Independent review of the

science, implementation and administration

of the Draft European Communities

(Good Agricultural Practice for Protection of Waters)

Regulations 2010

with associated proposals for amendments

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Executive Summary

Purpose of this review

The purpose of this review is to appraise the draft European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2010, published jointly by the Department of Environment, Heritage and Local Government and the Department of Agriculture, Fisheries and Food, on 11 June 2010, in light of the current state-of-the-art of Irish and international agri-environmental science, and the current collective technical and practical knowledge of Teagasc's Advisory Services. This review has been prepared by Teagasc's Working Group on the Water Framework Directive, with input from researchers from all research centres, from specialists, Area Managers and advisors.

Preliminary Environmental Impact Assessment of S.I.378-06 / S.I.101-09

The introduction of S.I.378-06 / S.I.101-09 has resulted in significant and sweeping changes in farm infrastructure and farm practices across the Republic of Ireland, specifically in relation to nutrient management facilities and practices. Based on a comprehensive programme of field-experiments, laboratory experiments, and modelling studies, and supported by consensus in the large body of international scientific literature, Teagasc anticipates that:

- The implementation S.I.378-06 / S.I.101-09 will have led to significant reductions in *point-source* losses and *incidental* losses of nutrients from agriculture to water.
- The implementation S.I.378-06 / S.I.101-09 will, over time, significantly reduce *diffuse* nutrient pressures and losses from agriculture to water. While the implementation of S.I.378-06 / S.I.101-09 has instantly reduced farm-gate P and N balances, it may take years to decades for improvements in nutrient efficiency to translate into improvements in water quality.
- Teagasc's Agricultural Catchments Programme is specifically designed to facilitate the scientific assessment of the effectiveness of S.I.378-06 / S.I.101-09, even before improvements in on-farm nutrient management will have translated into improved water quality.

Proposed amendments

<u>Terms of reference</u>

In this submission, Teagasc proposes 21 amendments to the draft GAP regulations 2010, with a view to achieve:

- More effective protection of the rural aquatic environment, and/or:

- More efficient production of food, fibre and biofuel, with no differentially elevated risk of nutrient loss to the aquatic environment.

In the preparation of these proposed amendments, Teagasc adhered strictly to three guiding principles:

- All proposed amendments are based on solid scientific research;
- All proposed amendments have been subjected to an explicit environmental impact assessment;
- All proposed amendments have been cross-evaluated against each other to ensure consistency and synergy between all proposed amendments.

Nutrient requirements for crops and grassland establishment

Based on the outcomes of new research projects completed in the last five years, Teagasc proposes amendments to the following data used in the GAP regulations 2010:

- Updated figures on the nitrogen availability of Spent Mushroom Compost, Farmyard Manure and other composts;
- A new method of accounting for the residual nitrogen availability of animal manures, in relation to the tillage N-Index;
- Updated figures on differences in nitrogen requirements for winter wheat between N Index 1 and N Index 2;
- Updated figures on nitrogen requirements of winter wheat;
- Phosphorus requirements for high-yielding cereals;
- Timing of phosphorus applications to cultivated soils;
- Phosphorus requirements for grassland establishment;

Definition of soiled water

Based on a scientific survey of the characteristics of soiled water on dairy farms, Teagasc requests that the current regulations pertaining to the definition and management of soiled water are simplified, and that soiled water is characterised by its chemical composition only.

Method of calculation of phosphorus allowance

Based on the collective organisational experience and first-hand interaction with over 44,000 farmer clients, Teagasc has identified that the implementation of the P-regulations in S.I.378-06 / S.I.101-09 has posed significant practical and logistical challenges to farmers and agricultural advisors, and in some cases have led to significant and structural P deficits on farms. Teagasc acknowledges the underlying fundamental principles of the regulations with regard to phosphorus, i.e. 1) P-application rates should be based on farm P-balances, 2) Build-up applications of P may be applied to Index 1 and 2 soils and 3) no external

P may be applied to Index 4 soils. At this point, Teagasc does not seek to propose changes to these underlying principles.

However, based on the experience of Teagasc's Research Programme on Nutrient Efficiency, on the application of its "Teagasc Nitrates Calculator" (Lalor and Gibson, 2007), and on the collective feedback from its Advisory Services, it is Teagasc's view that:

- the current format of implementation of the P regulations may be overly complicated, imposing a significant and unnecessary administrative burden on farmers and agricultural advisors;
- the current format of implementation of the P regulations may give rise to inherent anomalies in P-budgeting on individual farms. In this submission, we demonstrate that, in specific farm scenarios, these anomalies are leading to large and structural P deficits.

In this submission, Teagasc proposes that the method of calculation of phosphorus allowances is rationalised and simplified, to take account of:

- Planning of phosphorus fertiliser and year-end P balance
- Phosphorus levels in concentrate feedstuffs
- Spatial distribution of phosphorus inputs from concentrate feed

In addition, Teagasc proposes that the draft GAP regulations include a mechanism through which the GAP regulations can be amended to reflect the outcomes from of new research in relation to P requirements of crops and animals, as soon as these are published, i.e. before the next review of the GAP regulations in 3.5 years time, if required.

Flexibility in the closed period for spreading of animal manures

Based on the preliminary outcomes of its ongoing research programme on the assessment of environmentally safe opportunities for land application of animal manures, Teagasc proposes that the flexibility in the implementation of the "closed periods", as applied by the Minister in 2008 and 2009, is regularised and based on an objective assessment of current environmental risks.

Transitional arrangements for pig and poultry manure

In relation to the transitional arrangements for pig and poultry manure, Teagasc urges:

- That the proposed amendments in this submission in relation to Nitrogen availability in organic manures and the Nitrogen Index for tillage crops be adopted to encourage the use of pig and poultry manure by tillage farmers.

- That the proposed amendments in this submission in relation to the simplification of calculations of maximum fertiliser N and P allowance be adopted to encourage the use of pig and poultry manure by livestock farmers.
- That the provision of pig and poultry manure storage facilities on tillage farms be encouraged and supported in order to ensure that the manure is available in the limited time period when it can be applied.
- That the provision of the specialist equipment for the application of pig manure to growing crops be encouraged and supported.

Administrative considerations

In relation to the administration of the proposed GAP regulations 2010, Teagasc offers constructive considerations in relation to:

- The designation of storage requirements where land is distributed across different zones.
- Soil sampling requirements on derogation farms
- The development of an integrated online nitrates facility
- Streamlining of the application process for a derogation
- Issues surrounding cross-compliance inspections
- The impact of the draft GAP regulations on REPS plans

Glossary

ACP	Agricultural Catchments Programme
BER	Break-even ratio
BMP	Best management practice
BOD	Biological oxygen demand
C	Carbon
DAFF	Department of Agriculture, Fisheries and Food
DM	Dry matter
DoEHLG	Department of Environment, Heritage and Local Government
DSS	Decision Support System
EPA	Environmental Protection Agency
FYM	Farmyard manure
GAEC	Good Agricultural and Environmental Condition
GAP	Good Agricultural Practice
K	Potassium
LU	Livestock unit
N	Nitrogen
N_2	Di-nitrogen gas
N_2O	Nitrous oxide
NAP	Nitrates Action Programme (also known as National Action Programme)
NFRV	Nitrogen Fertiliser Replacement Value
NH_4	Ammonium
NH_4-N	Ammonium nitrogen
NO_3	Nitrate
N_{opt}	Optimum nitrogen application rate
P	Phosphorus
RBDMP	River Basin District Management Plan
REPS	Rural Environment Protection Scheme
SFP	Single Farm Payment
S.I.378-06	European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2006
S.I.101-09	European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2009
SMC	Spent mushroom compost
SPS	Single Payment Scheme
UCD	University College Dublin

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Introduction

The purpose of this review is to appraise the draft European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2010 (hereafter referred to as the draft GAP regulations 2010), published by the Department of Environment, Heritage and Local Government on 11 June 2010, in light of the current state-of-the-art of Irish and international agri-environmental science, and the current collective technical and practical knowledge of Teagasc's Advisory Services. This review has been prepared by Teagasc's Working Group on the Water Framework Directive, with input from researchers from all research centres, from specialists, Area Managers and advisors.

On foot of the introduction of S.I.378-06 / S.I.101-09, Teagasc reviewed the knowledge base from national and international research to identify knowledge gaps on the interactions between agriculture and the aquatic environment (Schulte, 2006; Schulte *et al*., 2009a). Since 2005, Teagasc has pursued a comprehensive research and advisory programme in order to address these knowledge gaps, in collaboration with Irish and international universities, and with financial support from the Department of Agriculture, Forestry and Food (DAFF), the Research Stimulus Fund (administered by DAFF), INTERREG, Science Foundation Ireland and STRIVE (administered by the Environmental Protection Agency).

As part of this process, Teagasc reviewed the agronomic and environmental implications of the temporal restrictions on autumn ploughing, resulting from S.I.378-06/S.I.101-09. In 2009, it submitted "Some Agronomic, Economic and Environmental Considerations associated with the Nitrate Directive and the Tillage Sector" (Teagasc, 2009) to DAFF. Teagasc notes that, in the draft GAP regulations 2010, articles 21(1), 21(4) and 21(5) have been amended. Teagasc welcomes these amendments as being consistent with its aforementioned submission.

In **Part 1** of this submission, Teagasc conducts a further and wider review of the expected Environmental Impact of the original regulations (S.I.378-06 / S.I.101-09), based on Teagasc's monitoring programmes, experiments, modelling exercises and findings in the international scientific literature.

In **Part 2** of this submission, Teagasc proposes amendments to the draft GAP regulations 2010, based on the outcomes of its environmental research programme, supported by reviews of the current international scientific literature. The objectives of these proposed amendments are:

- To achieve more effective protection of the rural aquatic environment,

and/or:

- To achieve more efficient production of food, fibre and biofuel, with no differentially elevated risk of nutrient loss to the aquatic environment.

In the preparation of these proposed amendments, Teagasc adhered strictly to three guiding principles:

1. All proposed amendments are based on solid scientific research that has been subjected to scientific peer-review and published in international scientific journals;
2. All proposed amendments have been subjected to an explicit environmental impact assessment, with emphasis on the impact on water quality, and with cognisance to potential impacts on biodiversity and greenhouse gas emissions. Only those proposed amendments for which the projected differential environmental impact is neutral or positive, in comparison to S.I.378-06 / S.I.101-09, have been included in this submission.
3. All proposed amendments have been cross-evaluated against each other to ensure consistency and synergy between all proposed amendments (Figure A).

In addition, following the introduction of S.I.378-06 / S.I.101-09, Teagasc embarked on a major advisory programme to assist the agricultural industry with the implementation of the regulations. This included:

- One-to-one advice to more than 44,000 Teagasc client farmers on nutrient management planning, farmyard facilities and cross-compliance;
- The development of software to aid nutrient management planning;
- Dissemination and awareness-raising activities (farm-walks, discussion groups, open days)
- Publications through technical and popular media (e.g. radio, farming press, Today's Farm, TResearch, Advisory Newsletters)

As part of this advisory programme, Teagasc, as an organisation, has gained a unique collective knowledge and understanding of the practical and technical difficulties that are currently being witnessed by advisors when assisting farmers with the implementation S.I.378-06 / S.I.101-09.

In this submission, this collective knowledge on the implementation and the administration of the regulations, respectively, has been harnessed and collated through detailed workshops with representative groups of Teagasc specialists and advisors. In addition, each Teagasc programme area was surveyed and consulted on the draft Nitrates Action Programme for Ireland. These include: Dairy, Beef, Sheep, Pigs, Tillage, Horticulture, Farm Management, Equine, Organics and Agricultural Catchments Programme.

In **Parts 3 and 4** of this submission, Teagasc proposes amendments to the implementation and administration of GAP regulations 2010, with a view to:

- Reducing anomalies that in some instances have arisen as a result of S.I.378-06 / S.I.101-09,

and/or:

- Rationalising the on-farm administrative burden associated with the regulations, by simplifying the complex calculations required to ensure full compliance, thereby reducing the risk of involuntary discrepancies.

Similar to the proposed amendments in Part 2, the proposed amendments in Parts 3 and 4 have all been subjected to rigorous Environmental Impact Assessments; only those proposed amendments for which the projected differential environmental impact is neutral or positive, in comparison to S.I.378-06 / S.I.101-09, have been included in this submission.

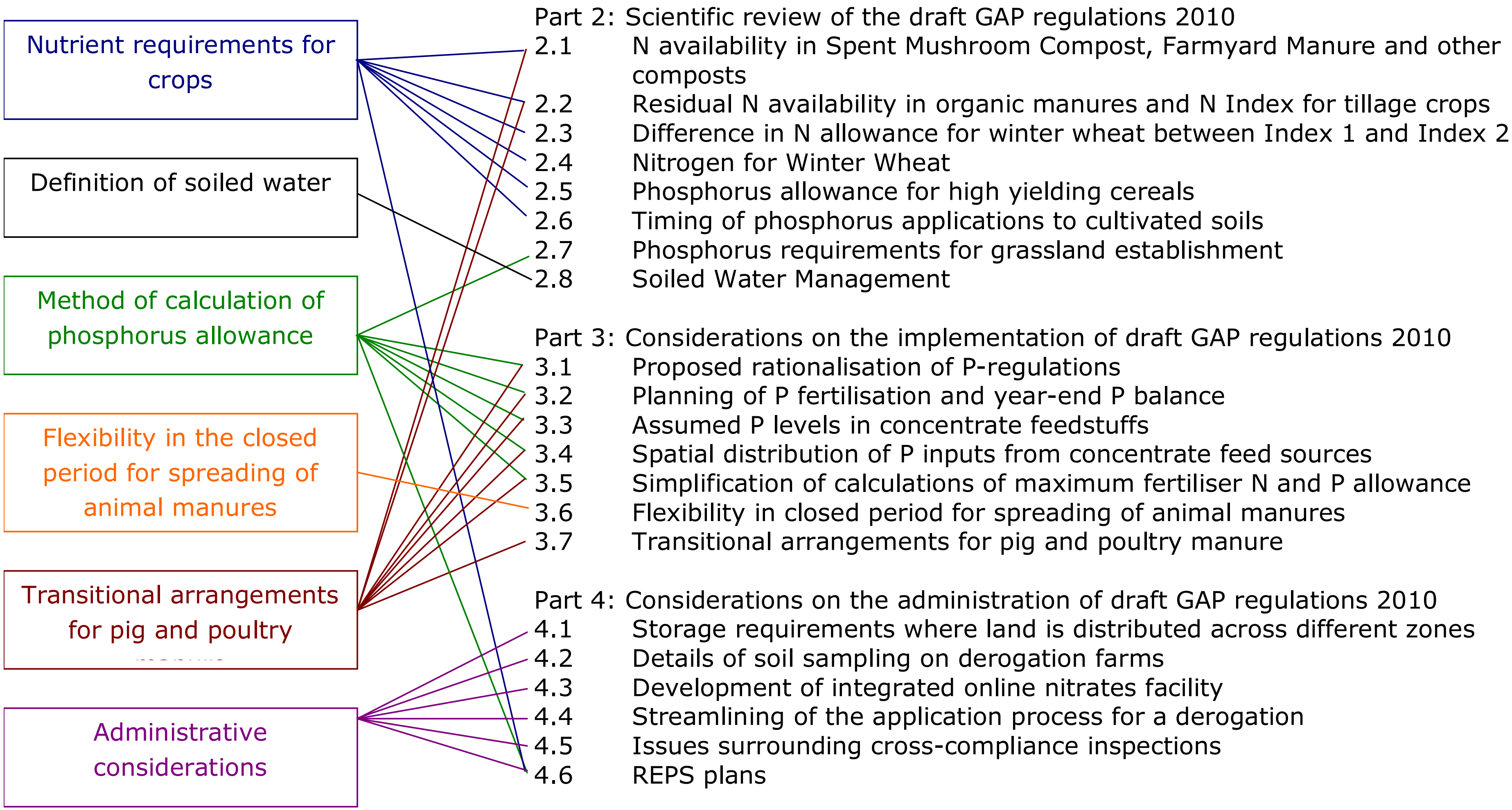

Figure A: Associations and cross-references between the amendments proposed in this submission.

Part 1:
Expected Environmental Impact of the original Nitrates Regulations (S.I.378-06 / S.I.101-09)

1.1 Changes in agricultural practices and infrastructure

The Good Agricultural Practice for Protection of Waters (GAP) Regulations (S.I.378-06 / S.I.101-09) were implemented at a national scale with a view to reducing the spatio-temporal interactions between nutrient pressures and nutrient transport factors to aquatic environments. These controls are now legally binding for farmers, and breaches can result in both prosecution, and penalties in single farm payment through cross-compliance. The legally binding measures in place since 2005 have placed restrictions on agricultural practices regarding:

i. stocking rates;
ii. mineral and organic fertiliser application rates;
iii. spatial restrictions on mineral and organic fertiliser applications based on soil test results, and location of water bodies and water abstraction points;
iv. timing of mineral and organic fertiliser applications;
v. farmyard management and animal manure storage, including minimum storage capacity; and
vi. ploughing and the use of non-selective herbicides.

Since the introduction of these measures, farmers have invested *c*. €2.5bn in manure management facilities. This has been facilitated in-part by various National Exchequer- and EU-funded on-farm investment schemes. An estimated €2bn has been awarded in grant-aid for animal housing, manure storage, and manure management equipment since these regulations have been introduced. In some cases, the fertiliser rates now prescribed in law are lower than those in previous agronomic advice (Coulter, 2004). Also, restrictions on animal manure management, particularly storage capacity and spreading restrictions, have required significant changes in nutrient management practices at farm level.

1.2 Impact of S.I.378-06 / S.I.101-09 on nutrient losses

Risk of nutrient losses from agriculture to water may arise when high nutrient pressures (e.g. excessive soil phosphorus (P) and/or soil nitrogen (N) concentrations) coincide in space and time with nutrient transport factors (e.g. overland flow and/or percolation below the rooting zone) (Haygarth *et al*., 2005; Schulte *et al*., 2006). Nutrient losses to water can be categorised into point source losses, incidental losses and diffuse losses (Jennings *et al*., 2003).

<u>Impact on point source losses</u>
In the past, point source losses from agriculture to water have mainly been associated with direct nutrient losses from farmyards, and from the disposal of excessive amounts of soiled water through stationary rotor-rainers (Bartley *et al*., 2006) (*cf*. Section 2.8). S.I.378-06 / S.I.101-09 contained specific and significant measures that were aimed to address both of these nutrient pressures. Since the introduction of the regulations, farmers have been required to have sufficient and adequate storage facilities to capture all animal manures for a duration in excess of the closed period for land application of animal manures. In addition, sufficient and adequate storage facilities must be in place to capture all sources of soiled water for a period of at least ten days. Since 2006, *c*. €2.5bn has been invested by the agricultural sector to meet and comply with these storage requirements. A recent presentation on cross-compliance inspections reported that the vast majority of farms (88% of farms that were randomly selected) were found to be compliant (Spain, 2010).

These new storage facilities reduce the connectivity between nutrient pressures and nutrient pathways; as a result Teagasc anticipates that the unprecedented investment in these facilities will have led to an immediate and significant reduction in prevalence and severity of point-source losses from agriculture to water. The anticipated effectiveness of these aspects of the regulations is currently being monitored in Teagasc's Agricultural Catchments Programme (*cf.* Section 1.4).

<u>Impact on incidental nutrient losses</u>
Incidental nutrient losses have historically been associated with direct losses of nutrients to waterbodies; such losses may have arisen from spatially inaccurate land-spreading of mineral and/or inorganic fertilisers adjacent to waterbodies, and/or from application of mineral and/or inorganic fertilisers at times and places where nutrient transport vectors were present during or subsequent to land application, e.g. during

overland flow events. S.I.378-06 / S.I.101-09 contained specific and significant measures that were aimed to address both sources of incidental losses. Since the introduction of the regulations, farmers must observe "buffer strips" for land application of fertiliser, the widths of which amount to a minimum of 1.5m for mineral fertiliser and 5m for organic fertilisers. Additional and more severe restrictions apply to land adjacent to public and/or group water abstraction points, mainly for the additional objective to prevent microbial contamination.

Furthermore, land application of fertilisers and animal manures is now subject to "closed periods", coinciding with the time of year with the most frequent average occurrence of pathway vectors. The length of the "closed period" is dependent on type of fertiliser (organic, mineral) and region ("zone") in which farms are based, reflecting geographic differentiation of climatic factors. In addition to these "closed periods", S.I.378-06 / S.I.101-09 states that land application of fertilisers, soiled water and animal manures can only take place when soil and weather conditions are suitable.

