

FOREWORD

The adverse effects of nutrient enrichment of our waters, 'aquatic eutrophication', have been identified as a major environmental issue at national and international levels. A range of statutory and international commitments, including EC Directives, the OSPAR Convention and the UK Biodiversity Action Plan, requires action to be taken to address the threats to the quality, ecology and uses of our waters. However, while these initiatives are helpful in controlling eutrophication, each addresses certain parts of the problem, rather than the whole. There is also a lack of consistent methodologies for assessing and controlling eutrophication. This strategy, which was produced following extensive consultation with interested parties, promotes a more co-ordinated framework for action and a partnership approach to eutrophication management in England and Wales. It will contribute to the delivery of the Agency's proposed Environmental Vision (Environment Agency, 2000). The aim is to maximise the environmental benefits and cost effectiveness of control action.

The reduction of nutrient inputs to water and control of eutrophication locally are shared responsibilities, involving a range of stakeholders. In taking forward this strategy, we will work with Government departments, other environmental regulators, industry and interest groups. Tackling eutrophication will be a long-term commitment, linked to our objective of contributing to sustainable development. Reducing nutrient contributions from sewage treatment works and agricultural sources will be particularly important. In some instances it will be necessary to go beyond the sewage treatment measures set out in the Urban Waste Water Treatment Directive. With regard to nutrient pollution from agriculture, we will push for the introduction of improved mechanisms for encouraging or requiring the adoption of good agricultural practice. We will promote a general reduction of nutrient inputs to water from the main sources, complemented by more concerted action in catchments where the impacts or risks justify this approach.

The introduction of new local measures, over and above continuing action under the various statutory drivers, will initially be through a series of pilot action plans. These will test and help refine tools and techniques for assessing and managing eutrophication. We are committed to addressing problems caused by eutrophication in England and Wales, and will extend our work as research and the outcomes of the pilot action plans inform our approach. This will help serve the needs of legislative and national commitments.



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SUMMARY

The Environment Agency of England and Wales (the Agency) has adopted an integrated approach to the management of the environment, as set out in its 1997 Environmental Strategy (Environment Agency, 1997) and proposed Environmental Vision (Environment Agency, 2000). Through this approach, certain environmental issues are emerging for which specific strategies are required. One such issue is aquatic eutrophication, where nutrients deriving from human activities enrich environmental waters, giving rise to adverse effects on both the ecology and the legitimate uses of waters. The problems and risks of eutrophication, together with the nature and complexities of the issue, are sufficient to warrant a strategic approach. The Agency's proposals for a national strategy to manage aquatic eutrophication were published in December 1998. Further to that consultative report, and a response to the comments received (*issued in August 2000*), this document sets out our agreed strategy in this area.

Eutrophication has been identified as a priority environmental issue at European and UK level. Its national importance was highlighted in our 1998 report on the state of the freshwater environment in England and Wales. Impacts are most evident in, but not exclusively confined to, lakes, reservoirs and slow-flowing rivers in central, eastern and southern England. There is also concern about effects in some waters of high conservation status. With regard to estuaries and coastal waters, the Agency's 1999 report on the state of our coasts highlights the need for further investigation into the effects of nutrient enrichment. We are assessing a number of estuaries to determine the need for additional designations under EC Directives.

The strategy is intended as a proportionate response to the challenges associated with the eutrophication issue. It aims to strike a balance between the recognised need for further and improved management action and the uncertain benefits of control measures, stemming from the relatively poor, albeit steadily improving, understanding of cause and effect. A national framework for managing eutrophication is defined, the key elements of which are:

- the promotion of a partnership approach, at both local and national level, since solutions are generally beyond the remit of any one regulatory body or other party;
- a two-pronged approach whereby measures to reduce nutrient inputs to the water environment nationally are complemented by more comprehensive, catchment-based management action, within the context of a national framework, for waters most at risk from or affected by eutrophication;
- the adoption of a range of mechanisms (regulatory, voluntary, collaborative, educational and economic) by the Agency and others, as appropriate, in order to reduce nutrient inputs to environmental waters and manage local problems;
- the development and adoption of consistent methodologies for assessing problems and control options;
- a review of the arrangements for measuring the extent of eutrophication in the different types of environmental waters and the impacts of discharges and land use on water quality;
- the prioritisation of waters for management action on the basis of specified criteria: initial priorities will be waters where there are statutory requirements, or where water uses are adversely affected, or where special conservation interest is at risk, or where benefits can be delivered or deterioration prevented, with adequate confidence, at reasonable cost;
- the adoption of interim targets for eutrophication control in freshwaters and the continuing application of specific statutory and/or international commitments in relation to saline waters;
- trials of the proposed tools, techniques and procedures through pilot catchment-based action plans, to inform any wider adoption of the approach;
- the promotion of a wider understanding of the nature and significance of aquatic eutrophication;
- a programme of research and development to improve understanding of the eutrophication process.

In taking forward the strategy, we intend to promote, in partnership with others, best use of the regulatory framework, to ensure it is applied in an integrated catchment-based manner, complemented by other measures (incentive-based, educational/advisory, voluntary/collaborative) as appropriate.

Annexe 1 to this document comprises an initial implementation plan, summarising the actions, the main partners with whom we intend to work and the timescales for initial tasks. Delivery of the plan will build upon and be strongly influenced by the main statutory drivers and international commitments, and over and above these initiatives, by the success of national and local collaboration.

1. INTRODUCTION

1.1 Purpose of this document

The purpose of this document is to set out the strategy of the Environment Agency for assessing and managing aquatic eutrophication in England and Wales, further to the consultation exercise of December 1998 to March 1999.

The document summarises the background to, and need for, the strategy (Section 1) and the outcome of the consultation exercise (Section 2). It provides perspective on the priority of eutrophication as an environmental issue (Section 3) and sets out the objectives, principles and elements of the Agency's strategy (Section 4). An initial implementation plan, with tasks and timescales, is included in Annexe 1.

1.2 Background

In December 1998 the Agency published a consultation document, *Aquatic eutrophication in England and Wales; a proposed management strategy* (Environment Agency, 1998a). This document discussed the problem of eutrophication, its causes, the risks and impacts in England and Wales, and outlined the Agency's proposals for improving the management of eutrophication at national and local level. The proposed strategy built upon a significant body of work in this area undertaken by the former National Rivers Authority (NRA), one of the bodies subsumed within the Agency in 1996.

Following preliminary discussions in 1997 and strong support from DETR, MAFF, English Nature/CCW and SEPA, the Agency progressed its proposals to formal consultation through the December 1998 report. This was distributed within the Agency, sent to external interested parties and made available on our website (<http://www.environment-agency.gov.uk>). The aim was to seek the views of major stakeholders and other interested parties before finalising the strategy. The Agency asked for general feedback on the proposed strategy and invited comments on specific key elements. The consultation period ended following a one-day national seminar on 8 March 1999. The response to the consultation is discussed in Section 2.

1.3 The need for a national strategy on aquatic eutrophication

The case for a strategy in this area was discussed in the consultation document and is summarised as follows.

- Eutrophication hinders the Agency's delivery of some of its primary statutory responsibilities in respect of the water environment, particularly in relation to water quality, conservation, water resources, flood defence and fisheries. Controlling eutrophication is an explicit objective of the Agency's Environmental Strategy and proposed Environmental Vision.
- The impacts and risks associated with eutrophication in England and Wales and the nature of the issue warrant a strategic approach. Similar strategies are in place or under development by environmental bodies in other parts of the UK, Europe and beyond.
- Eutrophication management is often beyond the remit of any one regulatory body or other interested party. Furthermore, regulation is not always the only or best approach. There is a need to promote a partnership approach to managing the issue both nationally and locally.
- Considerable resources are being directed at eutrophication control under the major statutory drivers and international commitments. Such efforts are likely to intensify if the proposed EU Water Framework Directive is adopted. However, there is a need for improved co-ordination of these measures and the development of consistent methodologies for assessing and managing eutrophication, via a catchment-based approach pursued within the context of a national framework. This will maximise the benefits and cost-effectiveness of the investment and provide a firm basis for future action.

The strategy is intended as a proportionate response to the challenges associated with the eutrophication issue. It aims to strike a balance between the recognised need for further and improved management action and the uncertain benefits of control measures, stemming from the relatively poor, albeit steadily improving, understanding of cause and effect. A wide range of collaborative actions is proposed at national level, to review and refine the management framework and

measures, and to reduce nutrient inputs to water. At local level, pilot testing of the tools, techniques and procedures is proposed as a precursor to the potential more widespread adoption of actions over and above those driven by statutory or international commitments. Research will continue to inform the development of improved methodologies for eutrophication management.

2. THE OUTCOME OF THE 1998/99 CONSULTATION EXERCISE

Overall, the Agency received 73 responses by letter, fax, e-mail and via the website. These came from a wide range of stakeholders including other environmental regulators, government departments, the water industry, nutrient producing industries, academics, individual scientists, consultants, wildlife bodies and non-governmental organisations. In general, the Agency was commended for its consultation document and the transparency of the process.

The Agency produced two reports associated with the consultation exercise; a report of the 8.3.99 national stakeholder seminar (issued July 1999) and a document (issued August 2000) summarising and responding to the comments received on the main issues raised in the December 1998 report.

Overall, the outcome of the consultation demonstrated strong support for the proposed strategy; it was seen by most as comprehensive, balanced and forward looking. The responses clearly endorsed the key principles of: improved policy co-ordination; promotion of a partnership approach; catchment-based action in the context of a national framework; adoption of a "case by case" approach in determining the best mix of control mechanisms; and prioritisation of waters for management action on the basis of specified criteria. Proposals to gather better information on the extent of the problem, promote a wider understanding of eutrophication issues and continue funding targeted research and development were widely supported. There was less agreement on the validity of the proposed interim phosphorus (P) standards and the degree to which a precautionary approach should apply. In addition, some respondents stressed the need to give greater emphasis to land use/management, and in particular the importance of soil and soil processes as influences on nutrient losses to the water environment. A large number of comments on the detail of the proposals were received.

3. EUTROPHICATION AS A PRIORITY ENVIRONMENTAL ISSUE

3.1 Eutrophication in the EU and the UK

The European Environment Agency (EEA) report *Europe's Environment: The Dobris Assessment* (EEA, 1995) identified eutrophication (of inland and saline waters) as a pan-European problem of major concern, a finding reiterated in *The Environment in the European Union at the turn of the Century* (EEA, 1999) and in *Europe's Environment: The Second Assessment* (EEA, 1998). The EEA has called for more effective and co-ordinated policies in this area. In the UK, eutrophication has been identified as a major environmental issue in Northern Ireland (as it is in the Republic), particularly in loughs and rivers. In Scotland, SEPA has identified eutrophication as its second most important environmental issue for lochs and its third for rivers. In England and Wales, tackling nutrient enrichment was identified as one of 10 priority issues in the Agency's 1998 report on the state of fresh waters (Environment Agency, 1998b), with development and implementation of this strategy as the key management response.

