Nitrate Working Group 2014

1) Introduction and background

This section gives some brief background and outlines the purpose of the document

2) Review and timeline of 'the Nitrate Problem' in Jersey

This section is set out a chronological account of the main nitrate related evidence, legislation and policy of note since the late 1980's.

1) Introduction and background

Nitrate levels in Jersey's surface water and groundwater have been consistently high for many years. Average nitrate levels have declined since 1998 but in many instances are still significantly above acceptable levels.

The link between nutrient losses from agriculture and high nitrate concentrations in surface and groundwater has been well established. Agricultural activities are not the only source, but as agricultural land occupies over 50% of the island's area, they have an undeniable impact. Intensive agricultural land use has a significant impact on surface and ground water quality throughout Europe. The main agricultural pollutants are nutrients (phosphates and nitrates), pesticides and other agrichemicals, faecal bacteria and soil. In relation to nutrients, as well as sources from animal manures and other organic matter, heavy fertilizer use since the mid-20th century has caused spikes in nutrient concentrations in public drinking water. A recent evidence document on nitrate produced by the Environment Agency shows[1] that agricultural nitrate sources are the dominant cause in both England and Wales of failure to achieve nitrate standards in fresh, transitional and coastal waters.

As well as having unwanted impacts on drinking water quality, excess nutrients in natural environmental waters have other consequences. These include growth of algal or bacterial populations leading to unsightly blooms, de-oxygenation of the water and harm to fish and other animals. The socio-economic costs of diffuse pollution from agriculture are often bourne 'downstream' by other sectors including water supply (public and private water supply issues and sewage treatment), recreational water use, fisheries and shellfish production.

In 2014 a 'Nitrate Working Group' for Jersey has been proposed by the Minister for Planning and Environment.

It is expected that the group will review previous actions in respect of 'the nitrate problem' and then make recommendations to address the issues which are, for the purpose and terms of reference of this review:

1. Nitrate levels in many surface and ground waters in Jersey are still not meeting the EU environmental standard and objectives for nitrate of 50mg/l NO_3.

2. Nitrate in the public water supply in Jersey is currently not meeting the UK/EU standard for nitrate of 50mg/l NO_3 at all times. It is however currently meeting local standards for wholesomeness with a dispensation under the relevant local legislation.

3. Up to 10% of households in Jersey are reliant upon private water supplies (boreholes and wells) for their water. Many of these sources are likely to have levels of nitrate well in excess of UK/EU standard for nitrate of 50mg/l NO_3.

Nitrate Levels in Jersey

In Europe the Water Framework Directive[2] (WFD) has set the direction of EU water policy, and that (and the subordinate legislation associated with it) has set objectives and standards for environmental water and water for various human uses in the member states.

Although Jersey is not part of the EU it has set standards for drinking water that mirror EU/UK standards, and where applicable, it also looks to set standards equivalent to the EU and UK for other waters. The standard for nitrate in drinking water and for groundwater in the EU is 50mg/l NO_3.

In Jersey nitrate levels in water increased throughout the 1980's. These peaked in the late 1990's and have since declined somewhat. The severity of the problem in Jersey led to it being used as a case study in a school text book on pollution in the 1980's (Foster, 1991)[3]. During that time it was not uncommon for Nitrate levels in Jersey surface and groundwater to be 100mg/l NO_3 or more.

Over the last 10 years about 60% of surface water samples taken by Jersey Water have had nitrate levels of above 50mg/l. Island-wide borehole and well testing show approximately the same sort of percentage of samples exceeding 50mg/l of nitrate in groundwater. This compares to about 3% of surface water and 15% of groundwater samples exceeding 50mg/l of NO_3 in the 27 countries of the EU.

The link between land use, specifically intensive cultivation, and high nitrate concentrations in surface and groundwater in Jersey has been conclusively demonstrated in a number of studies[4]. Analysis of Environment Division water quality and land use data illustrates the strong correlation between the island-wide area under potatoes, head of cattle and Nitrate levels in local water.

A concerted effort to tackle agricultural sources of nitrate and/or mitigate the consequences needs to be a high priority for the Island. This chronological review will inform the Nitrate Working Party discussions in 2014.

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[2] EU Water Framework Directive 2000/60/EC.

[3] Cited in "The Jersey Groundwater Study", British Geological Survey Research Report RR/98/5, prepared for the Public Services Department, 1998.

[4] The Nitrate and Pesticide Working Party Report in 1996; the Centre for Research into Environment and Health (CREH) report 'Stream Water Quality on the Island of Jersey' in 1997; British Geological Survey annual and summary reports prepared for the Public Services Dept, 1990-2000; and the Plymouth University final report entitled 'Nitrates and Phosphates in Jersey Surface Waters' of October 2001. Foster, IDL, Ilbury BW and Hinton MA, Agriculture and Water Quality: A Preliminary examination of the Jersey nitrate problem. Applied Geography (1989), 9, 95-113.

Evidence review and timeline of ‘the Nitrate Problem’ in Jersey

This section is set out a chronological account of the main nitrate related evidence. Original documents are available for review - only extracts are produced here.