The concept of calendar-driven "closed-periods" has posed significant practical challenges to manure management in an Irish context, as annual weather patterns do not necessarily equate to multi-annual climatic patterns. As a result, "open" and "closed" periods do not necessarily equate to "suitable" and "unsuitable" conditions for land-spreading, which is further discussed in Section 3.6. Not withstanding these reservations, the implementation of buffer strips and "closed periods" are expected to have reduced the prevalence of spatio-temporal connectivity between nutrient pressures and nutrient pathways and hence reduced the prevalence and severity of incidental nutrient losses from agriculture to water. The effectiveness of these aspects of the regulations is currently being monitored in Teagasc's Agricultural Catchments Programme (*cf.* Section 1.4)

<u>Impact on diffuse nutrient losses</u>
Diffuse nutrient losses may arise in instances where elevated soil nutrient concentrations, in excess of crop requirements, interact with transport vectors (e.g. Haygarth and Jarvis, 1997; Haygarth *et al*., 2005; Kurz *et al*., 2005). In most cases, such elevated nutrient concentrations reflect long-term accumulations of nutrients as a result of historic imbalances between nutrient inputs (fertiliser, animal manures) and offtakes (silage, animal produce). S.I.378-06 / S.I.101-09 contained specific and significant measures that were aimed at addressing such imbalances and elevated soil nutrient concentrations. Nutrient inputs are subject to

maximum application rates, and no mineral P application is permitted on soils on which elevated soil P concentrations (P Index 4; Coulter and Lalor, 2008) have been identified. In addition, a maximum stocking rate equating to 170 kg organic N per ha has been applied on a whole-country basis. Farmers seeking to carry stocking rates in excess of this limit (up to 250 kg organic N per ha) must apply for individual farm "derogations", which requires the implementation of even stricter standards on nutrient management, including mandatory soil testing and field-by-field nutrient management plans. For tillage, the requirement for green cover, combined with restrictions on autumn ploughing of land were aimed at minimising concentrations of soluble soil nitrogen at the time of year with the highest prevalence of transport vectors (i.e. percolation).

The agricultural industry has proactively responded to the implementation of S.I.378-06 / S.I.101-09, by increasing nutrient efficiency and reducing farm-gate inputs. The latest Fertiliser Use Survey (Lalor *et al*., 2010) and fertiliser sales (DAFF, 2009) show that national P and N application rates have declined by 40% and 20%, respectively, between 2003 and 2008. The total national usage of fertiliser P and K has decreased to 1950's levels, while N fertiliser usage has not been so low since the early 1980's (Murphy and Heavey, 1969; Murphy *et al.*, 1997; Coulter *et al.*, 2005) (Figure 1.1; Table 1.1).

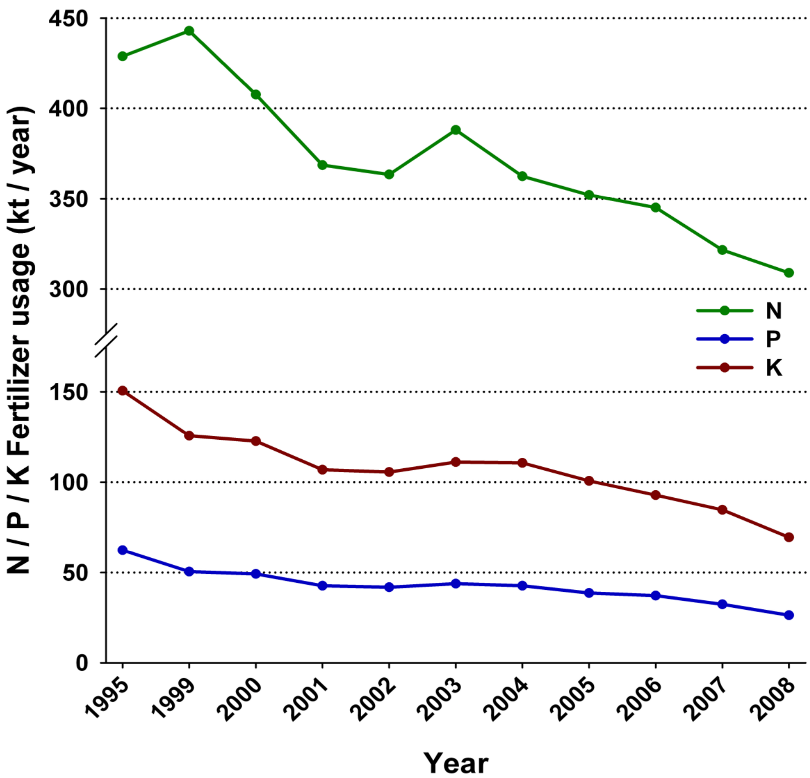

Figure 1.1: National usage of N, P and K fertiliser in Ireland from 1995 to 2008 (DAFF, 2009)

Table 1.1: Fertiliser usage on grassland and tillage crops in 2008 (percentage change in nutrient usage since 2003) (Lalor *et al*., 2010).

Crop	N	P	K
	—— kg/ha (% change from 2003) ——		
Grazing	65 (-38%)	3 (-63%)	9 (-50%)
Silage	101 (-16%)	7 (-46%)	24 (-41%)
Grassland Overall	86 (-30%)	5 (-55%)	14 (-48%)
Winter wheat	179 (-12%)	19 (-17%)	52 (-5%)
Spring wheat	139 (-9%)	20 (-17%)	49 (-8%)
Winter barley	163 (-2%)	25 (-17%)	64 (-10%)
Spring barley	118 (-4%)	21 (-19%)	45 (-18%)
Malting barley	117 (4%)	16 (-20%)	48 (-9%)
Winter oats	141 (2%)	23 (-12%)	51 (6%)
Spring oats	75 (-34%)	11 (-56%)	23 (-53%)
Cereal crops Overall	137 (-10%)	20 (-20%)	48 (-14%)
Forage maize	152 (30%)	41 (52%)	96 (57%)
Fodder beet	155 (20%)	51 (6%)	184 (14%)
Potatoes	93 (-19%)	73 (-28%)	170 (-24%)
Root crops Overall	106 (-24%)	46 (-21%)	138 (-18%)

This drastic decrease in farm-gate nutrient inputs is expected to result in significant reductions in N-surpluses. At national level, the P surplus applications that were common in previous decades (Tunney, 1990) have been substantially reduced in recent years (Lalor *et al*., 2010), and are now exceeded by the total P build-up requirements of soils in P Index 1 and 2.

Teagasc anticipates that these changes in nutrient balances will:

- Reduce the prevalence of soils with elevated soil nutrient concentrations over time, and
- Prevent the new build-up of elevated soil nutrient concentrations on soils.

Teagasc expects that, while nutrient efficiency has significantly improved following the introduction of S.I.378-06 / S.I.101-09, it may take many years for elevated soil nutrient concentrations, resulting from historic nutrient surpluses, to decline towards agronomically optimal concentrations (*cf.* Section 1.3).

1.3 Impact on Water Quality: the role of time-lags

It is widely recognised that it may take a considerable time to elapse before current improvements in nutrient management will become apparent in the receiving waterbodies (Sharpley *et al*., 2009). Depending on local hydrology and hydrogeology, nutrient loss to a waterbody can be a very slow process. As far back as 1985, Denmark was one of the first countries to adopt measures to reduce nitrate and phosphorus loss to water; however, improvements in water quality, particularly nitrate levels, have only become evident in recent years, 20 years after implementation, with no improvement yet in phosphorus levels from diffuse sources (Kronvang and Grant, 2008). Similarly, several recent studies of agricultural catchments in Nordic and Baltic countries have demonstrated that, especially in medium-sized and large catchments, the water quality response to reduced fertiliser application or to a decrease in agricultural intensity may be slow and limited (Löfgren *et al*., 1998; Stålnacke *et al*., 1999; Grimvall *et al*., 2000).

Therefore, even though Teagasc expects that the implementation of S.I.378-06 / S.I.101-09 has resulted in immediate and significant reductions in the risk of "newly-applied" nutrients being lost to the aquatic environment, Teagasc does not expect that this will instantly translate into improved quality of waterbodies. Instead, Teagasc expects that there will be a significant time period between the improvements in farm nutrient management and improvements in water quality. In November 2008, Teagasc organised an international conference on "Grassland and the Water Framework Directive" (WFD), in which this issue was explored in detail (see www.teagasc.ie/publications/2009/20090106/).

Teagasc emphasised the principles of time-lags in its submission to the draft River Basin District Management Plans (RBDMPs), as part of the consultative process for the implementation of the WFD. Following this submission, at the request of the Department of Environment, Heritage and Local Government (DoEHLG) and RPS Group Ltd., Teagasc has conducted extensive modelling studies to estimate the time-lags for P and N under Irish conditions. The results of these studies are presented below.

<u>Estimated time-lags for P</u>

While surface water P-concentrations may rapidly decline from high to moderate levels in response to the elimination of point sources and phasing-out of phosphatic detergents, as was observed in the Rhine in the mid 1980s (van Dijk *et al*., 1996), a further lowering of P-concentrations in response to reductions in diffuse P loss may take decades to become evident (Grimval *et al.*, 2000). Such time-lags reflect the accumulation of high levels of P in soils and sediment and the complexity of P redistribution through catchments, due to storage and remobilisation at intermediate locations between primary sources and catchment outlets (Boesch *et al*., 2001; Wang *et al*., 2002).

Numerous international studies support the notion that several years can elapse before the effects of best management practices translate into measurable improvements in water quality. For example, mandatory best management practices (BMPs) were implemented in the Everglades Agricultural area, Florida, in 1995, in an effort to reduce P loads in drainage waters (Daroub *et al*., 2009). A decrease in P loss from sugarcane farms was seen only after 7-10 yr of BMP implementation. At a small agricultural catchment scale in Norway, P mitigation measures over 18 years, including soil nutrient management, led to reductions in highly impacted catchments, but the rate of reductions between catchments was highly variable (Bechmann and Stålnacke, 2005). Similarly in Sweden, nutrient management in agricultural catchments over 21 years only showed a very small particulate P response in receiving rivers and a soluble P response only in low flows, attributed to mitigation of household point sources (Ulén and Fölster, 2007).

In a recent study (Schulte *et al*., 2010), Teagasc has estimated how many years it will take for soil P concentrations of P Index 4 soils to return to P Index 3, following the introduction of S.I.378-06 / S.I.101-09. This study was based on extensive 4-year field trials, at 32 sites across Ireland, the results of which were analysed and modelled to predict the lag-time involved in reducing P pressures. The outcomes showed that the decline of soil P concentrations of P Index 4 soils will primarily be a function of the relative P balance of a field, i.e. P inputs minus P outputs, relative to the total soil P reserves. The actual P balance varies between farming systems and may be subject to geo-physical constraints, and ranges from -7 to -30 kg per ha per year (Schulte *et al.*, 2009b; Schulte *et al*., 2010; Tunney *et al.*, in prep.). Figure 1.2 shows, for an *average* agricultural catchment, with a Total Soil P concentration of 1200 ppm (Kramers, 2007), the estimated decline in the prevalence of P Index 4 soils, for three contrasting P balances: -7 (red line), -15 (orange line), and -30 (green line) kg P per ha per year, assuming that all P Index 4 soils have been identified through soil testing.

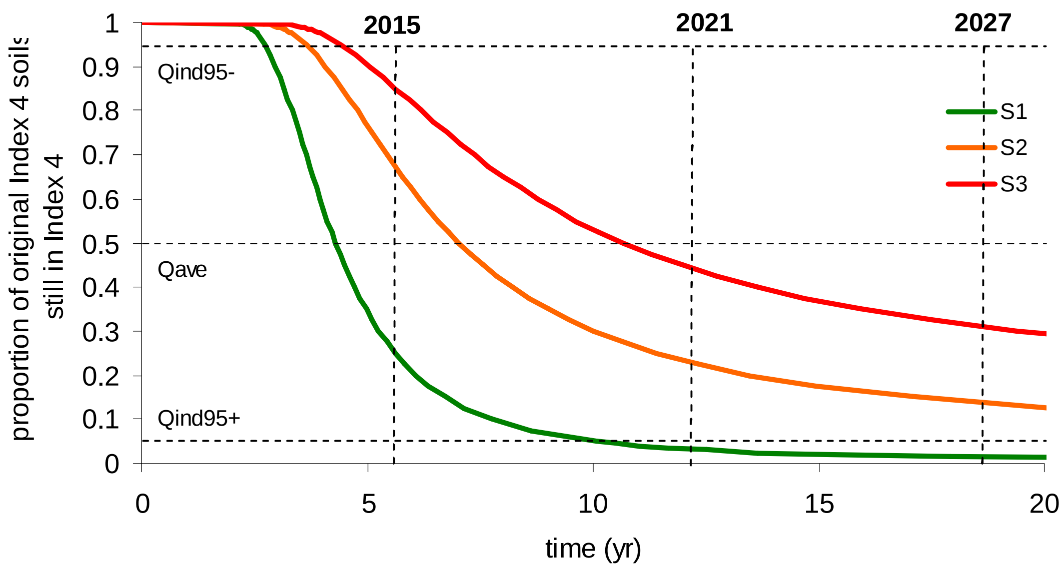

Figure 1.2: Analysis of the time required to reduce the relative prevalence of Index 4 soils, for three scenarios (S1, S2, S3, corresponding to P balances of -30, -15 and -7 kg P ha^{-1} yr^{-1}, respectively), and for Total soil P concentration = 1200 mg kg^{-1} (Schulte *et al*., 2010).

Figure 1.2 shows for this average catchment that, while in all scenarios the *onset* of the reduction in prevalence of P Index 4 soils may be expected to manifest itself within 5 years, it will take between 10 years (Scenario 1) and in excess of 20 years (scenario 3) for *all* P Index 4 soils to return to Index 3. Shorter delay times may be expected in catchments with lower Total P concentrations; conversely, longer delay times may be expected in catchments with higher Total P concentrations.

In a participatory study in the Lough Melvin catchment, Byrne *et al*. (2008) evaluated the potential cost-effectiveness of ploughing and reseeding of Index 4 grasslands, with a view to reducing soil test phosphorus concentrations at the soil surface, and accelerating the reduction in P Index 4 soils. While they estimated that reseeding such soils may significantly reduce P pressures and risk of P loss to water, the cost-effectiveness of this measure (kg P saved per € spent) was low, as reseeding is expensive; they found that this mitigation measure was very unpopular with farmers. In addition, in Section 2.7 of this submission, we suggest that current annual maximum fertiliser rates of P on grassland, permitted under S.I.378-06 / S.I.101-09, may impose significant constraints on the practicalities of reseeding Index 4 grassland.

Whereas the studies above showed lag-times associated with reductions in P pressures, lag-times associated with the entire source-pathway-receptor chain are further compounded by the uncertainty of transformation and attenuation processes in the stream network, due to storage and remobilisation at intermediate locations between primary sources and catchment outlets. Jarvie *et al*. (2005) and House (2003), for example, have indicated how new P equilibria can be established at the sediment-water interface, as catchment derived P inputs are mitigated – even from point sources where the mitigation of the P source would happen relatively quickly. Here, historically loaded sediment P can find a chemical mechanism for release into overlying P-depleted river water, thus potentially slowing the detection of apparent soil scale P reductions. Johnes *et al*. (2007) suggested that it is not possible to determine the length of time required for systems to respond to measures for control of diffuse P loss, due to the substantial reserves that have accumulated in soils and aquatic sediments in many parts of the U.K. Others have stated that it may take decades for reductions in soil P levels to translate into reduced end-of-catchment soluble P loads (Rayment, 2003; Rayment and Bloesch, 2006). This could be further delayed, due to excessive particulate P loss from the Total P pool persisting after soluble P losses decline (Withers *et al*., 2009).

The implications of these studies are that the P management regulations of S.I.378-06/S.I.101-09 will reduce diffuse P loss to water; however, it may take many years for excessive levels of plant-available P in soils to return to agronomically optimum levels, at which the environmental risk of diffuse P loss to water is low. Further delays can be expected in the receptor waterbodies, due to the potential historic reserves of P in sediment. As a result, there is a strong consensus in the international scientific literature that there is an unavoidable delay period between the implementation of on-farm BMPs to reduce diffuse P losses, and improvements in the water quality of the aquatic receptor, which, in some cases, may be in excess of 20 years.

<u>Estimated time-lags for N</u>

For N, similarly slow responses of water quality to reductions in farm N inputs have been observed. Soil N content typically ranges from 5,000 to 15,000 kg/ha in long-term permanent grasslands. This N may have built up over many years of N application, until, eventually, equilibrium is reached between N inputs and soil N content; it may take between 50 and 200 years for this equilibrium to be established (Whitehead, 1995). When N inputs (manure and fertiliser N) are reduced, it may take similar periods of time before a new, lower equilibrium is reached again. During this time, the process of soil N mineralisation is an important N source (Whitehead, 1995), as reduced carbon and nitrogen inputs change the soil C/N ratio, which may impact positively on soil N mineralisation. High rates of N mineralisation has been observed under grassland systems with high soil N and C loadings, with rates reported to vary from 135 and 376 kg N ha^{-1} $year^{-1}$ for intensively managed grasslands in the U.K (Gill *et al*., 1995).

Nutrients lost from the rooting zone migrate vertically in the unsaturated zone to the watertable and laterally along shallow flow lines to a surface water receptor, or vertically to the greater groundwater body. Due to this lag time, water quality improvement at a waterbody receptor may not occur for a long time even after mitigation measures have been introduced and experiments in the shallow sub-surface have shown positive trends. Factors affecting the response time of groundwater bodies to mitigation measures include the amount of recharge, the hydrology of the unsaturated zone (including matrix and preferential flow paths); the depth of the unsaturated zone; hydrogeological factors, such as porosity, storage and permeability; and the length of the pathway between recharge and discharge (Stark and Richards, 2008).

The time required for soil N to equilibrate to management systems with reduced N inputs should be considered when estimating the time required for waterbodies, affected by elevated nitrate concentrations, to reach "good status". Indeed it has been emphasised in the literature that if large

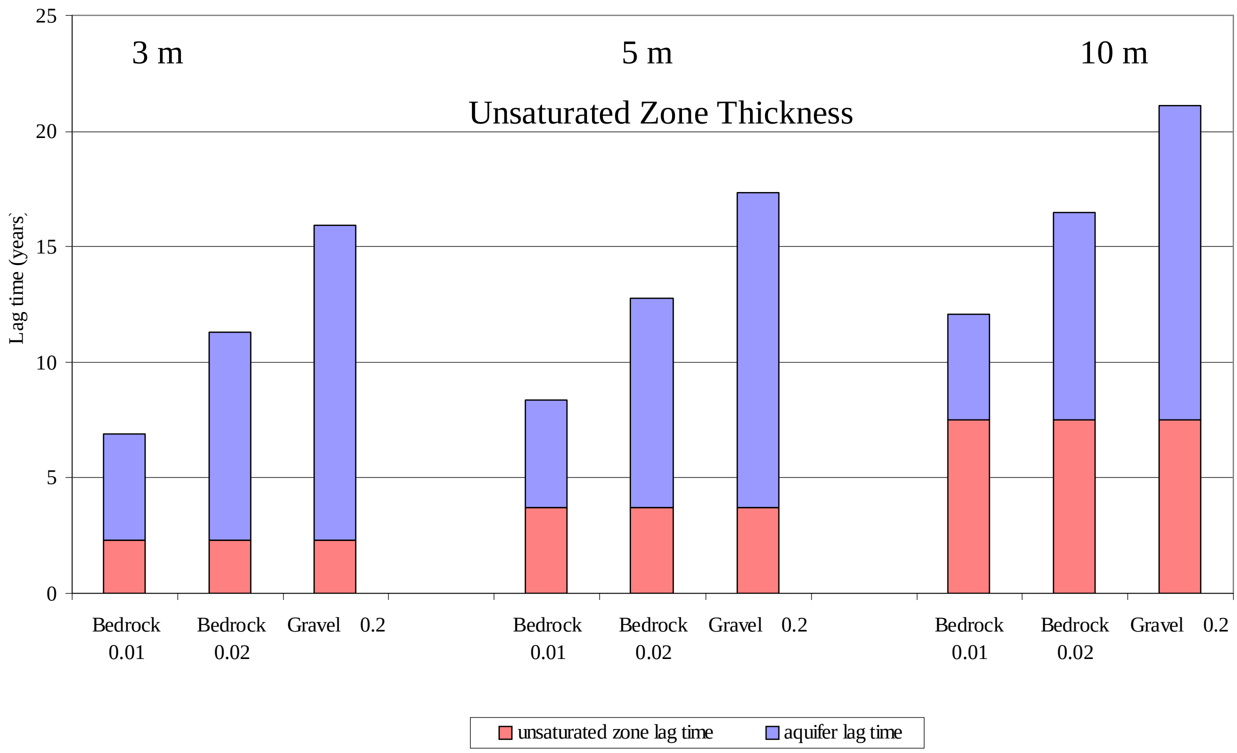

Figure 1.3: estimated lag times associated with nitrogen transport through the unsaturated zone and aquifers, for contrasting sub-soil types and depths of the unsaturated zone (Fenton *et al.*, in prep).

amounts of organic nitrogen have accumulated in soil during periods of higher application rates, nitrogen losses with agricultural runoff will decline very slowly, even though fertiliser inputs are reduced (Shen *et al*., 1989; Löfgren *et al*., 1998; Grimvall *et al*., 2000). For example, in several major Eastern European rivers, Grimvall *et al*. (2000) observed a remarkable lack of response to the dramatic decrease in the use of commercial fertilisers that started in the late 1980s, and they concluded that the water quality response to lowered input of N to a drainage area may be slower than the original response to the post-war increase in nutrient inputs.

