GBR 24 - Operating sheep dip facilities.

- a) Sheep must be prevented from having access to any river, burn, ditch, wetland, loch, transitional water or coastal water while there is a risk of transfer of sheep dip fluid from its fleece.
- b) Mobile sheep dipping facilities, or any part of a sheep dipping facility constructed after 1 April 2008, must not be located within 50m of any river, burn, ditch, wetland, loch, transitional water, coastal water, well, spring or borehole.
- c) Sheep dipping facilities must not discharge underground, leak or overspill.
- d) Sheep dipping facilities must not be filled with water taken from the water environment unless: a device preventing back siphoning is fitted to the system; or the water is first placed in an intermediate container.
- e) Sheep dip facilities shall be emptied within 24 hours following completion of dipping. (Please be aware that disposal of any sheep dip requires appropriate authorisation under CAR).

8.3 Enforcement of the General Binding Rules

Enforcement of the GBR is undertaken on two levels. At a national level, 1% of farms receive site inspections by SEARS⁷ Partners to check on cross-compliance adherence in line with EU CAP requirements. As part of these cross-compliance inspections, SEARS Partners have been trained by SEPA to 'bolt on' an assessment of GBR compliance, thereby undertaking cross-compliance and GBR compliance simultaneously. Where failure to adhere to the GBR is encountered, this information is passed on by SEARS Partners to SEPA. Approximately 2000 inspections are carried out under this national programme each year.

Not to discount the national level enforcement outlined above, the main thrust of GBR enforcement in Scotland is undertaken at a priority catchment level, with farmer contact made exclusively by SEPA. There are currently 14 priority catchments⁸ in Scotland which have been identified as generating significant pollution problems. Within each of these priority catchments, specific target areas have been selected by SEPA who has been visiting every farm within these target areas since 2010 to undertake a full audit of GBR and also to identify pollution risks on a farm-by-farm basis. Over 4000 farm visits have been undertaken in priority catchments by SEPA so far. Where breaches of GBR and/or significant pollution risks are identified, farmers are given time (usually 1 year) to address these breaches and risks before a second repeat visit is arranged by SEPA to check on progress.

Breaches in GBR have been widespread. For example, in the Urgie catchment, of the 420 farms visited 43% have had issues to resolve. In terms of the profile of in-field issues identified in the catchment, 80% relate to poaching by livestock, 20% cultivation too close to watercourses and 40% inappropriate spreading of manures and slurries. Farm yard problems identified mainly relate to poor clean/dirty water separation, oil storage, pesticide handling areas and slurry storage.

Secondary visits are currently underway. A key point to note is that 85% of farmers have taken action to address failings identified during their initial visit from SEPA. This is a fundamental statistic which would strongly suggest the farm visit process adopted by SEPA is working.

Where action has not been taken by the farmers at the second visit, it is SEPA's plan to undertake a third and final visit to check on progress. These final visits have not yet begun. Where no action is apparent, SEPA intends to levy a Fixed Penalty System due to be introduced in 2016. Penalties will involve standardised financial penalties issued and administered by SEPA rather than legal prosecutions and will therefore involve far less costs (transaction costs) than bringing farmers to court.

⁷ Scotland's Environment and Rural Services (SEARS) is a partnership between eight public bodies

⁸ More detailed information on priority catchments can be found at www.sepa.org.uk/dpprioritycatchments

8.4 Assessment of the efficacy of the GBR model as a method for regulating agricultural pollution

Based on the available evidence, it would appear that the GBR rules outlined in Section 8.2 address a good number of the key measures identified by respondents to the expert opinion survey as crucial to addressing diffuse pollution from agriculture. The list of expert derived measures presented in Section 6.0 is recreated in the table below, together with an indication of whether the GBR rules address these issues:

Table 19. Scope of GBR rules

Top 10 measures needed as cited by expert farm advisors	Addressed by GBRs
Manage soil exposure during winter months through early establishment of winter crops/leave rough surface/plant cover crops	✓
Adoption of nutrient planning and precision farming	✓
Take steps to address and repair soil compaction	✓
Introduce riparian buffer strips	
Install 5+ months slurry/manure storage facility	
Fence out livestock from water courses	
Do not grow high risk crops on sloping ground	✓
Separate clean and dirty water	
Optimum maize management (early varieties, no maize stubble over winter)	✓
Increase Soil Organic Matter	

Perhaps more important than the measures themselves, however, is the way the DP GBRs are being enforced. It is here where the GBR model appears to have undoubted strengths and where valuable lessons can be learnt by policy makers elsewhere in the UK. At this stage, it is not possible to make a definitive assessment of whether the process being used to ensure GBR compliance is working. This is because SEPA has not fully completed its repeat visit process so a complete picture of whether farmers have taken action does not exist. However, early indications suggest that the policy of repeat visits within priority catchments is delivering significant behaviour change on farms. As already mentioned above, across the programme as a whole, 85% of farmers receiving a second visit have taken action to address the issues identified by SEPA during their initial visit. Evidence from the River Ayr Priority catchment demonstrates how 90% of farmers have taken action to rectify problems without any need for SEPA to take further action⁹.

This represents a significant body of targeted pro-environmental behaviour taking place which was not being undertaken previously. Encouragingly, farmers and their representative bodies appear to have received the programme in a favourable light, regarding the enforcement process as balanced and fair.

It is important to note that, prior to initial and secondary farm visits being conducted by SEPA, an extensive period of evidence building and awareness raising was undertaken, involving wide scale engagement with the farming community. During this process, the causes of pollution were examined and communicated at a priority catchment scale, with detailed information made available to farmers in identified areas. 5000 km of river bank was walked to accrue evidence with 5000 GBR issues encountered (1 per km walked). Significantly, farmers were given assurances that

⁹ Mind the Gap Conference - November 2013. Lucy Filby, SEPA Catchment Coordinator - The River Ayr Priority Catchment

the purpose of these walkovers was to assess the scale and severity of local pollution problems, not to implement regulation per se. This has helped to build trust in the process with the farming community.

Based on evidence from the academic literature and practitioner experience world-wide, transparent problem identification involving extensive two-way stakeholder dialogue has been shown to be a key component to successful pollution mitigation programmes. It should be noted that a Defra Strategic Evidence Partnership project undertaken in 2012 to investigate potential policy options for tackling diffuse pollution from agriculture in England strongly recommended an enforcement approach very similar to the one that has been adopted in Scotland¹⁰.

A strong indication that the strategy in Scotland is working has been made by SEPA management who have committed additional resources for the priority catchment initiative in the second WFD river basin cycle. So far, only 14 of the 103 catchments identified as impacted by rural diffuse pollution have been addressed by the programme, highlighting the scale of the task ahead.

¹⁰ See Component B of the report

<http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17412&FromSearch=Y&Publisher=1&SearchText=RiversTrust&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

9.0 Conclusions and Recommendations

Based on the evidence and discussion presented in this report, it is possible to offer the following conclusions and recommendations:

Focus on priority farm management practices – As demonstrated in Table 13 (Section 6.0), the study has identified a ‘top 10’ of measures which, if implemented by farmers, are likely to make the greatest contribution to achieving improved water quality and GES under the Water Framework Directive:

- Manage soil exposure during winter months
- Adoption of nutrient planning and precision farming
- Take steps to address and repair soil compaction
- Introduce riparian buffer strips
- Install 5+ months slurry/manure storage facility
- Fence out livestock from water courses
- Do not grow high risk crops on sloping ground
- Separate clean and dirty water
- Optimum maize management (early varieties, no maize stubble over winter)
- Increase Soil Organic Matter

Many of these measures are (and will continue to be) covered by cross-compliance/other regulatory controls whilst some (particularly those involving infrastructure investment e.g slurry stores, fencing) will involve voluntary capital investment. Other activities relating to nutrient planning and increasing soil organic matter represent likely win-win scenarios (i.e economic gains to the farmer and environmental gains to society). When working with Corporates under the ‘Water Stewardship’ banner, WWF should encourage them to work with their respective supply chains on a number of levels. In particular, Corporates have a role to remind their suppliers of legal responsibilities; it is suggested focussing on those legal requirements identified within the ‘top 10’ measures cited above. In addition, efforts should be made to explore whether there is any potential for Corporates to offer financial assistance to their suppliers to adopt pro-environmental capital investments (e.g no/low interest loans). There is also potential for Corporates to play an increasing role in an advisory capacity, working with suppliers to explore agronomic opportunities which have both economic and environmental advantage. Again, opportunities embodied within the ‘top 10’ measures above should offer a focus for this work.

Non-compliance with regulatory requirements requires targeted enforcement – The results from this study suggest that non-compliance is not an industry wide issue; rather a feature which is present on a minority of farms – probably around a third. It is these farms where any future enforcement effort should be concentrated to alleviate the inconvenience of compliance visits on compliant farmers. Defra’s work to explore opportunities surrounding ‘earned recognition’ for farmers demonstrating high levels of environmental stewardship (when selecting farms for compliance inspections) should be supported. With a focus on the ‘non-compliant minority’, it is strongly recommended that Defra adopt the policy currently operating in Scotland; specifically a process of warnings rather than immediate penalties with follow-up visits undertaken to ensure mitigation action has been adopted. The evidence suggests such a policy will be regarded as fair by the farming community and will result in appropriate actions being taken on-the-ground to deliver better water quality.

A societal response to water pollution is needed – The modelling work undertaken for this study has highlighted that full compliance with current regulations will make a significant contribution to meeting GES targets under the Water Framework Directive. It is, however, very likely that targets will only be met through a combined response involving the water industry (management of Sewage Treatment Works) and wider society (e.g management of septic tanks, behaviour change away from phosphorous loaded consumables).