3.2 Update on eutrophication in England and Wales

Section 2.5 of the Agency's December 1998 consultative report summarised best available information on the extent of eutrophication in England and Wales for standing fresh waters, running fresh waters and saline waters. Given that only a short period has elapsed since that report, a review of those data is inappropriate. However, we have recently completed an internal national review to assess the degree to which eutrophication appears as an environmental issue within Local Environment Agency Plans (LEAPs) and their forerunner Catchment Management Plans (CMPs). The outcome is discussed below.

LEAPs are the Agency's main vehicle for identifying and resolving local environmental issues. Of the 130 LEAPs/CMPs reviewed (from a possible 134), 102 (78 per cent) contained eutrophication-related issues, with 44 (34 per cent) identifying eutrophication as a specific environmental issue for a catchment or named water body. Eutrophication was also cited as a component of a wider environmental issue in 84 plans (65 per cent). The issues identified were primarily in relation to fresh waters but also some estuaries.

This analysis of LEAPs helps to establish the importance of eutrophication as an issue nationally, and to local Agency staff and those within local communities who respond to the LEAP consultation process. This information complements and supports the national and international level assessments of the state of the environment, referred to in 3.1. Future reviews will be undertaken periodically to determine changes to the current position.

In 1999 the Agency produced a national state of the environment report relating to our coasts. This highlighted the need for further investigation into the effects of nutrient enrichment of coastal waters, reflecting our relatively poor understanding of cause and effect compared to the freshwater environment. This position, taken together with the low incidence of obvious eutrophication symptoms compared to parts of continental Europe, means that action under the strategy in relation to saline waters, over and above that for statutory and international commitments, will focus primarily on research and development at this stage.

3.3 Continuing action under statutory and international commitments

This strategy is intended to add value to continuing activity under a number of statutory drivers and international commitments relating to the assessment and control of eutrophication. These were discussed in Section 4.2 of the 1998 consultation document. A summary of ongoing actions under the most relevant initiatives is included at Annexe 2 to this strategy. Figure 1 shows the location of waters in England and Wales designated as Sensitive Areas (Eutrophic) under the EC Urban Waste Water Treatment (UWWT) Directive.



Figure 1. Sensitive Areas (Eutrophic) designated under the EC UWWT Directive

4. THE MANAGEMENT STRATEGY

The following sub-sections set out the overall objectives and underlying principles of the strategy, together with the major actions which the Agency, often working in partnership with others, intends to take in respect of each key component of the initiative. Timescales and detailed tasks are generally omitted, to give the strategy longevity, but are set out in the initial implementation plan (see Annexe 1).

4.1 Definition of eutrophication, overall objectives and underlying principles

4.1.1 The definition of eutrophication and its application

The Agency believes that the precise wording of the definition, providing it contains certain essential elements (cause, process, and effects), is less important than the way it is applied. It has adopted the following definition, taking into account the comments of consultees and the terms used in OECD, OSPAR and EC Directive texts.

The enrichment of water by nutrients, stimulating an array of symptomatic changes including increased production of algae and/or higher plants, which can adversely affect the diversity of the biological system, the quality of the water and the uses to which the water may be put.

The strategy focuses on the macronutrients, phosphorus (P) and nitrogen (N). In freshwater situations, control measures will primarily be directed to the control of P, which is generally the nutrient that is, or could most readily be made, limiting. In saline waters, N is generally the limiting nutrient and hence the subject of control measures, while estuaries tend to show P-limitation at their freshwater extreme, grading to N-limitation at their seaward end. However, we recognise the need to take into account exceptions to these generalities and the influence of nutrient ratios and non-nutrient factors (for example light, temperature, zooplankton grazing, fish) in some situations (see Action 30).

This strategy relates primarily to the management of eutrophication in “controlled waters”. That is to say rivers and streams, canals, lakes and reservoirs, estuaries and coastal waters, for which the Agency has powers to control pollution under Water Resources Act 1991. Wetlands will also be addressed. Small ponds and pools are not usually “controlled waters” (unless they discharge to a watercourse), so will not in general fall within the scope of the strategy. However, the Agency recognises their value to wildlife and is working with others on improved approaches to their ecological assessment and conservation at a local level. The work is complementary to the partnership approach set out in this strategy.

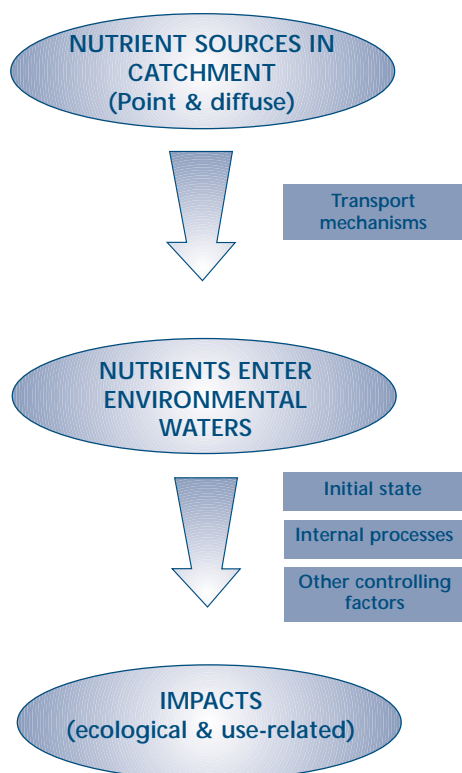


Figure 1. Conceptual diagram of the eutrophication process

The strategy is aimed at addressing the accelerated eutrophication that can result from human activities, termed **cultural eutrophication**. This is a process involving *chemical* (nutrient) enrichment of waters due to human activities within catchments, which can cause a *biological* response (plant or algal proliferation) in the water body, which in turn can adversely affect *water quality, ecology and water uses*. A conceptual diagram of the process is given in **Figure 1**. We intend that action be taken to **prevent or reverse** the process where the **risks of adverse impacts**, or **actual adverse impacts**, warrant such action. This may apply to waters from any point on the trophic continuum between oligotrophic (low nutrient status) and hypertrophic (very high nutrient status). Decisions over when to act involve difficult judgements, since there are no single or simple indicators of risk or impact and the success of control measures cannot always be readily predicted due to incomplete understanding of cause and effect. Local decisions must be based on the balance of evidence using best available information and technical judgement on a site-specific basis. We intend, however, to promote consistency of approach through the introduction of the strategy. Most of the key components will contribute, but when assessing eutrophication problems, Sections 4.4 (measuring eutrophication), 4.5 (prioritisation) and 4.7 (developing local action plans) are most relevant.

4.1.2 Overall objectives of the strategy

- *To provide a framework for managing aquatic eutrophication in England and Wales, in order to protect, rehabilitate or restore the ecology, quality and legitimate uses of waters at risk from, or adversely affected by, cultural eutrophication.*
- *To contribute to the delivery of the Agency's proposed Environmental Vision, its commitments towards achieving sustainable development and the fulfilment of its statutory functions. In particular to fulfil the specific commitments to eutrophication control in the final Vision and its associated delivery frameworks.*
- *To provide a focus for delivering the Agency's contribution to the implementation of the Habitat Action Plans for mesotrophic and eutrophic standing waters and other elements of the UK Biodiversity Action Plan (UK BAP).*
- *To promote a reduction in cultural nutrient inputs to water nationally, plus consistency, co-ordination and catchment-based management in respect of policies, procedures and methodologies for the assessment and control of eutrophication locally.*
- *To promote improved understanding of eutrophication and the role of the Agency and other stakeholders in tackling the issue.*

4.1.3 Underlying principles

In taking forward the strategy the Agency will adopt and/or promote the following principles.

- *A partnership approach to the management of eutrophication, at both national and local level.*
- *A two-pronged approach to eutrophication management: measures to reduce nutrient inputs to the water environment nationally, complemented by more comprehensive catchment-based action, within the context of a national framework, for waters most at risk from or affected by eutrophication.*
- *Achievement of environmental improvements through a case by case approach to determining the best local mix of regulatory, voluntary, educational, economic and other control mechanisms.*
- *That prevention is better than cure in eutrophication management.*
- *Wise use of non-renewable resources.*
- *Good or best environmental practice in controlling nutrient inputs to water.*
- *Development and application of solutions based on sound science and the assessment of risk.*

- *The precautionary principle should guide decisions affecting waters of high conservation status (SSSI/SAC/SPA), that is, that control action is taken even where scientific evidence is not conclusive, if the risks and the balance of likely costs and benefits justifies it.*
- *Adoption of best practicable environmental option (BPEO), so that alleviation of aquatic eutrophication will not lead to undesirable impacts on land or the air.*

4.2 Establishing a national framework for eutrophication management

We believe that the regulatory framework and the way in which it has been applied so far have not ensured the most coherent and effective national approach to the management of eutrophication. While the various statutory initiatives are helpful in controlling eutrophication, each addresses certain parts of the problem, rather than the whole. Within the Agency, annual expenditure associated with the assessment and control of eutrophication is significant. As one example, the costs of additional monitoring for the Urban Waste Water Treatment (UWWT) Directive, in preparation for the 2001 review of Sensitive Areas, have been estimated as around £210,000 for inland waters. Expenditure by the water companies for this directive, to reduce nutrient contributions from sewage treatment works (STWs), will amount to many millions of pounds. For example, under the water companies' investment programme for the period 2000-2005, it has been estimated that expenditure on phosphorus removal at STWs will be in the region of £250 million. Further expenditure is likely to result if the proposed EU Water Framework Directive is adopted. In order to maximise the environmental benefits from this considerable expenditure and provide a firm basis for future action, we believe that a more co-ordinated and integrated approach to eutrophication management is required nationally. The intention is to establish a national framework, through:

- promotion, within and outside the Agency, of consistent methodologies, procedures and criteria for assessing eutrophication problems and control options;
- national collaboration, in accordance with the partnership approach, with other key organisations, on issues of policy, control measures, education/advice, technical guidance and R&D activities.

The objective of an improved management framework will be achieved through the implementation of this strategy in partnership with others. Each of the key components of the strategy will contribute.