In recent Teagasc studies, Fenton and Richards (2009) and Fenton *et al*. (in prep) suggested that for Irish soils, lag-times associated with N-transport through the unsaturated zone and aquifers may range from 7 to 22 years, depending on local geology and hydrology (Figure 1.3).

Recent Teagasc studies suggest that sub-surface denitrification (a process in which nitrates are converted into N_2O and/or N_2 gas) is likely to be an ameliorating factor in reducing nitrate concentrations during the transport process (Jahangir *et al*., 2010a). While most of the denitrification (61.3%) takes place in the topsoil, subsoil processes are characterised by more complete denitrification, with N_2 accounting for 64-90% of total subsoil denitrification emissions. In addition to the denitrification potential of subsoils, further denitrification may occur in groundwater. Denitrification in shallow groundwater accounted for the amelioration of between 3 and 29% of groundwater NO_3-N concentrations. Of particular relevance is that higher groundwater denitrification rates are more likely to be related to site-specific hydrogeological conditions, e.g. DOC, DO and redox-potential, rather than to land-use. Crucially, the mean N_2O:N_2O+N_2 ratios, ranging from 0.01 to 0.05, indicated that 95-99% of total groundwater denitrification emissions were in the form of environmentally benign molecular N_2 (Jahangir *et al*. 2010b).

These denitrification rates, combined with long hydrological lag times, indicate that complete denitrification is an important mechanism in subsoils and groundwater for a range of hydrogeological settings in Ireland. In these catchments, nitrate leached from the rooting zone will be reduced to N_2 before it reaches a sensitive water receptor.

The implication of these results is that, similar to P, long and unavoidable delay periods can be expected between the implementation of on-farm BMPs to reduce N loss to water, and improvements in water quality of the aquatic receptor. These delays result from the time required for historic excess soil contents to reduce to a lower equilibrium, and the time required for nitrates to travel through, and be flushed of the groundwater system. During this delay period, a large proportion of nitrate is expected to be ameliorated and denitrified to environmentally benign N_2 gas.

1.4 Teagasc's Agricultural Catchments Programme

River monitoring schemes on a monthly basis using meso to macro-scale catchments in Ireland are likely to be insufficiently sensitive to detect changes in agricultural practices following the introduction of S.I.378-06 / S.I.101-09, because the resolution of sampling will not account for, or capture, the episodic nature of diffuse nutrient transfers from agricultural land. In many surface water catchments, a coarse spatio-temporal resolution sampling regime will only follow the trends from apparent and mitigated point sources (Bowes *et al*., 2003; Foy, 2007; Jordan *et al*., 2007; Sharpley *et al*., 2009), but may fail to reflect the delayed reduction in diffuse losses of nutrients.

For this reason, DAFF has arranged that Teagasc conduct an Agricultural Catchments Programme (ACP) in line with the requirements of Article 8 of the Commission Decision of 22/10/07. The ACP operates on a partnership basis with farmers and other stakeholders, both in the catchments and nationally, and a key element in the successful operation of the Programme is the support and participation of the catchment farmers. Farmers in the catchments are in close contact with the Programme through the locally-based advisers and technicians, who regularly meet them on a one-to-one basis and through group meetings. At national level, the ACP Consultation and Implementation Group provides an opportunity for the farm organisations and other stakeholders to monitor the progress of the Programme and contribute to its implementation.

The ACP is evaluating the effectiveness of the Nitrates Action Plan (NAP) mitigation measures which have been implemented under the Nitrates Directive. This evaluation will provide the basis for any modifications of the measures that might be required to achieve Nitrates Directive and Water Framework Directive water quality objectives. The programme initially runs from 2008 to 2011 with an annual budget of approximately €2m.

Teagasc appointed a Programme Manager and commenced preparatory work on the Programme in 2007. A further 15 staff (multidisciplinary) are now in place. During 2008, a detailed assessment of a range of possible candidate catchments was undertaken with a view to shortlisting the most suitable for inclusion in the Programme. The selection of catchments was influenced by EU guidelines which suggest that monitoring efforts should be concentrated in "areas of intensive crop and livestock production …with elevated nitrate concentrations... adjacent to existing or projected eutrophication areas…with similar land use, soil type or agricultural practice." Six intensively farmed catchments on a range of contrasting soil types have been selected. An Expert Steering Group, consisting of internationally recognised scientific experts, independent experts, as well as national experts from DAFF, DoEHLG and the EPA, was established to provide scientific oversight and advice.

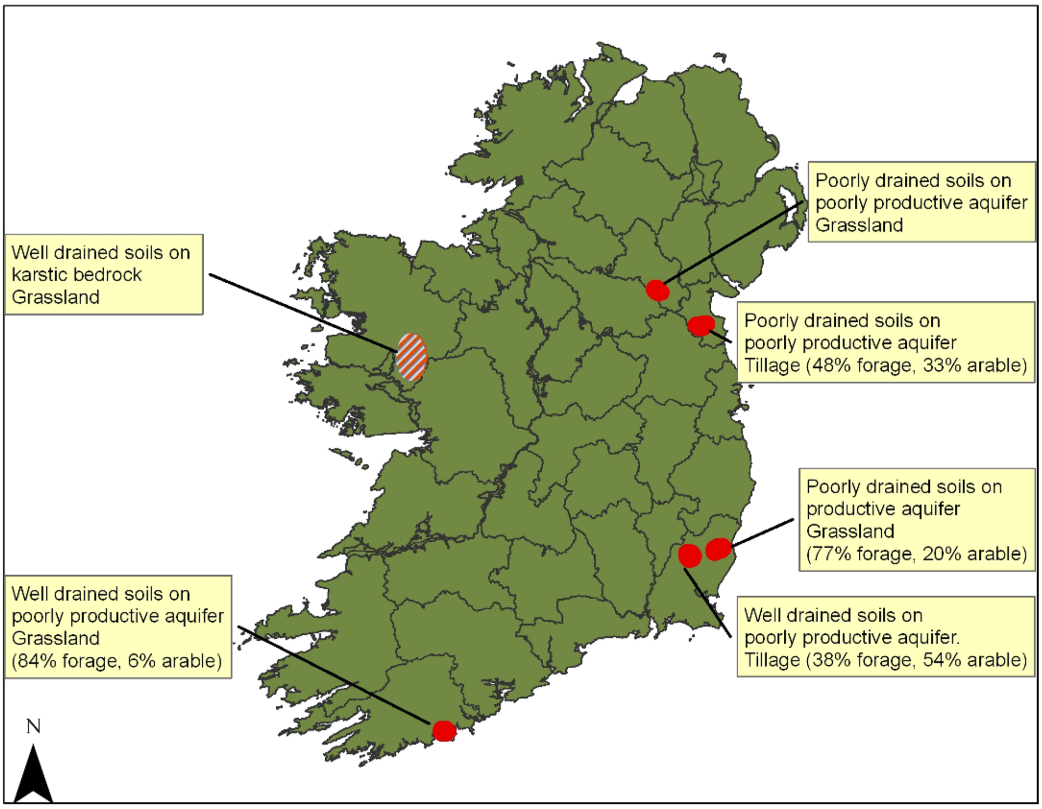

Figure 1.4: Location and characterisation of the ACP catchments.

There are a substantial number of derogation holdings (principally dairy farms) in the catchments and these are included in the overall evaluation of the NAP measures. The evaluation includes monitoring the effect of changes in farm management practices on the transfer of nutrients from source to water and the impact of those nutrients on water quality. Measurements, modelling and socio-economic studies are being used to evaluate the efficacy, cost effectiveness/economic impact of the NAP measures, as well as farmers' attitudes to the measures and broader agri-environmental issues. Knowledge gaps will be identified where evidence indicates that water quality targets may not be achieved.

The objectives of the programme are to:

- Provide a scientific evaluation of the effectiveness of the NAP measures;
- Underpin the basis for any modifications of the measures that might be required to achieve Nitrates Directive water quality objectives;

- Consider the scaling up of the results to larger catchments scales by model development or adaptation and validation in conjunction with national and international expert groups;
- Provide information on attitudes and awareness of farmers to water pollution issues and the economic impact of changed agricultural practices arising from compliance with Nitrates Directive measures;
- Provide national focal points for technology transfer and education;
- Provide advisory support for participating farmers to underpin the profitability of their enterprises and facilitate the implementation of the NAP measures;

All six catchments where the ACP operates are now established and all elements of the programme (farm advice, nutrient source/pathway/delivery, socio-economic, data management) are underway. All of the farmers in the catchments have been briefed by ACP advisers and the core farmers have been recruited as clients of the programme. Instrumentation for water and weather monitoring is operational in all of the catchments and soil sampling is complete in four of the catchments and will be completed in the remaining two others in the second half of 2010. Economic and attitudinal survey methodologies have been developed and are being implemented in all catchments and control areas. An initial ecological survey has been completed in five of the catchments and a further two surveys will be completed in all catchments in 2010. Links have been developed that will provide the potential for co-operation and collaboration. These include the Lough Melvin project and the UNESCO HELP project, as well as other links within Teagasc and outside through the Walsh Fellowship programme. Four Walsh Fellowships have commenced in the following areas:

- Bacterial pathogen sources and transfer hydrodynamics in rural catchments (with University College Galway);
- Developing soil based nitrogen tests for grassland soils (with Queens University Belfast);
- Processes of P and N attenuation in streams draining agricultural land in Ireland (with University College Dublin);
- Facilitating technology transfer: An examination of the adoption of grassland management practices and environmental-related technologies (with Dublin City University).

Further details of the ACP can be found at: www.teagasc.ie/agcatchments/

1.5 Conclusions

The introduction of S.I.378-06 / S.I.101-09 has resulted in significant and sweeping changes in farm infrastructure and farm practices across the Republic of Ireland, specifically in relation to nutrient management facilities and practices. Based on a comprehensive programme of field-experiments, laboratory experiments, and modelling studies, and supported by consensus in the large body of international scientific literature, Teagasc anticipates that:

- The implementation S.I.378-06 / S.I.101-09 will have led to significant reductions in point-source losses and incidental losses from agriculture to water;
- The implementation S.I.378-06 / S.I.101-09 will, *over time*, significantly reduce diffuse P and N pressures and losses from agriculture to water. While the implementation of S.I.378-06 / S.I.101-09 has instantly reduced farm-gate P and N balances, it may take years to decades for improvements in nutrient efficiency to translate into improvements in water quality.
- The latter delay periods are a result of biophysical constraints and are unlikely to be overcome by further and/or supplementary measures to manage soil source pressures. Further delays at water body receptor level may be reduced by pathways measures, but the efficacy and cost-effectiveness of these has not yet been unambiguously established for the full array of contrasting geo-climatic conditions (Stevens and Quinton, 2009; Haygarth *et al*., 2009; Schulte *et al*., 2009c).

Teagasc's Agricultural Catchments Programme is designed to monitor the effectiveness of the measures of S.I.378-06 / S.I.101-09 over time, and is instrumented to assess effectiveness well before improvements are expected to translate into improved water quality of the final aquatic receptors.

Part 2:
Scientific considerations on the draft GAP regulations 2010

2.1 *N availability in Spent Mushroom Compost, Farmyard Manure and other composts*

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

15. (3) The amount of nitrogen or phosphorus available to a crop from a fertiliser of a type which is specified in Table 9 of Schedule 2 in the year of application of that fertiliser shall, for the purposes of this Part, be deemed to be the percentage specified in that table of the amount of nitrogen or phosphorus, as the case may be, in the fertiliser.

(4) The amount of nitrogen or phosphorus available to a crop from an organic fertiliser of a type which is not specified in Table 9 of Schedule 2 shall be deemed to be the amount specified in that table in relation to cattle manure unless a different amount has been determined in relation to that fertiliser by, or with the agreement of, the relevant local authority or the Agency, as the case may be.

Context

Recycling of nutrients contained in Farmyard Manure (FYM), Spent Mushroom Compost (SMC) and other compost material has economic, agronomic and environmental advantages. In order to obtain maximum benefits from nutrients in these materials, fertiliser N applications should be reduced by an amount equal to the amount of crop available nutrients in the material. If the amount of crop available nutrient in the material is overestimated, an excessive reduction will be made in the amount of allowed fertiliser nutrient that can be applied to the crop, which will lead to under-fertilisation of the crop. As well as supplying nutrients, the application of organic manures is an effective means of maintaining/increasing organic matter levels in arable soils which is required under GAEC regulations.

Summary of issue:

Within the draft GAP regulations, the amount of total nutrients deemed to be available to a crop in the year of application of FYM or SMC is outlined in Table 9 of Schedule 2. The figures in Table 9 indicate the fertiliser replacement value of the nitrogen and phosphorus in the manure in the year of application. Residual N release in subsequent years must also be included when applied to tillage crops, as specified in Table 10 of Schedule 2 of the draft GAP regulations. For SMC and FYM, the assumed relative nitrogen fertiliser replacement values (NFRV) are 45% and 30% respectively. For other organic fertiliser types not specified in Table 9 of

Schedule 2, the NFRV in the year of application is 40%, i.e. is assumed to be equal to that of 'cattle and other livestock manure'.

While there is relatively little available work examining the NFRV of SMC and FYM, there are clear indications that the current assumed NFRV values in the year of application are excessively high. Maintaining NFRV values that are unachievably high has the direct effect of discouraging farmers from using these materials on both arable and grassland areas, as excessive reductions in fertiliser N are required, which will lead to sub-optimal N nutrition of the crop. In practice, NFRV's for composts are substantially lower than those for organic manures with more readily available nutrients such as slurries and poultry manures, due to the fact that much of the nitrogen is in organic forms.

Scientific Background

The N fraction in organic fertilisers is not all readily available for plant uptake. A portion of the total N content is in a mineral form that is readily available for uptake, and this occurs mainly in the form of ammonium (NH_4^+) (and uric acid in the case of poultry manures). The remaining portion of the total N is in an organic form. This "organic N" is not readily available at the time of application, but will be released over time. The speed of release of this organic component of the manure depends on a range of soil and manure type factors, and is often slow and usually occurs over many years. (DEFRA, 2010). (See section 2.2 for details on residual N release of organic-N).

The availability of N in the year of application is dependent on the relative ratio of inorganic N to organic N in the organic fertiliser. The higher the inorganic N proportion, the higher the availability of N in the year of application, and the lower the residual release in subsequent years. Conversely, the lower the inorganic N proportion, the lower the availability of N in the year of application and the higher the residual release in subsequent years (Schröder, 2005). Organic fertilisers with high proportions of N in a mineral form include pig slurry (60-70%), cattle slurry (45%) and poultry manures (40-50%) (DEFRA, 2010). Those with low proportions of inorganic N include farmyard manure (FYM) (10-20%) (DEFRA, 2010) and spent mushroom compost (SMC) (11%) (Maher *et al.*, 2000).

Available scientific information, both on the chemical composition of SMC and FYM, and field trials examining the availability of N to crops, indicates that availability of nitrogen from these materials in the year of application is substantially lower than the values of 30% and 45% for FYM and SMC, respectively, that are assumed in the draft GAP regulations.

Examination of the chemical composition of SMC indicates that nitrogen release from the SMC will be slow. The release of N from an organic material is influenced by the C:N ratio of the material. The higher the C:N ratio, the slower the release of N. Jordan *et al*. (2008) reported a mean C:N ratio for Irish SMC of 18 (range 14-24). Wallace (2006) indicated that for composts with a C:N ratio of 17.5, only 2.5% of applied N would be mineralised in the first year after application. High C:N ratios are also typical to FYM. Studies using FYM in field experiments report C:N ratios of FYM in the range 13.7 to 14.9 (Salazar *et al*., 2005; Schröder *et al.*, 2007).

Field experiments examining the NFRV of SMC and FYM for arable crops are scarce. Duggan *et al*. (1999) reported that, under Irish conditions, only 5 % of N applied as SMC was recovered by a winter wheat crop, but they did not calculate an NFRV value based on yield. Ongoing work at Teagasc, Oak Park is examining the NFRV of SMC when used as a N source for spring barley. In these trials, the yield obtained where SMC has been applied in the absence of fertiliser N is being compared to a fertiliser N response curve in the absence of SMC, on two contrasting soil types. After two seasons, NFRV values between 5% and 26%, with a mean NFRV of 13.8%, have been obtained, with no obvious relationship between NFRV and either soil type or SMC application rate. This corresponds with data from Maher *et al.*, (2000), which suggest an NFRV of 11%.

Similarly, for FYM, previous agronomic advice assumed that the maximum NFRV achievable in the year of application under optimum application conditions (spring application) was 10% (Coulter, 2004). Gutser *et al*. (2005) reported NFRV from FYM in the year of application of 12%.

<u>Proposed solution</u>
Teagasc proposes that the NFRV or availability figure in Table 9 of Schedule 2 should be reduced from 30 and 45% to 10-15% for both FYM and SMC. Other composted materials that are not listed in Table 9 of Schedule 2, but have similar C:N and NH_4-N to organic-N ratios should be stated as being equal to FYM in terms of NFRV in the year of application, rather than being equivalent to 'cattle and other livestock manure' as specified under Article 15(4) of the draft GAP regulations.

Environmental impact of proposed solution

N release from FYM and SMC is a slow process, which is the primary cause of the low availability of nitrogen from these materials. This is due to the low amount of inorganic N present in SMC, combined with a relatively high C:N ratio. Maynard (1993) examined nitrate leaching from a fine sandy loam that received annual applications for three consecutive years, of SMC containing either 365 or 731 kg N/ha, and found little effect on nitrate leaching. Under Irish conditions, applications of up to 400 kg N/ha as SMC (i.e. at rates well in excess of SMC application rates permitted by the draft GAP regulations 2010) had little effect on soil nitrate concentrations in a clay loam soil (Maher, 1991; Maher, 1994).

In a field lysimeter experiment where SMC was applied at the beginning of the drainage season, Stewart *et al*. (1998) found that only 8% of N applied was leached, where no crop was present. They attributed an initial peak in leaching to the presence of inorganic N in the SMC. Under current Irish regulations, land is not allowed to remain without a green cover over the winter period so any inorganic N in the SMC, even if applied in the autumn, is likely to be accumulated by the crop or green cover.

2.2 Residual N availability in organic manures and N Index for tillage crops

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

15. (5) A reference in this Part to the "nitrogen index" or the "phosphorus index" in relation to soil is a reference to the index number assigned to the soil in accordance with Table 10 or 11 of Schedule 2, as the case may be, to indicate the level of nitrogen or phosphorus available from the soil.

Context

The N availability of organic fertilisers, assumed in S.I.378-06 / S.I.101-09, has increased steadily since the beginning of the Nitrates Action Programme, as per Schedule 2, Table 9 of S.I.378-06 / S.I.101-09. Fertiliser N application rates must be adjusted to account for the contribution of organic fertilisers to the N supply to the crop in the year of application.

In addition to the impact of organic fertilisers on N fertiliser application rates in the year of application, the release of N from organic fertilisers in subsequent years following application must also be taken into account when calculating N application rates. At present, this is done through the N Index system for tillage crops. In the case of the draft GAP regulations 2010, the application of any organic fertilisers in two consecutive years results in the crop grown in the third year being fertilised at N rates for Index 2 soils. This has the effect of reducing the N application rate on tillage crops.

Summary of issue:

Where organic manures are applied to arable land for two consecutive seasons the land is deemed to change from soil N Index 1 to soil N Index 2 in the third season. This change occurs without reference to the type or amount of organic manure applied.

For cereal crops, this results in a 20-50 kg N per ha reduction in the allowed amount of fertiliser N in the third season, depending on the crop grown, irrespective of whether organic manures are applied in the third season or not. Below, we demonstrate that it is unlikely that, taking into account that applications of organic manures are limited by both organic nitrogen loading and maximum P fertiliser limits, two successive applications of organic manure would supply 50 kg N per ha to a crop in the season after application of the manure.

Therefore, the deductions applied to the maximum fertiliser N rates following two years of application of manures, do not reflect the cumulative amount of N released from these manures. This has resulted in a reluctance by tillage farmers to apply organic manures for two consecutive years, which specifically restricts the amount of tillage land available for the recycling of pig and poultry manures (*cf*. Section 3.7).

Scientific background:

As explained in Section 2.1, the speed of release of organic N from manure depends on a range of soil and manure type factors, and is often slow and usually occurs over many years. (DEFRA, 2010). The current reference to organic fertilisers in the N Index determination (Table 10 of Schedule 2 of the draft GAP regulations) is a reflection of this slowly available portion of N in organic fertilisers. Organic fertilisers with high proportions of N in a mineral form include pig slurry (60-70%), cattle slurry (50%) and poultry manures (40-50%) (DEFRA, 2010). Those with low proportions of inorganic N include farmyard manure (FYM) (10-25%) (DEFRA, 2010) and spent mushroom compost (SMC) (11%) (Maher *et al.*, 2000) (see Section 2.1).