Annex 1 – Expert Opinion Survey (administered on-line)

WWF Expert Opinion Survey On Farm Measures (A)

Type A Survey Questions

1. PLEASE NOTE: This question relates to farms growing cereals, combinable crops and grass seed

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers (growing cereals, combinable crops and grass seed) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers use 'minimum tillage and direct drilling techniques', please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Maintain land drainage on heavy and medium soils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Where organic matter is low, apply bulky organic manures, compost or digestates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Where organic matter is low, introduce grass leys into the rotation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Where organic matter is low, introduce cover crops into the rotation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drill autumn-sown cereals early to ensure a good cover	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For winter cereals in particular, avoid a very fine, smooth seedbed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sow crops and establish tramlines across the slope	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use Minimum tillage and direct drilling techniques	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Where shallow cultivation is carried out, care is taken to prevent soil compaction near the soil surface	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Before establishing a following crop, remove	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (A)

compaction by loosening the topsoil or
subsoiling where necessary, particularly
along old tramlines and on headlands

WWF Expert Opinion Survey On Farm Measures (A)

2. PLEASE NOTE: This question relates to farms growing potatoes, sugar beet, salad crops, vegetables and bulbs (If you do not have farms fitting this description in the area you work, please go to Question 3)

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers (growing potatoes, sugar beet, salad crops, vegetables and bulbs) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers 'cultivate and plant across the slope', please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Maintain land drainage on heavy and medium soils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoid planting on slopes in a way that channels runoff and erosion and/or divide long slopes into smaller units by planting some ridges (beetlebanks) and grass strips across the slope	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On light soils leave the seedbed as coarse as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On intensively cropped soils where organic matter is low, apply bulky organic manures, composts or digestates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On intensively cropped soils where organic matter is low, introduce grass leys into the	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (A)

rotation												
On intensively cropped soils where organic matter is low, introduce green manures into the rotation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cultivate headlands and gateways to remove compaction following planting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cultivate and plant across the slope where safe to do so	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use tied ridges and dykes in furrow bottoms to improve infiltration and improve runoff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use nurse crops or planted straw to prevent windblow on sandy and peaty soils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On fields that are vulnerable to compaction, runoff and soil erosion, choose early maturing varieties to allow an early harvest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Site plastic mulch carefully so as to avoid direct runoff into watercourses and roads	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To prevent capping/sealing of the soil and runoff, ensure irrigation is uniform, rates are not too high and droplet sizes too big	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cultivate the soil as soon as conditions are suitable after harvest, to remove wheelings and compaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rough plough sandy and silty soils following harvest to produce a cloddy coarse surface	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (A)

3. PLEASE NOTE: This question relates to farms growing Maize and Forage Crops (If you do not have farms fitting this description in the area you work, please go to Question 4)

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers (growing Maize and Forage Crops) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers 'sow temporary cover crops', please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Maintain land drainage on heavy and medium soils	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On fields that are vulnerable to compaction, runoff and soil erosion, choose early maturing varieties to allow an early harvest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Undersow maize	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage the grazing of forage crops and crop residues to minimise poaching and runoff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cultivate as soon as conditions are suitable after harvest or grazing to remove wheelings and compaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rough plough sandy and silty soils following harvest to produce a cloddy coarse surface	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (A)

Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow

Sow with a temporary cover crop throughout winter

WWF Expert Opinion Survey On Farm Measures (A)

4. There are a huge number of farm management measures associated with delivering water quality benefits, some of which have been listed in this questionnaire but there are many others that have not been listed. In your professional opinion which 5 measures (listed or not listed) do you think have the most potential to deliver the greatest water quality benefits in your area. These measures can be either existing cross-compliance measures, existing measures funded under environmental stewardship or the catchment sensitive farming programme, or new measures which are required (could be either cross compliance or environmental stewardship/NELMS/CSF).

Please note it is the individual measures we are interested in - (e.g rough seedbeds, buffer strips, moving stock when ground is wet) - not whether they are (or might become) cross-compliance measures or funded through some form of agri-environmental payment.

Please list your measures in order of importance:

Most important	<input type="text"/>
Second most important	<input type="text"/>
Third most important	<input type="text"/>
Fourth most important	<input type="text"/>
Fifth most important	<input type="text"/>

WWF Expert Opinion Survey On Farm Measures (A)

5. The current cross-compliance regulations include a specific requirement for the post-harvest management of land used to grow a crop of oil-seeds, grain legumes or cereals (other than maize). Under this requirement, farmers must undertake one of the following measures from the first day after harvest until the last day of February in the following year:

- 1. Keep stubble of the harvested crop in the land**
- 2. Leave land with a rough surface over winter**
- 3. Create stale seedbeds over winter using cultivation sequences**
- 4. Sow a temporary cover crop over winter**
- 5. Sow a new crop within 10 days of a seedbed being prepared**

What proportion of farmers (0% to 100%) do you think undertake at least one of the above measures?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

WWF Expert Opinion Survey On Farm Measures (A)

Submitting Your Responses

6. Please indicate which catchments you have based your responses on so we can put your answers in context?

7. Have you based your responses on catchments which contain Nitrate Vulnerable Zone (NVZ) designations? (nb we would expect uptake of measures to be greater in NVZ areas)

Yes

No

8. And finally, if you would like a copy of the results from our survey, please write your name in the box below so that we know who to contact

PLEASE CLICK ON THE BUTTON BELOW TO SUBMIT YOUR RESPONSES.

ACKNOWLEDGEMENT OF YOUR SUBMISSION SHOULD APPEAR IN A FEW SECONDS.

WWF Expert Opinion Survey On Farm Measures (B)

Type B Survey Questions

1. PLEASE NOTE: This question relates to farms with improved grassland (if you do not have farms fitting this description in the catchments where you mainly work, please go to Question 2)

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers (with improved grassland) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers "plant grass strips to restrict runoff", please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Maintain land drainage systems to reduce the risk of damaging soil structure under wet conditions (for example when cutting silage)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use well drained tracks for vehicles and livestock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minimise damage to riverbanks by providing managed access to water for livestock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove sward compaction through subsoiling with a grass subsoiler, tines or spikes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regularly move ring feeders or place feeders and troughs onto a stone base	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When re-seeding grass, sow early enough to achieve a good cover before winter. Aim to create a coarse seedbed that is less likely to form a cap that will lead to runoff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove grazing livestock from the grassland when the soil is too wet and poaching occurs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If it is necessary to out winter stock, locate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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any sacrificial fields on freely drained soils
and not on fields that will lead to erosion.
Cultivate and reseed in the spring to remove
any compaction

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2. PLEASE NOTE: This question relates to farms with natural and semi-natural grassland and vegetation (if you do not have farms fitting this description in the catchments where you mainly work, please go to Question 3)

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers (with natural and semi-natural grassland and vegetation) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers "plant grass strips to restrict runoff", please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Adjust stocking rates to ensure that overgrazing does not result in loss of vegetation cover	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shepherd the stock to prevent overgrazing in localised areas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Install and maintain tracks to minimise runoff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minimise the need for vehicle use and use low ground pressure machinery when conditions require, keeping to established tracks and paths as far as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Undertake all supplementary feeding on ground away from sensitive vegetation and move the feeding sites as necessary to avoid breaking the soil cover. keep supplementary feeding away from watercourses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoid burning on blanket bog and deep peat where erosion can be serious	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoid leaving bare soil during bracken management on sites with a risk of erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (B)

Minimise damage to riverbanks by providing
managed access to water for livestock



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3. PLEASE NOTE: This question relates to farms with outdoor pigs and poultry (if you do not have farms fitting this description in the catchments where you mainly work, please go to Question 4)

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers (producing outdoor pigs and poultry) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers "plant grass strips to restrict runoff", please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Produce a Soil Management Plan (BPEX)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plan and manage paddocks and tracks to avoid channelling of water to grass and the sward can be maintained	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ensure field grass cover is well established at least 12 months before the pigs are introduced to the land. Choose deep rooted varieties of grass that are drought resistant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop a rotation so that pigs and poultry can be moved on to grass and the sward can be maintained	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Locate grass strips to restrict runoff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If problems of runoff and erosion occur, move pigs from the area and cultivate as soon as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When the pigs have been moved onto another paddock, loosen the compacted soil or cultivate and reseed as soon as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduce stocking densities on individual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (B)

fields

WWF Expert Opinion Survey On Farm Measures (B)

4. The current cross-compliance regulations include a specific requirement for the post-harvest management of land used to grow a crop of oil-seeds, grain legumes or cereals (other than maize). Under this requirement, farmers must undertake one of the following measures from the first day after harvest until the last day of February in the following year:

- 1. Keep stubble of the harvested crop in the land**
- 2. Leave land with a rough surface over winter**
- 3. Create stale seedbeds over winter using cultivation sequences**
- 4. Sow a temporary cover crop over winter**
- 5. Sow a new crop within 10 days of a seedbed being prepared**

For each measure listed, please provide an estimate of the proportion of farmers (growing oil seeds, grain legumes and cereals) you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers 'keep stubble of the harvested crop in the ground', please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable.

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Keep stubble of the harvested crop in the land	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leave land with a rough surface over winter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create stale seedbeds over winter using cultivation sequences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sow a temporary cover crop over winter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sow a new crop within 10 days of a seedbed being prepared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (B)

5. What proportion of farmers (0% to 100%) do you think undertake at least one of the post harvest management measures?

- 1. Keep stubble of the harvested crop in the land**
- 2. Leave land with a rough surface over winter**
- 3. Create stale seedbeds over winter using cultivation sequences**
- 4. Sow a temporary cover crop over winter**
- 5. Sow a new crop within 10 days of a seedbed being prepared**

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

WWF Expert Opinion Survey On Farm Measures (B)

6. There are a huge number of farm management measures associated with delivering water quality benefits, some of which have been listed in this questionnaire but there are many others that have not been listed. In your professional opinion which 5 measures (listed or not listed) do you think have the most potential to deliver the greatest water quality benefits in your area. These measures can be either existing cross-compliance measures, existing measures funded under environmental stewardship or the catchment sensitive farming programme, or new measures which are required (could be either cross compliance or environmental stewardship/NELMS/CSF).

Please note it is the individual measures we are interested in - (e.g rough seedbeds, buffer strips, moving stock when ground is wet) - not whether they are (or might become) cross-compliance measures or funded through some form of agri-environmental payment.

Please list your measures in order of importance:

Most important	<input type="text"/>
Second most important	<input type="text"/>
Third most important	<input type="text"/>
Fourth most important	<input type="text"/>
Fifth most important	<input type="text"/>

WWF Expert Opinion Survey On Farm Measures (B)

Submitting Your Responses

7. Please indicate which catchments you have based your responses on so we can put your answers in context?

8. Have you based your responses on catchments which contain Nitrate Vulnerable Zone (NVZ) designations? (nb we expect uptake of measures to be higher in NVZ areas)

Yes

No

9. And finally, if you would like a copy of the results from our survey, please write your name in the box below so that we know who to contact

PLEASE CLICK ON THE BUTTON BELOW TO SUBMIT YOUR RESPONSES.