1980’s

1989 Agriculture and Water Quality: a preliminary examination of the Jersey nitrate problem. **Foster, IDL; Ilbery BW; Hinton, MA. (1989) Applied Geography**(1989), 9, 95-113

Abstract: Jersey's public water supplies, from both groundwater and catchment sources, may exceed the EC absolute standards for as much as 70 per cent of the time. River water samples collected over a 10-month period also exceed the drinking water standard, especially during the spring. These trends reflect the high intensity of cropping practice with fertilizer application rates reaching 300 kg N ha/yr on small farm units. Although farmers are advised by the Department of Agriculture and the Jersey New Water Works Company to limit fertilizer application, especially in Water Pollution Safeguard Areas, little positive response is made because of economic pressures to increase farm productivity. Farmers are unaware of growing public concern and the blame which the public attach to farming as a source of nitrate pollution. The public are poorly informed by the responsible authorities of the nature of the problem in Jersey, obtaining most information from the media and a local pressure group. Their perception of the problem is strongly influenced by residential location, which reflects the distinction between urban mains water supplies and rural borehole supplies; the latter having a more significant nitrate pollution problem. Management organizations in general have not informed the public or implemented policies to tackle this problem, often perceiving other issues as being of greater significance.

1990’s

1992 Review of Findings on Jersey’s Water Resources **September 1992, British Geological Survey.**

A widespread first look at the quality and quantity of the groundwater resource in Jersey carried out for the States of Jersey concluded that:

- It is likely that current levels of groundwater abstraction will not be sustainable in the future
- Over 60% of the groundwater samples collected during the survey contain nitrate levels in excess of the EEC recommended maximum admissible concentration
- Ongoing hydrogeological monitoring and some form of legislative control is essential in the future to protect groundwater resources

Source Identification of Nitrate Contamination within groundwater of the Jersey bedrock aquifer using nitrogen stable isotopes. **Green, Adrian, University of East Anglia, 1992 (MSc)**

This was initially carried out as an MSc project and was later written up as a paper for the Geological Society, London, Special Publications 1998**,** v. 130, p. 23-35

The report concluded that "The nitrogen isotope analysis performed at the University of East Anglia have produced results consistent with a source of nitrate contamination within most of the Island's groundwater being derived from agricultural activities connected with the use of fertiliser and intensive agricultural practices, as opposed to the application of animal manures or inputs of human sewage wastes".

1994 Nitrate in Jersey's Groundwater: Results of unsaturated zone pore-water profiling Chilton, PJ and Bird, MJ, BGS Technical report (WD/94/65) 1994

This research was carried out for the States of Jersey by BGS.

The results indicate a clear relationship between unsaturated zone nitrate concentrations and land use. Low to moderate nitrate concentrations were observed beneath fallow land and lightly fertilised grassland, and significantly higher concentrations occurred beneath cultivated land….The results of the study suggest a rate of downward movement through the unsaturated zone of one metre in every 2-3 years. Even with the rather shallow depths to groundwater typical of Jersey, these rates imply varying timescales of between 5 and 18 years before modifications to practices at the land surface produce improvements in water quality.

1996 The Nitrate and Pesticide Working Party Report (Anon)

This was the report of a working party that was established by the Committee for Agriculture and Fisheries in 1994, following the concerns of the Chairman of the Jersey New Waterworks Company Ltd, and it met regularly between October 1994 and December 1995.

It consisted of an independent chairman and representatives of the Agriculture and Fisheries Committee, JNW Co. Ltd, Health and Social Services Committee and Public Services Committee.

The terms of reference for the working party included:

a) The identification of the impact of nitrogenous fertilisers and pesticides throughout the island and the other major contributors to the nitrate problem;
b) The consideration of setting up a Nitrate Sensitive Area in a significant finite area, say the Val de la Mare catchment area; and
c) Reporting it's findings to it's constituent Committees and Company.

The group formulated a number of possible options for treatment and options for prevention. Of these options the selected recommendations for uptake were as follows:

1. Denitrification

2. Modify Farming Methods

   "All the evidence concludes that the present intensive growing and livestock farming regime is the main source of the present high levels of nitrate in the island's groundwater".

"Some fairly drastic modifications to this regime could bring some improvement; but only a drastic re-think of our agricultural activities would bring nitrate consistently below 50mg/l. A detailed management plan would be needed for each farm. There is no common answer. However…..basic rules devised from MAFF…. would be appropriate to quote here":

a. Careful targeting of fertiliser (both inorganic and organic) to avoid exceeding the crop requirements.
b. Avoiding excessive slurry and other organic manure applications and minimising autumn applications.
c. Planting autumn rather than spring cereals.
d. Establishing autumn crops as early as possible.
e. Avoiding unnecessary autumn cultivations
f. Establishing green cover over winter where spring crops are to be planted.

3. Nitrate Sensitive Areas (catchment control)

4. Extension of public sewerage system and water supply

5. Private water supplies and sewerage systems

1997- 2005 Nitrogen Research

A number of studies were undertaken in this period by the Department of Agriculture and Fisheries. A brief summary of the trials follows.