National collaboration will be addressed, where appropriate, through existing fora, for example national/UK implementation and steering groups for relevant EC Directives (UWWT, Nitrate, Habitats, proposed Water Framework), UK Habitat Action Plans for mesotrophic and eutrophic standing waters and OSPAR. The need for an overall UK policy group in this area will be considered with key Government departments and others.

Action 1: *The Agency will implement the strategy, in partnership with others, to provide a more integrated, co-ordinated and effective approach to the management of aquatic eutrophication in England and Wales.*

Action 2: *The Agency will review, with DETR, NAW, MAFF and others, the suitability of current fora for ensuring an effective national approach to the management of aquatic eutrophication.*

4.3 Reducing nutrient inputs to water nationally

While we favour a catchment-based approach to the management of local problems, the risks posed by eutrophication and the nature of some nutrient sources also warrant consideration of "global", that is, across-the-board measures applied at national level, to reduce nutrient inputs to water. Such measures accord with our commitment to sustainable development and the principles of good environmental practice, wise use of non-renewable resources and pollution prevention. Codes of good practice and industry standards have much potential in this area. These "global" measures provide a general level of protection for the water environment, complementing more stringent or concerted measures within catchments vulnerable to or affected by eutrophication (see 4.7), thus providing a "two-pronged" approach to the problem.

Controlling nutrient losses from land to water (diffuse nutrient pollution), involves recognising the fundamental links between the land (particularly soil and soil processes) and water environments, and the major influence of land use and land management on water quality. These factors are equally important when considering water pollution by pesticides and sediments. We therefore intend increasingly to address diffuse pollution issues as a package, working with others to encourage more sustainable land use and promote pollution prevention through appropriate management practices. Discussion here is, however, intentionally focused on the control of nutrients and eutrophication.

We will encourage and initiate collaborative review (involving both regulators and regulated industries) and subsequent action via a range of existing or potential new control mechanisms, whether regulatory, voluntary, incentive-based, economic or educational. We will target action primarily in the industrial sectors that contribute the greatest loadings of nutrients to the water environment (summarised in **Annexe 3**), principally the **water industry**, the **phosphate and soap & detergent industries**, the **food processing industry** and the **agricultural sector**.

For each of these sectors, the main areas where we believe that collaborative effort is appropriate, to assess what new or further reduction in nutrient losses to water may be achieved, are discussed below. The role of the energy sector, road transport and agriculture in atmospheric N deposition is also addressed.

4.3.1 The water industry

i. Regulatory policy on nutrient removal at sewage treatment works

It would be technically feasible to introduce nutrient reduction treatment (for P and/or N) at every significant STW in the country, but installation and maintenance of such treatment processes is expensive. The most reliable form of P reduction at present involves the use of chemical additives, which can themselves pose environmental problems by affecting effluent or sludge quality. In addition, nutrient reduction processes increase the amount of sewage sludge for disposal or utilisation. We therefore support the historic UK policy and practice of assessing STW discharge requirements on a case, or in this instance catchment specific basis, so that controls are targeted to waters found to be affected by, or at risk from, eutrophication (see 4.7). This approach may warrant review as processes for recycling sewage sludge, to produce usable raw materials for other industries, become more technically and financially viable (see 4.3.2 ii).

The **Urban Waste Water Treatment Directive** is the major driver for discharges from sewage treatment works. The directive includes provision for a member state to apply the Sensitive Area requirements within specific catchments, or alternatively across its whole territory, to all qualifying STWs. This latter approach has not been adopted in the UK, which favours the targeting of STW nutrient removal to catchments where impacts of eutrophication have been detected. For the reasons outlined in the previous paragraph, the Agency supports this catchment-specific and sensitivity-based approach.

ii. Regulatory policy on sewage sludge disposal

The more widespread installation of nutrient (particularly P) removal nationally under UWWT Directive and other requirements (including this strategy) will increase the quantities of sludge for disposal or utilisation. The nature of the treatment method affects the quantity and quality of sludge and the potential options for disposal and recycling. It will be necessary to ensure that such additional sludge production can be accommodated without giving rise to unacceptable environmental risks or impacts, including potential nutrient pollution in the very catchments where measures to reduce P losses are being applied. (See also 4.3.2 ii.)

Action 3: *The Agency will work with Government departments, the water industry and other interested parties to ensure that the environmental implications of increasing sludge production, arising from more widespread nutrient removal at sewage treatment works, are considered and addressed through the policy framework.*

iii. Use of recycled phosphorus from sewage sludge

See 4.3.2 ii.

4.3.2 The phosphate and soap & detergent industries

i. Phosphorus inputs to water from detergents

Detergents in waste water make a significant contribution (typically 10 per cent) to the overall loading of P entering surface waters. In taking forward the strategy it is appropriate to review what more can be done to reduce these inputs. When doing this we must take into account policy on and efficacy of P reduction at sewage treatment works, sludge production and disposal, control of diffuse P inputs, environmental impact of substitute products, the 'polluter pays' principle and the Code of Good Environmental Practice launched by the industry in 1998.

Action 4: *The Agency will liaise with Government departments and representatives of the soap and detergent, phosphate and water industries, to review the national position with regard to phosphorus (P) contributions from detergents, and to pursue potential further reductions in such P inputs to the water environment.*

ii. Use of recycled phosphorus from sewage and animal wastes

A large proportion of the P loading to the water environment via detergents (in waste water) and land run-off (deriving from animal feeds and chemical fertilisers) originates from mined phosphorus rock - a non-renewable resource - mainly from Morocco. At European level, the phosphate detergent industry is promoting the future recycling of P by extracting it from sewage and intensive livestock wastes. This would potentially provide a raw material for use by detergent (and fertiliser) industries, reducing the use of the non-renewable resource and the loading of P entering the water environment.

Action 5: *The Agency is attracted by the concept of phosphorus recycling, utilising P from sewage and animal wastes in order to promote more sustainable use of resources and reduce pollution. It will work with the phosphate, soap & detergent, and water industries, the Government, and fertiliser manufacturers to encourage the development and uptake of such technologies and practice in the UK.*

4.3.3 The food processing industry

i. Regulatory policy on nutrient removal for discharges to controlled waters

We favour the assessment and control of discharges on a case or catchment specific basis, so that controls are targeted to waters found to be affected by, or at risk from, eutrophication. In addition, implementation of the Integrated Pollution Prevention and Control (IPPC) Directive is likely to provide a national reduction in releases from this sector of industry.

4.3.4 The agricultural sector

i. The codes of good agricultural practice for the protection of water, soil and air

The codes (MAFF/WOAD 1998a, 1998b, 1998c) are available free to all farmers and provide an excellent opportunity for promoting nationally the adoption of good environmental practice to prevent or reduce nutrient (particularly nitrogen and phosphorus) losses to water (either directly or via aerial emissions) from the farming industry. The revision of the codes in 1998 improved the guidance on reducing nutrient losses; further refinements will be required as the outcome of R&D extends knowledge of the processes and pathways of nutrient loss and hence of best management practices.

Uptake of the codes has historically been poor but the initial demand for the revised codes has apparently been encouraging. We are, however, keen to contribute to initiatives aimed at maintaining and improving uptake.

Action 6: *The Agency will continue to work with MAFF, NAWAD and other key interest groups, to refine the codes and promote their uptake, in particular the guidance on waste and nutrient management planning and avoiding/reducing nutrient losses to water.*

ii. Other forms of guidance from Government and regulatory bodies

Action 7: *The Agency will review, with MAFF and other interested parties, other forms of nationally applicable advice affecting nutrient contributions from agriculture, such as fertiliser recommendations, to maximise environmental protection requirements alongside those for production. In addition the Agency will consider the need for further specific guidance for farmers on agricultural nutrient pollution, its impacts and best management practices.*

iii. Common Agricultural Policy (CAP) reform and cross compliance

CAP reform, to tie environmental protection requirements into the basic financial arrangements of the CAP, for example through cross compliance, holds perhaps the greatest chance of ensuring widespread adoption of good practice.

Action 8: *The Agency will continue to contribute to the national and EU debate on reform of CAP, promoting environmental protection requirements and in this instance the need to reduce and prevent nutrient pollution.*

iv. Implementation policy for EC directives

Some of the main EC directives of relevance to the control of nutrient pollution from agricultural sources apply in a 'global' sense. For example, the IPPC Directive applies to all large intensive pig and poultry units and will address emissions to air, land and water. Another example is the Nitrate Directive which requires the national adoption of a code (or codes) of good agricultural practice aimed at reducing nitrate pollution.

Action 9: *The Agency will continue to work with Government departments and others to implement, review or contribute to policy and methodologies for these directives to ensure an appropriate level of environmental protection.*

v. Soil protection strategies

The important role of soil, including its properties and processes, in determining losses of nutrients (and other pollutants) to water was stressed by a number of respondents to the consultation. We concur with these views and are working with Government and internally to develop national strategies aimed at protection of soils, including their potential to mediate nutrient losses to the water environment.

Action 10: *The Agency will continue to work with Government departments and other parties on the development of soil protection strategies, to aid, amongst other things, the control of nutrient losses to water.*

vi. Demonstration farms

Demonstration farms are seen as another useful initiative for encouraging good practice nationally. MAFF has already created four such farms in England, with Agency and NFU support, aimed at promoting the message of good nutrient management combined with commercial success.

Action 11: *The Agency supports the concept of demonstration farms and will continue to work with MAFF and the industry on their use as a means of promoting good nutrient management.*

vii. The fertiliser industry

An important facet of modern farming practice is the use of fertilisers. If however, they are not applied in accordance with good practice and/or on soils vulnerable to leaching, the losses of nutrients (N and P) to the water environment can be significant. The industry has made good progress in promoting good practice in the application of fertilisers, in particular through its Fertiliser Advisers Certification and Training Scheme (FACTS).

Action 12: *The Agency will work with representatives of the industry and Government to ensure continuing and wider promotion of good practice and nutrient management planning, to prevent or avoid nutrient losses to the water environment. The availability of fertiliser products of suitable composition will also be addressed.*

viii. The animal feed industry

A substantial proportion of the P and N input to livestock farms comes from animal feedstuffs. Much of this dietary P/N is subsequently excreted, making a significant contribution to the nutrient losses in land runoff and drainage. MAFF and farming industry research interests are undertaking R&D aimed at improving the efficiency of P/N utilisation by livestock and to reduce excess P/N intake.