ACKNOWLEDGEMENT OF YOUR SUBMISSION SHOULD APPEAR IN A FEW SECONDS

WWF Expert Opinion Survey On Farm Measures (C)

Type C Survey Responses

1. PLEASE NOTE: This question relates to general soil and nutrient management practices

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits (through reductions in nutrients, sediment and agro-chemicals reaching surface and/or ground water resources). For each measure listed, please provide an estimate of the proportion of farmers you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 90% of farmers "do not apply organic manure within 10 meters of surface water", please tick the 90% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Take action to remediate any damage caused by accessing waterlogged land as soon as possible within a 12 month period	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not allow overgrazing on natural and semi-natural vegetation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not carry out unsuitable supplementary feeding on natural and semi-natural vegetation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not cultivate or apply fertilisers or pesticides to land within 2 meters of centre of a hedgerow, watercourse or field ditch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not cultivate or apply fertilisers or pesticides to land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintain a green cover on land within 2 metres of the centre of a hedgerow, watercourse or field ditch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintain a green cover on land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (C)

bank

Do not apply manufactured nitrogen (inorganic) fertiliser within 2 metres of surface water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not apply organic manure within 10 meters of surface water (6 metres if applying using precision equipment)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not apply organic manure within 50 metres of a spring, well or borehole	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take into account nutrient needs of plants when applying sewage sludge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Only use sewage sludge which has been analysed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Only use sewage sludge on soils that have been analysed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not use sewage sludge on land where the limits for specified elements are exceeded	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not use sewage sludge on soil which has a pH value of less than 5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

WWF Expert Opinion Survey On Farm Measures (C)

2. PLEASE NOTE: This question relates to the management of nitrogen fertiliser (organic and inorganic)

The matrix below outlines a list of farm management measures which are commonly associated with delivering water quality benefits through reductions in nitrogen leaching. They are taken from the list of measures applied to Nitrate Vulnerable Zones (NVZs).

For each measure listed, please provide an estimate of the proportion of farmers you think undertake each measure within the catchments you spend most of your time working within. We appreciate uptake of measures will vary from farm to farm but we are asking you to take an average across the farms that you see.

Please give your answers from 0% to 100%. For example, if you estimate 20% of farmers "only spread slurry with low trajectory equipment", please tick the 20% answer button for this measure. Please provide estimates for each measure in turn.

Please note we are asking you to base your answers on your professional judgement and hands-on experience of working with farmers in your area. We appreciate many of your answers will be educated guesses rather than scientifically derived measurements. That's fine and is completely valid, given absolute data is largely unavailable

	0%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
The average nitrogen application rate of the farm (inorganic and organic fertiliser) does not exceed the maximum nitrogen limit for each crop type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The rate of application of organic manure (excluding manure deposited by grazing animals) in any 12 month period to any individual field is limited to 250kg of total nitrogen per hectare (in any 2 year period 500kg of total nitrogen)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The rate of livestock manure applied (including manure deposited by grazing animals and any imported livestock manures) is limited to 170kg of total nitrogen per hectare in each calendar year averaged over the area of the holding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Slurry is only spread with low trajectory equipment (les than 4m from the ground) or other precision techniques such as band spreading or injection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. The current cross-compliance regulations include a specific requirement for the post-harvest management of land used to grow a crop of oil-seeds, grain legumes or cereals (other than maize). Under this requirement, farmers must undertake one of the following measures from the first day after harvest until the last day of February in the following year:

- 1. Keep stubble of the harvested crop in the land**
- 2. Leave land with a rough surface over winter**
- 3. Create stale seedbeds over winter using cultivation sequences**
- 4. Sow a temporary cover crop over winter**
- 5. Sow a new crop within 10 days of a seedbed being prepared**

What proportion of farmers (0% to 100%) do you think undertake at least one of the above measures?

- 0%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

WWF Expert Opinion Survey On Farm Measures (C)

4. There are a huge number of farm management measures associated with delivering water quality benefits, some of which have been listed in this questionnaire but there are many others that have not been listed. In your professional opinion which 5 measures (listed or not listed) do you think have the most potential to deliver the greatest water quality benefits in your area. These measures can be either existing cross-compliance measures, existing measures funded under environmental stewardship or the catchment sensitive farming programme, or new measures which are required (could be either cross compliance or environmental stewardship/NELMS/CSF).

Please note it is the individual measures we are interested in - (e.g rough seedbeds, buffer strips, moving stock when ground is wet) - not whether they are (or might become) cross-compliance measures or funded through some form of agri-environmental payment.

Please list your measures in order of importance:

Most important	<input type="text"/>
Second most important	<input type="text"/>
Third most important	<input type="text"/>
Fourth most important	<input type="text"/>
Fifth most important	<input type="text"/>

WWF Expert Opinion Survey On Farm Measures (C)

Submitting Your Responses

5. Please indicate which catchments you have based your responses on so we can put your answers in context?

6. Have you based your responses on catchments which contain Nitrate Vulnerable Zone (NVZ) designations? (nb we expect uptake of measures to be higher in NVZ areas)

Yes

No

7. And finally, if you would like a copy of the results from our survey, please write your name in the box below so that we know who to contact

PLEASE CLICK ON THE BUTTON BELOW TO SUBMIT YOUR RESPONSES.

ACKNOWLEDGEMENT OF YOUR SUBMISSION SHOULD APPEAR IN A FEW SECONDS

Annex 2 – Overview of ECM+ Predictive Model

ECM+ was developed by Tobias Krueger, Alex Inman, Laurence Smith and Kevin Hiscock as part of a Rural Economy and Land Use (RELU) project funded by the UK Research Councils.



Predicting nutrient inputs into rivers

ECM+ (Extended Export Coefficient Model) is a computer model that predicts yearly average concentrations of phosphorus and nitrogen in a river resulting from the activities within its catchment. The model aims to be inclusive to all sources of pollution: waste water treatment works (WWTWs), domestic septic systems, agriculture, and other sources deemed important, such as other industry discharges and roads & tracks. The model enables the simulation of a mix of solutions: improvement in the nutrient removal efficiency of WWTWs, reduction of domestic sewage treatment, change in farming practices and land use change. Results are presented for sub-catchments, which are smaller divisions of the catchment. Phosphorus is expressed as soluble reactive phosphorus (SRP), one of the standards for ecological status under the EU Water Framework Directive. Nitrogen is expressed as total inorganic nitrogen (TIN). For each application, ECM+ is calibrated against the water quality measurements made routinely by the Environment Agency. The calibration is a statistical attribution of the measured level of pollution to the different sources present in the catchment. Such attribution can never be precise, and the resulting uncertainty is expressed as a probability distribution (Figure 1).

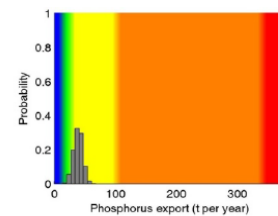


Figure 1: ECM+ results are expressed as probability distributions, here against the background of Water Framework Directive ecological status: "high" (blue), "good" (green), "moderate" (yellow), "poor" (orange), "bad" (red).

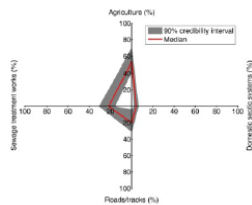


Figure 2: ECM+ can be used to apportion pollution to different sources, here four, including uncertainty estimates (shaded area).

What ECM+ can do In its simplest form, the model can be used for source apportionment (Figure 2). Its main strength, however, is interactive scenario development using a computer interface to evaluate sewage treatment options, farming practices and land use changes in real time (Figure 3).

What ECM+ cannot do At present, the model cannot simulate changes in precipitation and temperature. It also does not currently differentiate soil and topography variations in the catchment beyond those apparent as land use variations. Future developments may add these functionalities.

Recommended use If ECM+ is to inform decisions, then it is best used in a participatory setting, involving as wide a range of stakeholders as possible. Experience suggests that the model assumptions should be reviewed and the input data scrutinised and updated by the stakeholders for every application.

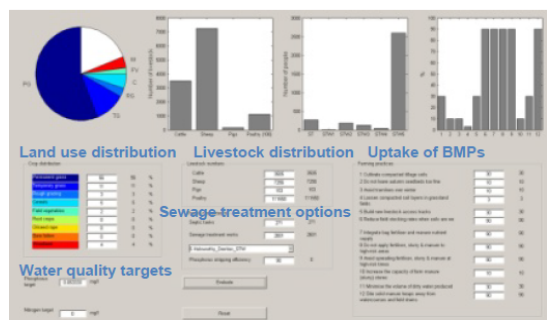


Figure 3: The ECM+ computer interface is designed for interactive scenario development by stakeholders.

Input data ECM+ uses data available from national databases: topography; precipitation; river flow; water quality; population; land use; livestock numbers; road and track density; river network; lakes; reservoirs. Other data have to be obtained by working with the respective sectors: uptake of agricultural Best Management Practices (BMPs); data on waste water treatment works: coordinates, number of people served, nutrient removal efficiency (tertiary treatment); data on domestic septic systems if available; other industry discharge data: coordinates, consented values.

Annex 3 – Mapping Regulation Measures to ECM+ Measures

Regulation Measure	Measure from Newell at al incorporated within ECM+
SOIL PROTECTION REVIEW MEASURES (Table C) - Cereals, Combinable Crops, Grass Seed	
A1 - Maintain land drainage. Heavy and medium soils that are regularly cultivated often require land drainage to increase opportunities for working the land without damage	
A2 - Where organic matter is low, apply bulky organic manures, compost or digestates	
A3 - Where organic matter is low, introduce grass leys into the rotation	
A4 - Where organic matter is low, introduce cover crops into the rotation	Establish cover crops in Autumn (4)
A5 - Drill autumn sown crops early on soils vulnerable to capping and slumping, drill autumn-sown cereals early to ensure a good cover and leave a coarse seedbed	Early harvesting and establishment of crops in Autumn (5)
A6 - For winter cereals in particular, avoid a very fine, smooth seedbed. A coarse seedbed is less likely to form a cap that will lead to runoff	Leave Autumn seedbed rough (10)
A7 - Where it is safe and practical, sow crops and establish tramlines across the slope. If possible, do not use tramlines until the spring	Cultivate and drill across the slope (9)
A8 - Minimum tillage and direct drilling techniques used	Adopt reduced cultivation system (7)
A9 - Where shallow cultivation is carried out, care is needed to prevent soil compaction* near the soil surface. Sandy and silty soils benefit from regular loosening	Cultivate compacted tillage soils (8)
A10 - Before establishing the following crop, remove compaction* by loosening the topsoil or subsoiling where necessary, particularly along old tramlines and on headlands	Manage over-winter tramlines (11)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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SOIL PROTECTION REVIEW MEASURES (Table C) - Potatoes, Sugar beet, Salad crops, Vegetables and Bulbs	
B1 - Maintain land drainage. Heavy and medium soils that are regularly cultivated often require land drainage to increase opportunities for working the land without damage	
B2 - Avoid planting on slopes in a way that channels runoff and erosion and/or divide long slopes into smaller units by planting some ridges (beetlebanks) and grass strips across the slope (where safe or practical to do so)	Establish in-field grass buffer strips (13)
B3 - On light soils leave the seedbed as coarse as possible (for example, by drilling directly into furrow pressed land or into loosened cereal stubble)	Adopt reduced cultivation system (7)
B4 - On intensively cropped soils where organic matter is low, apply bulky organic manures, composts or digestates	
B5 - On intensively cropped soils where organic matter is low, introduce grass leys into the rotation	
B6 - On intensively cropped soils where organic matter is low, introduce green manures into the rotation	
B7 - Cultivate headlands and gateways to remove compaction* following planting	Cultivate compacted tillage soils (8)
B8 Cultivate and plant across the slope where safe to do so	Cultivate and drill across the slope (9)
B9 - Use tied ridges and dykes in furrow bottoms to improve infiltration and improve runoff	
B10 - Use nurse crops or planted straw to prevent windblow on sandy and peaty soils	
B11 - On fields that are vulnerable to compaction*, runoff and soil erosion, choose early maturing varieties to allow an early harvest	Early harvesting and establishment of crops in Autumn (5)
B12 - Use modular transplants to stabilise the soil	