Successive applications of organic manures to soils will have an additive effect and will lead to an increase in the N supply potential of the soil (Schröder, 2005). However, there are differences between different organic manures with respect to the magnitude of this effect and the number of applications required before the effect becomes significant. Manures with a high proportion of available N (pig and cattle slurry and poultry manures) will have less of a residual effect in the years following the year of application while those with a smaller proportion of available N (FYM, SMC) will have a greater residual effect in the years following the year of application. Sorensen and Amato (2002) concluded that the residual effect of a single pig slurry application was relatively low. Gutser *et al*. (2005) demonstrated a much higher short-term effect and a lower long-term residual effect of cattle slurry and sewage sludge, when compared to farmyard manure. Luxhoi *et al*. (2004) found no significant effect of short term (3 years) animal slurry applications on N turnover. Whalen *et al*. (2001) also reported that annual inputs of cattle slurry of up to 180 t/ha for 5 years did not change the N mineralisation potential of the soil substantially.

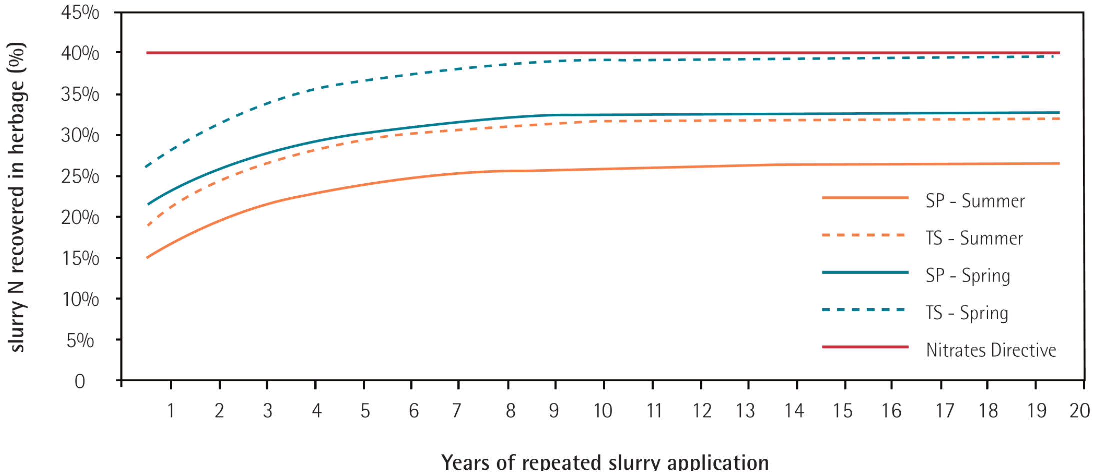

Figure 2.1: Cumulative N recovery from slurry following annually repeated applications, as functions of application method and timing (SP = splashplate; TS = trailing shoe) (Hoekstra *et al*., in prep).

Organic manures with a low proportion of available N, such as SMC, FYM and composts, tend to have a greater residual effect which is often manifested as a slow release of N over an extended period of years. Sullivan *et al.* (2003) reported that N became available from a food waste compost for up to seven years after application. Nevens and Reheul (2003) found that where repeated applications of compost were made over four years to maize, the mean Nitrogen Fertiliser Replacement Value (NFRV) was 6.9%.

The speed of release of N from organic fertilisers in subsequent years following application depends on a number of factors, including the carbon to N ratio in the material, and it can take many years or even decades to reach an equilibrium rate of release (Schröder, 2005). Recent work completed by Teagasc (Figure 2.1; Hoekstra *et al*., in prep.) found that *c*. 6% of the total N applied in slurry to grassland was taken up by the grass in the years *after* application, through mineralisation of the organic N fraction. If slurry is applied annually to the same soil, the *cumulative* supply of N through mineralisation was predicted to accrue to 12-14% of the total N that is applied annually.

<u>Proposed solution:</u>
Teagasc proposes that, following application of organic fertilisers with high available N content (≥ 40% NH_4-N as % of total N) (cattle slurry, pig and poultry manure), the N Index of tillage crops in subsequent years should not be affected. Teagasc research has demonstrated that the residual effects will not increase the long-term NFRV above the 40% for cattle slurry and 50% for pig slurry that is currently already assumed for the

NFRV for the first year of application (Lalor *et al*., in press; Hoekstra *et al*., in prep., Figure 2.1).

For organic fertilisers with low available N content (≤ 40% NH_4-N as % of total N) (FYM, SMC, Other Composts), account should be taken in the N application rates for higher residual N recovery in subsequent years.

Teagasc proposes that reference to organic fertilisers in the current N Index for cereals should be removed. Instead, the fertiliser N application rates to tillage crops should be adjusted to account for the application rate over time of total N from organic fertilisers. This could be implemented by amending the current Table 16 of Schedule 2 of the draft GAP regulations (N application rates to tillage crops) to reduce N application rates based on average application rates of FYM, SMC, or other composts, e.g.:

- 0 kg/ha where N application rates from FYM, SMC or other composts are on average less than or equal to 50 kg/ha over the previous 3-5 years;
- 11 (11.25) kg/ha where N application rates from FYM, SMC or other composts are on average greater than 50 and less than or equal to 100 kg/ha over previous 3-5 years;
- 23 (22.50) kg/ha where N application rates from FYM, SMC or other composts are on average greater than 100 kg/yr over 3-5 years.

(This system of options would make administration simpler than calculating exact residual availabilities).

<u>Environmental impact of proposed solution:</u>
The environmental impact of the proposed solution is expected to be positive, as this amendment negates one of the main current impediments to the use of organic manures on tillage land, particularly pig and poultry manure and SMC. Currently, availability of tillage crops for organic manures is limited by the draft GAP regulations 2010, which designates tillage land receiving two consecutive applications of manures into N-Index 2. Based on the results above, the reduction in the maximum N fertilisation rates in N-Index 2 is not an accurate reflection of the residual N mineralised from previously applied organic manure. Our proposed amendment accounts more accurately for this residual N, and will therefore encourage application of organic manures to tillage land, thus improving the potential for nutrient recycling within arable and livestock systems (*cf.* Section 3.7). At national level, Teagasc expects that this will result in reduced fertiliser P imports.

2.3 Difference in N allowance for winter wheat between Index 1 and Index 2

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

15. (5) A reference in this Part to the "nitrogen index" or the "phosphorus index" in relation to soil is a reference to the index number assigned to the soil in accordance with Table 10 or 11 of Schedule 2, as the case may be, to indicate the level of nitrogen or phosphorus available from the soil.

Context

Fertiliser N advice for tillage crops in Ireland is adjusted for the supply of nitrogen from the soil. This adjustment is made using an N Index system which is based primarily on previous cropping history. The N Index system is therefore used to estimate the potential supply of N from the soil to the crop. The N Index for a soil ranges between 1 and 4 with a soil N Index 1 signifying the lowest soil N supply potential. Previous crops leaving greater N residues than cereals lead to an increase in the soil N Index with a consequent reduction in allowed fertiliser N. (Tables 10 and 16 of Schedule 2 of the draft GAP regulations 2010)

Summary of issue:

Where winter wheat is grown after sugar beet, fodder beet, potatoes, mangels, kale, oilseed rape, peas, beans or short term leys (1-4 yrs), or where organic manures have been applied in the two consecutive previous seasons, the soil N Index for subsequent crops equates to soil N Index 2. The maximum allowed fertiliser N rate for winter wheat on N Index 2 soils is 50 kg N/ha lower than that allowed for soil N Index 1 soils (where the wheat crop follows either cereals or maize). This suggests that the above-mentioned crops provide a 50 kg N/ha benefit to the succeeding winter wheat crop. However, a review of international literature would indicate that a nitrogen benefit of this order is unlikely (see below). This reduction acts as a disincentive to use crop rotations instead of cereal monocultures.

Scientific background

A considerable amount of the N accumulated by grain legumes such as peas and beans is harvested and therefore these crops are unlikely to add appreciable N to the soil through unharvested residues (Brunner and Zapta, 1984; Senaratne and Hardarson, 1988). Kumar and Goh (2000) reviewed the N benefit of grain legumes to subsequent crops and concluded that, on average, grain legumes contributed 15-20kg N/ha to subsequent crops, while Evans *et al*. (1991) reported that wheat grown after lupins or beans accumulated 36kg N/ha more than wheat grown after a cereal. Senaratne and Hardarson, (1988) reported that the total N yield of a cereal succeeding beans and peas was approximately 25kg N/ha greater than when barley was the preceding crop.

This range of N benefits of preceding grain legumes is further confirmed by the values used in recommendation systems throughout the world. For example, the UK recommendations indicate that the N value of legumes as a preceding crop in high rainfall areas is 30 kg N/ha on deep clayey soils (i.e. the fertiliser N recommendation for cereals following peas or beans is 30 kg N/ha less than that for cereals following cereals); no benefit is attributed to these preceding crops on medium soils or shallow soils (DEFRA, 2010). Similar values are used in other worldwide recommendation systems (Rehm *et al.*, 2001; Anon, 2002). Additionally, under the draft GAP regulations 2010, where other cereals are grown, the reduction in allowed fertiliser N as a result of moving from soil N Index 1 to soil N Index 2 is 20-35 kg N/ha, depending on the cereal being grown.

<u>Proposed solution</u>

Teagasc proposes that the reductions in maximum fertiliser N rates as a result of moving from soil N Index 1 to soil N Index 2 for winter wheat are reduced from 50 kg N/ha to 20-30 kg N/ha. Ideally, the effect of moving from Index 1 to Index 2, in terms of maximum fertiliser N rate, should be the same for all cereal crops.

<u>Environmental impact of proposed solution</u>

Encouraging rotations in winter wheat systems, by reducing the reduction in allowed fertiliser N as a result of having a preceding rotational crop, is desirable from a number of viewpoints such as increased biodiversity, potential increase in soil organic matter and more efficient use of applied nitrogen, due to reductions in levels of take-all root disease.

The proposed solution is suggesting a more realistic estimate of the N benefit to winter wheat accruing from a preceding crop, such that fertiliser N can be used to fully supply the crop requirement. As excess fertiliser N is not being applied the risk of increasing N leaching is low.

2.4 Nitrogen for Winter Wheat

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

16. (3) Without prejudice to the generality of sub-article (1) and subject to sub-article (4), the amount of available nitrogen or available phosphorus applied to promote the growth of a crop specified in Table 12, 13, 14, 15, 16, 17, 18, 19, 20 or 21 of Schedule 2 shall not exceed the amount specified in the table in relation to that crop having regard to the relevant nitrogen index or phosphorus index, as the case may be, for the soil on which the crops are to be grown.

Context

Winter wheat is the second most important crop (based on acreage) in Ireland, after spring barley. Yields of winter wheat in Ireland are amongst the highest in the world (FAOStat), with a mean yield generally in the range of 9-10 t/ha (Central Statistics Office, 2009). Yields in excess of 10 t/ha from individual fields are common. Fertiliser N applications to winter wheat are limited by the draft GAP regulations 2010. Maximum allowed fertiliser N for winter wheat, according the draft GAP regulations 2010, is determined by the soil N Index, historic yield and end use.

Summary of issue:

For feed wheat in a soil Index 1 situation (lowest soil N supply potential), where yields in excess of 9 t/ha cannot be proven, the allowed maximum fertiliser N application rate is 190 kg N/ha. Where higher yields can be proven, an additional 20 kg N/ha for each additional tonne above 9 t/ha can be applied. Therefore, for a 10 t/ha winter wheat crop, 210 kg fertiliser N/ha can be applied. A combination of calculated crop fertiliser N requirements, based on crop off-takes and measurements of soil N supply, and analysis of Irish data on the response of winter wheat to fertiliser N, indicates that this is insufficient to consistently produce yields of 10 t/ha, and a similar situation exists for yields in excess of 10 t/ha.

Scientific background

Fertiliser N advice in Ireland is based on recommending the economic optimum amount (N_{opt}), i.e. the amount that maximises the return on investment in fertiliser N. While N_{opt} is an agro-economic factor, international research has indicated that it is also a useful indicator of the potential risk of nitrate leaching (Goulding, 2000; Chaney, 1990), N_{opt} will depend on the incremental yield response of the crop to applied fertiliser

N, and the cost of the fertiliser N and the value of the crop product. The relationship between crop value and fertiliser cost is described by calculating a Break-even ratio (BER). The BER is the crop yield (kg) required to pay for one kg of nitrogen and is calculated using the formula BER= cost of nitrogen (€/kg) / value of grain (€/kg). Using empirical data on the response of winter wheat to applied N on a range of sites (Hackett, 2000), the mean optimum N rate for continuous wheat sites was calculated at 233 kg N for a BER of 7. Using data from soil N Index 1 sites, Hackett (2009) reported the economic optimum N level for winter wheat in soil N Index 1 soils of 230 kg N/ha for a BER of 7. A review of fertiliser N prices and grain prices between 2000 and 2008 (using CSO CAN prices and Eurostat soft wheat prices for Ireland) indicates an average BER of 6.9 (6.4 if 2008 is excluded as an atypical year).

In addition to empirical studies on the response of wheat to fertiliser N, the crop requirement for fertiliser N can be calculated using information on grain nitrogen content, soil N supply, nitrogen harvest index and the efficiency of recovery of fertiliser N. Sylvester-Bradley and Clarke (2009) reported that for feed wheat in the UK, grain N content at optimum N fertiliser rate was 1.7%. Hackett (2000) reported an average soil N supply (as indicated by crop N uptake in the absence of fertiliser N) of 75 kg N/ha for continuous wheat sites under Irish conditions. Sylvester-Bradley *et al*. (2008) used a figure of 0.7 for the nitrogen harvest index, the proportion of total aboveground crop N uptake present in the grain.

Using these data, a 10 t/ha crop would require 170 kg N/ha in the grain and a further 73 kg N/ha in the straw, giving a total requirement of 243 kg N/ha. This indicates that 168 kg N/ha (crop N requirement – soil N supply) must be supplied as fertiliser N. Taking the efficiency of recovery of fertiliser N at 70%, which is at the upper range of what can be achieved under north-west European conditions (Bloom *et al*., 1988; Foulkes *et al.*, 1998; Sylvester-Bradley and Kindred, 2009; DEFRA, 2010); this indicates that a 10 t/ha crop requires 240 kg fertiliser N/ha.

<u>Proposed solution</u>
Teagasc proposed that the maximum fertilisation rates of nitrogen for the standard yield (9 t/ha) of winter wheat for Index 1 soils are increased by 20 kg N/ha from 190 kg N/ha to 210 kg N/ha, with similar increases for Indices 2, 3, 4, and that the existing footnote 1 under Table 16 of Schedule 2 of the draft GAP regulations are retained.

Environmental impact of proposed solution

While N_{opt} is determined by economic and agronomic considerations, research has shown that increases in residual inorganic N at harvest are small where fertiliser N inputs are below N_{opt}, but increase relatively steeply as fertiliser N inputs exceed the economic optimum amount (Chaney 1990; Lord and Mitchell, 1998). Therefore, where N_{opt} is not exceeded, increases in N fertiliser rate are unlikely to have a significant impact on nitrate leaching. This was confirmed by Goulding (2000), who reported that losses of N by leaching were low while fertiliser N rates were at or below N_{opt}, but that they increased once fertiliser N addition increased above N_{opt}. As the increased rates recommended here do not exceed the economic optimum N rate, it is the view of Teagasc that the risk of nitrate leaching will not be significantly increased.

2.5 Phosphorus allowance for high yielding cereals

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

16. (3) Without prejudice to the generality of sub-article (1) and subject to sub-article (4), the amount of available nitrogen or available phosphorus applied to promote the growth of a crop specified in Table 12, 13, 14, 15, 16, 17, 18, 19, 20 or 21 of Schedule 2 shall not exceed the amount specified in the table in relation to that crop having regard to the relevant nitrogen index or phosphorus index, as the case may be, for the soil on which the crops are to be grown.

Context

A key tenet of maintaining the fertility of soils is to replace the nutrients removed by a crop. Where sufficient nutrients to replace crop offtake are not applied, soil fertility will decline. Teagasc advice on P is based on maintaining the soil test P (Morgan's P test) for tillage crops between 6.1 mg/l and 10 mg/l (tillage soil P Index 3). Therefore, where a soil is at soil P Index 3, P inputs should equal crop P offtakes. At lower soil P Indices, the objective is to replace crop offtake and to add additional P to raise the soil test P level to between 6.1 mg/l and 10 mg/l. Maintenance of the P fertility of arable soils is important as cereal crops perform better in soils of good P status than on soils of low P status that have been supplemented with higher levels of phosphorus fertilisers.

Summary of issue:

Phosphorus applications to cereal crops (wheat, barley, oats) are limited to 45, 35, 25, and 0 kg P/ha at soil P Indices 1, 2, 3, 4 respectively (Table 17 of Schedule 2 of the draft GAP regulations 2010. These rates are the same for all cereal crops. There is no allowance for differences in yield potential between sites or crops. As a result, where high yields of cereals are achieved, crop offtakes may now exceed allowable P inputs, particularly at soil P Index 3.

Scientific background

Where phosphorus removed in crop product is not replaced, soil test P concentrations will reduce (Conry and Hogan, 2001). The majority of P removed by cereal crops is in the grain, with only low levels present in the straw. Typical offtakes of P for cereal crops, including P removal in straw, are 3.8 kg P per tonne of grain (DEFRA, 2010). Offtakes for a range of yield levels are presented in Table 2.1. This table demonstrates that where yield exceeds 7 t/ha at soil P Index 3 offtakes now exceed inputs. Mean yields in excess of 7 t/ha are common in Ireland, particularly for winter-sown crops (Central Statistics Office, 2009), and this is reflected in the reference yields for cereals that are prescribed in the draft GAP regulations 2010 regarding fertiliser N allowance in cereals.

Table 2.1. Effect of yield on grain P offtakes by cereal crops for P Index 1, 2 and 3 soils (for calculations see text).

Yield (t/ha)	**Offtake** (kg P/ha)	**Allowed P input** (kg P/ha)			**P balance (inputs-offtake)** (kg P/ha)		
		Index 1	Index 2	Index 3	Index 1[a]	Index 2[a]	Index 3
7	26.6	45	35	25	18.4	8.4	**-1.6**
8	30.4	45	35	25	14.6	4.6	**-5.4**
9	34.2	45	35	25	10.8	0.8	**-9.2**
10	38	45	35	25	7.0	**-3.0**	**-13.0**
11	41.8	45	35	25	3.2	**-6.8**	**-16.8**
12	45.6	45	35	25	**-0.6**	**-10.6**	**-20.6**

a: On P Index 1 and 2 soils, positive P balances reflect the P build-up requirements necessary to raise soil test P levels to P Index 3, as facilitated by S.I.378-06 / S.I.101-09.

Proposed solution

Teagasc proposes that, where proof of higher wheat, barley or oats yields is available, an additional 3.8 kg P/ha may be applied for each additional tonne above 6.5 t/ha. For consistency, Teagasc proposes that the implementation of this provision should reflect the method currently adopted for calculating the maximum permitted N fertiliser rates on cereals. Therefore, the higher yields should be based on the best yield achieved in any of the three previous harvests, at 20% moisture content.

Environmental impact of proposed solution

Increased phosphorus applications should only apply to proven higher yields. Where such higher yields are being achieved, crop offtakes are higher. Where the additional P applied is being removed in crop product, it cannot accumulate in the soil and add to P source pressures. Therefore, this proposed change is unlikely to have any significant impact on P loss from arable soils. Risk of P loss has been identified as being highest on Index 4 soils. While these proposed changes will increase the P application rate in cereals on Index 1, 2, and 3 soils, they will not increase the P application rates on Index 4 soils, nor will they lead to an increase in the prevalence of Index 4 soils.

2.6 Timing of phosphorus applications to cultivated soils

The draft GAP regulations 2010 state:

SCHEDULE 4

PERIODS WHEN APPLICATION OF FERTILISERS TO LAND IS PROHIBITED

1. In counties Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, Wexford and Wicklow, the period during which the application of fertilisers to land is prohibited is the period from—

(a) 15 September to 12 January in the case of the application of chemical fertiliser

(b) 15 October to 12 January in the case of the application of organic fertiliser (other than farmyard manure)

(c) 1 November to 12 January in the case of the application of farmyard manure.

2. In counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath, the period during which the application of fertilisers to land is prohibited is the period from—

(a) 15 September to 15 January in the case of the application of chemical fertiliser

(b) 15 October to 15 January in the case of the application of organic fertiliser (other than farmyard manure)

(c) 1 November to 15 January in the case of the application of farmyard manure.

3. In counties Cavan, Donegal, Leitrim and Monaghan, the period during which the application of fertilisers to land is prohibited is the period from—

(a) 15 September to 31 January in the case of the application of chemical fertiliser

(b) 15 October to 31 January in the case of the application of organic fertiliser (other than farmyard manure)

(c) 1 November to 31 January in the case of the application of farmyard manure.

Context

The timing of applications of chemical N and P fertilisers is restricted within the draft GAP regulations 2010. Applications are prohibited between 15 September (in all regions), and 12/15/31 January (region dependent). In the case of P, the restrictions are in place to avoid the risk of P loss through overland flow, as the prohibited period was identified as the period during which average meteorological and soil conditions indicate an increased risk of overland flow. Therefore, it is deemed that P fertiliser applications to the soil surface is more prone to overland flow losses during this period.

Summary of issue:
The restrictions of P fertiliser application timing can have negative impacts on the establishment of autumn sown crops, as cultivation practices, and hence optimum fertiliser application opportunities, can often take place during the prohibited period for fertiliser application. Where crops have a requirement of P for establishment, the absence of P can restrict the growth of the crop.