OP1 97 To assess the feasibility of reducing fertiliser input on the early potato crop.
Site One suffered from wind damage and dry soil conditions and yields were consequently low. Differences between treatments cannot be explained by the amounts of fertiliser applied. Variable results were also seen at Site Two, due to some frost effect.

OP2 97 To assess in-ridge irrigation lines to supply water.
The fertigation system prevented soil moisture deficits rising too high, particularly in the exceptionally dry April experienced this year. Supplying feed through low level lines gave good yields, even where low base rate N had been applied (35 units).

OP11-97 To determine the effects of a range of foliar feeds on a seed crop of Jersey Royals.
There were no significant differences in yield between <u>any</u> of the foliar feeds. Marinure gave a yield significantly higher than the untreated control.

OP2-98 To assess the feasibility of reducing fertiliser input on the early potato crop.
A difficult season gave rise to considerable variation in crop stands, this in turn made interpretation of trial results difficult. In this season the results obtained varied from site to site. Though generally taking into account previous work, acceptable yields can be obtained from using lower rates of nitrogen by either placing or drilling compared with the standard 65 units per vergee.

OP3-98 To assess two methods of supplying water and feed directly to the potato crop roots via in/on ridge irrigation lines.
The two irrigation systems gave significantly greater yields than the non-irrigated control treatment. It was possible to achieve yields as good as those where 65 units of nitrogen sere

given as a base dressing with no base N and only 30 units N applied through the irrigation system.

OP6-98 To assess yield and quality benefits derived from the use of organic supplements, foliar treatments and top dressing.
None of the treatments improved yield compared with the standard fertiliser application.

OP7-98 To determine the effect of a range of foliar feeds on an early crop of Jersey Royals.
There was no significant yield benefit from applying foliar feeds compared with the untreated control.

OP1-99 To look at the effect on yield and quality of the Jersey Royal of a number of organic manures and the effect on soil nitrogen.

- There was no difference in yield between any of the treatments
- The extra nitrogen added via the organic additives did not increase yield.
- There was more residual nitrogen left after cropping where the organic manures had been applied.
- There was no effect of the organic manures on soil organic matter in the first year.

OP1-00 To investigate the long term cumulative effects of continued application of organic manures. Little difference was found in the yield of potatoes grown with organic manures in the 1999 trial. The 2000 trial continued in the same field as the 1999 trial investigating the cumulative effects of the treatments. The organic fertilizers compared were seaweed, farmyard manure and slurry. The availability of nitrogen for the following crops and any quality benefits derived from increased organic matter levels were recorded.

OP2-00 To investigate the use of nitrogen inputs via fertigation on potato yield and quality.
Fertigation techniques allow the timing of the nitrogen application to be adjusted according to crop growth and more importantly perhaps, in a wet year, weather conditions. The reduction in fertilizer use coupled with better utilization of water is a key feature of fertigation. This is important from an environmental perspective as it could lead to less nitrate leaching, reduced incidence of scab (in a dry year) and more efficient use of water.

OP3-00 To evaluate a range of fertilisers on the early Royal crop for performance and economics of use.
There is no different between these fertilizers when used as soil requirement dictates. In these high P index fields, Index 6, (high index fields are generally regarded as having a P index > 4), there was no benefit of adding additional phosphate fertilizer. This confirms earlier work carried out by the Department

OP3-2001 This project is investigated applying a range of nitrogen levels via base fertilizer and fertigation and the effect of this on tuber size, number and quality.
Even though yield tended to show a gradual increase, the optimum levels occurred at around 72/75 units/vg of nitrogen in terms of both yield and tuber numbers

OP8 2002 To assess if using lower rates of N fertiliser by direct inrow direct drilling with an automatic potato planter will give equivalent yields and quality compared to broadcasting fertilizer.

- Nitrate levels in the leaf drop rapidly as the tubers bulk up.
- Drilled treatments had higher leaf nitrate levels than the broadcast treatment.
- The 50 and 70 drilled treatment gave significantly higher yields than the 70 broadcast treatment.

OP1-00 To examine the effect of a range of organic fertilizer on quality and yield of Jersey Royals
No significant difference between treatments yields.

OP -2003 To investigate the timing of split dressings at different stages of crop growth and the effect on tuber size, number and quality
NO significant difference between ANY treatment for ANY grade

2000's

2001 Nitrates and Phosphates in Jersey Surface Waters – Sources and Land Management Strategies Final Report, University of Plymouth.

Parkinson et al. 2001

This report summarises a four year research project, commissioned by the States of Jersey Agriculture and Fisheries Committee, into sources and land use management strategies to control losses of nitrates and phosphates from agriculture to surface waters on Jersey . The research, which was carried out during the period March 1997-May 2001, focused primarily on losses from cropping systems.

This research was commissioned to fulfil the recommendation of the Nitrate and Pesticide Working Party to investigate the relationship between agricultural practices and nitrates in water.

Extracts from the executive summary are reproduced here as they provide key evidence and recommendations. The 11.3 mg/l nitrate limit quoted here as N is equivalent to the 50mg/l limit as NO_3.