B13 - Site plastic mulch carefully so as to avoid direct runoff into watercourses and roads	
B14 - To prevent capping/sealing of the soil and runoff, ensure irrigation is uniform, rates are not too high and droplet sizes too big	
B15 - Cultivate the soil as soon as conditions are suitable after harvest, to remove wheelings and compaction	Manage over-winter tramlines (11)
B16 - Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow	
B17 - Rough plough sandy and silty soils following harvest to produce a cloddy coarse surface that is less likely to cap and slump	Leave Autumn seedbed rough (10)
Regulation Measure	Measure from Newell et al incorporated within ECM+

SOIL PROTECTION REVIEW MEASURES (Table C) - Maize and Forage Crops	
C1 - Maintain land drainage. Heavy and medium soils that are regularly cultivated often require land drainage to increase opportunities for working the land without damage compaction	
C2 - On fields that are vulnerable to compaction*, runoff and soil erosion, choose early maturing varieties to allow an early harvest	Early harvesting and establishment of crops in Autumn (5)
C3 - Undersow maize	Establish cover crops in Autumn (4)
C4 - Manage the grazing of forage crops and crop residues to minimise poaching and runoff. This can be done by limiting periods of access, providing run-back areas, strip grazing, cultivating strips across the slope to reduce runoff and by avoiding slopes vulnerable to erosion and runoff	Reduce field stocking rates when soils are wet (37)
C5 - Where necessary, cultivate as soon as conditions are suitable after harvest or grazing to remove wheelings and compaction	Cultivate compacted tillage soils (8)
C6 - Rough plough sandy and silty soils following harvest to produce a cloddy coarse surface that is less likely to cap and slump	Cultivate compacted tillage soils (8)
C7 - Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow	

C8 - The field is sown with a temporary cover crop throughout winter	Establish cover crops in Autumn (4)
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Regulation Measure	Measure from Newell at al incorporated within ECM+
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SOIL PROTECTION REVIEW MEASURES (Table C) - Outdoor Pigs and Poultry	
G1 - Employ a BPEX Soil Management Plan	
G2 - Plan and manage paddocks and tracks to avoid channelling of water to grass and the sward can be maintained	
G3 - Ensure field grass cover is well established at least 12 months before the pigs are introduced to the land (i.e. so root structure is well developed and have a good established grass sward before the pigs arrive). Choose deep rooted varieties of grass that are drought resistant	
G4 - Develop a rotation so that pigs and poultry can be moved on to grass and the sward can be maintained	Move feeders at regular intervals (38)
G5 - Locate grass strips to restrict runoff – it is good practice to establish grass buffers to intercept runoff, but these should be in addition to the points above and must not be relied on to prevent off-site impacts	Establish in-field grass buffer strips (13)
G6 - If problems of runoff and erosion occur, move pigs from the area and cultivate as soon as possible	Move feeders at regular intervals (38)
G7 - When the pigs have been moved onto another paddock, loosen the compacted soil or cultivate and reseed as soon as possible	
G8 Reduce stocking densities on individual fields	

Regulation Measure	Measure from Newell at al incorporated within ECM+
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SOIL PROTECTION REVIEW MEASURES (Table C) - Improved Grassland (including equine)	
I1 - Maintain land drainage systems to reduce the risk of damaging soil structure under wet conditions (for example when cutting silage)	
I2 - Use well drained tracks for vehicles and livestock	Farm track management (79)
I3 - Minimise damage to riverbanks by providing managed access to water for livestock	Fence off rivers and streams from livestock (76)
I4 - Remove sward compaction through subsoiling with a grass subsoiler, tines or spikes	
I5 - Regularly move ring feeders or place feeders and troughs onto a stone base	Move feeders at regular intervals (38)
I6 - When re-seeding grass, sow early enough to achieve a good cover before winter. Aim to create a coarse seedbed that is less likely to form a cap that will lead to runoff	Early harvesting and establishment of crops in Autumn (5)
I7 - Remove grazing livestock from the grassland when the soil is too wet and poaching occurs. Ensure there is enough shelter for livestock in areas where the soil is wet for long periods	Reduce field stocking rates when soils are wet (37)
I8 - If it is necessary to out winter stock, locate any sacrificial fields on freely drained soils and not on fields that will lead to erosion. Cultivate and reseed in the spring to remove any compaction	

Regulation Measure	Measure from Newell at al incorporated within ECM+
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SOIL PROTECTION REVIEW MEASURES (Table C) - Natural and Semi-natural Grassland and Vegetation	
J1 - Adjust stocking rates to ensure that overgrazing does not result in loss of vegetation cover	Reduce field stocking rates when soils are wet (37)
J2 - Shepherd the stock to prevent overgrazing in localised areas	Move feeders at regular intervals (38)
J3 - Install and maintain tracks to minimise runoff	Farm track management (79)
J4 - Minimise the need for vehicle use and use low ground pressure machinery when conditions require, keeping to established tracks and paths as far as possible	
J5 - Undertake all supplementary feeding on ground away from sensitive vegetation and move the feeding sites as necessary to avoid breaking the soil cover, keep supplementary feeding away from watercourses. See also GAEC 9	Move feeders at regular intervals (38) Construct troughs with a firm but permeable base (39)
J6 - Avoid burning on blanket bog and deep peat where erosion can be serious. You must also meet the requirements relating to heather and grass burning (GAEC 10), and if your land lies within a Site of Special Scientific Interest you must also take account of GAEC 6	
J7 - Avoid leaving bare soil during bracken management on sites with a risk of erosion	
J8 - Minimise damage to riverbanks by providing managed access to water for livestock	Fence off rivers and streams from livestock (76)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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Post Harvest Management Of Land (applies to arable crops except maize) - GAEC1	
Keep stubble of the harvested crop in the land	Cultivate land for crops in Spring rather than Autumn (6)
Leave land with a rough surface over winter	Leave Autumn seedbed rough (10)
Create stale seedbeds over winter using cultivation sequences	Leave Autumn seedbed rough (10)
Sow a temporary cover crop over winter	Establish cover crops in Autumn (4)
Sow a crop within 10 days of a seedbed being prepared	Early harvesting and establishment of crops in Autumn (5)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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Management of waterlogged land - GAEC1	
Take action to remediate any damage caused by accessing waterlogged land as soon as possible within a 12 month period	Cultivate compacted tillage soils (8) Loosen compacted soil layers in grassland fields (15)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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Managing overgrazing and unsuitable supplementary feeding on natural and semi-natural vegetation – GAEC9	
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Do not allow overgrazing	Reduce field stocking rates when soils are wet (37)
Do not carry out unsuitable supplementary feeding	Move feeders at regular intervals (38)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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Protection of hedgerows and watercourses – GAEC14	
Do not cultivate or apply fertilisers or pesticides to land within 2 meters of centre of a hedgerow, watercourse or field ditch	Do not apply manure to high risk areas (68) Do not apply fertiliser to high-risk areas (25)
Do not cultivate or apply fertilisers or pesticides to land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	Do not apply manure to high risk areas (68) Do not apply fertiliser to high-risk areas (25)
Maintain a green cover on land within 2 metres of the centre of a hedgerow, watercourse or field ditch	Establish Riparian buffer strips (14)
Maintain a green cover on land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank	Establish Riparian buffer strips (14)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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No spread zones – GAEC19	
Do not apply manufactured nitrogen (inorganic) fertiliser within 2 metres of surface water	Do not apply fertiliser to high-risk areas (25)
Do not apply organic manure within 10 meters of surface water (6 metres if applying using precision equipment)	Do not apply manure to high risk areas (68)
Do not apply organic manure within 50 metres of a spring, well or borehole	Do not apply manure to high risk areas (68)

Regulation Measure	Measure from Newell at al incorporated within ECM+
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Application of sewage sludge – SMR3	
Take into account nutrient needs of plants	
Only use sewage sludge which has been analysed	
Only use sewage sludge on soils that have been analysed	
Not use sewage sludge on land where the limits for specified elements are exceeded	
Not use sewage sludge on soil which has a pH value of less than 5	

Regulation Measure	Measure from Newell at al incorporated within ECM+
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Management in NVZs – SMR4	
The average nitrogen application rate of the farm (inorganic and organic fertiliser) must not exceed the maximum nitrogen limit for each crop type	Use a fertiliser recommendation system (22)
Limit the rate of application of organic manure (excluding manure deposited by grazing animals) in any 12 month period to any individual field to 250kg of total nitrogen per hectare (in any 2 year period 500kg of total nitrogen)	
Limit the rate of livestock manure applied (including manure deposited by grazing animals and any imported livestock manures) to 170kg of total nitrogen per hectare in each calendar year averaged over the area of the holding	
Only spread slurry with low trajectory equipment (les than 4m from the ground) or other precision techniques such as band spreading or injection	Use slurry band spreading application techniques (70)
Incorporate organic manure, slurries and sewage sludge within 24 hours if it is spread to bare soil or stubble	