Scientific background:
While the P loss in overland flow may be increased due to the application of surface applied P fertilisers, the increased risk of P loss will be minimal in situations where the P fertiliser is incorporated into the seedbed (Romkens *et al.*, 1973 and Mueller *et al.*, 1984 *in:* Pierzynski *et al.*, 2005). P fertiliser incorporated into the seedbed will have increased contact with soil particles, and hence become adsorbed more quickly by the soil. Additionally, the incorporation of the fertiliser in cultivation will remove the P fertiliser from the soil surface and distribute it deeper in the soil profile (Owens *et al*., 2008). In the UK, Withers *et al*. (2008) evaluated risks of P loss from cereal crops as a function of P management: these authors contrasted P loss from P surface-dressings in spring to control plots (no P), as well as P loss from incorporated P applications in autumn in contrast to control plots (no P). They found that surface P applications in spring increased the loads of Total Dissolved P (TDP) by a factor 12, compared to the control treatment, and Total P (TP) concentrations by a factor 5. Contrastingly, P-incorporation in autumn only increased the loads of TDP by a factor 2, and had no significant impact on TP concentrations, compared to the control treatment. These results show that, while P applications inherently increase risk of P loss compared to zero-P control plots, this risk is minimised when P is incorporated into the seedbed in autumn, rather than surface applied in spring.

Moreover, the addition of P to crops that have a requirement at establishment will improve plant development (Brady and Weil, 1999), thereby improving crop establishment and the uptake of other nutrients, especially N, from the soil. Hooker *et al*. (2008) demonstrated that improved crop establishment translates directly into reduced N losses through leaching.

Proposed solution:
As a solution to this issue, Teagasc proposes that the current prohibited period for fertiliser application should not apply for chemical P fertiliser where this is incorporated into the seedbed of a crop.

Environmental impact of proposed solution:

The environmental impact of this proposed solution is that fertiliser P applications applied to the soil surface in early spring will be replaced with applications incorporated to the seedbed in autumn.

The environmental benefits of this change are that:

- The fertiliser P will be incorporated into the soil profile, which will reduce the spatio-temporal coincidence of nutrient pressure (P) and pathway (overland flow) (*cf*. Section 1.2)
- The fertiliser P will be located closer to the seed, ensuring better crop establishment, which is expected to result in more efficient uptake of residual nitrogen during the autumn period (Hooker *et al*., 2008)

The environmental risk of this change is that:

- Nutrients are applied during a time of year that, on average, is associated with hydrological activity i.e. with increased prevalence of pathways for nutrient loss (*cf*. Section 3.6).

Based on the studies in the scientific literature cited above, Teagasc anticipates that the environmental benefits will outweigh the environmental risks.

2.7 Phosphorus requirements for grassland establishment

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

16. (3) Without prejudice to the generality of sub-article (1) and subject to sub-article (4), the amount of available nitrogen or available phosphorus applied to promote the growth of a crop specified in Table 12, 13, 14, 15, 16, 17, 18, 19, 20 or 21 of Schedule 2 shall not exceed the amount specified in the table in relation to that crop having regard to the relevant nitrogen index or phosphorus index, as the case may be, for the soil on which the crops are to be grown.

Context

The draft GAP regulations 2010 prescribe the maximum permitted rates of available P fertiliser for grassland. The rates of P application are based solely on the soil P Index and the grassland stocking rate. While the original derivation of the maximum P rates allowed does appear to have taken into account the difference in P requirements of silage swards compared to grazed swards, the P requirements for reseeded grassland appears to have been omitted.

Summary of issue:

Fertiliser P advice for reseeded pasture is different to that of cut or grazed pasture. However, the P fertiliser rates on grassland in the draft GAP regulations 2010 take no account of this aspect. As a result, there is an increased risk of P deficiency during establishment of reseeded grassland. Therefore, Teagasc proposes that the P requirements for grassland reseeding should therefore be provided for in the draft GAP regulations, in addition to the P allowance for grazed or cut grassland.

Scientific background:

Reseeding is well accepted to be a good practice within grassland farming. Reseeding pastures can increase sward productivity and improve the efficiency of nutrient usage (Whitehead, 2000).

Reseeding pasture has a higher P requirement than grazed pasture (Teagasc advice; Table 2.2). The P advice for reseeding is dependent on the soil P Index, but is independent of the stocking rate of the farm. This high P requirement is due to the high demand for P associated with cell division and root growth at the time of germination, seedling and root development, tillering, and sward establishment (Whitehead, 2000). This difference between P requirements for reseeding and grazed swards is not accounted for in the draft GAP regulations.

Table 2.2: Teagasc P advice for pasture establishment (Lalor and Coulter, 2008)

Soil P Index	P application rate (kg/ha)
1	60
2	40
3	30
4	0

P in permanent grassland soils is normally concentrated in the top few centimetres of the soil profile (e.g. Owens *et al.*, 2008). Ploughing of grassland for reseeding can result in P being redistributed deeper in the profile (e.g. Byrne *et al.*, 2008). Therefore, while the soil test P levels before ploughing may indicate adequate P fertility status, the available P around the roots of young grass seedlings after ploughing (which will be confined to the top few cm of the soil during the early stages of sward establishment) may be low, reducing seedling vigour. The absence of fertiliser P around the young seedlings in this case will jeopardise the success of the reseeding operation.

Proposed solution:
Where pasture establishment through soil inversion is carried out on a holding, Teagasc proposes that the additional P requirements are included in the maximum P allowance for the holding. To achieve this, pasture establishment could be included as a crop in table 17 of Schedule 2 of the draft GAP regulations. This would provide for sufficient P rates on reseeded areas where soil tests indicate a P requirement. This allowance for P for reseeded pasture should be additional to the P requirement for grazing or silage cuts on that area for the rest of the year.

Environmental impact of proposed solution:
According to Teagasc's assessment, there are no negative environmental implications of this solution. The additional P rate advised in this case is in line with the uptake requirements of the grass crop for root development and sward establishment. The P contained in the biomass of the previous grassland crop would become part of the soil organic matter pool, and would have low availability to plants, and pose no environmental risk (Whitehead, 2000).

While this solution will have an impact on the whole farm P balance, the increased application of P is only applicable to Index 1, 2 and 3 soils, which have low risk of P losses. It is not proposed to apply P to Index 4 soils, and therefore the risk of P loss from these soils will be unaffected. Additionally, where Index 4 soils currently exist, ploughing these soils to relocate the P at the surface to deeper in the soil profile is potentially beneficial for reducing P loss (e.g. Byrne *et al*., 2008; see Section 1.3 of this submission). However, the current restriction on P use for reseeding is a disincentive to ploughing pasture for reseeding, as non-inversion seedbed preparation helps maintain soil P levels in the in the upper soil layer around the seedlings.

2.8 Soiled Water Management

The draft GAP regulations 2010 state:

PART 1

PRELIMINARY

(2) (a) In these Regulations "soiled water" includes, subject to this sub-article, water from concreted areas, hard standing areas, holding areas for livestock and other farmyard areas where such water is contaminated by contact with any of the following substances—

(i) livestock faeces or urine or silage effluent,

(ii) chemical fertilisers,

(iii) washings such as vegetable washings, milking parlour washings or washings from mushroom houses,

(iv) water used in washing farm equipment.

(b) In these Regulations, "soiled water" does not include any liquid where such liquid has either—

(i) a biochemical oxygen demand exceeding 2,500 mg per litre, or

(ii) a dry matter content exceeding 1% (10 g/L).

(c) For the purposes of these Regulations, soiled water which is stored together with slurry or which becomes mixed with slurry is deemed to be slurry.

Context

Soiled water is produced on farms as effluent from farmyard areas that is contaminated by contact with livestock faeces or urine, silage effluent, chemical fertilisers or farmyard washings (S.I.101-09). Large volumes of soiled water are generated on dairy farms, in particular due to the frequent washing down of milking parlours (including dairy and plant) and collecting yards. S.I.101 of 2009 defined soiled water as having a Biological Oxygen Demand (BOD) of less than 2,500 mg l^{-1} and a dry matter (DM) content of less than 1 %. More concentrated effluent is considered to be slurry. Soiled water contains nutrients that are potentially available to plants, but also pose a potential threat to water quality if not managed correctly. However, these nutrients are in far lower concentrations than in slurry, and soiled water is not subject to calendar-driven closed periods for spreading, although it is subject to other limitations protecting water quality, such as application rates, soil and weather conditions, slope, proximity to water sources, etc. Therefore, the distinction between soiled water and slurry has important implications in terms of required storage capacity and management practices, particularly for dairy farms.

Summary of issue:
S.I.101 of 2009 stated that any soiled water that is stored with, or mixed with, slurry is deemed to be slurry. Therefore, soiled water must be stored in a separate tank from slurry and must meet the concentration requirements in order to be legally considered soiled water. The definition was the same in S.I.378 of 2006. However, when this S.I. was introduced there was debate and some confusion as to the practical interpretation of this definition on-farm. Central to this debate was the issue of whether or not effluent collected along with excreta is considered to be soiled water. The then Minister for Agriculture and Food issued a statement of the Department's position (DAFF, 2006), stating that "Where livestock excreta and soiled water are mixed in a collecting yard tank, this material cannot be spread during the closed period". Further clarifications were issued by DAFF, stating that "excreta and soiled water mixed in a collecting yard tank is classified as slurry".

This interpretation hinges on considering the mixture of excreta on any collecting yard and the water used to wash it down to be slurry, *before* it enters the tank. In practice, such an interpretation has resulted in almost all dairy yard effluent being regarded as slurry, regardless of its BOD or DM contents, as it is impractical for most dairy farmers to scrape down their collecting yards to a separate slurry tank prior to washing with water. S.I.101 of 2009 specifically stated that slurry does not include soiled water. Therefore, even if the Department's interpretation (basing the classification of the final effluent in the tank on the classification of the mixture of excreta and wash water before it enters the tank) is to be taken, the classification of this excreta and wash water mixture before it enters the tank should be dependent on its DM and BOD concentration. If this mixture is soiled water, based on its DM and BOD concentration, the final effluent in the tank should also be classified based on its DM and BOD concentration. However, basing the classification of the final effluent in the tank on an intermediary stage in the production of the effluent (the excreta and wash water mixture before it enters the tank) would seem to be inappropriate as the environmental risk associated with land spreading is determined by the nature of the effluent to be spread and not any of the intermediary stages in its production. It would seem more reasonable simply to classify the final effluent mix in a tank, which will actually be spread on the land, as either soiled water, or slurry based on its DM and BOD concentration. It would appear that this was the original intent of the S.I.

Scientific background:

At the time, there was limited data on the actual composition of these effluents on dairy farms. In response, Teagasc conducted a survey of effluent sampled from collecting yard tanks (draining the collecting yard, parlour, bulk tank and, in some cases, effluent from silage and farmyard manure pits) on 60 representative dairy farms in 2008/2009 (Minogue *et al.*, 2010) to provide this data and results are shown in Table 2.3.

Table 2.3: Composition of soiled water on 60 dairy farms sampled monthly over a full year: mean values, limits of 95% confidence intervals and standard deviation (Minogue *et al.*, 2010)

	BOD (mg/l)	DM (%)	TN (mg/l)	NH_4-N (mg/l)	P (mg/l)	K (mg/l)
Mean	2246	0.5	587	212	80	568
+/- (95% conf.)	148	0.04	38	14	5	36
SD	2112	0.6	536	206	68	512

Seventy one percent of soiled water samples were below the legal definition of soiled water for BOD and 88 % were below the legal definition for DM content. This increased to 87 % and 94 % for BOD and DM, respectively, during the closed period for slurry spreading. Mean BOD concentration was 2246 mg l^{-1} and mean DM was 0.5 % (Table 2.3). Therefore, most of the effluent generated could be considered as soiled water, based on BOD and DM contents. It should be noted that excreta was not scraped off and removed on any of the farms; i.e. the effluent analysed corresponds to what the DAFF interpretation regards as slurry. Mean Total N concentration was 587 mg l^{-1} while NH_4-N was 212 mg l^{-1}, the balance consisting mostly of organic N. Therefore, roughly a third of the N in soiled water consists of rapidly plant-available NH_4-N. Mean total P was 80 mg l^{-1} and K was 568 mg l^{-1}. However, nutrient concentrations are an order of magnitude lower than in slurry. The mean total N content of soiled water is equivalent to 0.6 kg N m^{-3}, in contrast to the 5 kg N m^{-3} that was assumed for cattle slurry in S.I.101-09. It should be noted that these results are for dairy soiled water only. There is very little knowledge of the composition of other farmyard effluents, such as silage effluent or effluents from hard areas on beef farms.

Proposed solution:

Teagasc recommends that, for the GAP regulations 2010, the *interpretation* of S.I.101-09 (S.I.378-06) is revised to allow effluents collected from collecting yards and dairy parlours with a Biological Oxygen Demand (BOD) of less than 2,500 mg l^{-1} and a dry matter (DM) content of less than 1 % to be considered as soiled water. This is on the basis that the survey results indicate that such effluents generally meet the BOD and DM limits for soiled water, as stated in S.I.101-09.

Environmental impact of proposed solution:

Ryan *et al*. (2006) and Bartley *et al*. (2006) found evidence that dairy soiled water application increased nitrate leaching from a free-draining Irish soil, *only* at application rates (up to 50 mm in a single application) far in excess of the limit imposed by the draft GAP regulations 2010 (50,000 l ha^{-1}, or 5 mm, over six weeks). Bartley *et al*. (2006) concluded that application rates of less than 10 mm did not result in nitrate leaching through summer or winter application. When the mean N concentration of soiled water found in this survey (587 mg l^{-1}) (Minogue *et al*., 2010) is compared to that of slurry (5,000 mg l^{-1}) (S.I.101-09) or urine from grazing cows (5,000-13,000 mg l^{-1}) (Saarijarvi and Virkajarvi, 2009) it can be expected that the risk of nitrate leaching from soiled water under most conditions will be considerably less than from land-applied slurry or urine patches. Indeed, Silva *et al*. (1999) found greater nitrate losses in leachate from urine or urea fertiliser than from dairy soiled water in a free-draining New Zealand soil. Therefore, the evidence suggests that the risk of nitrate leaching from soiled water at the rates established by S.I.101-09 are low.

Based on these studies, Teagasc expects that the proposed solution will have a negligible effect on the risk of nutrient loss to water, based on the assessments of risk implicit in the draft GAP regulations 2010. Spreading of soiled water throughout the year is allowed under the draft GAP regulations 2010. The survey results indicate that the effluent from dairy collecting yards and parlours is generally soiled water.

Part 3:
Considerations on the implementation of the draft GAP regulations 2010

3.1 Proposed rationalisation of P regulations

<u>The draft GAP regulations 2010 state:</u>

PART 3

NUTRIENT MANAGEMENT

Interpretation, commencement etc

15. (1) In this Part, "crop requirement", in relation to the application of fertilisers to promote the growth of a crop, means the amounts and types of fertilisers which are reasonable to apply to soil for the purposes of promoting the growth of the crop having regard to the foreseeable nutrient supply available to the crop from the fertilisers, the soil and from other sources.

(2) The amount of nitrogen or phosphorus specified in Table 7 or 8 of Schedule 2, as the case may be, in relation to a type of livestock manure or other substance specified in the relevant table shall for the purposes of this Part be deemed to be the amount of nitrogen or phosphorus, as the case may be, contained in that type of manure or substance except as may be otherwise specified in a certificate issued in accordance with Article 32.

(3) The amount of nitrogen or phosphorus available to a crop from a fertiliser of a type which is specified in Table 9 of Schedule 2 in the year of application of that fertiliser shall, for the purposes of this Part, be deemed to be the percentage specified in that table of the amount of nitrogen or phosphorus, as the case may be, in the fertiliser.

(4) The amount of nitrogen or phosphorus available to a crop from an organic fertiliser of a type which is not specified in Table 9 of Schedule 2 shall be deemed to be the amount specified in that table in relation to cattle manure unless a different amount has been determined in relation to that fertiliser by, or with the agreement of, the relevant local authority or the Agency, as the case may be.

(5) A reference in this Part to the "nitrogen index" or the "phosphorus index" in relation to soil is a reference to the index number assigned to the soil in accordance with Table 10 or 11 of Schedule 2, as the case may be, to indicate the level of nitrogen or phosphorus available from the soil.

Duty of occupier in relation to nutrient management

16. (1) An occupier of a holding shall take all such reasonable steps as are necessary for the purposes of preventing or minimising the application to land of fertilisers in excess of crop requirement on the holding.

(2) (a) For the purposes of this article the phosphorus index for soil shall be deemed to be phosphorus index 3 unless a soil test indicates that a different phosphorus index is appropriate in relation to that soil.

(b) The soil test to be taken into account for the purposes of paragraph (a) in relation to soil shall, subject to paragraph (c), be the soil test most recently taken in relation to that soil.

(c) Where a period of six years or more has elapsed after the taking of a soil test in relation to soil the results of that test shall be disregarded for the purposes of paragraph (a) except in a case where that soil test indicates the soil to be at phosphorus index 4.

(3) Without prejudice to the generality of sub-article (1) and subject to sub-article (4), the

amount of available nitrogen or available phosphorus applied to promote the growth of a crop specified in Table 12, 13, 14, 15, 16, 17, 18, 19, 20 or 21 of Schedule 2 shall not exceed the amount specified in the table in relation to that crop having regard to the relevant nitrogen index or phosphorus index, as the case may be, for the soil on which the crops are to be grown.

(4) In the case of a holding on which grazing livestock are held, the amount of available phosphorus supplied to the holding by the concentrated feedstuff fed to such livestock shall be deemed to be 0.5 kg phosphorus in respect of each 100 kg of such concentrated feedstuff.

(5) (a) In the case of a holding on which grazing livestock are held, the amount of available nitrogen and available phosphorus supplied to the holding by manure from such livestock shall (save insofar as such manure is exported from the holding) be deemed to be the relevant proportion of the amount of available nitrogen and available phosphorus contained in the total manure produced by such livestock.

(b) In paragraph (a), the "relevant proportion" means the proportion of a year as is represented by the storage period specified in Schedule 3 in relation to the holding.

<u>Context</u>

The introduction of S.I.378-06 / S.I.101-09 has brought fundamental and far-reaching changes to nutrient management on all farms. Nutrient applications are now strictly regulated, and each farm is required to calculate the precise amount of nutrients that may be imported onto the farm, based on, *inter alia*, stocking rates, livestock movements, nutrient supply from soil and organic manures, as well as P imported onto the farm in the form of concentrate feeds. The fundamental principles underlying these calculations are:

- P-application rates should be based on farm P-balances, i.e. should be aimed at replacing farm P exports with farm P imports.
- Where soil P deficiencies occur (P Indices 1 and 2) and have been identified through soil testing, build-up applications of P may be applied to raise the soil test P to Index 3 over time.
- Where excessive soil P (P Index 4) have been identified, no external P may be applied, allowing soil test P to decline to Index 3 over time (see Section 1.3 of this submission for a detailed discussion).

<u>Summary of issue:</u>

While Teagasc subscribes to these underlying principles, the implementation of the P-regulations in S.I.378-06 / S.I.101-09 has posed many significant practical and logistical challenges to farmers and agricultural advisors. Based on the experience of Teagasc's Research Programme on Nutrient Efficiency and on the application of its "Teagasc Nitrates Calculator" (Lalor and Gibson, 2007), it is Teagasc's view that the precise format of the implementation of the P regulations may be overly complicated, imposing a significant and unnecessary administrative burden on farmers and their agricultural advisors.

Most significantly, there is mounting collective circumstantial evidence, collated by Teagasc's Advisory Services, that the introduction of S.I.378-06/S.I.101-09 has resulted in an increased prevalence of P deficiencies on farms, resulting in loss of productivity, and in extreme cases, in animal P deficiencies.

<u>Background</u>
At this point, Teagasc does not yet have conclusive evidence on the cause of such reported deficiencies. Three hypotheses have been put forward, which may each be contributing to the problem:

1. A preliminary but randomised survey of P concentrations in silage (Kavanagh, unpublished data) suggests that the introduction of S.I.378-06 / S.I.101-09, through its contribution to reducing P fertiliser use on farms (Lalor *et al*., 2010), may have resulted in a decline in herbage P concentrations, and therefore in a reduced P excretion per cow. In this scenario, the P excretion per cow that is assumed in the draft GAP regulations would be too high, and may result in disproportionate P deductions from the P fertiliser allowance due to an over-estimation of the assumed contribution of P contained in slurry to meeting crop requirements. Preliminary modelling studies show that these discrepancies may be as large as 2 kg ha^{-1} per year.

2. There is circumstantial evidence that farmers may be spreading less P fertiliser than allowed, to ensure that they are not in breach of maximum P fertilisation rates. Maximum P fertilisation rates are currently calculated at the end of the year, taking into account records of stocking rate, and P imported onto the farm in the form of concentrate feeds. Since these calculations are based on year-end records, the amount to be imported onto the farm each year cannot be planned in absolute detail, as this amount depends on, *inter alia*, dates of livestock movements and variations in concentrate feed usage primarily due to weather conditions, neither of which are fully predictable. As a result, there is circumstantial evidence that farmers may not be spreading their full allowance of P fertiliser as estimated at the start of the year, in order to ensure that they retain sufficient P allowance for the unexpected purchase of concentrate feeds or stocking rate changes at the end of the year, to cater for worst-case scenarios.