Project approach

A scientific study of the water quality and losses from agricultural land was conducted in the Val de la Mare catchment, located in the parishes of St Ouen and St Peter. This catchment was selected for detailed study because nitrate-nitrogen levels in the Val de la Mare (VDM) reservoir were above the EC maximum admissible concentration (MAC) of 11.3 mg nitrate nitrogen per litre on more than 50% of sampling occasions during the 1990s. Land use within the catchment contains a representative mix of agricultural land , semi-natural areas and domestic/urban land.

Stream water feeding into the VDM reservoir was analysed at two weekly intervals during the periods August 1997-July 1998 and October 1999- September 2000 to determine nitrate, total nitrogen, phosphate and total phosphorus concentration. Results of nitrate concentration analyses for the same streams conducted by the Jersey New Waterworks Company over a ten year period 1991-2000 were also evaluated.

Land use surveys for the catchment area were conducted for the years 1995, 1996, 1999 and 2000. Data from these surveys were used to predict total nitrogen losses from all sources within the catchment. These predictions were compared to losses calculated from routine stream water sampling carried out by the Jersey New Waterworks Company.

Two major field experiments were conducted between 1997-2000 in order to establish the magnitude of losses of nitrate and phosphate from agricultural land in Jersey.

A cultivation experiment was set up to investigate N and P losses from soils under contrasting potato cultivation systems, with temporary and permanent grass included as a comparison. A fertiliser rates trial was established to evaluate the effect of contrasting rates of fertiliser application on N and P losses.

Results from the field experiments enabled Jersey-specific validation of a Nitrogen cycling predictive model (N_ABLE), which was designed for use in horticultural crops by Horticulture Research International, Wellesboume, U.K. This model is used throughout the horticultural industry to assess nitrogen fertiliser requirements. A range of selected cropping scenarios, focusing on efficient nitrogen management, were investigated.

Results- water quality and land use

Nitrate levels in the streams that drain into the VDM reservoir exceeded the EC MAC (11.3 mg NO3-N per litre) on all but two occasions during the period 1991-2000. Water abstracted from the reservoir showed lower concentrations, with a mean of 12 mg NO3-N per litre. This water exceeded the EC MAC on 57% of sampling occasions. Lower nitrate concentration at the point of abstraction from the reservoir was probably due to N immobilisation and denitrification during storage in the reservoir.

Nitrate comprised greater than 90% of the total N in the VDM East and West streams, the remainder being N in organic forms, for example from manure and septic tank effluent. Higher organic N concentrations were observed during periods of high rainfall, due to contributions from surface runoff.

The average N loss for the whole catchment was 70 kilogrammes of nitrogen per hectare (kg N per ha in 1997/98 and 53 kg N per hectare in 1999/2000.

Mean soluble phosphorus concentration in the VDM East and West stream for the two years August 1997-July 1998 and October 1999-September 2000 was 64 microgrammes of phosphorus per litre (µg P per litre). Mean total P concentration was 197 µg P per litre. These stream water concentrations are within or exceed the range stated by the Organisation for Economic Co- operation and Development (OECD) of 30-100 µg P per litre where eutrophication is likely.

Land use surveys carried out in 1995/96 and 1999/2000 indicated that agriculture accounted for 70% of the catchment area, with urban areas occupying 12% and scrub or woodland 18%. The predominant crop continues to be the 'Jersey Royal' early potato.

The export coefficient modelling approach was found to provide a reasonable estimate of the loading of total N from the VDM feeder streams to the VDM reservoir in 1996 (a drier year) but not in 1999 (a wetter year). Losses were greater in periods of higher rainfall. In 1996, total losses from the catchment were predicted to be 132 tonnes (t) N, compared to observed losses of 16.2 t N . In 1999, a much wetter year, catchment losses were predicted to be 14.6 t, compared to observed losses of 25.1 t. This discrepancy in 1999 indicates that the export coefficient output can only be used as a general description of nutrient losses from the VDM catchment.

Arable land occupied 60% of the VDM catchment area but contributed an estimated 74% of the total N load entering the VDM reservoir in 1996. Domestic land occupied 6% of the catchment area but contributed an estimated 10% of the total N load. Grass, woodland and scrubland occupied 20% of the catchment area but only contributed an estimated 6% of the total N load entering the reservoir. Livestock contributed an estimated 10% of the total N load entering the reservoir.

Results - nutrient losses from cultivation and fertiliser systems

Ungrazed permanent grass plots potentially lose the least N and P by leaching, reflecting low inputs. Nitrate concentrations in--soil solution were consistently less than 11 mg N03-N per litre, and were low compared to cultivated treatments.

Mineral nitrogen present in the soil in contrasting early potato cultivation systems showed few significant differences after two years. Delayed autumn cultivation lead to higher mineral N values in late May the following year.

Plastic crop cover had no significant effect on nutrient losses. It should be noted that these experiments were conducted over a short time period of two years. Contrasting weather patterns introduce considerable year to year variation in field trials data.

Nitrate-N in soil solution in the cultivation systems trial showed peak values in excess of 100mg N03-N per litre in the late autumn and late spring in some treatments. Due to high rates of evapotranspiration on Jersey, soil drainage is limited. Thus there is little opportunity to dilute this water en route to streams and the reservoir.