Provide sufficient storage to house all pig and poultry manure produced between 1 October to 1 April (6 months) and all manure/slurry from all other livestock between 1 October to 1 March (5 months)	Increase the capacity of farm manure storage (52)
Store poultry manure and other types of solid manure either in a vessel, on an impermeable surface, in a roofed building or in temporary field heaps as long as they are solid enough to be stacked in a freestanding heap	Install covers on slurry stores (54)
Cover with an impermeable material any solid poultry manure that does not have bedding material or litter mixed into it and is stored on a temporary field site	
Must not apply organic manures with a high readily available nitrogen content (e.g slurry, poultry manure) to land during the following closed periods: 1 st September to 31 st December for grassland with sandy or shallow soils; 15 October to 31 January for grassland on all other soils; 1 st August to 31 December for tillage land with sandy or shallow soils (application is allowed between 1 August and 15 September as long as a crop is sown on or before 15 September); 1st October to 31 January for tillage land on all other soils	Do not spread FYM to fields at high risk times (72)
Must not apply manufactured nitrogen (inorganic) fertilisers to any soil type during the following closed periods (unless exemptions apply) - 15 September to 15 January for grassland; 1 September to 15 January for tillage land	Avoid spreading fertiliser to fields at high risk times (26)
Must not apply more than 30 cubic metres per hectare of slurry or 8 tonnes per hectare of poultry manure to land at any one time, from the end of the above closed periods until the last day in February. Must allow at least 3 weeks between each individual application	Do not spread slurry or poultry manure at high-risk times (69)
Must not apply any nitrogen fertiliser before a field inspection is carried out to assess the risk of runoff to surface water and not apply nitrogen fertiliser if there is a significant risk. The inspection must take into account: the slope of the land, particularly if the slope is more than 12 degrees (1 in 5); any land drains (other than a sealed impermeable pipe); and ground cover, closeness to surface water, weather conditions and soil type;	
Must not apply any nitrogen fertiliser when the soil is waterlogged, flooded, has been frozen for 12 hours or more in the last 24	Do not spread slurry or poultry manure at high-risk times (69) Avoid spreading fertiliser to fields at high

hours or is snow covered	risk times (26) Do not spread FYM to fields at high risk times (72)
Must not apply manufactured nitrogen (inorganic) fertiliser within 2 metres of surface water	Do not apply fertiliser to high-risk areas (25)
Must not apply organic manure within 10 metres of surface water. The limit is reduced to 6 metres if slurry, sewage sludge or anaerobic digestate is applied using precision equipment	Do not apply manure to high risk areas (68)
Must not apply organic manure within 50 metres of a spring, well or borehole;	Do not apply manure to high risk areas (68)
Must not locate temporary field heaps: <ul style="list-style-type: none"> • within 10 metres of a surface water or land drain; • within 50 metres of a spring, well or borehole; • on land likely to become waterlogged; • on land likely to flood; • in a single position for more than 12 successive months; • in the same place as an earlier heap constructed within the last two years; With effect from 16 May 2014, the following additional rule applies: <ul style="list-style-type: none"> • on land with a slope of 12 degrees or more which is within 30 metres of surface water; 	
Must not carry out separation of slurry into its solid and liquid fractions unless it is done mechanically or on an impermeable surface where the liquid fraction drains into a suitable container	
Regarding silage making and storage of silage and slurries, the farmer must notify their local Environment Agency office in writing about a new, substantially enlarged, or substantially reconstructed installation at least 14 days before work constructing the new or improved installation is to begin	
Farmer must notify their local Environment Agency office of the place where field silage is to be made at least 14 days before that site is first used	
Farmer must make sure that installations meet requirements for capacity, durability, maintenance and safety zones, are built in accordance with the relevant construction standards, and field silage site rules are met	
Farmer must comply with any notices served by the Environment Agency that require improvements to be made to an installation or field silage site if the	

Agency does not consider them to be suitable	
Farmer must carry out regular inspections of installations and make timely repairs where necessary	

Annex 4 – Summary of farm practice survey undertaken by DTC programme

Demonstration Test Catchments

Attitudes of Farmers Towards Diffuse Pollution Mitigation Measures in the Demonstration Test Catchments

Extensive research has been carried out to determine the best agricultural practices for water pollution control. However it is recognised that the implementation of such measures will only be effective with the co-operation of stakeholders.

Whilst many agricultural management options remain voluntary, farmer participation is increasingly seen as a necessary ingredient for catchment management. There is a need for more information on the realistic farmer uptake and acceptability of different measures to enhance the potential for pollution mitigation.



Figure 1: Map showing the three DTC catchments

A survey was conducted as part of the Demonstration Test Catchments (DTC) project to create a baseline regarding current agricultural practices and give insight regarding farmer attitudes to the future adoption of other mitigation measures. 73 farmers were surveyed between February 2012 - 2013 in three contrasting DTC catchments: the grassland dominated Eden catchment; the arable dominated Wensum catchment and the mixed farming of the Hampshire Avon catchment (see Figure 1). There was a great variation in size amongst the surveyed farms, varying from relatively small livestock farms in the Eden to large arable farms in the Wensum. Overall 87% of farmers surveyed currently participate in Entry Level Stewardship (ELS) and 40% in Higher Level Stewardship (HLS).

Current uptake of mitigation measures amongst farmers

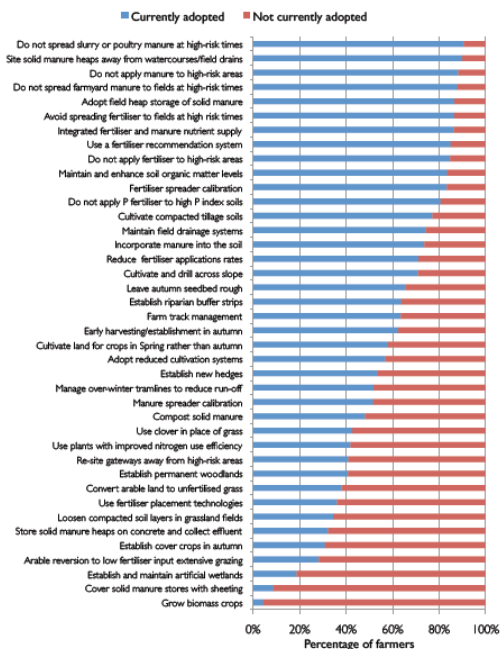


Figure 2: The current uptake of DWPA mitigation measures from the DTC baseline survey applicable to over 75% of participants.

Opinions were obtained on 70 diffuse pollution (DWPA) measures taken from a recent guide 'An Inventory of Mitigation Methods: User Guide' (see footnote). Farmers were asked:

"Do you currently do... mitigation measure? If not would you be likely or unlikely to consider doing it in the future?"

Of the 70 measures, the extent to which they are used varies widely. Figure 2 illustrates the current uptake of measures which are relevant to over 75% of participants.

- Measures with the highest uptake were all concerned with fertiliser or manure management and form part of cross compliance requirements for receipt of the CAP Pillar 1 Single Farm Payment.
- Measures which are compatible with current farm practice were more likely to have been adopted than those which require radical management or land use change.
- There was no obvious difference in uptake of measures according to whether they related to source minimisation, pathway reduction or receptor protection.
- Several measures with known benefits (e.g. cover crops) were less widely used than might have been anticipated. These could be particularly appropriate targets for increased adoption under advice campaigns or agri-environmental scheme support.



Farmers' attitudes to future adoption of measures

Survey participants currently not practicing in a particular mitigation measure were asked how *'likely'* they would be to adopt the measure in the future. Figure 3 outlines the responses given for a selection of measures which are considered to provide benefits to the wider environment.

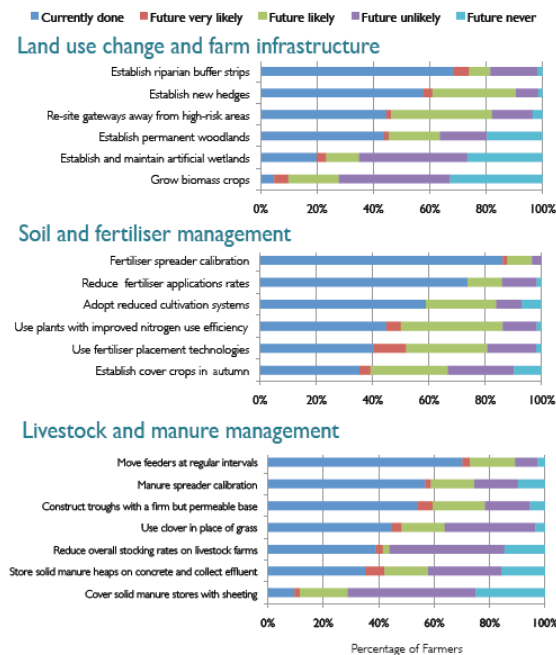


Figure 3: Farmer attitudes to future uptake of DWPA mitigation measures from the DTC baseline survey categorised by management type.

- Overall, measures requiring land use change were less likely to be adopted than measures improving farm infrastructure.
- Measures likely to be adopted in the future were those which decrease the use of fertiliser and fuel, therefore reducing costs.
- Farmers from the survey were more negative towards future adoption of livestock and manure management measures than soil and fertiliser management measures.

The baseline survey included questions about some measures which are not currently supported within agri-environment schemes. The results highlight several measures with relatively low current uptake but positive attitudes regarding future adoption, such as re-siting gateways, establishing cover crops and reduced cultivation systems, which could merit inclusion in such programmes. The findings also indicate that improvements in farmyard infrastructure are a priority for many farmers and suggest that radical changes in activities will not occur without substantial financial incentives or regulatory requirements.

It is intended that the DTC will repeat the survey in years to come to assess changes in attitudes.

Farmer - priority mitigation measures

The survey requested participants to list three mitigation measures they would prioritise on their farm. 65 farmers responded, listing 105 priorities in total, each stating between 0 and 3 measures (22% of farmers had no priorities). The priorities stated by participants have been categorised into management type and location of measures (see Figure 4).

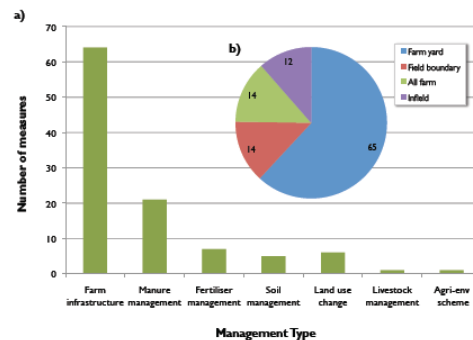


Figure 4: The number of measures respondents prioritised, categorised by a) management type and b) location

- Nearly two-thirds of the priorities involve changing farm infrastructure, particularly additional concrete areas. A variety of uses were identified, including concrete for manure heaps, diverting dirty water and track repair. Farmers suggested these are inexpensive options if grants are provided to assist with payment.
- Manure and fertiliser management included options related to correct timing and application efficiency, as well as storage covers.
- Location of priorities had a significant bias towards measures occurring in farmyards, whilst in-field and field boundary measures received less attention.

Further Information: This survey was conducted as part of The Demonstration Test Catchment project which is a collaborative research project funded by the UK Department for Environment, Food and Rural Affairs (Defra). To find out more, or if you have any comments or queries, please contact Emilie Vrain (e.vrain@uea.ac.uk) or Andrew Lovett (a.lovett@uea.ac.uk) at the University of East Anglia.