3. It is clear that the current format of implementation of the P regulations may give rise to inherent anomalies in P-budgeting on individual farms. In these cases, compliance with the draft GAP regulations may result in large and structural P deficits. The following example illustrates this point:

A hypothetical farm of 40 ha (10 ha in each of the 4 P Index levels) in Zone A, with 80 dairy cows, feeding 500 kg of concentrate feed per cow (amounting to 40 tonnes). All calves are sold at birth, and replacement heifers are bought in before calving. All cows produce the national average milk yield of 4700 l milk per annum. Table 3.1 shows the calculation of the total allowance of chemical P fertiliser under the current draft GAP regulations:

Table 3.1: Example of calculation of total allowance of chemical P fertiliser, for a hypothetical dairy farm (for specifics see text), under the current draft GAP regulations.

P Index	1	2	3	4	All
Max available P fertiliser rate (kg/ha)	39	29	19	0	
Area of land in each Index(ha)	10	10	10	10	40
Total Available P Fertiliser allowed (kg)	390 (a)	290 (b)	190 (c)	0 (d)	870 A=a+b+c+d
P assumed from slurry (kg) (16 weeks storage period)					320 (B)
P assumed from concentrate feeds (kg)					200 (C)
Maximum Chemical Fertiliser P allowed (kg)					**350** (=A-B-C)

The actual farm P requirement is calculated in Table 3.2; this table shows that this requirement significantly exceeds the P allowance:

Table 3.2: Actual P requirements and structural P deficit for the same hypothetical farm used in Table 3.1.		
P Movements at farm-gate level	Imported P (kg)	Exported P (kg)
P sold in milk (= 4700 litres/cow x 80 cows x 0.001 kg P / litre milk)		376
P bought in liveweight (= 16 heifers x 450 kg x 0.01 kg P / kg)	72	
P sold in liveweight (calves) (= 75 calves x 40 kg x 0.01 kg P / kg)		30
P sold in liveweight (cull cows) (= 16 cows x 550 kg x 0.01 kg P /kg)		88
P in concentrate feeds (= 40 tonnes x 5 kg P / tonne)	200	
Totals	**272**	**494**
Farm gate P deficit (Export – Import)		222
Adjustment for Index 4 (=224 x (10/40)) (i.e. 10 of the 40 hectares are in Index 4 and have no P requirement. Therefore the proportion of the farm gate P deficit that is attributable to these soils need not be replaced by fertiliser.)		-56
Adjustment for Index 1 build-up (= 20 kg/ha x 10 ha)		+200
Adjustment for Index 2 build-up (= 10 kg/ha x 10 ha)		+100
Adjusted P requirement		466
Total maximum chemical fertiliser allowed (Table 3.1)		350
Structural P deficit		**-116**
Assumptions: - all calves sold off the farm @ 40kg live weight (75 calves per year) - replacement heifers purchase weight = 450 kg - cull cows sales weight = 550 kg/cow - 20% replacement rate (16 heifers per year) - 1 litre milk = 0.001 kg P - 1 kg meat = 0.01 kg P - Adjustment for Index 4 = Total Farm gate P deficit x proportion of farm in P Index 4 - Adjustment for Index 1 build-up = 20 kg/ha - Adjustment for Index 2 build-up = 10 kg/ha		

On this hypothetical – but realistic - farm, the draft GAP regulations result in a structural P deficit of 118 kg P per annum, equating to *c*. 3 kg ha^{-1} per annum. For a similar farm in a zone with a 22-week storage requirement, the same calculations show that this structural P deficit will be doubled to *c.* 6 kg ha^{-1} per annum. The reason for the increasing deficit with increasing slurry storage requirement is because the assumed contribution of P from slurry is increasing with storage period length, without differences in farm-gate P output between both farms.

Proposed solutions

1. Solution for hypothesis 1: in 2010, Teagasc has initiated a new research programme on soil-herbage-animal P dynamics. The objectives of this programme are to fully quantify the P supply by the soil, P uptake by herbage, P intake by animals and the P excretion by animals, for a range of contrasting farming systems, soil types and soil P Indices. Teagasc proposes that the draft GAP regulations include a mechanism through which the GAP regulations can be amended to reflect the outcomes from this and other relevant research programmes, such as the results from Teagasc ACP programme (*cf.* Section 1.4), as soon as these are published, i.e. before the next review of the GAP regulations in 3.5 years time, if required.

2. Solution for hypothesis 2: In Section 3.2, we propose a solution, in which fertiliser allowances are aimed at *last* year's net P exports and imports, instead of this year's *projected* P exports and imports. This solution will give farmers reassurance to utilise their full fertiliser P allowance, without risks of inadvertently exceeding the allowance through causes beyond the farmer's control (e.g. weather conditions).

3. Solution for the inherent P anomalies: In Parts 3.3 to 3.5 of this submission, Teagasc proposes a suite of amendments to the format of implementation of the P regulations that seek to rationalise and simplify on-farm P management. Teagasc expects that adoption of these suggestions will assist farmers in developing P management plans in compliance with the regulations, and reduce the number of anomalies that will arise as a result of the format of calculations. Teagasc has calculated that adoption of the full suite of proposals would correct the P deficit of 3-6 kg ha^{-1} per year in the aforementioned example towards P balance (the combination of measures proposed in example above would result in P balance of +0.3 kg ha^{-1} per year).

Environmental impact of proposed solution:

Teagasc acknowledges the underlying fundamental principles of the regulations with regard to phosphorus, namely that:

- P-application rates should be based on farm P balances, i.e. should be aimed at replacing farm P exports with farm P imports.
- Where soil P deficiencies occur (P Indices 1 and 2) and have been identified through soil testing, build-up applications of P may be applied to raise the soil test P to Index 3 over time.
- Where excessive soil P deficiencies occur (P Index 4) and have been identified through soil testing, no external P may be applied, allowing soil test P to decline to Index 3 over time (see Section 1.3 of this submission for a detailed discussion).

At this point, Teagasc does not seek to propose changes to these underlying principles. All of the proposed amendments to the implementation of the GAP regulations, outlined in Sections 3.2 to 3.5, are in line with these principles. The proposed amendments will merely address the structural P deficits that are arising on Index 1, 2, and 3 soils, and therefore negate the undesirable long-term decline in soil fertility.

The proposed amendments will:

- Not result in external P applications on Index 4 soils (other than P originating from concentrate feed being excreted by grazing animals on Index 4 soils, which is unavoidable in any case, and already the situation under S.I.378-06 / S.I.101-09).
- Not increase the prevalence of Index 4 soils
- Not result in a positive farm P balance

Therefore, the proposed amendments will not have a negative environmental impact.

3.2 Planning of P fertilisation and year-end P balance

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

15. (1) In this Part, "crop requirement", in relation to the application of fertilisers to promote the growth of a crop, means the amounts and types of fertilisers which are reasonable to apply to soil for the purposes of promoting the growth of the crop having regard to the foreseeable nutrient supply available to the crop from the fertilisers, the soil and from other sources

Context

Within the framework of the current regulations, the rate of N and P fertiliser and concentrate feed usage are calculated at the start of the year, based on estimated projections of the grassland stocking rate and farm feed budgets. However, at the year end, the current implementation of the regulations requires that the maximum allowance of P fertiliser is re-calculated based on the actual stocking rate and the actual concentrate feed usage over the year. This implementation creates problems with nutrient management planning.

Summary of issue:

In the case of maximum permissible N and P fertiliser and stocking rate, many farmers find themselves on the margin of the grassland stocking rates bands at which the N and P fertiliser allowance changes (i.e. 130 / 170 / 210 kg/ha Organic N). This oscillation between stocking rate bands in a given year can be explained by a number of common farm events, for example: the purchase or sale of livestock being delayed to accommodate market issues, increased mortality due to disease, etc. Where the farm changes between stocking rate bands, it can either increase or decrease the maximum N and P rate permitted on the farm. Where it decreases, particularly nearing the end of the year, it is often too late for the farmer to make adjustments to the fertiliser applications, as the material may already be applied to land.

In the case of concentrate feeds, a similar situation arises where a farmer needs to use more concentrate feeds than was originally planned, due to common causes such as for example: poor weather conditions reducing grass utilisation or winter forage yields, or the market situation requiring holding animals for longer prior to sale, etc.

Proposed solution:

- The stocking rate of the preceding year could be used in determining the maximum fertiliser allowance of N and P for the current year. In contrast to N, P is a "slow" nutrient; within annual time-windows, fertiliser P application rates and soil test P concentrations are largely interchangeable (Schulte and Herlihy, 2007), and P application rates can be aimed at replacing last year's farm P exports, rather than this year's projected farm P export. (Note: some flexibility should be applied to cases where a significant change in stocking rate between consecutive years is appropriate).

- Regarding P from concentrate feeds used, a solution to this issue would be to use the actual P sourced in concentrate feeds in the previous year to plan for the following year. This would have no effect on the principle of achieving P balance in the longer term, and would allow the farmer to be sure of the actual amount of P that must be accounted for in the nutrient management plan in the year in question.

Environmental impact of proposed solution:

There would be no net environmental impact of this solution since the overall objectives of farm P balance remain unchanged in the long-term.

3.3 Assumed P levels in concentrate feedstuffs

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

16. (4) In the case of a holding on which grazing livestock are held, the amount of available phosphorus supplied to the holding by the concentrated feedstuff fed to such livestock shall be deemed to be 0.5 kg phosphorus in respect of each 100 kg of such concentrated feedstuff.

Context

Within the draft GAP regulations 2010, the maintenance of soil P balance, whereby inputs and outputs of P within the farm system should be in balance for the maintenance of soil P levels in the range of Index 3, is one of the guiding principles behind the derivation of P fertilisation rates for grassland. Within this context, the additions of P into grassland systems from the use of concentrate feeds must be included when calculating the maximum P fertiliser rates permitted.

Summary of issue:

Within the draft GAP regulations 2010, an assumption is made that all concentrate feedstuffs contain a fixed concentration of P of 5 kg/t (Article 16(4)). In reality, the concentration of P in concentrate feeds can be highly variable, particularly where straight feedstuffs are used. As a result, the actual addition of P from concentrate feeds will often be different to that assumed within the draft GAP regulations 2010, and result in incorrect P fertiliser rates as a result. The issue is particularly relevant to farms using large quantities of straight feeds with low P contents, and can result in large over-estimation of P contribution from concentrate feeds, and a large under-supply of fertiliser P as a result. This can have serious negative impacts on both soil fertility and animal health.

Background:

Compounded concentrate feedstuffs are usually formulated to contain balanced P contents appropriate to the animal diet. However, where straight feedstuffs are used, such feeds are not formulated to balance the mineral supply. The typical P contents of some straight feeds are shown in Table 3.3. In the case of low protein concentrates such as cereals, and more critically, citrus pulp and soya hulls, the P content in fresh material is substantially lower than 5 kg/t.

Table 3.3: Typical dry matter (DM) and phosphorus (P) contents of straight concentrate feedstuffs (UCD, 2000)			
Feed	DM%	P content	
		kg/t DM	kg/t Fresh
Citrus Pulp	88	1.1	1.0
Soya Hulls	88	1.8	1.6
Maize	86	2.8	2.4
Barley	87	3.9	3.4
Wheat	87	4.1	3.6
Soyabean meal	86	7.1	6.1
Maize distillers grains	89	7.5	6.7
Rapeseed meal	86	10.9	9.4
3-way mix (1/3 citrus pulp; 1/3 barley; 1/3 Maize distillers grains) (Approx. 16% Crude Protein)	88	4.2	3.7

Proposed solution:

While the assumption that concentrate feeds contain 5 kg P / t may be an appropriate average for concentrate feeds, farmers using large amounts of feedstuffs with P levels lower than 5 kg/t are disproportionately penalised, due to reduced P fertiliser allowances. A proposed solution in this case would be to continue to assume an average P level of 5 kg/t as a default value that can be used in the absence of further information, but to also allow farmers to use alternative P contents for feeds in certain circumstances. On individual farms where alternative P concentrations are adopted, it may be appropriate to require that all concentrate feeds used are recorded based on actual P concentrations. This would ensure that the total P inputs in such feeds are fully accounted for on these farms.

In this case, the alternative P contents to be used can be based on either the documentation accompanying the feed, or on indicative P contents of various feeds that can be referenced from an appropriate source.

Environmental impact of proposed solution:

This solution would have no environmental impact, since the solution is fully within the guiding principle of farm P balance.

3.4 Spatial distribution of P inputs from concentrate feed sources

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

16. (4) In the case of a holding on which grazing livestock are held, the amount of available phosphorus supplied to the holding by the concentrated feedstuff fed to such livestock shall be deemed to be 0.5 kg phosphorus in respect of each 100 kg of such concentrated feedstuff.

(5) (a) In the case of a holding on which grazing livestock are held, the amount of available nitrogen and available phosphorus supplied to the holding by manure from such livestock shall (save insofar as such manure is exported from the holding) be deemed to be the relevant proportion of the amount of available nitrogen and available phosphorus contained in the total manure produced by such livestock.

(b) In paragraph (a), the "relevant proportion" means the proportion of a year as is represented by the storage period specified in Schedule 3 in relation to the holding.

Context

Within the draft GAP regulations 2010, the maintenance of soil P balance, whereby inputs and outputs of P within the farm system should be in balance for the maintenance of soil P levels in the range of Index 3, is one of the guiding principles behind the derivation of P fertilisation rates for grassland. Within this context, the additions of P into grassland systems from the use of concentrate feeds must be included when calculating the maximum P fertiliser rates permitted.

Summary of issue:

The allocation of P that is imported into a grassland system (either from off-farm or from an on-farm tillage enterprise) is currently included within the regulations, in order to maintain P balance. Despite the fact that the distribution of P in concentrate feeds fed to grazing animals is not uniform, the principle of including this P in a farm balance calculation is valid. However, there is an issue with the current method of calculation of the distribution of this P around the farm.

Background:

Within the draft GAP regulations 2010, all concentrate feeds used on the farm are assumed to contribute 5 kg/t of P to the available P fertiliser allowance of the farm. In order to account for this P in farm nutrient allowance calculations, the methodology currently being used involves the subtraction of the P in concentrate feeds used from the total P fertiliser allowance on the whole farm.

While this methodology may be justifiable on the basis of whole farm P balance, this calculation on a whole farm level is inappropriate on farms that have a range of soil P Index levels on the farm. The problem is exacerbated when a portion of the farm has P Index 4 soils. In reality, the distribution of P from concentrates, fed to animals while grazing, will be imperfect and random. Since grassland soils with P Index 4 are permitted 0 kg/ha of fertiliser P, the current method of distributing P from concentrate feeds results in reductions being applied to P rates on Index 1, 2 and 3 soils only, effectively assuming that grazing animals being fed concentrates will selectively not defecate on Index 4 soils.

This calculation method is illustrated in the following example of a hypothetical grassland farm of 40 ha stocked with dairy cows with a grassland stocking rate of 170 kg/ha, assuming that the soil levels on the farm are evenly distributed between indices (i.e. 10 ha in each Index 1, 2, 3 and 4). The assumed total organic P excreted for the whole farm is 1040 kg (26 kg/ha). Therefore, assuming a 16 week winter housing zone, the deduction of P from slurry would be 320 kg (8 kg/ha). A total concentrate feed usage rate of 40 tons is assumed (= 500 kg/cow). This equates to a total P contribution from concentrates of 200 kg P (5 kg/ha).

Table 3.4: Current sequence of calculations to determine the maximum permitted rate of chemical P fertiliser.

P Index	1	2	3	4	Whole farm
Max available P fertiliser rate (kg/ha)	39	29	19	0	
Area of land in each Index (ha)	10	10	10	10	40
Total Available P Fertiliser allowed (kg)	390 (a)	290 (b)	190 (c)	0 (d)	870 (A=a+b+c+d)
P assumed from slurry (kg)					320 (B)
P assumed from concentrate feeds (kg)					200 (C)
Maximum Chemical Fertiliser P allowed (kg)					**350** (=A-B-C)

In this example, because the land in P Index 4 has no allowance for available P fertiliser, the current methodology results in the deduction for P in concentrates being effectively taken only from the application rates of P on the Index 1, 2 and 3 soils. This equates to a reduction of 200 kg P over 30 ha that are allowed to receive P, equalling 6.7 kg/ha. However, in reality, it is impossible to ensure that all the P from concentrate feeds would go to these soils exclusively. Therefore, under the current methodology, the Index 1, 2 and 3 soils are compromised in this case. Assuming a uniform distribution of concentrate P over the whole farm, the reduction in allowed P on each hectare should equate 5 kg/ha in this example, irrespective of the soil index levels of other areas of the farm.

The result of this is that soils that have a P requirement (i.e. Index 1, 2 and 3 soils) are assumed to be receiving more P than they are in reality, and therefore the P fertilisation rates will be below what is required, which will impact negatively on soil fertility and animal health.

<u>Proposed solution:</u>
A proposed solution to this situation is to adjust the calculation method for reducing the P fertilisation rates to account for the P from concentrates. A simple approach to this would be to adjust the rate of P allowed at each soil P Index, depending on the concentrate P usage.

This can be done by calculating the total P in concentrate feeds used, and dividing this by the total grassland area. This calculation will give the rate of reduction that should be applied per hectare of grassland. This reduction should then be applied to the P allowed at each soil Index, resulting in Index 4 soils, that have no P requirement remaining constant, and indices that have a P requirement having a more appropriate adjustment, as they would no longer be 'absorbing' the P surplus from Index 4 areas.

Taking the example outlined above, the calculation of the maximum chemical P allowed on the farm would be done as follows within the solution proposed:

Table 3.5: Proposed sequence of calculations to determine the maximum permitted rate of chemical P fertiliser.					
P Index	1	2	3	4	Whole farm
Max available P fertiliser rate (kg/ha)	39	29	19	0	
Deduction for P in concentrate feeds (kg/ha)	**5**	**5**	**5**	**5**	
Max available P fertiliser after concentrate feed P adjustment	**34**	**24**	**14**	**0**	
Area of land in each Index (ha)	10	10	10	10	40
Total Available P Fertiliser allowed (kg)	340 (a)	240 (b)	140 (c)	0 (d)	720 (A=a+b+c+d)
P assumed from slurry (kg)					320 (B)
Maximum Chemical Fertiliser P allowed (kg)					**400** (=A-B)

In this case, the deduction of P from each hectare is a more accurate reflection of the actual P that is returned to grassland from concentrate P fed to animals. Therefore, Index 1, 2 and 3 soils, which have a genuine requirement for soil P in order to be productive, are not individually penalised because of other areas of the farm.

This solution does not equate to the promotion of a field level P balance approach and a subsequent increase in the depth of planning and recording of the activities specific to each field of the farm. The proposed solution merely highlights and attempts to satisfy the requirement to meet the P requirements of a farm based on the requirements of individual soils rather than by crude whole farm assumptions.

Environmental impact of proposed solution:

In the example shown, the proposed solution leads to an increase in the chemical P fertiliser that is permitted on the farm, and will therefore impact on the P balance at the whole farm level. It is expected that the adoption of this solution will result in a trend towards increased P fertiliser allowance on selected farms.

However, there would be no environmental impact of this solution. It was identified in the original formulation of the regulations that Index 1, 2 and 3 soils were at low risk of P loss to waters at P fertiliser application rates that equal soil and crop requirements. The proposed solution will not increase the P application on these soils to levels above soil and crop requirements. The fact that Index 4 soils will be receiving a contribution of P from concentrates fed to grazing animals is unavoidable and will not change compared to the status quo. By changing the calculation method, the P inputs on Index 4 soils will not change; therefore the risk of P loss to waters will not be increased on these soils.

Regarding whole farm P balance, in situations where this solution may allow farms to have a P surplus on the farm, this surplus now simply and more accurately equates to the requirements for P fertiliser for soil P build-up from Index 1 and 2 into Index 3, since the P ‘surplus’ is now directed towards the Index 1, 2 and 3 soils, on which risk of P loss is low.

3.5 Simplification of calculations of maximum fertiliser N and P allowance

The draft GAP regulations 2010 state:

PART 3

NUTRIENT MANAGEMENT

16. (5) (a) *In the case of a holding on which grazing livestock are held, the amount of available nitrogen and available phosphorus supplied to the holding by manure from such livestock shall (save insofar as such manure is exported from the holding) be deemed to be the relevant proportion of the amount of available nitrogen and available phosphorus contained in the total manure produced by such livestock.*

(b) *In paragraph (a), the "relevant proportion" means the proportion of a year as is represented by the storage period specified in Schedule 3 in relation to the holding*

Context

Under the draft GAP regulations 2010, the total maximum permitted usage of chemical N and P fertilisers on the whole farm must be calculated using the maximum permitted rates of total available fertiliser, taking into account the contribution to available fertiliser of both home-produced animal manures (N and P), imported and exported animal manures (N and P), and concentrate feed usage (P only).