Estimated leaching losses from all potato cultivation treatments for 1997/98 were approximately 130 kg N per hectare ' (46 units per vergee). Leaching losses from the grazed grass and ungrazed grass treatments in the same year were approximately 24 kg N per hectare. (8 units N per vergee) and 7 kg N per hectare units N per vergee) respectively.

Potato plots lost an estimated 90 kg N per hectare (32 units N per vergee) in 1998/99 compared to typical fertiliser application rates of 170-200 kg N per hectare (60-70 units N per vergee). These losses are comparable to maincrop potato production systems in the UK.

Soil P levels were extremely high (Index 8) for all cultivation trial plots. Despite the high soil P status, phosphate-P concentrations in leachate from the cultivation trial plots ranged from 2 to 300 µg P per litre. These values are low compared to equivalent arable soils in the UK. Further work is needed to identify the cause of this discrepancy. No consistent treatment effects were observed within the cultivation systems trial.

In the fertiliser trial, soil mineral N showed a general increase with fertiliser application rate. The highest values, in the range 200-250 kg N per hectare were observed for the 337 kg N per hectare (120 units N per vergee) treatment and the seaweed treatment with 169 kg N per hectare (60 units N per vergee). Nitrate-N concentrations in leachate in the fertiliser trial ranged from <10 to 80 mg N0 3-N per litre, tending to peak in the February-April period in both seasons.

In 1998/99 there were no significant differences between treatments.

Seaweed contributed large quantities of total N (5 t per vergee added 150 units N per vergee or 400 kg N per hectare), and resulted in elevated mineral N concentrations in the soil and enhanced leaching risk. The nitrogen content and availability from seaweed should to be assessed when deciding fertiliser application rates.

Autumn soil mineral N levels (0-60 cm profile) in potato fields across the Val de la Mare catchment were 60-70 kg N per hectare (21-25 units N per vergee), compared to 35 kg N per hectare (12 units N per vergee) for ungrazed grass.

For cover crops after potatoes, natural regeneration (ungrazed) tended to have lower mineral N than grass or barley. Barley sown with peas tended to have higher values, and slurry produced high but variable mineral N levels.

Modelled scenarios using N_ABLE demonstrate that adhering to 'good agricultural practice' will produce losses in the range 70-130 kg N per hectare (25-45 units per vergee). If fertiliser inputs were reduced to 110 kg N per hectare (40 units per vergee) then the predicted losses would be 50-100 kg N per hectare (18-36 units per vergee). Early ploughing and use of seaweed increased N losses dramatically.

Conclusions and recommendations

Nitrate losses from arable land within the VDM catchment area were found to be equivalent to those observed in similar cropping systems in the UK. High rates of evapotranspiration and hence low volume of runoff results in concentrations of nitrates in streams and reservoirs that frequently exceed the EC drinking water limit.

Consideration should be given to the designation of at least part, if not all of Jersey as a Nitrate Vulnerable Zone (NVZ), using guidelines based on those implemented in the UK. These guidelines should be modified to take into account island-specific factors, such as the early planting of the potato crop.

Technical advice should be made available to the agriculture industry to support changes in crop husbandry required in an NVZ scheme in order to reduce N losses.

Crop management strategies based on the UK NVZ scheme could include:

1. Restrict fertiliser use to agreed limits for specific crops.
2. Use soil mineral nitrogen assessments to determine fertiliser requirements.
3. Restrict cultivation to periods immediately prior to planting.
4. Ensure cover crops between successive potato crops are planted early and managed effectively.
5. Take account of the nutrient content of organic soil amendments such as manure, slurry and seaweed prior to application.
6. Avoid autumn use of animal manure.

To be effective, these measures would require substantial input of additional resources for monitoring on individual farms.

The phosphorus status of soils in the VDM catchment was observed to be very high. It is recommended that no P fertiliser is used on soils with an index of 5 or above, and that manure inputs are restricted in these situations. Due to the risk of P loss by soil erosion, it is recommended that land growing arable crops such as potatoes and maize should be managed carefully, adhering to the MAFF guidelines contained in the code of Good Agricultural Practice for the Protection of Soil. This will minimise opportunities for runoff to watercourses.

Future work

- Assess the contribution that livestock manures and other organic materials such as seaweed make to whole farm nutrient balances. Consider restricting the grazing of pastures with unfenced surface watercourses. Develop and implement best-practice guidelines for the sound use of nutrients by agriculture. These should be fully supported and well-resourced by advisory bodies, such as the Department of Agriculture and Fisheries and Jersey Farmers' Union. Publication and effective dissemination of the Code of Good Agricultural Practice for the Protection of Water is vital.

- Consider the impact of introduction of a modified NVZ designation for Jersey in terms of arable and livestock farming systems.

- Identify critical buffer zones adjacent to surface water bodies that should be managed more extensively, and carry out an assessment of water movement routes by monitoring and modelling nitrogen and phosphorus transport pathways.

- Develop water catchment-based strategies that focus on landscape zones that are at high risk of nutrient loss. Assess and fully quantify all nutrient sources in water catchment areas, including domestic dwellings.