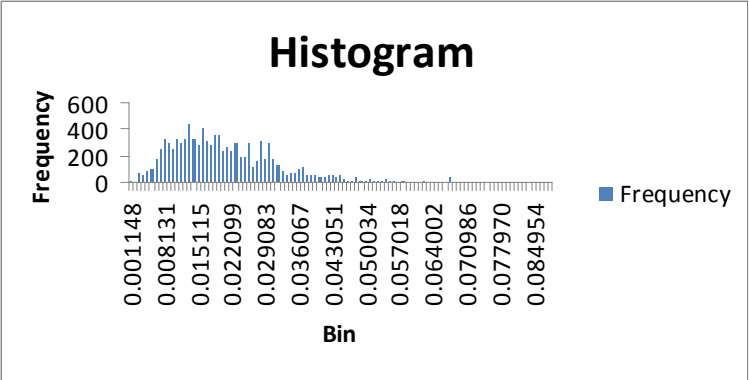
Annex 5 – ECM+ Model Scenario with 100% uptake of key regulatory requirements

Uptake of management practices (%)	
Uptake of management practices (%)	
Establish cover crops in Autumn (4)	100
Early harvesting and establishment of crops in Autumn (5)	100
Cultivate land for crops in Spring rather than Autumn (6)	50
Adopt reduced cultivation system (7)	40
Cultivate compacted tillage soils (8)	100
Cultivate and drill across the slope (9)	40
Leave Autumn seedbed rough (10)	100
Manage over-winter tramlines (11)	100
Establish in-field grass buffer strips (13)	50
Establish Riparian buffer strips (14)	100
Loosen compacted soil layers in grassland fields (15)	100
Allow field drainage systems to deteriorate (16)	10
Fertiliser spreader calibration (21)	50
Use a fertiliser recommendation system (22)	100
Do not apply fertiliser to high-risk areas (25)	100
Avoid spreading fertiliser to fields at high risk times (26)	100
Use fertiliser placement technologies (27)	40
Use clover in place of grass (31)	40
Do not apply P fertiliser to high P index soils (32)	80
Reduce dietary N and P intakes (33)	30
Reduce field stocking rates when soils are wet (37)	100
Move feeders at regular intervals (38)	100
Construct troughs with a firm but permeable base (39)	100
Increase the capacity of farm manure storage (52)	100
Install covers on slurry stores (54)	100
Minimise volume of dirty water and slurry produced (57)	70
Change from slurry to solid manure handling system (65)	5
Manure spreading calibration (67)	60
Do not apply manure to high risk areas (68)	100
Do not spread slurry or poultry manure at high-risk times (69)	100
Use slurry band spreading application techniques (70)	100
Do not spread FYM to fields at high risk times (72)	100
Fence off rivers and streams from livestock (76)	40
Re-site gateways away from high-risk areas (78)	40
Farm track management (79)	30
Establish and maintain artificial wetlands (81)	20

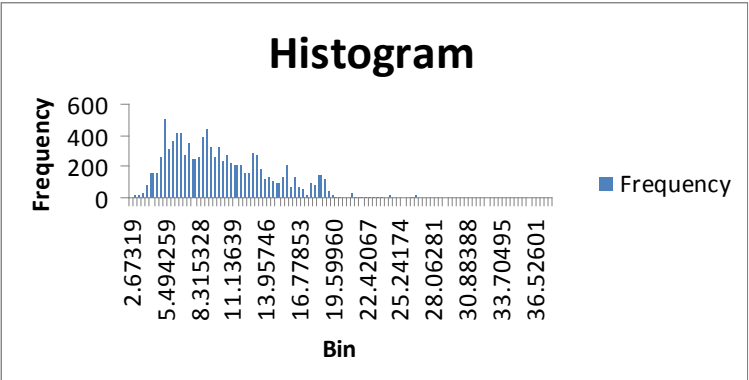
Annex 6 – Histograms outlining the ECM+ probability distributions for phosphorus and sediment load reductions from various farming measures

Early harvesting and establishment of crops in Autumn

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

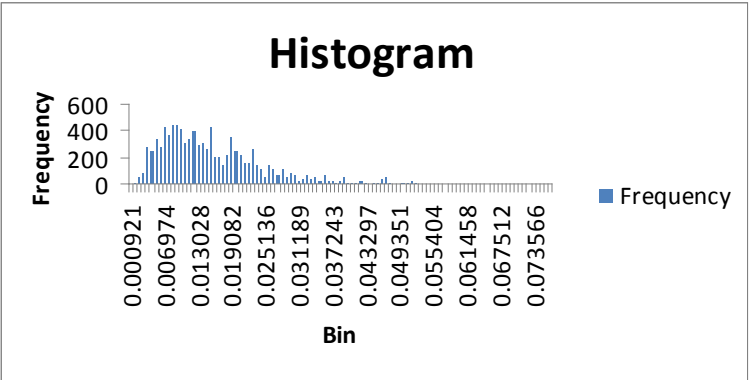


Sediment load reduction (tonnes yr-1)

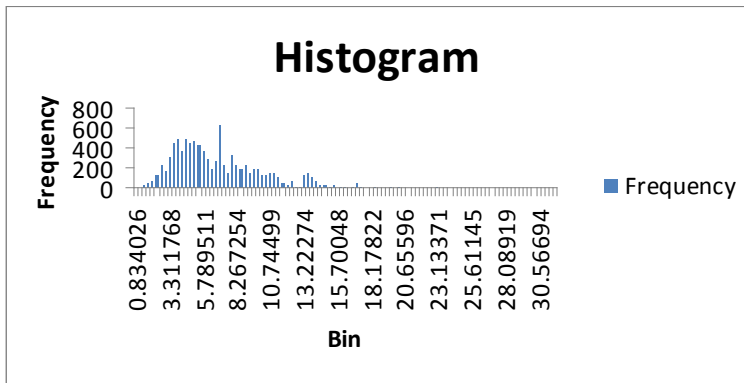


Leave Autumn seedbed rough

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

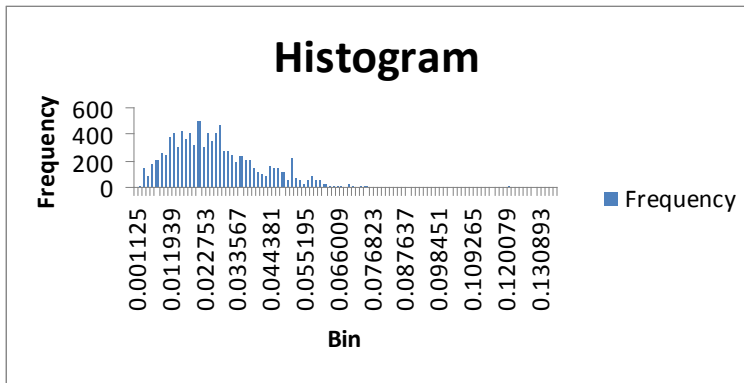


Sediment load reduction (tonnes yr-1)

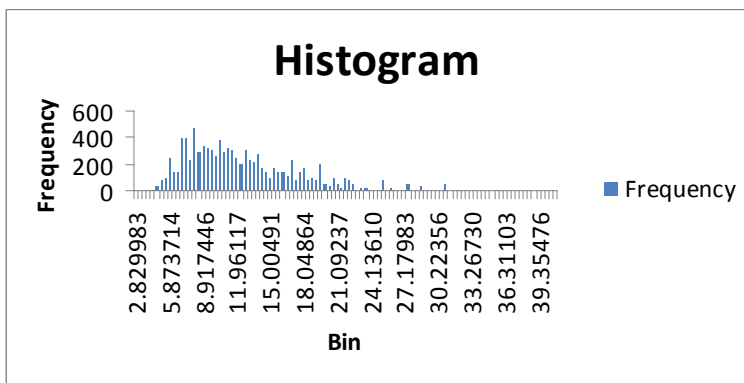


Establish cover crops in Autumn

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

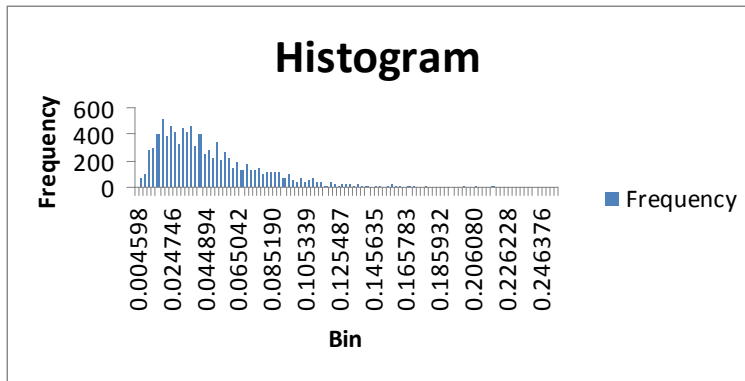


Sediment load reduction (tonnes yr-1)



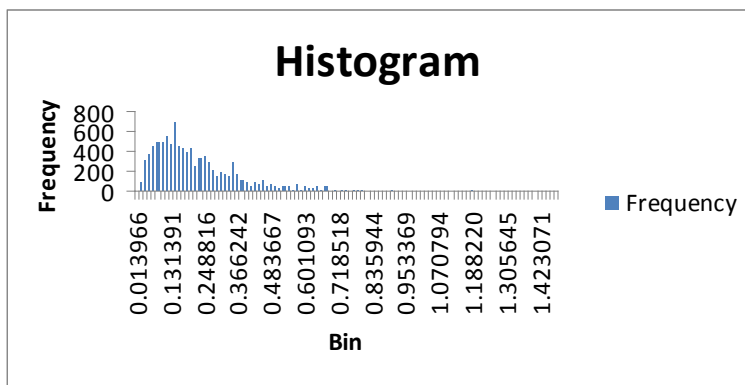
Use a fertiliser recommendation system

Soluble Reactive Phosphorus load reduction (tonnes yr-1)



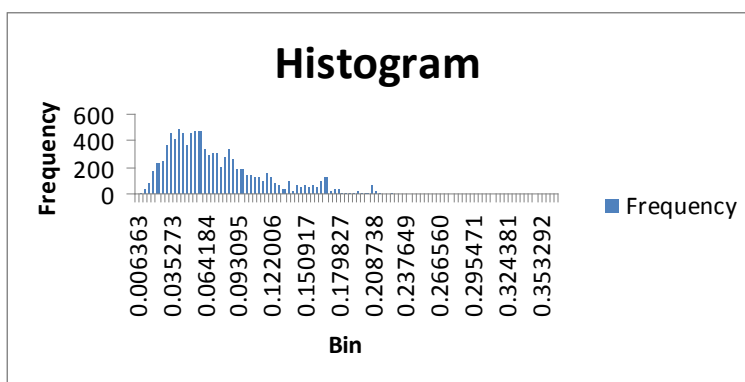
Do not apply P fertiliser to high P index soils