The deduction of N and P from chemical N and P fertiliser allowances for home produced animal manures is dependent on the region in which the farm is located with regard to the slurry storage capacity requirements. Farms in areas that have longer slurry storage periods are assumed to have greater volumes of slurry and are allowed lower rates of chemical fertiliser N and P as a result.

Summary of issue:

The inclusion of the imported and exported manures and the concentrate feed usage are valid considerations as they affect the input and output of nutrients from the farm system. However, the inclusion of home-produced manures that are recycled within the farm, into the calculation of the maximum permitted chemical fertiliser allowance, unnecessarily complicates the calculations.

The variation in maximum chemical fertiliser N and P allowances between regions with different storage capacity requirements is not in agreement with nutrient advice or with farm nutrient balance.

The exact calculation of chemical N and P allowance is also stocking rate specific, as the deduction for home produced manures is dependent on the total annual N and P excretion by the grazing livestock. This further increases the complexity within subsequent nutrient management planning.

Background:

The advice for fertiliser N on grassland farms is calculated as the difference between the background N release from the soil and the total N uptake, required by the grass to achieve the stocking rate specific grass production requirements. The advice for P fertiliser is based on maintaining soil P levels in Index 3, and replacing net P offtakes.

Organic manures produced on the farm contain N and P that can replace chemical fertilisers. Since home-produced forages make up the majority of the feed intake during the winter housing period, it can be assumed that the nutrients present in organic manures will have originated from areas of the farm from which forages have been harvested and conserved as hay and/or silage. The longer the winter period, the more manure will be produced. Therefore, on farms with longer housing periods, more manure will be available to meet the nutrient requirements of the farm. However, with longer winter housing periods comes an increased requirement for silage and hay. Effectively, the manure production will usually be proportional to the area of land harvested for silage/hay, and the N and particularly the P will be recycled accordingly.

In this situation, where P, and to a lesser extent N, is recycled each year, it will not affect the farm nutrient balance, as the nutrients are retained within the farm system. The requirement to recycle manures as efficiently as possible need not be compromised by the amendments proposed in this submission, as this can be implicit in the derivation of the maximum fertiliser rates allowed.

Proposed solution:

Maintain the current N calculation but base P rates on calculated farm P balance

The solution in this case is to change the fertilisation rates for grassland prescribed in the draft GAP regulations 2010, so that there is no longer a requirement to deduct home produced slurries to calculate chemical fertiliser N and P allowances.

The existing N allowance rates for the whole farm should be amended to remove the available N allowance that is currently being deducted (Table 3.6). The rates of maximum chemical fertiliser N allowed proposed in Table 3.6 are then calculated based on the current deductions required in the draft GAP regulations 2010, assuming 40% N availability, and a 16-week slurry storage period. The calculation of the chemical N fertiliser allowed should only be affected by the import (decrease N allowance) or export (increase N allowance) of organic manures. Home produced manures should no longer be included. This will make calculations simpler, but will not affect the N balance of the farm.

The existing P rates should be similarly amended. Table 3.6 shows alternative rates for P that are calculated based on P offtakes from dairy systems, assuming a national average milk output of 4700 litres per cow, and an annual liveweight production of 60 kg (40 kg from calf, plus 20 kg from cow liveweight gain assuming weight gain of 100 kg between calving as a heifer and sale as a cull cow over an average of five lactations). Assuming 1 kg P removal per 1000 litres of milk or per 100 kg of liveweight gain, the P removal per dairy cow (= 1 LU = 85 kg/ha of organic N excreted) would be approximately 5.3 kg/annum.

Table 3.6: Proposed Maximum chemical N and P allowance for grassland, before adjustments for manure export and imports and concentrate feeds.

Grassland Stocking Rate (kg N/ha)	Nitrogen Kg/ha	Phosphorus kg/ha			
		Index 1	Index 2	Index 3	Index 4
<130	205	28	18	8	0
131-170	205	31	21	11	0
171-210	280	33	23	13	0
>210	248	36	26	16	0

The level of removal would be higher on farms with higher than average milk yields (e.g. if milk yield = 6500 litres, the equivalent P removal would be 7.1 kg/cow).

Variant on proposed solution: Deduct 16 week storage period N and P from current P rates in the draft GAP regulations 2010
A variant of the solution is to change the fertilisation rates for grassland, prescribed in the draft GAP regulations 2010, so that there is no longer a requirement to deduct home produced slurries to calculate chemical fertiliser N and P allowances.

The existing N allowance rates for the whole farm should be amended to remove the available N allowance that is currently being deducted (Table 3.7). The rates of maximum chemical fertiliser N allowed proposed in Table 3.7 are then calculated based on the current deductions required in the draft GAP regulations 2010, assuming 40% N availability, and a 16 week slurry storage period. The calculation of the chemical N fertiliser allowed should only be affected by the import (decrease N allowance) or export (increase N allowance) of organic manures. Home produced manures should no longer be included. This will make calculations simpler, but will not affect the N balance of the farm.

The existing P rates should be amended in the same way as for N (Table 3.7). The rates of maximum chemical fertiliser P allowed proposed in Table 3.7 are calculated based on the current deductions required in the draft GAP regulations 2010, assuming 100% P availability, and a 16 week slurry storage period. The calculation of the chemical P fertiliser allowed should only be affected by the import (decrease N allowance) or export (increase N allowance) of organic manures, or by the usage of concentrate feeds. Home produced manures should no longer be included. This will make calculations simpler, but will not affect the P balance of the farm.

Table 3.7: Proposed Maximum chemical N and P allowance for grassland, before adjustments for manure export and imports and concentrate feeds. ("variant on proposed solution").

Grassland Stocking Rate (kg N/ha)	Nitrogen	Phosphorus			
	Kg/ha	kg/ha			
		Index 1	Index 2	Index 3	Index 4
<130	205	29	19	9	0
131-170	205	31	21	11	0
171-210	280	34	24	14	0
>210	248	37	27	17	0

<u>Environmental impact of proposed solution:</u>

There are no environmental impacts of this solution, since farm nutrient balance remains the principle of nutrient advice (Table 3.8). This more simple approach may allow for increased compliance with the regulations as breaches associated with confusion surrounding the complexity of the current regulations may be reduced.

At first sight, this solution may incorrectly appear to reduce the potential within the regulations to encourage more efficient nutrient recycling from manures, since the assumption of N availability is no longer part of the calculations on each farm. However, there is an assumption of efficient nutrient recycling (P = 100%; and N = 40%) inherently included in the derivation of the rates proposed. These assumed N and P availabilities for imported and exported manures can still remain in the regulations.

Table 3.8: Comparison of chemical N and P allowances, at different stocking rates, of the current system with that of the two solutions proposed. Concentrate is not included in any of the scenarios.

Stocking rate	N		P		
	Current	All Solutions	Current	Proposed solution	Variant solution
16 week storage period					
<130	210	205	9	8	9
131-170	205	205	11	11	11
171-210	280	280	14	13	14
>210	248	248	17	16	17
18 week storage period					
<130	208	205	8	8	9
131-170	202	205	10	11	11
171-210	277	280	13	13	14
>210	244	248	16	16	17
20 week storage period					
<130	206	205	7	8	9
131-170	200	205	9	11	11
171-210	274	280	12	13	14
>210	241	248	14	16	17
22 week storage period					
<130	204	205	7	8	9
131-170	197	205	8	11	11
171-210	270	280	10	13	14
>210	237	248	13	16	17

3.6 Flexibility in closed period for spreading of animal manures

The draft GAP regulations 2010 state:

SCHEDULE 4

PERIODS WHEN APPLICATION OF FERTILISERS TO LAND IS PROHIBITED

1. In counties Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, Wexford and Wicklow, the period during which the application of fertilisers to land is prohibited is the period from—

(a) 15 September to 12 January in the case of the application of chemical fertiliser

(b) 15 October to 12 January in the case of the application of organic fertiliser (other than farmyard manure)

(c) 1 November to 12 January in the case of the application of farmyard manure.

2. In counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath, the period during which the application of fertilisers to land is prohibited is the period from—

(a) 15 September to 15 January in the case of the application of chemical fertiliser

(b) 15 October to 15 January in the case of the application of organic fertiliser (other than farmyard manure)

(c) 1 November to 15 January in the case of the application of farmyard manure.

3. In counties Cavan, Donegal, Leitrim and Monaghan, the period during which the application of fertilisers to land is prohibited is the period from—

(a) 15 September to 31 January in the case of the application of chemical fertiliser

(b) 15 October to 31 January in the case of the application of organic fertiliser (other than farmyard manure)

(c) 1 November to 31 January in the case of the application of farmyard manure.

Context

The closed period for spreading of fertilisers and animal manures has presented challenges, both to farmers and the environment. Since the introduction of S.I.378-06 / S.I.101-09, farmers have been required to invest significantly in manure management facilities. This has been facilitated in-part by various National Exchequer and EU-funded on-farm investment schemes. An estimated €2bn has been awarded in grant-aid for animal housing, manure storage and manure management equipment since these regulations have been introduced. The regulations have led to significant changes in manure management practices at farm level.

Summary of issue:

The use of calendar dates to allow or prohibit the landspreading of animal manures does not account for significant inter-annual variation in weather and/or spreading conditions. Teagasc's main concern is that the use of fixed dates to determine the extent of the closed period has led to situations were the "closed" period and the "open" period have not equated to "unsuitable" and "suitable" spreading conditions, respectively.

Table 3.9: Median and range of the number of suitable spreading days[a] in the month preceding the end of the closed period, and in the first week of the open period, for well-drained soils for the winters from 2004/2005 to 2008/2009.

	Last month of closed period			First week of open period		
	Weather Station[b]			Weather Station[b]		
	Johnstown Castle	Mullingar	Clones	Johnstown Castle	Mullingar	Clones
Median	7	1	7	0	0	2
Range	4-19	0-6	0-9	0-3	0-2	0-7

a: A suitable spreading day has been defined as a day that is followed by at least five consecutive days during which the soil temperature at 5cm depth exceeds 4ºC *and* during which there is no net drainage of water from the soil through either leaching or overland flow.

b: Weather data courtesy of Met Éireann.

Table 3.9 compares the number of suitable spreading days in the month *before* the end of the closed period with the number of suitable spreading days in the first week *after* the end of the closed period, for well-drained soils, for the last five years, for three weather stations located in zones A, B and C, respectively. It shows that the current calendar-based regulations may inadvertently result in landspreading of fertiliser and animal manures when soil and weather conditions are less suitable, even though in each year, suitable spreading days have been available on well-drained soils in the last month of the closed period. It should be noted that the dates of these "suitable days" differed between years. In practice, this means that the current use of inflexible calendar dates may inadvertently have led to increased risk of nutrient loss to water.

In an ideal scenario, slurry storage facilities are empty at the start of the closed period; in this case the storage capacity should exceed the length of the closed period. However, particularly in recent years, it is has not always been possible to fully empty slurry storage tanks before the onset of the closed period, due to unusually adverse weather and spreading conditions during the summer, and/or ongoing indoor slurry production before the start of the closed period.

In recognition of the insurmountable constraints that the fixed "closed periods" imposed on nutrient management, the Minister of Agriculture granted temporary nationwide derogations from the "closed periods" in the autumns of both 2008 and 2009. In this submission, Teagasc proposes that:

- The flexibility employed in 2008 and 2009 can be regularised without increasing risk of nutrient loss to water, if such flexibility is based on objective criteria for assessing suitable spreading conditions.
- Risk of nutrient loss to water will be reduced if this flexibility is employed at the *end* of the closed period instead of the start of the closed period.

Background:
Animal manures are a valuable source of nutrients to grassland, but spreading of animal manures or fertiliser may lead to nutrient losses to water if this coincides with unsuitable weather and soil conditions (Schulte *et al*., 2006).

Under *suitable* weather and soil conditions, ammonium in animal manures is rapidly made unavailable for leaching through either immobilisation or uptake by grass. In Ireland, data (Hoekstra *et al.*, 2007a) and a scientific review (Hoekstra *et al*., 2007b) established that the majority of available N was taken up by grass in *less than* two weeks following application of nitrogen. There are very few studies that have quantified the temporal patterns of N uptake in grassland *within* this two-week period, but in France, Morvan *et al.* (1997) found that the cumulative ammonium immobilisation by soil biomass and cumulative ammonium uptake by grass both reached their maxima within the first five days following application of manure. It has been well-established that soil and grass processes depend on soil temperature, and temperatures between 3-6ºC are commonly used as threshold values for these processes to commence (Brereton, 1981; Schulte, 2005).

Under *unsuitable* weather and soil conditions, nutrients may be lost to water through leaching or overland flow before they are immobilised, adsorbed or taken up by the grass. Leaching and overland flow may occur when soil water contents are in excess of field capacity. Downward movement of nutrients (particularly nitrates) can contribute to nitrate leaching only if cumulative water recharge during the autumn/winter period is sufficient to move nutrients below the rooting zone. Nutrients applied towards the end of the closed period are subject to smaller volumes of cumulative water recharge (Schulte *et al*., 2006). As a result, the risk of nutrients being transported below the rooting zone, before the commencement of nutrient uptake by grass, declines over time during the closed period.

In 2005, Teagasc, Met Éireann and UCD developed a common model (Schulte *et al*., 2005) to predict movement of water in Irish grassland soils, based on current and antecedent weather conditions; model output is available in real-time at www.met.ie/agmet/default.asp.

For the purpose of this preliminary study, a "suitable spreading day" was defined as a day which is followed by at least five days during which soil moisture contents stay below field capacity, *and* during which average soil temperatures at 5 cm depth are above 4ºC (corresponding to average air temperatures between 5 and 6 ºC). For a comprehensive agronomic review of spatio-temporal patterns of spreading conditions, see Lalor and Schulte (2008).

Proposed solution:

1. Long-term solution: Teagasc, UCD, University of Ulster and Met Éireann, with funding from DAFF's Research Stimulus Fund, are currently developing a joint Decision Support System (DSS) that predicts, *inter alia*, slurry and fertiliser spreading conditions in real-time on a 10x10km grid basis. Output of the DSS will be based on the 10-day forecast from the European Centre of Medium-Range Weather Forecasts (ECMWF), and will provide individual farmers with reliable and auditable forecasts on spreading opportunities. This research project is ongoing and is scheduled to be completed by 2013.

2. Interim solution: Teagasc recommends that, in the interim, DAFF grant derogations for spreading of fertiliser and slurry in the last month of the closed periods on an ad-hoc basis, following objective assessment of spreading conditions. Teagasc recommends that these derogations be based on the 5-day soil moisture forecasts by Met Éireann, which have a high degree of reliability (Lancaster *et al*., in prep.). Teagasc recommends that fertiliser and slurry may be applied at low rates to well-drained soils for which the weather forecast predicts at least 5 consecutive days during with soil temperatures remain above 4ºC *and* soil moisture contents remain above field-capacity.

Environmental impact of proposed solution:

Teagasc expects that the proposed interim solution will reduce risks of nutrient loss to water. Under the current regulations, timing of first slurry spreading is largely dictated by the fact that slurry volumes may reach slurry storage capacity by the end of the closed period; this may inadvertently lead to landspreading of slurry when conditions are sub-optimal. Our proposed interim solution allows the timing of first slurry spreading to be based on the suitability of spreading conditions, as defined above, and hence on minimising risk of nutrient loss to water, whilst maximising grass uptake and immobilisation.

3.7 Transitional arrangements for pig and poultry manure

The draft GAP regulations 2010 state:

PART 6

FUNCTIONS OF PUBLIC AUTHORITIES

34. (3) Notwithstanding Articles 16 and 26 and sub-article (2), the application to land prior to 1 January 2011 of phosphorus in excess of the quantities prescribed by Article 16 shall not be an offence for the purposes of Article 16 in a case where—

- *(a) the excess arises from the application of spent mushroom compost or manure produced by pigs or poultry,*
- *(b) such compost or manure, as the case may be, is produced on a holding on which, activities were being carried on which gave rise to spent mushroom compost or manure from pigs or poultry and there has not been an increase in the scale of such activities on the holding since 1 August 2006, and*
- *(c) the occupier of the holding on which the phosphorus is applied to land holds records which demonstrate compliance with paragraphs (a) and (b).*

Context

The four-year period during which the transitional arrangements applied ends on 31st December 2010. During this period, subject to certain conditions, the application of pig and poultry manure to land was restricted only by the 170 kg per hectare Organic Nitrogen limit, whether from livestock on the farm or from pig manure. From January 2011, the current regulations dictate that P must also be taken into account. This will significantly restrict the amount of pig and poultry manure that can be applied to a given area of land, whether tillage or grassland. This reduction will vary from unit to unit, depending on the type and intensity of farming in the area. The reduction in the volume that can be applied to a given area of land is of the order 33-35%, based on a land area that is predominantly grassland (Soil P Index 3). This is calculated to lead to a 50% increase in the land area required for application of the manure.

Summary of issue:

Pig and poultry producers will incur significantly increased costs in transporting manure greater distances than under the transitional provisions 2007-2010, either to tillage farms or to grassland farms that can import sufficient quantities of P under the P regulations.

These increases in costs are likely to be exacerbated by some of the anomalies in the current regulations, relating to the nutrient management of the potential recipient farms of pig and poultry slurry, particularly the anomalies in relation to the tillage N Index (*cf*. Section 2.1) and the calculation of maximum permissible P fertilisation rates on grassland (*cf*. Section 3.5).

<u>Background:</u>
Issues surrounding the application of pig slurry to tillage land
The application of pig manure as a fertiliser to tillage land is considered desirable in that this facilitates the recycling of the plant nutrients nitrogen, phosphorus and potassium. The higher application rate of P permitted under S.I.378-06 / 101-09 on tillage land (25kg per ha at Soil P Index 3) compared to grassland (15-19 kg P at Soil P Index 3), means that tillage land is the favoured outlet for pig manure.

Therefore, application of the pig manure to arable land represents the best the solution, but typically requires transporting some of the manure to lands further away from the production, which involves significantly increased costs. The nutrient value of pig slurry depends on fertiliser prices, and has ranged from €4.50 to €6.68 per m^3 over the last three years (Plunkett and Lalor, 2009). Subsequently, the Teagasc Pig Development Unit have calculated the cost of handling, transporting and land application of pig manure over various distances using either $11.8m^3$ tractor drawn tanker or $25m^3$ truck. For distances of 17 km or less, the tractor drawn tanker is more economical, but above 17 km the use of a truck is more cost-effective (McCutcheon and Lynch, 2008). As part of a study funded by the Research Stimulus Fund, a spatial analysis by Fealy and Schulte (2009) suggested that, for pig producers in the North-Western half of the country, the average distance to potential tillage recipients will be well excess of 17 km.

This availability is further reduced by the following factors:

- Tillage N-Index: under the draft GAP regulations 2010, tillage land which receives dressings of pig manure for two consecutive years moves to Soil Nitrogen Index 2 in the third year. This severely restricts the Available Nitrogen (kg / ha) that is allowed in that third year and in subsequent years, if pig manure continues to be applied annually. This has presented a serious limitation to the use pig and poultry manure as a fertiliser on tillage land (*cf*. Section 2.2).

- Pig manure must be applied within a narrow time period, typically immediately before ploughing for spring crops, or at particular growth stages on a winter crop in the spring. The manure needs to be available on or close to the tillage farm at the appropriate time of application. The provision of pig and poultry manure storage at or near tillage farms is required (and currently lacking) to facilitate the widespread use by tillage farmers. Based on DAFF farm building costings and commercial quotes, indicative costs for manure storage on tillage land amount to €60-75 per m^3 (depending on size and excluding cover).

- The application of pig manure to growing crops requires specialist equipment that is not currently readily available in this country. Significant capital investment is required to facilitate this.

Issues surrounding the application of pig and poultry slurry to grassland
For grassland, the calculation of the amount of P that may be applied, has to account for the P in the manure produced by livestock housed on the farm over the winter period. This amount of P depends on the length of the Minimum Storage Period for that zone (*cf*. Sections 3.1-3.5). The effect of this is farmers in areas with longer winter storage periods are restricted by how much P they may apply to land, whether chemical or as pig or poultry manure. This reduces the quantity of pig manure these farms can import, particularly in Zones C and D.

Alternative options
The mechanical separation of pig manure, using a decanter centrifuge, and transporting the P-rich solid fraction 100 km while spreading the liquid fraction 5 km from the unit is estimated to cost €14.90 per m^3 (McCutcheon and Lynch, 2008). This equates to €0.10 - €0.17 per kg deadweight for sows (incl. progeny) producing 12 or 20 m^3 of slurry, respectively, per annum. These costs are broadly equivalent to transporting the manure 125 km by truck, followed by land-spreading. As a result, manure separation is not a realistic option in all but very exceptional situations.

Critical to minimising costs is maximising the dry matter content of the manure by minimising the water content and, consequently, the volumes produced. Investment at farm level has been required to maximise dry matter content through improvements in feeding, drinking, washing systems and in manure storage facilities. Over the three years 2007-9, investment in pig production facilities has been severely curtailed by the prevailing poor margins in pig production through much of this period. During this period, the Margin over Feed Costs per kg dead weight has averaged €0.44 for units using purchased compound feed. This is substantially below the €0.48 per kg deadweight that is estimated to be required to cover all non-feed costs.