- Careful consideration should be given to linking these water catchment-based nutrient control strategies to wildlife and conservation objectives for each area. Land management strategies for the control of nutrient losses can have many benefits in terms of enhancing environmental quality. For example, buffer zones adjacent to watercourses can minimise nutrient losses and provide wildlife habitats.

2000/2001 The introduction of the Water Pollution (Jersey) Law, 2000

"A law to provide for the control of pollution in Jersey Waters, and the implementing of provisions of the OSPAR convention, the monitoring and classification of waters, the setting of quality objectives for classified waters, administrative, regulatory, preventative and remedial measures; and related purposes"

For the first time Jersey now had a legal mechanism in place for controlling and regulating point source water pollution and making pollution a statutory offence.

There is also the facility for the Minister by order to approve codes of practice in order to provide practical guidance on good practice. These approved codes may act as part of the defence of due diligence should pollution be caused.

There is currently a prescribed voluntary 'Water Code', under the Water Pollution (Jersey) Law, 2000 which recommends agricultural practices to reduce nutrient losses. Introduced in 2004 the water code was last reviewed in 2009.

The provision for Water Quality Orders and Water Catchment Management Areas and Orders

Under the Water Pollution (Jersey) Law, 2000 there are also the means to set water quality objectives and control catchment activities to achieve the objectives [5].

This has not yet been done and would be a key mechanism to achieve improvements in water quality that cannot be attained by education, advice or financial incentives such as Single Area Payment conditionality.

Once objectives have been set by Water Quality Order under Article 12 there is an onus on 'the Minister' to carry out his or her functions under Articles 14, 15 and 16, and Parts 5 and 6 in a manner that ensures that the objectives are achieved. The States may therefore then by Regulation designate any area of land as a Water Catchment Management Area and specify *"conditions, for the prevention, control, reduction or elimination of pollution in controlled waters or of the risk of pollution in controlled waters that the Minister may impose by a Water Catchment Management Order in respect of an Area or part of an Area"*.

There are penalties under the Law for not complying with these conditions that are equivalent to those for causing or knowingly permitting pollution.

Under Article 45 there is a compensation clause under the Water Pollution Law in respect of Water Catchment Management Areas that need further legal clarification.

2004 The 'wholesomeness' of the public water supply is defined under the Water (Jersey) Law, 1972

The Water (Jersey) Law covers:
- Powers of the Company,
- Supply of Water for Domestic and Non Domestic Purposes (water quality monitoring, service provision and sufficiency and wholesomeness of the water);
- Water Rates – including the power of the States in connection with Water Rates (by Regulation);
- Conservation and Protection of Water Resources – including the provision for the introduction of bye-laws to protect against pollution any water of the company; and
- Certain Powers of the Minister (Minister for Planning and Environment)

The wholesomeness of drinking water in Jersey was defined in 2004 and is set out in a schedule. Under this law[6] and schedule Jersey Water must supply drinking water with a concentration of nitrate below 50 mg/l.

An application for a dispensation from the requirements of the schedule may be made to the Minister for Planning and Environment on the grounds that:

a) That the dispensation is necessary to maintain a supply of water for domestic purposes;
b) That a supply of water for these purposes cannot be maintained in the specified area by any other reasonably practicable means; and
c) That the supply of water in accordance with the dispensation does not constitute a potential danger to human health.

[5] Water Pollution (jersey) Law, 2000 - Water Quality Orders (Article 12), and also Water Catchment Management Areas and Orders (Article 14 and 15).
[6] According to the definition of wholesome water contained in the Water (Jersey) Law 1972

It is written into the Law under Article 19 that the Minister shall consult the Minister for Health and Social Services on any health issues relating to dispensations.

As a consequence of the high levels of nitrate in source waters, the Company applies and receives from the Minister for Planning and Environment a dispensation under the Water Law, and has done since 2004 when 'wholesomeness' was first defined in Jersey. This dispensation has allowed 33% of samples in any one year to exceed the 50 mg/l limit (but be no greater than 70 mg/l) in the Drinking Water supply.

During the consultation on the 2009 dispensation Health Protection (Health and Social Services Department) agreed to the dispensation but advised that they would not continue to support this dispensation unless steps were taken to tackle catchment inputs of Nitrogen.

In August 2012 Health Protection (Health and Social Service Department) confirmed that they would support a dispensation for 3 more years from 2013 on the condition that the maximum level in supply under the derogation was reduced from 70mg/l nitrate to 65mg/l. The latest dispensation runs from January 2014 to December 2016 under revised conditions, which are for any year:

a) Regulatory samples must not exceed the maximum allowable concentration (50mg/l) for six months of the calendar year;
b) No regulatory sample shall exceed 65 mg/l;
c) No more than 15% of regulatory samples shall exceed 55 mg/l; and
d) No more than 33% of regulatory samples shall fail to satisfy the formula [nitrate]/50 + [nitrite]/3 < 1, where the square brackets signify the concentrations in mg/l for nitrate (NO_3) and nitrite (NO_2) respectively.