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

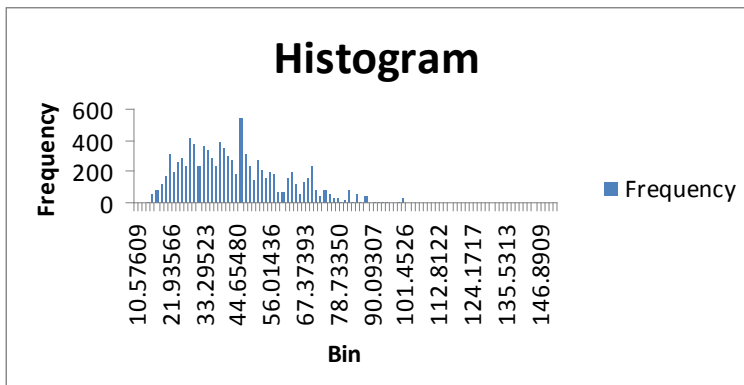


Cultivate compacted tillage soils

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

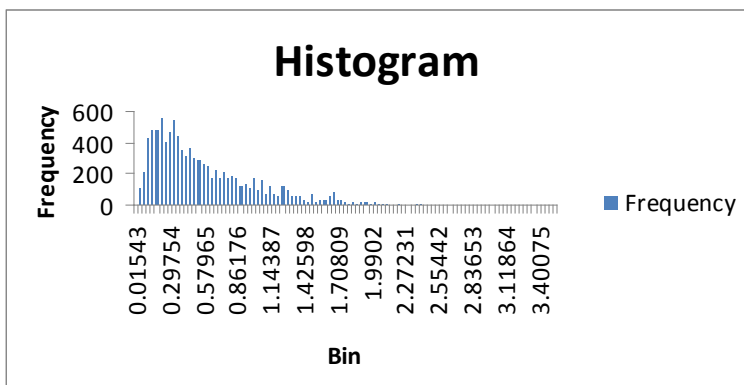


Sediment load reduction (tonnes yr-1)

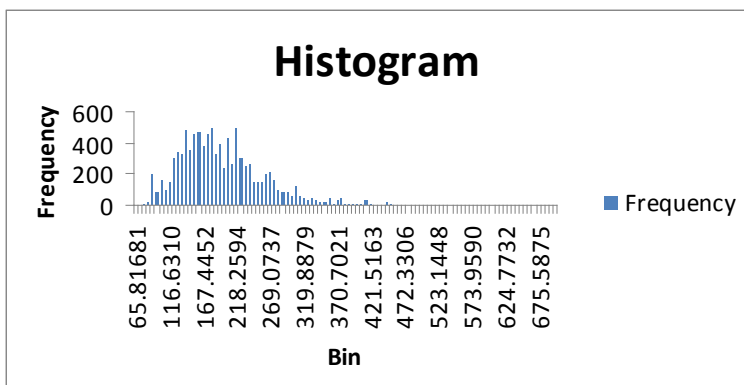


Loosen compacted soil layers in grassland fields

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

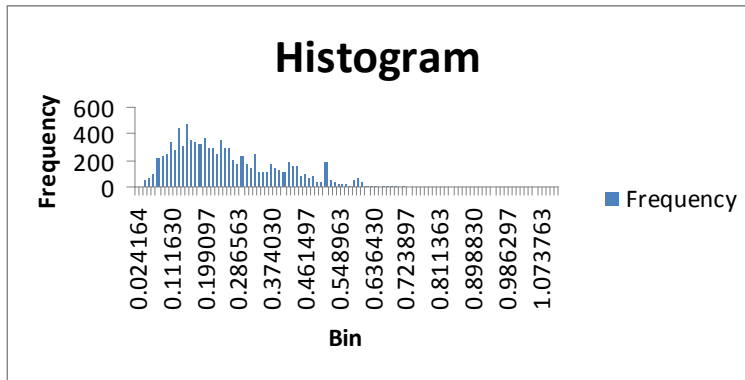


Sediment load reduction (tonnes yr-1)

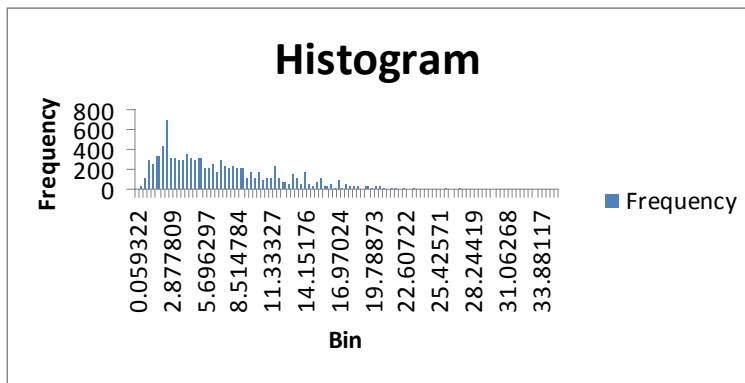


Reduce field stocking rates when soils are wet

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

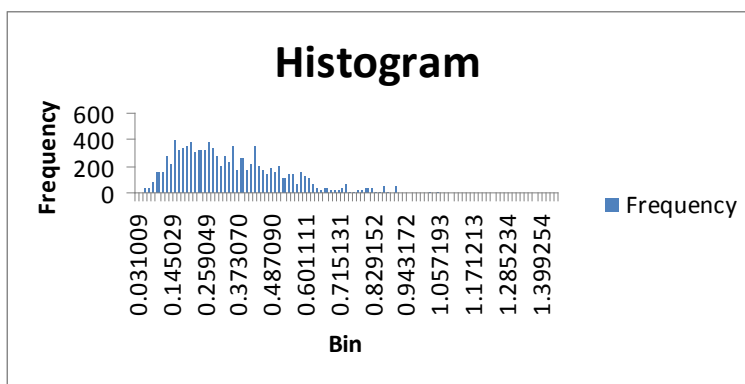


Sediment load reduction (tonnes yr-1)

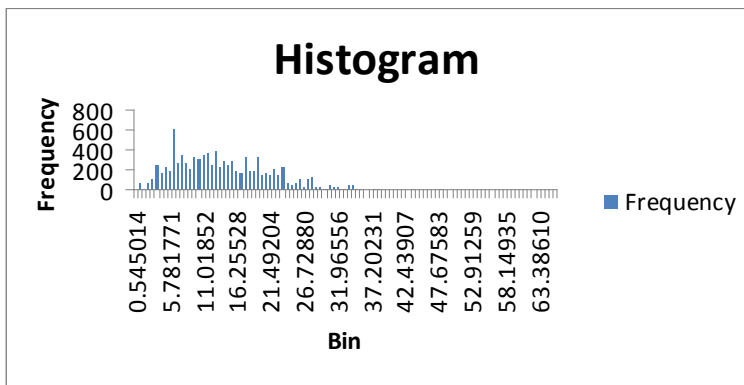


Move feeders at regular intervals

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

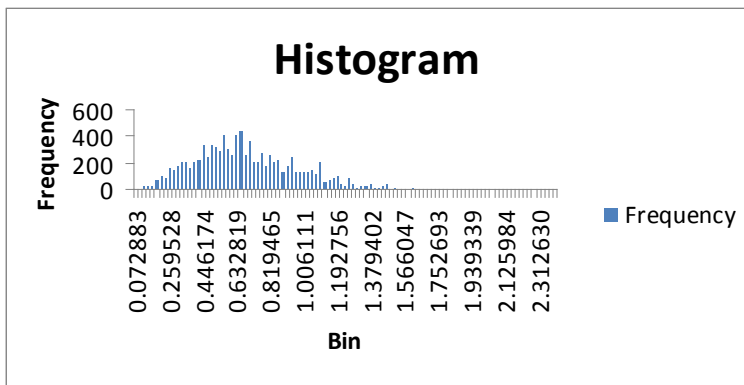


Sediment load reduction (tonnes yr-1)

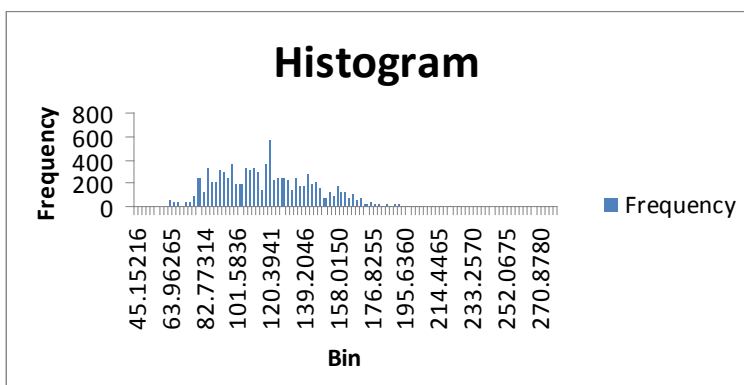


Establish Riparian buffer strips

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

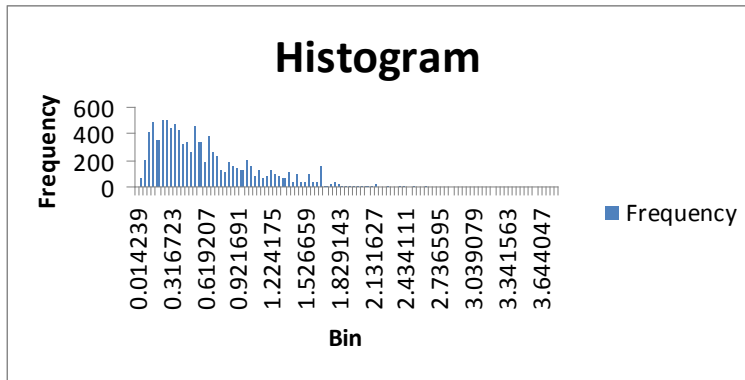


Sediment load reduction (tonnes yr-1)



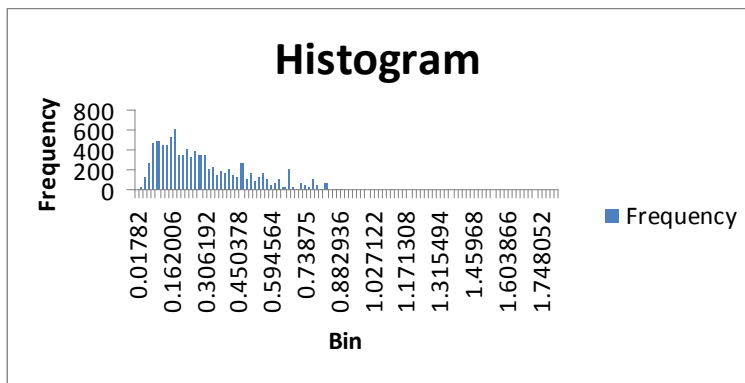
Increase the capacity of farm manure storage

Soluble Reactive Phosphorus load reduction (tonnes yr-1)