Action 13: *The Agency will work with MAFF and the industry to further the development and implementation of potential measures to reduce P and/or N losses to water originating from animal diets.*

4.3.5 The energy industry and road transport

The main contributors to atmospheric N deposition in the UK are aerial emissions of oxidised N (NO_x) from power stations and road transport, together with ammonia emissions from agriculture. Controls on these emissions are primarily global in nature (for example through the application of "best available techniques" and emission standards) and the subject of various EC directives including those on large combustion plants, Integrated Pollution Prevention and Control, fuel quality and vehicle exhaust emissions. Such controls also help give effect to UK commitments to international protocols on atmospheric emission/deposition of N compounds (and other pollutants). These include the United Nations Economic Commission for Europe (UNECE) long-range transboundary air pollution convention, the proposed UNECE multi-pollutant protocol and the UN framework convention on climate change. We have no direct jurisdiction over road traffic emissions but are responsible for IPPC implementation, which includes the regulation of emissions from combustion plants and large pig and poultry units. These controls will reduce N emissions, and no specific additional control action is proposed under this strategy, at this stage.

4.4 Measuring eutrophication and the effects of human activities

Measuring the extent and potential risks of eutrophication in different water body types and in individual waters depends on robust monitoring programmes and reliable risk assessment procedures. We are involved in a number of initiatives including:

- monitoring for statutory purposes and international commitments;
- surveillance monitoring to provide state of the environment information;
- site-specific regional operational monitoring at sites affected by blue-green algal blooms or other eutrophication problems.

The arrangements for each of the main water body types were outlined in the consultation document. A series of actions to refine the current approach forms an important part of the management strategy.

i. Review of existing data and its presentation

Large quantities of chemical and biological data have been generated by the Agency (and its predecessors) and other organisations, specifically for eutrophication-related work and indirectly through other water quality monitoring programmes. It is important that these historic data sets are reviewed in the light of new technology (for example Geographic Information Systems) and new concepts (such as the Agency's "Viewpoints" framework for the state of the environment).

Action 14: *The Agency will seek to obtain better value from existing eutrophication data, and review the suitability of this data for presentation in terms of spatial state change and degree of change through time.*

On a specific point, the wider introduction of P-reduction treatment from 31 December 1998 at STWs associated with waters identified in May 1994 as Sensitive Areas (Eutrophic) under the UWWT Directive, will enable an initial assessment of the benefits of such treatment in a range of (mainly riverine) situations.

Action 15: *The environmental benefits of the first tranche of P-reduction measures under the UWWT Directive will be assessed to help inform future decisions on eutrophication control.*

ii. Review of sampling and analytical procedures

Since differences in sampling and analytical procedures can adversely affect the findings of research and monitoring programmes, it is important to have a reliable, consistent and accurate methodology. Field-sampling strategies must be able to detect temporal variability in chemical and biological parameters, and storage/preservation methods must aim to minimise sample transformations. Analytical procedures may need to be amended, for example to ensure that detection limits for phosphorus fractions and total phosphorus are adequate for the protection of pristine waters, and to determine best practice in the measurement of chlorophyll.

Action 16: *The Agency will review its sampling, storage and analytical procedures of relevance to eutrophication, to ensure that measurements are more reliable, precise and accurate.*

iii. Review of eutrophication monitoring in the context of an overall Agency review of environmental monitoring

We are currently undertaking a major review of our environmental monitoring programmes. This will ensure that information needs are met in respect of the Agency's statutory duties and functions, and its new integrated environmental management approach set out in the proposed Environmental Vision. The latter includes a "Viewpoints" framework (for gathering and presenting data on the state of the environment) and a "Stresses & Strains" framework (for assessing the natural and human pressures on the environment). As part of this overarching review, the eutrophication aspects of the Agency's monitoring programmes will be specifically addressed with a view to generating better, and more cost-effective, information on the extent of the problem, its causes and its relative importance compared to other environmental issues.

Action 17: *As part of its overall review of environmental monitoring, the Agency will review eutrophication monitoring arrangements and implement appropriate changes. Opportunities for collaboration over monitoring and exchange of information will continue to be pursued, where necessary via the National Collaborative Forum on Environmental Monitoring.*

iv. Improved methods for assessing eutrophication

A clear area of consensus established through the consultation exercise was the need for the increased use of biological indicators and ecological assessment in measuring eutrophication. Some respondents were dismissive of chemically based classification systems and national chemical targets as the relationship between nutrient levels and the desired ecological objectives can be unpredictable and differs according to water body type. Ecological assessment methods using indicator species (macrophytes, invertebrates, algal species) and diversity indices were also deemed more appropriate than chemical assessment. This shift in emphasis from predominantly physico-chemical parameters towards biological parameters is in line with the proposed Water Framework Directive, which specifies the need to assess ecological quality (including physico-chemical, biological and hydromorphological elements). The Agency believes that eutrophication is best assessed both through chemical parameters (reflecting the cause – nutrient enrichment – and some effects, for example on dissolved oxygen) and biological parameters (reflecting the effects).

Action 18: *The Agency will support further R&D into biological monitoring and assessment techniques, including the use of macrophyte and diatom communities as indicators of eutrophication, for the different water body types, to complement the use of chemical parameters.*

Most current monitoring and assessment systems do not explicitly utilise reference conditions. However, realistic environmental targets can theoretically best be set in the light of information about pre-disturbance, or base-line chemical and ecological conditions. Only a small number of waters have long-term historic data sets which allow the pristine or other reference state to be determined; most sites require “hindcasting” (prediction of historic water quality) either based on paleolimnological techniques or computer modelling. Such methods are subject to continuing R&D.

Action 19: *The Agency will continue to fund R&D to develop reference-based methods for assessing eutrophication.*

In the short term, to encourage consistency in defining waters adversely impacted by eutrophication, we believe that the Government criteria for identifying Sensitive Areas

(Eutrophic) under the UWWT Directive could potentially be applied to any waters, regardless of the presence or absence of a “qualifying” discharge under the directive. These criteria involve considering the balance of evidence in each case, but in relation to sets of national criteria for different types of water body. To complement these criteria, evidence or predictions of past or future increases in nutrient concentration and loadings would also be useful, to help assess the extent or risk of deterioration. Refined methodologies for assessing the status of coastal waters may also result from international work being undertaken in relation to the OSPAR strategy to combat eutrophication.

Action 20: *In progressing its review of arrangements for measuring eutrophication, the Agency will work with others to assess the potential wider use of the UK criteria for identifying Sensitive Areas (Eutrophic) under the UWWT Directive as a means of promoting consistency of approach in the short term.*

v. Identification and fulfilment of data requirements for risk-assessment techniques and eutrophication models

While existing problems represent situations where eutrophication risk has been realised, the wider assessment of risk will provide an early warning system for future problems. Eutrophication risk models form an important part of a suite of eutrophication management and prediction models. Factors affecting choice of model include level of detail required, model complexity and limitations, and availability of data. Environmental impact assessment of eutrophication management options requires a predictive understanding of biological responses to changes in nutrient loadings and thus process representation of nutrient transport, transformation and fate. It is therefore important to develop integrated models which consider (a) interactions between the soil, land use and flux of water and nutrients through the catchment, and (b) the processes that occur within water bodies.

Action 21: *The Agency will assess the available eutrophication models and risk assessment systems in order to identify the best available models. It will also ensure that future monitoring programmes meet their data requirements in the most cost-effective manner. Development needs will be addressed through R&D.*

vi. Climate change

A recent report on the implications of climate change (R&D Publication 22, *The Implications of Climate Change for the Environment Agency*) has identified a number of implications for eutrophication. These include changes in rainfall, and its seasonal and geographic distribution, and increased temperatures.

Action 22: *The Agency will support further R&D to explore in more detail the implications of climate change for eutrophication, and take these into account, at both national and local level, in the overall implementation of this strategy.*

vii. Measuring the costs and benefits of eutrophication control

At present we have relatively poor information on the costs, to the country, associated with the impacts (in the environment and upon water users) of eutrophication. Some initial work was undertaken by the NRA on the benefits of blue-green algal control and the costs of a range of eutrophication control methods. The Agency intends to develop this work further, to inform national and local estimates of the costs, benefits and cost-effectiveness of eutrophication control. This will feed into the development of the "toolkit" for use in developing local action plans (see 4.7.3).

Action 23: *The Agency will initiate further work on estimating the costs, benefits and cost-effectiveness of eutrophication control, to inform national and local assessments and the development of guidance.*

4.5 Setting priorities for management action

4.5.1 The importance of eutrophication alongside other environmental issues

In 1997, the Agency published its Environmental Strategy, which is now evolving into our Environment Vision, setting out a framework for managing the environment in an integrated way. Through this approach, which is progressively being incorporated into our environmental management procedures, the relative importance of different environmental issues including eutrophication, at both national and local level, can be determined. This is achieved through coming to an overview as to the state of the environment at any one time, using six complementary "viewpoints", together with an assessment of the "stresses and strains" or

pressures on the environment that affect its state. This analysis forms a key element of our long-term approach to managing the environment. While the discipline is relatively new at present, it will form an increasingly firm basis for determining the relative significance of eutrophication, to inform the decisions of policy makers and others.

At **national level** this discipline is already being applied in the production of Agency reports on the state of the environment. As mentioned in Section 3, the Agency's 1998 report on the state of our fresh waters identified nutrient enrichment and its impacts as one of 10 key issues needing to be addressed. At **local level** the same approach is now incorporated into the Local Environment Agency Plan (LEAP) process, as described in the consultation document. This will inform catchment-based assessments of local environmental priorities, including the relative importance of eutrophication.

Action 24: *The Agency will apply its integrated environmental assessment approach at national and local level, to ensure that the relative importance of eutrophication, in comparison to other environmental issues, is determined and accounted for in initiating management action.*

4.5.2 Prioritisation of waters at risk or impacted through eutrophication

In the December 1998 consultation paper, the Agency proposed five inter-related criteria for use in prioritising waters for management action. This approach was endorsed through the consultation process. However a sixth criterion, feasibility of remediation, was proposed by a number of consultees and has been accepted by the Agency.

In setting priorities for management action, we will adopt the following criteria:

- the presence of a statutory driver or international commitment;
- the strength of evidence of cause and effect;
- the wildlife conservation interest of the water body;
- the extent to which water uses are adversely affected;
- the risk of deterioration;
- the feasibility of remediation.

In addition, as stated at consultation stage, having set priorities, final decisions on control action (beyond that required as a result of statutory drivers), will take into account the likely costs and benefits (including social and environmental ones) of proposed actions, so as to avoid the imposition of unnecessary or excessive costs on society.

The above criteria are intended to focus on the protection of oligotrophic (low nutrient status) waters in addition to the remediation, where feasible and appropriate, of enriched and impacted waters.