Table 1 Uses of the dispensation for nitrate

Year	Number of dispensation uses
2007	19
2008	0
2009	23
2010	23
2011	30
2012	0
2013	22

2007 Private water supplies, boreholes and wells, and the Water Resources (Jersey) Law, 2007

About 15% of the population in Jersey have private water supplies to their homes, most of which are situated in the more rural parts of Jersey. The source of the supply may be a well, borehole, spring or stream and may serve just one property or several properties.

There is currently no legislation that specifically pertains to the quality of private drinking water supplies in Jersey. Since 2007 there has been a requirement for private boreholes and wells to be registered under the Water Resources (Jersey) Law, 2007 and any larger abstractions (>15cubic metres per day) to be licenced. Boreholes and wells are part of the groundwater body as a whole and as such are 'controlled waters', under the Water Pollution (2000) Law, which therefore applies to redress the impact of any gross pollution incidents.

Historically, prior to 2007, Environmental Health sampled private water supplies for householders on an annual basis on request, and interpreted and advised on the results. In 2007 this service ceased and since then the public are now advised to submit a sample to the States of Jersey analyst privately (for a fee). The SOJ Analyst sends the results to the householder direct. Health Protection (Environmental Health) still have the remit to advise on the quality of private drinking water supplies should the householder have any concerns.

2005 – present The Rural Economy Strategy 2005-2010 and 2011-2015 and the Diffuse Pollution Project

Receipt of the Single Area Payment (SAP) subsidy, introduced by the RES 2006 – 2010, was made conditional on all farms adhering to Good Agricultural Practice as set out in the Water Code (Jersey). These conditions initially included each farm having a Farm Manure and Waste Management Plan (FMWMP) to ensure each farm had sufficient slurry storage and that a field risk assessment had been carried out on each field concerning the danger of runoff of slurry into the Islands water courses and reservoirs.

During that RES period, under the Countryside Renewal Scheme (CRS) grants amounting to £1.5 million were awarded to dairy farmers (50% of the budget 2005 – 2010) for the construction of 4 months slurry storage on the Islands dairy farms. This construction program was designed to stop the disposal of slurry as a waste at inappropriate times (autumn and winter closed period) and to ensure the nutrients it contains can be applied as a crop fertiliser during the growing season reducing the need for the application of expensive inorganic fertilisers.

In 2009 the Department of the Environment instigated the Diffuse Pollution Project. This has used a mixture of education, advice and incentives to try and effect the necessary changes in farmer behaviour and see what effect defining and implementing 'good agricultural practice' would achieve.

The measures in the DPP have been mainly delivered through initiatives linked to the Rural Economy Strategy 2011-2015 –and have included economic incentives – a tightening of SAP subsidy compliance requirements for good practice - and the Countryside Enhancement Scheme.

In the RES 2011 -2015 SAP conditionality, as a result of the DPP training program, has been upgraded to include the following to ensure all agricultural businesses are following good agricultural practice standards and contributing to the delivery of public goods such as a high quality water and soil protection.

1. Individual field by field run-off risk assessments (Red, Orange or Green). There is a map to assist with this risk assessment at http://gis.digimpa.je/RiskMap/.
2. Farm Manure and Waste Management Plan.
3. Crop Nutrient Budget Plan (crop & field basis).
4. Field application records (field, crop, dates and product/amount used) of pesticides, slurry, manure, compost, sewage sludge and artificial fertilisers applied.
5. Farm Water Pollution Contingency Plan for your farm premises to reduce the risk of contaminating the islands water resources.
6. Soil Protection plan.

The above measures contribute to farm efficiency and are also required under crop assurance audits (Red Tractor, Nurture) which are mandatory before UK supermarkets and other food retailers will consider taking Jersey produce. Therefore SAP conditionality assists agriculturalists in improving efficiency and meeting their market audit standards.