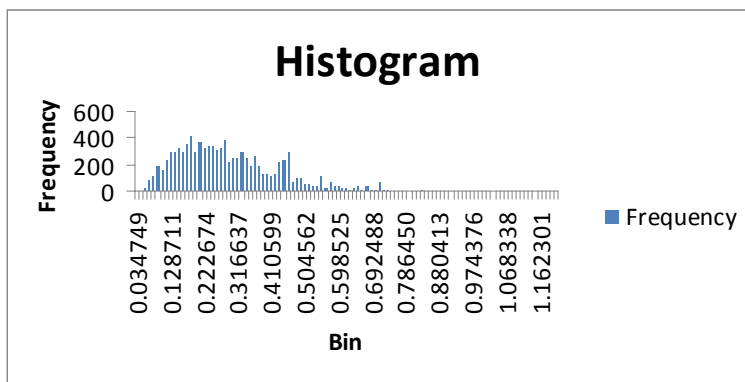
Install covers on slurry stores

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

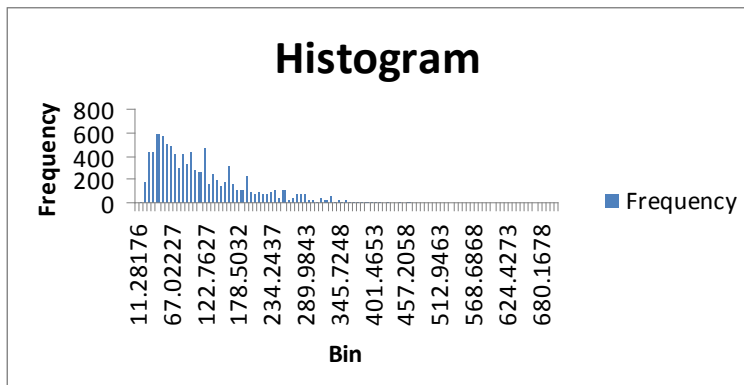


Fence off rivers and streams from livestock

Soluble Reactive Phosphorus load reduction (tonnes yr-1)

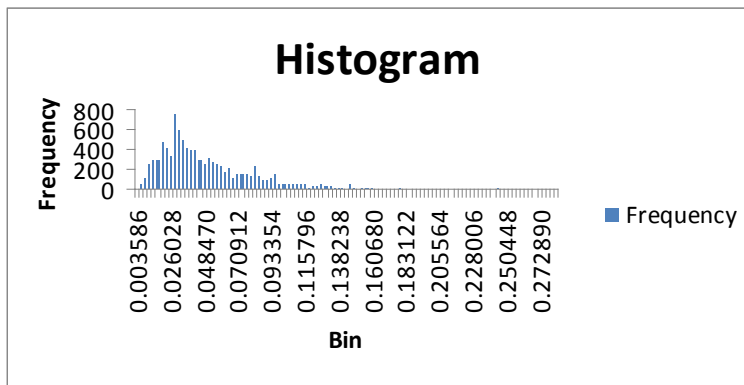


Sediment load reduction (tonnes yr-1)



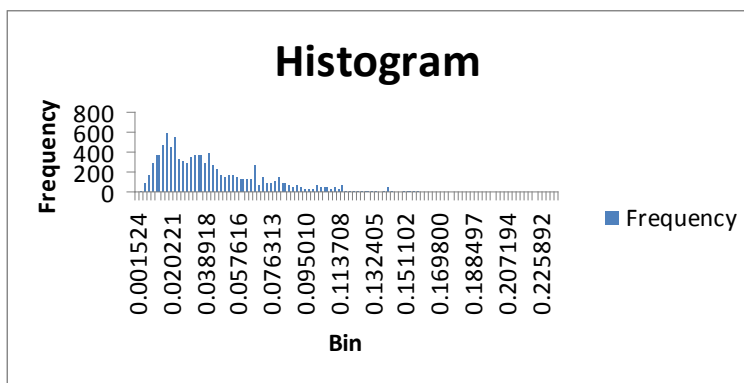
Do not apply manure to high risk areas

Soluble Reactive Phosphorus load reduction (tonnes yr-1)



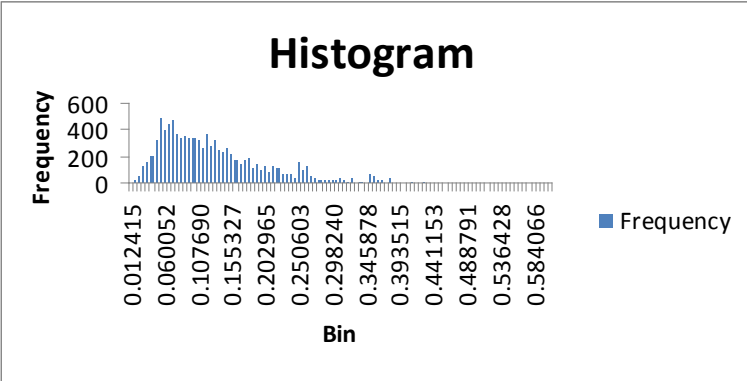
Do not apply fertiliser to high-risk areas

Soluble Reactive Phosphorus load reduction (tonnes yr-1)



Minimise volume of dirty water and slurry produced

Soluble Reactive Phosphorus load reduction (tonnes yr-1)



Annex 7 – Cross Compliance Inspection Data (Source: RPA)

Reference – RFI 3047

RPA Selected Cross Compliance Inspection

Breaches

SMR 4 Breach Types	2010	2011	2012	2013
	No of Breaches	No of Breaches	No of Breaches	No of Breaches
Records incomplete.	68	61	114	360*
Any temporary field heap is not solid enough to be stacked in a freestanding heap and/or is producing free drainage from within the stacked material.	0	0	0	6*
Poultry manure and/or other types of solid manure have not been stored either in a vessel, on an impermeable surface, in a roofed building (this includes greenhouses) or, in an appropriate temporary field heap	0	0	1	0
None of the required records are available on request.	0	0	52	205*
Fails to comply with the N max limit for the specified crop types. Organic manure applied from 01/01/14 to specified crop types or grass, etc without knowing how much crop available Nitrogen it contains	4	6	0	1*
Field based limit for organic manure exceeded.	0	1	0	2*
Livestock manure nitrogen farm loading limit exceeded. Note: The limit is 250kg of total N per hectare if the farmer holds a grassland derogation.	0	4	2	2*
Nitrogen fertiliser (manufactured and organic) not applied to land in as accurate a way as possible.	0	0	0	1*
Any organic manure applied to the surface of bare soil or stubble not incorporated into the soil in accordance with the rule.	0	0	0	0

Sufficient storage capacity has not been provided during the specified storage periods.	0	0	2	9*
Closed period for organic manure with high readily available nitrogen breached.	0	0	2	7*
Closed period for manufactured nitrogen fertiliser breached and agronomic justification not demonstrated.	0	1	1	0
Restrictions on spreading following the closed period breached.	1	0	0	0
"Organic manure has been applied within 10 metres (or 6 metres when using precision equipment) of surface water on land that is not covered by the exception that allows spreading on land managed for breeding wader birds or as a species-rich semi-natural grassland. Organic manure has been applied within 10 metres (or 6 metres when using precision equipment) of surface water on land that is covered by the exception mentioned above, but has been applied in a way that does not comply with all restrictions. Restrictions are listed in Article 21(2) of the Nitrate Pollution Prevention Regulations 2008.	0	0	4	4*
Organic manure has been applied within 50m of a spring, well or borehole.	0	0	1	0
Temporary field heaps have been sited in a high risk location.	0	0	13	22*
Neat poultry manure has been stored on a temporary field site and not covered with an impermeable material	0	0	0	2*

* These figures may include breaches reported by the Environment Agency

GAEC 1 Breach Types	2010	2011	2012	2013
	No of Breaches	No of Breaches	No of Breaches	No of Breaches
The farmer has not implemented the measures identified in the SPR 2010 for the relevant year.	0	1	0	7

The farmer has not completed an SPR 2010 or not made it available to an inspector during inspection.	67	59	134	382
The farmer has not updated his SPR 2010 as and when required.	4	10	8	54
The farmer has carried out mechanised field operations and/or used motorised vehicles on waterlogged land that is not covered by one of the exceptions, and has not recorded the access in Part 4, Table D (Access to Waterlogged Land) of the SPR 2010 from 1 January of the first year they submitted a claim.	0	0	0	2
The farmer is unable to make a copy of the 2010 SPR available for inspection.	0	1	0	0
the farmer has not adequately completed the SPR 2010 in accordance with the instructions given in the SPR 2010 and the Cross Compliance Guidance for Soil Management 2010, Or, the farmer has not used the SPR 2010 template or recorded the same information in a similar format	8	9	27	136
The farmer has failed to take into account specific guidance issued on behalf of the SoS	0	0	0	2
Mechanical field operations and/or the use of motorised vehicles on waterlogged land that is not covered by one of the exemptions has not been recorded in Part 4, Table D of the SPR 2010.	1	1	2	1
The farmer has not taken action to remediate damage caused by mechanised access to waterlogged land within the required time.	0	0	0	1

GAEC 14	2010	2011	2012	2013
Breach Types	No of Breaches	No of Breaches	No of Breaches	No of Breaches

You must not cultivate or apply fertilisers or pesticides to land within 2 metres of the centre of a hedgerow, watercourse or field ditch;	28	30	53	63
You must not cultivate or apply fertilisers or pesticides to land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank.	5	6	11	26
You must take all reasonable steps to maintain a green cover on land within 2 metres of the centre of a hedgerow, watercourse or field ditch;	9	7	16	17
You must take all reasonable steps to maintain a green cover on land between the edge of the watercourse or field ditch and 1 metre on the landward side of the top of the bank.	1	0	10	19

GAEC 15	2010	2011	2012	2013
Breach Types	No of Breaches	No of Breaches	No of Breaches	No of Breaches
Farmer has removed relevant hedgerows after seeking permission of the local authority, but permission was not granted (authority issued a hedgerow retention notice).	0	0	2	1
The Farmer has removed relevant hedgerows without seeking permission of local authority	0	1	5	0
The farmer has removed a hedgerow following permission from authority, or expiry of the 42 days notification period, but the removal is not in accordance with that permission or in accordance with the proposal as set out in the notification	0	1	0	0
The farmer has illegally cut or trimmed any hedgerow between 1 March and 31 July.	3	2	2	4

GAEC 19	2010	2011	2012	2013
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Breach Types	No of Breaches	No of Breaches	No of Breaches	No of Breaches
Manufactured nitrogen has been applied within 2 metres of surface water.	N/A	N/A	0	0
Organic manure has been applied within 10 metres (or 6 metres where precision equipment is used) of surface water on land that is not land covered by the exception that allows spreading on land managed for breeding wader birds or as a species-rich semi-natural grassland. Organic manure has been applied within 10 metres (or 6 metres where precision equipment is used) of surface water on land that is covered by the exception mentioned above, but has been applied in a way that does not comply with all restrictions. Restrictions are listed in Article 21(2) of the Nitrate Pollution Prevention Regulations 2008.	N/A	N/A	6	7*
Organic manure has been applied within 50 metres of a spring, well or borehole.	N/A	N/A	2	0
The farmer has failed to produce and/or keep a map of their holding showing: — all surface waters and land within 10 metres of them; — all springs, wells and boreholes and land within 50 metres of them or the boundary of the holding.	N/A	N/A	73	91*
Failure to update map within 3 months from the date of change.	N/A	N/A	4	1*
* These figures may include breaches reported by the Environment Agency				