Proposed solutions:

1. That the proposed amendments in this submission in relation to Nitrogen availability in organic manures and the Nitrogen Index for tillage crops be adopted to incentivise the use by tillage farmers of pig manure as a fertiliser (*cf*. Section 2.1).
2. That the proposed amendments in this submission in relation to the rationalisation of calculations of maximum fertiliser N and P allowance be adopted to incentivise the use by livestock farmers of pig manure as a fertiliser (*cf*. Sections 3.1-3.5).
3. That the provision of pig manure storage facilities on tillage farms be encouraged and supported, in order to ensure that the manure is available in the limited time period when it can be applied. Such support may be extended to facilities for the storage of Spent Mushroom Compost (*cf.* Section 2.1), the use of which is restricted by similar issues.
4. That the provision of the specialist equipment for the application of pig manure to growing crops be encouraged and supported.

Environmental impact of proposed solution:

The proposed solutions will aid to remove some of the constraints for the use of pig slurry as a fertiliser on tillage land and on grasslands with a P requirement. This will promote efficient recycling of nutrients in pig slurry and will ultimately result in further reductions in imported mineral fertilisers on recipient farms. This will reduce the total nutrient balances and pressures, and associated risk of nutrient loss (*cf*. Section 1.2).

Part 4:
Considerations on the administration of the draft GAP regulations 2010

4.1 Storage requirements where land is distributed across different zones

The draft GAP regulations 2010 state:

SCHEDULE 3

STORAGE PERIODS FOR LIVESTOCK MANURE

1. The storage period specified for the purposes of Articles 9(2), 10(2),12 and 16(5)(b) is—

(a) 16 weeks in relation to holdings in counties Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, Wexford and Wicklow;

(b) 18 weeks in relation to holdings in counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath;

(c) 20 weeks in relation to holdings in counties Donegal and Leitrim, and

(d) 22 weeks in relation to holdings in counties Cavan and Monaghan.

2. Where a holding lies partly in one county and partly in one or more other counties, the holding shall be deemed for the purposes of this Schedule to lie wholly within the county in relation to which the longest storage period is specified by paragraph 1.

Context

The draft GAP regulations 2010 divide Ireland into three different zones (A, B, C). Dates in which organic and mineral fertilisers can be spread vary between these zones. The zones are also linked to the manure storage periods required on each farm holding. The storage periods are 16, 18, 20 and 22 weeks. An interpretation provided by the Department of Agriculture, Fisheries and Food, subsequent to the publication of S.I.378 (now S.I.101-2009), stated that farmers who include SFP forage lands from a number of different zones on their Single Payment Scheme (SPS) must have the manure storage capacity needed in the zone with highest requirements.

Summary of issue:

This is issue is best illustrated by example:
Where a farmer's primary holding is located in Co. Meath (18 weeks) and he or she rents, leases or owns a half of an acre of land in Co. Cavan (22 weeks), he/she is required to have 22 weeks storage capacity on their entire farm.

Proposed solution:

The proposed solution is to base the storage requirements on the zone where the primary farmyard is located. This means that a farmer, who in reality may only need 18 weeks storage, is not required to build additional storage or reduce the number of stock wintered.

This proposal provides for a fairer system whereby farmers who own small portions of land in more restrictive areas are not penalised for this.

Environmental impact of proposed solution:

There are no environmental impacts from this solution, as this issue only relates to the storage of organic fertilisers. Farmers spreading organic fertilisers within a particular zone will still be required to adhere to the prohibited spreading periods within that zone.

4.2 Details of soil sampling on derogation farms

The draft GAP regulations 2010 state:

SCHEDULE 5

CONDITIONS APPLYING IN RELATION TO DEROGATION

6. Nitrogen and phosphorus analysis in soil shall be performed for the holding at least every four years for each homogeneous area of the holding, with regard to crop rotation and soil characteristics. At least one analysis per five hectares of land shall be required.

Context

Farmers wishing to farm at greater than 170 Kg Org N/ha are required to apply to DAFF for a derogation on an annual basis. This application must be accompanied by a detailed fertiliser plan for the farm. Article 6 under Schedule 5 states that:

"Nitrogen and phosphorus analysis in soil shall be performed for the holding at least every four years for each homogeneous area of the holding, with regard to crop rotation and soil characteristics. At least one analysis per five hectares of land shall be required."

The current interpretation of Article 6 is that a single soil analysis cannot represent an area greater than 5 ha.

Summary of issue:

Soil sampling is an effective means of establishing soil fertility and allows farmers to match crop requirements with nutrients. For nutrient advice, Teagasc recommends that soil samples are taken to represent 2-4 ha on average, but where soils and crop management are uniform, fields may be blocked into bigger units.

At a practical level where a farm is being divided for soil sampling purposes, plots size can vary considerably. Under the current interpretation of Article 6, where a farmer has a field of 5.2 ha two separate soil samples must be taken so as not to exceed the 5 ha maximum. This requirement causes considerable difficulty for advisers and farmers when developing nutrient management plans that include small areas that do not represent practical management units.

Proposed solution:

The proposed solution entails changing the 5 ha requirement to an average soil sample area over the cropped area of the farm. For example, under this proposal a farm of 100 ha would need at least 20 soil samples on the farm to comply with the regulations. This would ensure that the farm is soil sampled on average every 5 ha.

<u>Environmental impact of proposed solution:</u>
This solution would have no negative environmental impact and will ensure that derogation farms are comprehensively soil sampled in a practical manner, and that soil sampling protocols for nutrient recommendations are aligned with soil sampling for derogation requests.

4.3 Development of integrated online nitrates facility

<u>The draft GAP regulations 2010 state:</u>

PART 5

GENERAL

General duty of occupier

22. (1) An occupier of a holding shall ensure compliance with the provisions of these Regulations in relation to that holding.

(2) An occupier of a holding shall, for the purposes of compliance with these Regulations, have regard to any advice or guidelines which may be issued from time to time for the purposes of these Regulations by the Minister, the Minister for Agriculture, Fisheries and Food or the Agency.

Keeping of records by occupier

23. (1) Records shall be maintained for each holding which shall indicate—

(a) total area of the holding,

(b) net area of the holding,

(c) cropping regimes and their individual areas,

(d) livestock numbers and type,

(e) an estimation of the annual fertiliser requirement for the holding and a copy of any Nutrient Management Plan prepared in relation to the holding,

(f) quantities and types of chemical fertilisers moved on to or off the holding, including opening stock, records of purchase and closing stock,

(g) livestock manure and other organic fertilisers moved on to or off the holding including quantities, type, dates and details of exporters and importers, as the case may be,

(h) the results of any soil tests carried out in relation to the holding,

(i) the nature and capacity of facilities on the holding for the storage of livestock manure and other organic fertilisers, soiled water and effluents from dungsteads, farmyard manure pits or silage pits including an assessment of compliance with Articles 8 to 13,

(j) the quantities and types of concentrated feedstuff fed to grazing livestock on the holding, and

(k) the location of any abstraction point of water used for human consumption from any surface watercourse, borehole, spring or well.

(2) Where fertiliser is used on a holding and a certificate of the type mentioned in Article 15 or 20 was issued in relation to that fertiliser in accordance with Article 32, a copy of the certificate shall be retained and be available for inspection on the holding for a period of not less than five years from the expiry of validity of the certificate.

(3) Records shall be prepared for each calendar year by 31 March of the following year and shall be retained for a period of not less than five year

Context

The Department of Agriculture Fisheries and Food has invested significant resources into developing web enabled applications for farmers. Agfood.ie provides farmers with up-to-the-minute information on their stock numbers, area farmed, crops farmed as submitted under the SPS; as well as details of organic nitrogen and phosphorus loading.

Summary of issue:

Many of the calculations required under the draft GAP regulations are complex in nature. Whilst Excel sheets have been developed by Teagasc to assist farmers, there is a need to streamline the process. DAFF databases contain virtually all of the information required by a farmer and/or their agent to produce the necessary documentation.

Proposed solution:

Agfood.ie has proven itself as an effective tool for farmers and their agents to apply for the Single Payment Scheme online. The Agfood.ie platform already hosts the vast majority of the critical information to help farmers complete their:

- Nutrient estimate for the year ahead (optional to use online system);
- Derogation plan, where required;
- Nitrates records (optional to use online system).

By expanding the current online system to facilitate the inputting of a small amount of additional data, farmers and/or their agents will be able to visit a one-stop-shop to ensure that the farm is Nitrates compliant, by producing accurate records and nutrient estimates, based on correct stock numbers (from AIMS), claimed area of land (as declared for SPS), etc. Farmers can also be assured that information that they base their nutrient calculations on, are direct from source and are the same as what DAFF will use to adjudicate applications.

This proposal could also bear significant benefits for the DAFF staff who are involved in administering Cross-compliance inspections as well as the Nitrates Derogation. By having a single repository for Nitrates Derogation Fertiliser Plans, unnecessary paperwork and time delays can be eliminated. A clear example of the benefits is illustrated by the derogation process, in which farmers submit yearly records to DAFF Johnstown Caste by the 1st March yearly. Where these farmers receive a Cross-compliance Nitrates inspection during that calendar year, they are required to furnish the Cross-compliance unit in Portlaoise with the same fertiliser records. By harnessing technology, this duplication could be avoided.

If required, Teagasc would take a positive view towards a request to provide assistance and technical input to the development of such a facility.

Environmental impact of proposed solution:
This proposal would have a positive environmental impact. It would result in a reduction in paper usage and streamline the administrative processes associated with the draft GAP regulations.

4.4 Streamlining of the application process for a derogation

<u>The draft GAP regulations 2010 state:</u>

SCHEDULE 5

CONDITIONS APPLYING IN RELATION TO DEROGATION

3. A fertilisation plan shall be kept for the holding describing the crop rotation of the farmland and the planned application of manure and nitrogen and phosphorus chemical fertilisers. The fertilisation plan shall be available on the holding by 1 March at the latest and shall include the following:

(a) the number of livestock, a description of the housing and storage system, including the volume of manure storage available;

(b) a calculation of manure nitrogen (less losses in housing and storage) and phosphorus produced on the holding;

(c) the crop rotation and area of each crop, including a sketch map indicating location of individual fields;

(d) the foreseeable nitrogen and phosphorus crop requirements;

(e) the amount and the type of manure delivered outside the holding or to the holding;

(f) the results of soil analysis related to nitrogen and phosphorus soil status if available;

(g) nitrogen and phosphorus application from manure over each field (parcels of the holding homogeneous regarding cropping and soil type), and

(h) application of nitrogen and phosphorus with chemical and other fertilisers over each field.

A plan in relation to the holding shall be revised no later than seven days following any changes in agricultural practice on the holding to ensure consistency between the plan and actual agricultural practice on the holding.

<u>Context</u>

Application form

Currently, farmers are required to send a separate yearly application form and derogation plan to DAFF, Johnstown Castle, applying for a derogation to exceed 170 kg of Organic N/ha/yr up to a max of 250 kg Organic N/ha/yr, before 31 March.

Fertiliser plan

Article 3, Schedule 5 of the draft GAP regulations 2010 states that *"A fertilisation plan shall be kept for the holding describing the crop rotation of the farmland and the planned application of manure and nitrogen and phosphorus chemical fertilisers. The fertilisation plan shall be available on the holding by 1 March at the latest…."*

Under the current operation of the GAP regulations, a farmer wishing to apply for a derogation from the 170 kg organic N/ha limit is obliged to prepare and submit a 'Fertiliser Plan' to DAFF, Johnstown Castle, on an annual basis, before 31 March.

Fertiliser accounts

Farmers who have applied for a derogation under the GAP Regulations are required to submit fertiliser accounts to DAFF, Johnstown Castle, before 1 March.

Summary of issue:

Teagasc believe that there are opportunities to streamline the process for applying for derogation under the GAP Regulations. Currently, there are three separate components to the derogation process:

a) Apply for a derogation to DAFF;
b) Send a copy of derogation fertiliser plan to DAFF;
c) Send records to DAFF for previous year, by 1st March.

Teagasc believes that having two separate dates associated with the process can cause unnecessary confusion for derogation applicants and participants.

Requirement for annual fertiliser plan

The current administrative process for farmers applying for a derogation from the 170 kg organic N/ha limit, requires a paper copy of the Derogation Fertiliser Plan to be submitted annually to DAFF, Johnstown Castle. Each year a farmer must draw up a Derogation Fertiliser Plan for their farm. In many instances there is no significant change to the farming system from year to year.

Proposed solution:

Dates

Teagasc believes that there is an opportunity to amalgamate the deadlines outlined in a) to c) above, into one date, i.e. 31st March. This will eliminate the confusion that exists around the two separate dates that are in place for records and applications. In addition, many farmers do not decide on their full cropping regime for the year by 1st March each year.

Automatic withdrawal

In previous years, DAFF have permitted farmers to withdraw their applications for derogation, if they had not exceeded the 170 kg organic N/ha. For 2010, where the whole farm stocking rate did not exceed 170 kg organic N/Ha/yr, DAFF automatically withdrew the derogation application in early 2010 for 2009. Teagasc believes that it would be beneficial for this process to continue.

First time applicants for derogation
Where a farmer is applying for a derogation for the first time, he/she sends their completed derogation fertiliser plan to DAFF, Johnstown Castle, by 31st March. Teagasc proposes that this submission of their derogation fertiliser plan could simultaneously be considered as an application for a derogation. The fertiliser plan cover page could be adjusted to incorporate an application form. Teagasc proposes that in subsequent years, the farmer would be permitted to renew their derogation application via the SPS system.

Applicants who previously applied for derogation
Where a farmer has already applied for a derogation in a previous year, Teagasc proposes that he/she be given the option of 'renewing' their application on an annual basis for the duration of their fertiliser plan. The renewal would occur when the farmer signs the SPS application form and agrees to the terms and conditions. As outlined below, Teagasc proposes that derogation plans last for a period of four years and be updated as required. Farmers who are following an 'active' derogation plan would then be required to renew their application on an annual basis, as part of their SPS application.

Four year derogation plan
Many farmers who apply for a derogation under the GAP Regulations are commercial grassland based enterprises. These farming systems tend not vary significantly from year to year in terms of crops grown and stock numbers. By permitting derogation farmers to maintain a four year derogation plan, it will greatly reduce the paperwork involved. Teagasc proposes that farmers would be required to amend their derogation plan within six weeks of any significant changes to the farming system.

Environmental impact of proposed solution:
This proposal would have a positive environmental impact. The aim of this proposal is to streamline the administration of the derogation under the GAP Regulations. It would reduce the amount of paperwork and communications required between DAFF and farmers and in general simplify the process without compromising any of the objectives of the derogation.

4.5 Issues surrounding cross-compliance inspections

The draft GAP regulations 2010 state:

PART 6

FUNCTIONS OF PUBLIC AUTHORITIES

30. (1) A local authority shall carry out, or cause to be carried out, such monitoring of surface waters and groundwaters at selected measuring points within its functional area as makes it possible to establish the extent of pollution in the waters from agricultural sources and to determine trends in the occurrence and extent of such pollution.

(2) A local authority shall carry out or cause to be carried out such inspections of farm holdings as is necessary for the purposes of these Regulations and shall aim to co-ordinate its inspection activities with inspections carried out by other public authorities.

(3) For the purposes of sub-article (2) a local authority shall aim to develop co-ordination arrangements with other public authorities with a view to promoting consistency of approach in inspection procedures and administrative efficiencies between public authorities and to avoid any unnecessary duplication of administrative procedures and shall have regard to any inspection protocol which may be developed by the Minister, following consultation with the Minister for Agriculture, Fisheries and Food.

Context

Inspection follow-up

All applicants of the Single Payment Scheme are required to abide by the rules of Cross-compliance. The DAFF carry out inspections on 5% of applicants annually.

Following a Cross-compliance inspection by the DAFF, farmers are currently given a period of 14 days to respond or provide supplementary documentation to DAFF. In general, farmers will contact their agricultural adviser/consultant to assist them with this process.

Records

The format of Cross-compliance Nitrates Records is different to those associated with Nitrates Derogations records.

Summary of issue:

Inspection follow-up

Much agricultural advisory/consultancy calendar year is now driven by deadlines relating to Nitrates, SPS, REPS etc. These deadlines have created several pinch points throughout the year for both farmers and agricultural advisers/consultants.

To date, many of the inspection campaigns carried out by the DAFF have occurred during peak times of the year in terms of the workload of the Teagasc Advisory Services and agricultural consultants. Prior to and following an inspection, farmer clients will contact their local Teagasc adviser or agricultural consultant for assistance and support with the process.
Following a Cross-compliance inspection farmers are required to submit copies of their:

- fertiliser records;
- Nitrates derogation plan (where applicable);
- nutrient estimate for the year;
- details of storage facilities on the farm.

Collation of this information can take time for the farm and the agricultural adviser/consultant. Inspections occurring during peak times in the advisory calendar can create significant bottlenecks. This issue is further exacerbated where Cross-compliance inspections are concentrated on specific geographic areas.

Records

Where a derogation farmer receives a Cross-compliance inspection from the DAFF, he/she is required to provide the inspection team with a copy of the Cross-compliance Nitrates Records. This means that the farmer must translate or rewrite his/her Nitrates records into the Cross-compliance Nitrates format. Teagasc believes that this is unnecessary duplication of effort.

Proposed solution:

Inspection follow-up

Whilst it is unrealistic to expect that inspections take place only at certain times of the year, Teagasc proposes that farmers are given a six week period to return documentation, so that they, together with their agricultural adviser/consultant, have sufficient time to collate the necessary information. This proposal will help to relieve bottlenecks that occur during the year. Extending the response period from fourteen days to six weeks will allow the Teagasc Advisory Service and agricultural consultants to plan workloads more efficiently. This proposal will also reduce the possibility of clashes with other annual deadlines in the farming calendar.

Records

Where a farmer has applied for a derogation in the previous year and receives an inspection from DAFF, Teagasc proposes that the Nitrates

Derogation Records would be acceptable for Cross-compliance inspection purposes.

Environmental impact of proposed solution:
There are no negative environmental impacts from this solution.
The acceptance of Nitrates Derogation records for Cross-compliance inspection purposes will eliminate unnecessary paperwork.

4.6 REPS plans

<u>The draft GAP regulations 2010 state:</u>

PART 6

FUNCTIONS OF PUBLIC AUTHORITIES

34. (1) A holding on which the application of fertilisers is carried out in accordance with a nutrient management plan approved on or before 1 December 2006 for the purposes of the Rural Environmental Protection Scheme shall be deemed to be compliant with the requirements of Article 16 for the duration of that plan.

<u>Context</u>

REPS Measure 1

REPS 4 was closed to new applicants on 9 July 2009. However, the last of the agri-environmental plans prepared to REPS 4 specifications will not expire until 2015. REPS 3 contracts will expire at end of 2011. Each contract awarded under REPS lasts for a minimum period of five years. During this period, REPS participants are required to maintain records for their farming system. In addition, if there are any significant changes made to the farming system, the participant is obliged to update their REPS agri-environmental plan to reflect any changes.

Part 6, Article 34 of S.I.101-09 stated that:

"A holding on which the application of fertilisers is carried out in accordance with a nutrient management plan approved on or before 1 December 2006 for the purposes of the Rural Environmental Protection Scheme shall be deemed to be compliant with the requirements of Article 16 for the duration of that plan."

This means that REPS plans developed before 1 December 2006 are considered to be in compliance with the GAP Regulations. .

REPS Records

REPS participants are required to maintain detailed records of their farming system as well as items completed on their work schedule. REPS records are currently accepted by the DAFF as fulfilling GAP Regulation requirements.

<u>Summary of issue:</u>

REPS Measure 1

It is generally accepted that the ICT infrastructure as well as the REPS Scheme conditions are complex in nature. The REPS 4 specification is

designed so that participants do not exceed the nutrient limits stipulated within S.I.101-09.
Where a REPS agri-environmental plan is required to be amended or adjusted after the revised GAP Regulations are published, it is possible that nutrient calculations/limits may be different. This has the potential to cause significant confusion and unnecessary effort in amending REPS plans.

REPS Records
If the GAP regulations are revised in any way, this has the potential to have serious implications for how REPS records are maintained.

Proposed solution:
REPS Measure 1
Teagasc proposes the continuation Part 6, Article 34 of S.I.101-09 for REPS agri-environmental plans, until they expire. Therefore, Teagasc proposes that farmers, who continue to be participants of REPS are deemed to be compliant with the requirements of the GAP Regulations for the duration of their REPS agri-environmental plan, even if the plan is amended in the subsequent period.

REPS Records
Teagasc proposes that REPS Records will remain acceptable for Cross-compliance and GAP Regulation purposes. REPS participants who use REPS records should continue to be deemed compliant with the GAP regulations.
These proposed solutions will mean that both farmers and their advisers/consultants will not be forced to expend large resources in amending REPS plans for inconsequential issues.

Environmental impact of proposed solution:
Teagasc does not foresee any significant environmental impact from these proposed solutions. The proposed solutions will ensure that REPS participants are not subject to unnecessary costs or bureaucracy. REPS participants would continue to farm in an environmentally sustainable manner.

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