In order to take forward the process of setting priorities via the agreed criteria, it will be necessary to develop and apply a methodology, involving the use of scoring/ranking systems and/or decision trees. This will then be applied in regions, taking into account the findings of LEAP processes and through use of a national assessment panel, to ensure consistency of approach across the Agency. The process will involve consultation with key partners.

Action 25: *Within six months of publication of the strategy, the Agency will develop a methodology and procedures through which to apply the criteria for determining priorities for management action.*

The requirements and data generated for the purposes of the main legislative and international commitments will inform the process and timescales for setting priorities. The intention is to undertake an initial prioritisation exercise within 6 months of adopting the methodology. Priorities will then be reviewed via a rolling programme, taking into account relevant regulatory milestones. These include the four-yearly reviews of designations under the UWWT and Nitrate Directives (which provide useful data on the status of waters and the importance of nutrient inputs), and the classification and prioritisation requirements of the UK BAP Habitat Action Plans for standing waters. In some instances, initial collation of information and assessment of the need for action will show that further investigation or monitoring work is needed, the outcome of which will feed into future reviews. This general schedule will not apply in cases where more immediate action is required further to a particular statute such as an EC directive.

Action 26: *The Agency will apply the methodology, initially within six months of adoption, and take into account the findings of Agency LEAP processes, in order to identify priority sites across the regions. Key partners will be consulted. Priorities will be reviewed periodically.*

The pace at which action plans will be introduced, further to the setting of priorities, is discussed in Section 4.7.2.

With regard to the key statutory drivers and international commitments, as stated in the consultation document, there are six such initiatives of potential relevance to eutrophication control. These are the UWWT, Nitrate and Habitats Directives, SSSI designation, the UK Biodiversity Action Plan (habitat action plans for mesotrophic and eutrophic lakes) and the OSPAR strategy to combat eutrophication. The proposed Water Framework Directive will be an important future driver, if and when adopted; as currently drafted, the definitions of good ecological quality, which will be objectives under this Directive, preclude the occurrence of eutrophication problems. In addition to the application of these drivers at new sites, the Agency will apply the strategy so as to build, where appropriate, on existing investment under the key initiatives. An example would be to assess the case for introduction of P controls at smaller STWs and/or for diffuse sources in catchments designated under UWWT Directive where STWs of greater than 10,000pe already have P-reduction treatment.

The consultation document outlined the need for us to continue to respond to algal incidents, in parallel with (often) longer-term eutrophication control initiatives.

Action 27: *The Agency will continue to refine and implement its procedures for responding to potentially toxic algal bloom incidents, particularly those involving blue-green algae which may pose a threat to human and animal health or the environment. It will also continue to liaise with other organisations with responsibilities in this area, to promote clarity and consistency of approach.*

4.6 Defining objectives and targets

In implementing management action, we must define the objectives of such action. Overall objectives of this strategy are defined in 4.1. In addition, local (water-body specific) objectives need to be defined on a case by case basis. Objectives for eutrophication control may, for example, be to attenuate nuisance algal blooms, in order to protect water uses. Alternatively, for a water body of high conservation status, an objective may be to develop an ecological community characteristic of a less eutrophic state.

Action 28: *The Agency will define local objectives for eutrophication management action on a case- (waterbody) specific basis, taking into account the particular environmental issues and intended management actions.*

4.6.1 Interim targets for phosphorus in fresh waters

Respondents to the consultation had divergent views on the Agency's proposed interim P targets. The Agency recognises the technical difficulties associated with the selection and application of chemical nutrient criteria for eutrophication control, particularly for flowing fresh waters. In the longer term, adoption of the proposed EU Water Framework Directive is likely to require the introduction of biological targets, and R&D in this area should inform the development of suitable methodologies including those relating to eutrophication control.

However, in the short term at least, we intend to employ our proposed interim P standards as best available values for use in eutrophication control in standing and running fresh waters. These national suites of standards, shown in Table 1, should be used with care to guide the selection of local site-specific targets derived from a sound understanding and data for a particular water body. The standards will also be useful for assessing whether potential management options are likely to bring environmental benefits.

Table 1 Interim standards for phosphorus in standing and running fresh waters

Trophic category	Standing fresh waters (µg TP l ⁻¹ , annual geometric mean)	Running fresh waters (µg SRP l ⁻¹ , annual mean)
Oligotrophic	8	20
Mesotrophic	25	60
Meso-eutrophic	-	100
Eutrophic	85	200

Depending on the level of understanding of a given water body, derivation of local targets may be an iterative process, with targets being refined in the light of improved information from the outcome of monitoring and modelling.

Action 29: *The interim standards for P in fresh waters will be used to guide the selection of local targets for particular water bodies. They will also inform screening studies to assess whether benefits are likely to result from potential management actions.*

Whilst advocating the use of the interim P standards, we should not ignore the role of other nutrients, especially

nitrogen, or non-nutrient factors in freshwater eutrophication processes. In particular, we recognise the potential importance of nitrogen in some freshwater situations, and of fish, zooplankton and other factors in shallow lakes, and this will be accounted for in guiding the development of local action plans.

Action 30: *The role of nitrogen and non-nutrient factors in some freshwater situations (as well as in saline waters) will be accounted for in developing guidance on the formulation of local eutrophication control action plans.*

4.6.2 Objectives and targets for saline waters

As stated in the consultative report, quality objectives and standards associated with nutrients and their impacts in estuarine and coastal waters are inadequately developed at present. Research and development will improve understanding and inform policy development. Meanwhile, control action in relation to these waters will primarily be linked to the main statutory initiatives (UWWT, Nitrate and Habitats Directives and OSPAR).

4.6.3 Use of the precautionary principle

The consultation yielded no clear consensus about the potential adoption of the precautionary principle to eutrophication issues, that is, to introduce control measures despite poor understanding of cause and effect. There was most support for the introduction of a source-oriented, precautionary approach in cases where environmental risk was greatest, for example, for oligotrophic waters of high conservation value. We believe this to be a proportionate use of this principle, providing costs and benefits are taken into account.

Action 31: *The Agency will support the adoption of a source-oriented precautionary approach in instances where the environmental risks, costs and benefits warrant it.*

4.6.4 Future targets

As discussed in 4.6.1 and 4.4.iv, in order to meet the future needs of the proposed EU Water Framework Directive and this strategy, we will continue to support R&D in relation to biological and reference-based methods for assessing eutrophication. Such developments will also assist the future derivation of biological targets for eutrophication control. Targets for soil P and its potential loss to waters also warrant consideration.

Action 32: *The Agency will continue to support R&D in relation to biological and reference-based targets for the control of eutrophication in the various different water body types. It will also explore with others the potential to set targets in relation to nutrient surplus, soil P status and/or P loss to waters.*

4.7 Managing eutrophication locally: catchment-based action within a national framework

4.7.1 The national management framework

As stated in Section 4.2, we will promote collaborative action at national level to provide a more co-ordinated and integrated framework for eutrophication management. This will include a review of existing and potential environmental management measures relevant to **catchment-based** eutrophication control action. The principal areas that the Agency believes should be considered, in collaboration with others, are set out in i to vi below. Many of the potential measures relate to diffuse nutrient losses, since these are more difficult to control in practice than point sources, and in particular to agricultural nutrient contributions, which are significant in rural catchments. Other activities that give rise to nutrient losses to water will also be addressed, for example, forestry and aquaculture.

The main focus for the review of eutrophication control and management measures will be in relation to the reduction of **nutrient inputs** to water, from point and diffuse sources in catchments affected by or at risk from eutrophication. However, action in relation to **impacts** will continue to be taken, for example, in response to potentially toxic algal blooms (4.5.2).

The Agency's intention is to promote, in partnership with others, best use of the regulatory framework, to ensure it is applied in an integrated catchment-based manner, complemented by other measures (such as incentive schemes, education/advice and voluntary action) as appropriate. **Point sources** of nutrients will normally be controlled through regulatory powers. For **diffuse sources**, particularly from agriculture, the aim will be to encourage good practice, in the first instance by voluntary, collaborative and educational methods, with incentives or regulatory mechanisms reserved for cases where the voluntary approach is unsuccessful. Incentive-based and regulatory measures are also likely to be required in catchments where statutory drivers or international commitments apply and/or in cases where it is considered necessary to go beyond good to achieve best environmental practice.

With regard to agri-environment incentive schemes, we do not, in principle, support the provision of financial

payments for actions that do not go beyond basic good practice. We believe that agri-environment schemes could potentially be applied in the context of eutrophication control, to encourage best practice, particularly in controlling nutrient inputs in cases where the conservation value of a water body is reliant on its trophic status.

In the case of agricultural nutrient pollution, we believe that nutrient management planning (including avoidance of incidental nutrient losses) currently offers the most effective way of reducing nutrient losses from land to water, whilst maintaining profitability.

In addition to the proposed collaborative action, the Agency also intends to apply its own powers to best effect in the context of catchment-based eutrophication management. Proposed actions are set out below.

i. The regulatory framework

Making best use of the regulatory framework

Action 33: *Further to Section 4.2, the Agency will work with others nationally to promote increased consistency and coherence between implementation policies for the key drivers of relevance to eutrophication control, in order to improve their application at catchment level. It will also promote consideration of eutrophication as an issue in the development of policy and methodologies for all relevant regulatory initiatives. At local level the Agency will aim to apply these measures and its Water Resources Act pollution control powers to best effect.*

Control of point source discharges

Action 34: *The Agency will (continue to) use its consenting powers, under the Water Resources Act 1991 (as amended by the Environment Act 1995), the Environment Protection Act 1990 and the EC Urban Waste Water Treatment Directive regulations, to control nutrient contributions from sewage treatment works and trade premises. These will be applied where discharges are identified as making a significant contribution to the total nutrient loading in a catchment affected by eutrophication and where control action is considered likely to bring environmental benefits. Either P or N or both will be controlled, depending on local circumstances, but the norm will be to control P in freshwater situations and N in saline water situations. This approach will apply to sewage treatment works discharges above and below the UWWT Directive population threshold (for Sensitive Areas) of 10,000pe.*

Statutory water quality objectives, S.83 of the Water Resources Act 1991

The Agency intends to proceed on the basis of informal water quality targets for eutrophication control, as discussed in 3.6. The use of S.83 powers by the Secretary of State, in respect of nutrient standards, is not envisaged at present.