Synopsis of main activities under the DPP/RES since 2009

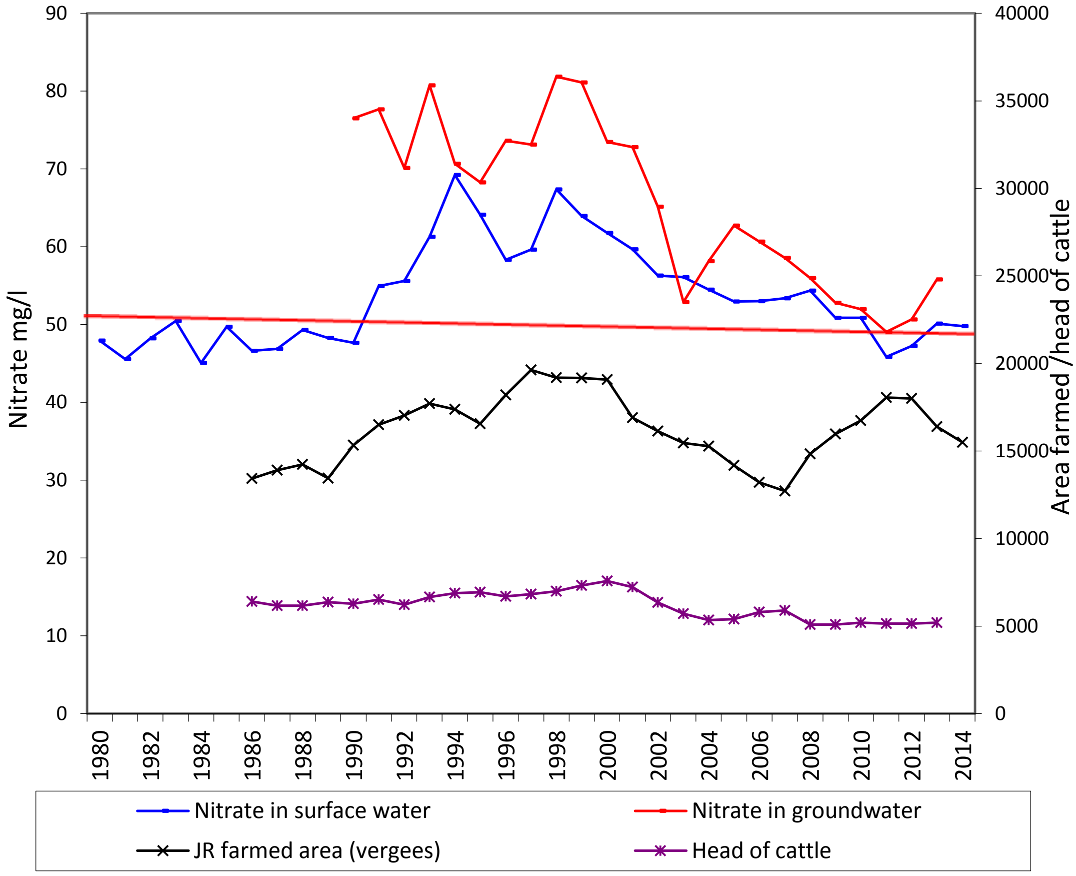
<table>
<tr><td>2009</td><td>• Renewal of dispensation for nitrate
• Initial approach made to agricultural industry representatives and trial areas identified.
• Water quality monitoring in three trial areas planned and implemented.
• Water Code renewed (2009-2013)
• Most effective and appropriate BMP's for Jersey were identified
− Diffuse Pollution Audits
− Nutrient Management Plans/Budgets
− Soil Management Plans
− Farm Manure and Waste Management Plans
− Field by field Record keeping of land use, crop type and nutrient inputs and outputs</td></tr>
<tr><td>2010</td><td>• Rural Economy Strategy 2011-2015
• On-farm interviews were conducted on 13 farms to research and record current farm nutrient management practices, establish trends and views and identify areas for possible development and training.
• Farmers and growers workshop. It was well attended and the ideas suggested by participants included:
− Areas for research and development
− Nutrient and soil management planning
− Ways of improving communication between all parties
− Ways of streamlining and improving record keeping
− Avoiding duplication with market-led assurance schemes
− The use of mapping systems to record, access and share information</td></tr>
<tr><td>2011</td><td>• Influence of Supermarkets: gap analysis of our cross compliance reporting requirements and those of the common supermarket assurance schemes to ensure as little bureaucracy and double reporting as possible.
• New slurry spreading closed period from October to December (After £1.6 million of States investment)
• Two training workshops targeted at dairy and arable/potato farmers, focusing on the win-wins from effective soil and nutrient management.
• Introduced enhanced cross compliance requirements.
• Developed record keeping and management planning templates for local farmers to use.
• Worked with 14 project farmers to produce example nutrient management plans for their farm business and trial the templates.</td></tr>
<tr><td>2012</td><td>• Online GIS 'farm risk map' produced
• Website information improved
• 50% of farmers assisted to produce farm environment plan
• Two practical training workshops hosted by volunteer farmers
• Environment Update magazine used as an additional communication tool</td></tr>
<tr><td>2013</td><td>• Additional farm environment plan requirements to be made compulsory under cross compliance at the end of 2013. Remaining 50% of farmers offered an advisory visit and assistance in producing a farm environment plan
• GIS map updated with feedback
• Jersey Water agreement to work together</td></tr>
</table>

	• No 'P' trial • Nitrate dispensation - initial DPP progress report on progress • BASIS Soil and Water training

2014

A five year review of the DPP showing that with effort form all concerned that average nitrate levels had come down in both ground and surface water, and decoupled from the area under Jersey Royal potatoes, which is almost at an all-time high again.

Nitrate (mgl^{-1}) in surface and groundwater compared to area of Jersey Royals planted (vergees) and number of cattle, 1980-2014



However, there have been continued concerns about episodic spikes of nitrate in the mains water supply and a setting and tightening of the latest dispensation (2013 -2016) for nitrate amid new concerns from Health Protection about nitrate in drinking water.
Therefore the time is right for a review of work that has already been done and a renewed urgency to introduce measures to address the nitrate problem in Jersey.

Whatever recommendations the group make, they need to ensure that there is consistency of purpose and delivery with the Water (Jersey) Law dispensation period, the RES 2016-20 and the Integrated Water Management Plan currently being produced for Jersey by Atkins to run from 2016-20.