Powers to establish water protection zones, S.93 of the Water Resources Act

Action 35: *The Agency will discuss with Government departments (DETR, NAW, MAFF) the potential use of this mechanism for eutrophication control purposes, as a last resort, in catchments where other control initiatives have failed to reduce adequately the nutrient inputs. The primary target of this potential measure would be activities giving rise to diffuse nutrient pollution, particularly P from agricultural sources, providing a similar (but P-related) control mechanism to the EC Nitrate Directive.*

Powers to establish nitrate sensitive areas (NSAs), S.94 and 95 of the Water Resources Act

The EC Nitrate Directive and UWWT Directive/Regulations already provide potential mechanisms to control eutrophication in catchments where this is induced by nitrates from agriculture and sewage effluent. Therefore no action is proposed in relation to the potential use of S.94 and 95 in this context at present. The situation will be kept under review, however, since the NSA mechanism can potentially provide more stringent measures than the Nitrate Directive, should these in future be considered necessary for eutrophication control purposes.

ii. Land-use planning regime

Action 36: *The Agency will work with other regulators and non-governmental organisations on the further development and adoption of policies and strategies for promoting more environmentally sympathetic use of the land. This is a long-term objective aimed primarily, in this context, at the prevention of diffuse nutrient pollution in catchments where the soil type, hydrology and topography combine to produce a high risk of nutrient loss from land to water.*

iii. Financial incentive schemes and the agricultural sector

Action 37: *The Agency will work with Government departments, English Nature, CCW, industry groups and NGOs to review the potential application of agri-environment schemes in the context of eutrophication control. The Agency wishes to explore the potential use of such schemes in catchments identified as sensitive to agricultural nutrient pollution and eutrophication, particularly where the conservation status of the water body is at risk. Sites to be identified under the Habitat Action Plans for mesotrophic and eutrophic standing waters (under UK Biodiversity Action Plan) are considered potential candidates in that context.*

Action 38: *The Agency will apply the same approach (in Action 37 above) with regard to the potential introduction of farm waste grants (for new or improved farm waste facilities) in the above catchments.*

Recognising that funding for these initiatives is finite, the Agency will liaise with the key sponsoring bodies to review the priority of eutrophication control in comparison to other environmental issues.

iv. Advice, guidance and technical support

Action 39: *The Agency will (continue to) work with Government departments, conservation agencies, industry groups and others to review and implement methods/vehicles for promoting the adoption of good environmental practice and the prevention or reduction of nutrient pollution and eutrophication at catchment level. This will include the use of codes of practice (either from Government, industry or others), other educational tools and material, on-the-ground promotional activities (such as farm visits and demonstration farms) and the provision of advisory services.*

v. **Total catchment management and other collaborative approaches**

Action 40: *The Agency will continue to promote and facilitate the adoption of collaborative approaches to eutrophication management, including Total Catchment Management techniques (as referred to in the December 1998 consultation document), where appropriate, in catchments where pilot eutrophication control action plans are introduced. The success of these trials will inform decisions on the wider adoption of this approach.*

vi. **Economic instruments**

The potential use of economic instruments (other than incentive schemes) as a mechanism for the control of nutrient pollution and eutrophication received little support at the consultation stage. We do not intend to promote the introduction of such instruments in the shorter term but will review the situation periodically to assess the need for such measures in the future.

4.7.2 Local eutrophication control action plans (ECAPs)

The December 1998 consultation exercise demonstrated strong support for the principle of managing eutrophication at local level via a catchment-based approach, within the context of a national framework. Waters will be identified for potential action through the Agency's catchment-based Local Environment Agency Plan (LEAP) process (described in the consultative report) and prioritised as described in 4.5.2.

In cases where the cause of a local eutrophication problem can be readily identified and addressed via regulatory means, for example a large sewage effluent discharge, then control action can be identified in the LEAP and introduced via relevant legislation. This might mean, for example, the introduction of P-removal treatment under the UWWT Directive. However, where a range of different, particularly diffuse, nutrient sources and a number of water uses are involved, assessing the problem and agreeing the best solutions can be a complex matter. Our proposal to address such situations through the introduction of catchment-based eutrophication control action plans (ECAPs) was endorsed via consultation. An ECAP is simply an extension of a LEAP, setting out, in greater detail than is appropriate in a LEAP

(which deals with all the many environmental issues of relevance to a particular catchment), a plan for assessing and managing a specific local eutrophication problem. An overview of the ECAP would be given in the LEAP.

Decisions about the best way of managing a eutrophication problem in a given water body are to a fair extent case-specific. They depend upon a wide range of interrelated factors including the uses and status of the water body, the scientific nature of the problem and our understanding of it (in terms of the ecological symptoms, nutrient sources and in-lake/stream processes), the technical management options and the applicability of regulatory, economic, voluntary, collaborative and other management mechanisms. The Agency supports a case-specific "horses for courses" approach to determining the best mix of management mechanisms. This should apply, however, within the context of the national management framework referred to in 4.7.1. Consistency of approach will be promoted through the introduction of national guidance (see 4.7.3).

Community involvement in the local decision-making process is an important element of LEAPs and ECAPs. This will be addressed via consultation processes or, if appropriate, through the promotion of active local partnerships to tackle eutrophication problems. As mentioned in 4.7.1, we will promote further trials of the Total Catchment Management (TCM) committee approach. In that context, it is important to reiterate that eutrophication management is not always simply a matter of controlling nutrient enrichment. It may require bio-manipulation of the fish community or de-stratification of a water body, for example. We cannot achieve these types of management actions solely through regulation. The appropriate scope and style of local partnership can best be determined on a case-specific basis.

With regard to saline, particularly estuarine waters, we recognise, further to comments on our consultation document, that the Habitats Directive, in addition to the UWWT and Nitrate Directives, may also drive catchment-based action to control eutrophication.

Action 41: *At local level, the Agency will address complex eutrophication problems through the introduction of eutrophication control action plans (ECAPs). The scope and style of each ECAP and the management mechanisms employed will be case-specific, but incorporating community involvement and informed by national guidance.*

Determining an appropriate pace for ECAP introduction is no easy matter. We now need to address the risks and impacts of eutrophication, and an increasing range of statutory and international commitments requires us and other parties to assess and determine solutions to local eutrophication-related problems. A few initiatives include specific timescales for the introduction of action plans, for example, 2005 for priority sites under the UK Habitat Action Plan for eutrophic standing waters. However, our current understanding of the science is insufficient, in some situations, to enable us to predict accurately the likely benefits of action. This gives rise to potential for poor targeting of effort and investment. Given these circumstances, the Agency believes the most balanced way to proceed is through the introduction of ECAPs on a pilot basis, to trial the tools and techniques and thereby inform future actions. A range of differing catchments (including different water body types) and scenarios will be selected. In some instances, pilot ECAPs will build upon work already planned or commenced under other initiatives (such as EC Directives or UK Habitat Action Plans). Care will be taken not to duplicate effort; for example where an appropriate forum, such as a Habitats Directive Marine SAC management committee, is already in place, this may be able to take forward the ECAP work without the need to create an additional group.

Action 42: *Pilot ECAPs will be introduced in a range of catchments to trial the tools and techniques for potential wider application. The requirements of statutory and international commitments, the success of the trials and the findings of R&D will inform decisions on the more widespread adoption of the approach.*

4.7.3 Refining the toolkit for developing and implementing ECAPs

At consultation we recognised the need to develop a “toolkit” to facilitate the various technical tasks involved in formulating and implementing a local eutrophication control action plan. A number of respondents, particularly other regulators, research/academic and advisory bodies were keen to contribute to this process. The principal areas covered by the toolkit are as follows:

- methods and criteria for assessing and predicting the impacts of eutrophication;
- methods/tools for identifying the main sources of nutrients in a catchment and their relative contributions to affected waters;

- tools for predicting the processes that occur within water bodies, involving nutrients, the biota and the influence of other factors on the biological symptoms of eutrophication;
- methods/tools for assessing the likely environmental benefits, risks and practicality of eutrophication management options;
- methods for assessing the costs, benefits and cost-effectiveness of eutrophication management options.

The toolkit will also address the determination of objectives and targets, derived and refined through an iterative process taking into account the status and uses of the water body and the result of applying the above methods/tools.

Over and above the technical issues, we need to produce and promote guidance on the best “administrative” mechanisms for implementing eutrophication management options, be they legislative, economic (including incentive-based schemes), collaborative or voluntary/educational, or some combination of these types of approaches.

Action 43: *The Agency will continue to develop guidance on the best available tools, techniques and approaches for the assessment and management of eutrophication in vulnerable or impacted waters/catchments, in liaison with others. The “toolkit” will be tested on pilot catchments and refined through experience, collaboration and the outcome of R&D. Internal training needs will be addressed.*

4.8 Deciding the options for eutrophication control

As stated in the consultative report, the issue of practical eutrophication control techniques is a major topic in its own right and the subject of many books, technical papers and ongoing R&D. The need for collaboration to draw together guidance on appropriate control techniques, including their environmental impacts, is addressed in 4.7.3 and the Agency and its predecessor the NRA have funded work in this area. One example is the 1996 book entitled *A guide to the restoration of nutrient-enriched shallow lakes*, jointly funded by the Agency, the Broads Authority and the EU Life project (Moss *et al*, 1996).

Detailed discussion of each specific control technique is inappropriate here. However, at the policy level, one significant issue not addressed elsewhere in the strategy is that of the approach to nutrient removal at sewage treatment works, particularly the pros and cons of chemical dosing versus biological nutrient removal as

methods of phosphorus reduction. The number of STWs requiring P-removal treatment is increasing. It is timely to review the pros and cons of the two methods, taking into account associated issues of sludge disposal, effluent quality and potential phosphorus recycling (see 4.3).

Action 44: *The Agency will work with the DETR, NAW, the water industry and others to review the environmental benefits and drawbacks of chemical versus biological nutrient (phosphorus) removal at sewage treatment works.*

4.9 Promoting a wider understanding of the nature and significance of eutrophication

The Agency's proposals to enhance awareness of eutrophication issues were widely supported by respondents to the December 1998 consultation. The comments received highlighted a wide range of important audiences and approaches to improving awareness. Improved understanding of eutrophication issues, across the community, will help fulfil the objectives of the strategy, through promoting shared ownership and responsibility.

There was consensus that improving public awareness must be done without raising undue concerns, or unrealistic expectations as to the feasibility and timescales for achieving ecological improvements, given the often long-term nature of the issue. Strong support was received for the use of educational projects through schools, colleges and universities. In addition, the need to target appropriate sectors of industry was stressed, particularly the agricultural sector including landowners, farmers, agronomists, agricultural colleges and advisory organisations. Working with other interested parties in respect of each sector of the community will be vital in agreeing the key messages for different audiences and the best means of conveying them.

Action 45: *The Agency will initiate and/or promote educational and awareness-raising campaigns in collaboration with others, to improve understanding of eutrophication issues in relevant sectors of the community.*

4.10 Pursuing research and development

Scientific understanding of some aspects of cause and effect in the eutrophication process is incomplete. It is important that Government departments, regulatory bodies, industry, academia and others continue to develop the science base in this area, to inform policy development.

Action 46: *In order to ensure that the management of eutrophication proceeds, as far as possible, on the basis of sound science, the Agency will continue to fund research and development (R&D) in this area. R&D needs will be prioritised and addressed, where appropriate in collaboration with other organisations in the UK and abroad. The Agency will also work with others to ensure that the outcome of sound R&D is fed through into UK policy and practice.*

Liaison with others will also help to maximise the benefits of knowledge and experience in this area. Together with the Foundation for Water Research (FWR) and the UK Water Industry Research (UKWIR) group, the Agency was instrumental in creating, in February 1999 the **UK Eutrophication Forum**. This group comprises the main UK bodies which commission R&D into nutrient inputs to water and eutrophication. The aim is to provide a vehicle for continued sharing and collation of information from within the UK and beyond, to the benefit of all, and to enhance the potential for focused collaborative effort. (FWR website address: <http://www.fwr.org>)

4.11 Developing national measures of success

Defining criteria for the success of a local action plan to address a specific environmental problem is, in most cases, relatively straightforward. For broad national strategies, the development of appropriate success measures is more challenging, particularly for an issue such as eutrophication. This is due to the broad ranging, long-term and complex nature of the phenomenon and the many and disparate influences on the ecological expression of eutrophication and the adoption of control measures. Measuring progress towards, and achievement of, objectives and plans is, however, an essential element of the Agency's environmental management role. We will, therefore, develop suitable success measures, linking as appropriate to our current initiative to produce a set of core environmental indicators. We will also consider further potential success measures relating to the strategy's influence on others and operational efficiency. The progress of the strategy will be assessed periodically against the actions and tasks in the implementation plan and the success measures as they are introduced.

Action 47: *The Agency will, in the short term, initiate work to develop appropriate success measures for the strategy, particularly in terms of environmental benefits, influence on others and operational efficiency.*

ANNEXE 1 – INITIAL IMPLEMENTATION PLAN

	Agency action	Main partners	Initial tasks	Timescales
4.2 Establishing a national framework for eutrophication management				
1	Implement the strategy to provide a more integrated, co-ordinated and effective approach to the management of aquatic eutrophication in England and Wales.	Government departments, other UK environmental regulators, conservation agencies, industry groups, water user groups, academics	-	Commencing 2000
2	Review the suitability of current fora for ensuring an effective national approach to the management of aquatic eutrophication.	DETR/NAW, MAFF/NAWAD, SEPA	Discussion with main partners	During 2000/01
4.3 Reducing nutrient inputs to water nationally				
4.3.1 Water industry				
3	Ensure that the environmental implications of increasing sludge production, arising from more widespread nutrient removal at sewage treatment works, are considered and addressed through the policy framework.	DETR/NAW, MAFF/NAWAD, water industry	Pursue via relevant government/industry policy groups and via R&D	Ongoing
4.3.2 Phosphate and soap & detergent industries				
4	Review national position with regard to P contributions from detergents, and pursue potential further reductions in such P inputs to the water environment.	DETR/NAW, soap & detergent industry, phosphate industry, water industry	Pursue via Technical Committee for Detergents in the Environment	By 2002
5	Encourage the development and uptake of P recycling technologies and practice for sewage and animal wastes in the UK.	DETR/NAW, soap & detergent industry, phosphate industry, water industry, MAFF/NAWAD, FMA	<ul style="list-style-type: none"> - Initiate discussion with relevant organisations - Support R&D initiatives 	By 2001 Starting 2000/01
4.3.4 Agricultural sector				
6	Encourage refinement and uptake of the codes of good agricultural practice, in particular the guidance on waste and nutrient management planning and avoiding/reducing nutrient losses to water.	MAFF/NAWAD, EN/CCW, NFU, DETR/NAW, CLA	Continue liaison with relevant organisations	Ongoing
7	(a) Review other forms of nationally applicable advice affecting nutrient contributions from agriculture. (b) Consider need for further specific guidance for farmers on agricultural nutrient pollution, its impacts and BMPs.	MAFF/NAWAD, EN/CCW, NFU, DETR/NAW, CLA, FMA	<ul style="list-style-type: none"> - (b) Produce Agency guidance on BMPs for farmers 	Ongoing During 2000

	Agency action	Main partners	Initial tasks	Timescales
8	Continue to contribute to the national and EU debate on reform of CAP, promoting environmental protection requirements and the need to reduce and prevent nutrient pollution	MAFF/NAWAD, DETR/NAW, NFU, CLA	Continue liaison with relevant organisations	Ongoing
9	Implement and review policy and methodologies for EC Directives relevant to the control of nutrient pollution, to ensure an appropriate level of environmental protection.	DETR/NAW, MAFF/NAWAD, EN/CCW, other UK environmental regulators	Pursue via relevant government/industrial policy groups.	Ongoing
10	Continue contribution to the development of soil protection strategies to aid the control of nutrient losses to water.	DETR/NAW, MAFF/NAWAD, NFU, CLA	<ul style="list-style-type: none"> - Contribute to the DETR "soil strategy for England" - Develop an Agency soil protection strategy 	Ongoing Consultation document by end of 2000
11	Continue to work with the main players on the use of demonstration farms as a means of promoting good nutrient management.	DETR/NAW, MAFF/NAWAD, NFU	Investigate ways of increasing Agency involvement in demonstration farms	Ongoing
12a	Ensure continuing and wider promotion of good environmental practice and nutrient management planning within the fertiliser industry.	MAFF/NAWAD, EN/CCW, NFU, LEAF, FMA, CLA	Enhance links with relevant partners and contribute to promotional campaigns	Ongoing
12b	Assess availability of fertiliser products of suitable composition.	MAFF/NAWAD, NFU, FMA	Assess current market availability and uptake	By end of 2001
13	Further the development and implementation of potential measures to reduce P and/or N losses to water originating from animal diets.	MAFF/NAWAD, NFU, feed manufacturers	Consider supporting relevant R&D	Ongoing
4.4 Measuring eutrophication and the impacts of human activities				
14	Seek to obtain better value from existing Agency eutrophication data, and review the suitability of this data for presentation in terms of spatial state change and degree of change through time.	Internal	<ul style="list-style-type: none"> a. As main action b. Continue to monitor orthophosphate at GOA river monitoring points during 2000 to inform quinquennial survey. 	<ul style="list-style-type: none"> a. Ongoing b. During 2000
15	Assess the environmental benefits of the first tranche of P-reduction measures under UWWT Directive to help inform future decisions on eutrophication control.	Internal plus UK water regulators	Progress as part of 2001 review of Sensitive Area designations.	During 2001
16	Review internal sampling, storage and analytical procedures to ensure Agency measurements are more reliable, precise and accurate.	Internal	-	During 2000 and 2001

	Agency action	Main partners	Initial tasks	Timescales
17a	As part of overall review of environmental monitoring in the Agency, review current eutrophication monitoring arrangements and implement appropriate changes.	MAFF/NAWAD, EN/CCW, DETR/NAW, CEFAS	-	During 2000 and 2001
17b	Pursue opportunities for collaboration over monitoring and exchange of information.	Wide range of interested parties	Explore potential opportunities via relevant fora such as National Collaborative Forum on Environmental Monitoring	Ongoing
18	Support R&D into biological monitoring and assessment techniques, for the different water body types to complement the use of chemical parameters.	DETR/NAW, MAFF/NAWAD, EN/CCW, academic and research institutions, SEPA	Fund relevant R&D projects in collaboration with others where appropriate	Ongoing
19	Support R&D to develop reference-based methods for assessing eutrophication.	DETR/NAW, MAFF/NAWAD, EN/CCW, academic and research institutions, SEPA	Fund relevant R&D projects in collaboration with others where appropriate	Ongoing
20	Assess potential wider use of the UK criteria for identifying Sensitive Areas (Eutrophic) under UWWT Directive, as a means of promoting consistency of approach in the short term.	UK water regulators	Address via UWWT Directive sub-group	During 2001
21	Assess available eutrophication models and risk assessment systems in order to identify best available models. Ensure future monitoring programmes meet data requirements in the most cost-effective manner. Address development needs through R&D.	MAFF/NAWAD, DETR/NAW, academic and research institutions, other regulators	-	Initial assessment during 2000/01, then ongoing
22	Support further R&D to explore in more detail the implications of climate change for eutrophication, and take these into account, at both a national and local level, in the overall implementation of the strategy.	DETR/NAW, UKCIP (UK Climate Impacts Programme), academic and research institutions	Explore potential scope and opportunities for research and fund relevant research.	Ongoing
23	Initiate further work on estimating the costs, benefits and cost-effectiveness of eutrophication control.	UK water regulators, EN/CCW, MAFF/NAWAD, SDIA, water industry, British Waterways, LEAP/ECAP partners	-	By end of 2000/01

	Agency action	Main partners	Initial tasks	Timescales
4.5 Setting priorities for management action				
24	Apply the integrated environmental assessment approach at national and local level, to ensure that the relative importance of eutrophication, in comparison to other environmental issues, is determined and accounted for in initiating management action.	Internal plus local consultation via LEAPs	<ul style="list-style-type: none"> - Produce State of the Environment reports (national) - Produce LEAPs (local) 	Ongoing, with periodic review
25	Develop a methodology and procedures through which to apply the criteria for determining priorities for management action (refer to Section 4.5.2)	Internal plus other UK water regulators and academia	-	Develop methodology within six months of publication of strategy
26	Apply the prioritisation methodology, taking into account the findings of Agency LEAP processes, in order to identify priority sites across the regions.	DETR/NAW, EN/CCW, MAFF/NAWAD	-	Initially within six months of developing methodology, then review periodically
27	Continue to refine and implement internal procedures for responding to potentially toxic algal bloom incidents. Promote clarity and consistency of approach with other organisations with responsibilities in this area.	EHOs, MAFF/NAWAD, CEFAS, consultants for communicable diseases	<ul style="list-style-type: none"> - Review via internal business groups - Continue liaison with external players - Produce awareness-raising material 	Ongoing
4.6 Defining objectives and targets				
28	Define local objectives for eutrophication management action on a case- (waterbody) specific basis, taking into account the particular environmental issues and intended management actions.	LEAP/ECAP partners	Site specific	Ongoing

	Agency action	Main partners	Initial tasks	Timescales
29	Use interim standards for P in fresh waters to guide the selection of local targets for particular water bodies and to inform screening studies to assess whether benefits are likely to result from potential management actions.	National – EN/CCW, DETR/NAW, MAFF/NAWAD, water industry, UK environmental regulators Local – LEAP/ECAP partners	Site specific	Ongoing
30	Ensure the role of nitrogen and non-nutrient factors in some freshwater situations (as well as in saline waters) are accounted for in developing guidance on the formulation of local eutrophication control action plans.	Internal, other environmental regulators, academic and research institutions	Develop as part of “toolkit” (see 43)	Initially during 2000/01 with further refinement ongoing
31	Support the adoption of a source-oriented precautionary approach in instances where the environmental risks, the costs and the benefits warrant it.	Internal Local – LEAP/ECAP partners	Develop approach as part of actions 21, 25 and 43, then apply	Ongoing
32a	Continue supporting R&D in relation to biological and reference-based targets for the control of eutrophication in the various different water body types.	DETR/NAW, MAFF/NAWAD, EN/CCW, academic and research institutions, SEPA	Fund relevant R&D projects in collaboration with others where appropriate	Ongoing
32b	Explore the potential to set targets in relation to nutrient surplus, soil P status and/or P loss to waters.	MAFF/NAWAD, DETR/NAW, Agricultural research institutes, NFU	Continue liaison with relevant organisations	Ongoing
4.7 Managing eutrophication locally: catchment-based action within a national framework				
4.7.1 The national management framework				
i. The regulatory framework				
33a	Promote increased consistency and coherence between implementation policies for key drivers of relevance to eutrophication control, in order to improve their application at catchment level.	Government departments, other UK environmental regulators, conservation agencies, industry groups, NGOs	Address via relevant fora and discussions with main partners	Ongoing
33b	Promote consideration of eutrophication as an issue in the development of policy and methodologies for all relevant regulatory initiatives.	Government departments, other UK environmental regulators, conservation agencies, industry groups, NGOs	Address via relevant fora and discussions with main partners	Ongoing
33c	At local level, apply the key drivers of relevance to eutrophication control and Water Resources Act pollution control powers to best effect.	LEAP/ECAP partners	Site specific	Ongoing

	Agency action	Main partners	Initial tasks	Timescales
34	Use consenting powers to control nutrient contributions from sewage treatment works and trade premises, where discharges make a significant contribution to the total nutrient loading in a catchment affected by eutrophication, and where control action is likely to bring environmental benefits.	DETR/NAW, water industry, industrial dischargers, other environmental regulators	Site specific	An agreed programme for 2000-2005 is defined for water company STWs, linked to UWWTD Sensitive Area reviews and Habitats Directive/SSSI sites, under the AMP3 National Environment Programme. Future requirements for STWs will need to be identified as part of the periodic review process for water company price limits. For trade discharges, future requirements will be identified as part of ongoing reviews of discharge consents.
35	Explore potential use of water protection zones for eutrophication control purposes, as a last resort, in catchments where other control initiatives have failed to reduce nutrient inputs. ii. Land-use planning regime	DETR/NAW, MAFF/NAWAD, NFU, CLA, EN/CCW, UK environmental regulators	Discussions with main partners	Commencing in 2000/01
36	Explore further development and adoption of policies and strategies for promoting more environmentally sympathetic use of the land. iii. Financial incentive schemes and the agricultural sector	Wide range of interested parties	Internal policy development and discussions with main partners	Ongoing
37	Review potential application of agri-environment schemes in the context of eutrophication control, for use in catchments sensitive to agricultural nutrient pollution and eutrophication.	MAFF/NAWAD, DETR/NAW, EN/CCW, UK environmental regulators, NFU, CLA	Further discussions with main partners	Commencing 2000/01
38	Review potential application of farm waste grant schemes in the context of eutrophication control, for use in catchments sensitive to agricultural nutrient pollution and eutrophication. iv. Advice, guidance and technical support	MAFF/NAWAD, DETR/NAW, EN/CCW, UK environmental regulators	Initiate discussions with main partners	Commencing 2000/01
39	Review and implement methods/vehicles for promoting the adoption of good environmental practice and the prevention or reduction of nutrient pollution and eutrophication at catchment level.	MAFF/NAWAD, DETR/NAW, EN/CCW, UK environmental regulators, FWAG, LEAF, CLA, NFU, conservation agencies, industry groups, Forestry Commission, aquaculture industry	-	Ongoing

	Agency action	Main partners	Initial tasks	Timescales
v. Total catchment management and other collaborative approaches				
40	Promote and facilitate the adoption of collaborative approaches to eutrophication management, including Total Catchment Management techniques, where appropriate, in catchments where pilot eutrophication control action plans are introduced.	MAFF/NAWAD, DETR/NAW, EN/CCW, UK environmental regulators, FWAG, LEAF, CLA, NFU, conservation agencies.	Further trials of collaborative approaches in pilot ECAPs	Commencing 2000/01
4.7.2 Local Eutrophication Control Action Plans (ECAPs)				
41	At local level, address complex eutrophication problems through the introduction of eutrophication control action plans.	Local interested parties, LEAPs partners	-	Dependent on success of pilots and statutory/international requirements
42	Introduce pilot ECAPs in a range of catchments to trial the tools and techniques for potential wider application.	Range of interested parties, national and local	Introduce around 10 pilot ECAPs covering different water body types	Commencing 2000/01
4.7.3 Refining the toolkit for developing and implementing ECAPs				
43	Continue to develop guidance on the best available tools, techniques and approaches for assessment and management of eutrophication in vulnerable or impacted waters/catchments. Address internal training needs.	Internal, other environmental regulators, academic and research institutes	-	Initially during 2000/01 with further refinement ongoing
4.8 Deciding the options for eutrophication control				
44	Review the environmental benefits and drawbacks of chemical versus biological nutrient (P) removal at sewage treatment works.	DETR/NAW, MAFF/NAWAD, water industry	- Discussion through relevant fora - Support R&D initiatives	Commencing 2000/01
4.9 Promoting a wider understanding of the nature and significance of eutrophication				
45	Initiate and/or promote educational and awareness-raising campaigns to improve understanding of eutrophication issues in relevant sectors of the community.	Wide range of interested parties	- Produce Agency leaflet on eutrophication - Formulate, promote and/or implement further awareness-raising proposals	- During 2000 - Ongoing

	Agency action	Main partners	Initial tasks	Timescales
4.10 Pursuing research and development				
46a	Continue to fund R&D in order to ensure that the management of eutrophication proceeds, as far as possible, on the basis of sound science.	Government departments, research councils, academic and research institutes, other national and international environmental regulators, industry groups	Ensure eutrophication issues are addressed within Agency R&D programmes and pursue potential collaborative projects with other interested parties.	Ongoing
46b	Prioritise R&D needs as regards eutrophication.	Government departments, research councils, academic and research institutes, other national and international environmental regulators, industry groups.	Complete current project to prioritise eutrophication-related R&D.	Summer 2000
46c	Ensure that the outcome of sound R&D is fed through into UK policy and practice.	Government departments, research councils, academic and research institutes, other national and international environmental regulators, industry groups.	-	Ongoing
4.11 Developing national measures of success				
47	Initiate work to develop appropriate success measures for the strategy.	DETR/NAW, MAFF/NAWAD, EN/CCW	Pursue as part of review of arrangements for measuring eutrophication and the development of environmental indicators.	During 2000 and 2001
<p style="text-align: center;">THE 47 ACTIONS GROUPED INTO AREAS OF GENERIC ACTIVITY</p> <p>1. DEVELOPING POLICY AND CO-ORDINATING IMPLEMENTATION NATIONALLY National actions = 1, 2, 3, 9, 10, 17b, 20, 22, 32b, 33a, 33b, 34, 35, 36, 37, 38, 44, 46c Local actions = -</p> <p>2. INFLUENCING OTHERS OVER POLICY AND PRACTICE National actions = 4, 5, 6, 7, 8, 10, 11, 12, 13, 23, 33b, 36, 37, 38, 39, 44, 45, 46c Local actions = 39, 40, 41, 42</p> <p>3. ASSESSING THE STATE OF THE ENVIRONMENT AND THE PRESSURES UPON IT National actions = 14, 15, 16, 17a, 17b, 21, 23, 47 Local actions = 14, 15</p> <p>4. PRIORITISING WATERS, SETTING OBJECTIVES AND IMPLEMENTING LOCAL ACTION PLANS National actions = 24, 25, 26, 27, 28, 29, 30, 31, 40, 41, 42, 43 Local actions = 24, 26, 27, 28, 29, 30, 31, 33c, 34, 40, 41, 42</p> <p>5. RESEARCH AND OTHER DEVELOPMENTAL WORK National actions = 5, 13, 18, 19, 21, 22, 23, 30, 32a, 32b, 43, 44, 46a, 46b Local actions = -</p> <p>6. RAISING AWARENESS AND EDUCATING National actions = 6, 7, 27, 45 Local actions = 40, 41, 42, 45</p>				

ANNEXE 2 - SUMMARY OF ACTION UNDER THE MAIN STATUTORY AND INTERNATIONAL COMMITMENTS

The Agency is involved in ongoing eutrophication-related monitoring and control actions under a range of statutory and international initiatives. A brief summary of the main initiatives and the action being undertaken is set out below.

1. ACTIONS IN RESPECT OF STATUTORY OBLIGATIONS

1.1 UWWT Directive

Review of Sensitive Areas (Eutrophic) and introduction of nutrient reduction at STWs

Waters are identified through a continuing four-yearly review of designations by the Government based on ongoing Agency data gathering.

Nutrient reduction treatment (for P and/or N) at qualifying STWs (>10,000 population equivalent) must be introduced within seven years of designation.

- | | |
|------|--|
| 1994 | 33 Sensitive Areas designated in England and Wales
P removal required at 51 STWs from 31 December 1998. |
| 1998 | 47 additional Sensitive Areas designated.
P removal to be required at approximately 100 STWs by 2005 |
| 2001 | Next review of designations. As part of a combined programme for UWWT and Nitrate Directives, approximately 140 waters (around 70 fresh and 70 saline) are being monitored for consideration as potential candidates for designation at that time. These are sites where local knowledge has indicated the need for more detailed investigation of the effects of elevated nutrient levels. Additional waters may also be considered at the 2001 review, should this be warranted on the basis of data gathered for other purposes, providing such data meet Agency quality control standards. Nutrient reduction treatment would need to be installed at the associated STWs by 2008 further to any new designations. |
| 2005 | Further review of designations. |

Cycle continues.

1.2 Nitrate Directive

Potential designation of Nitrate Vulnerable Zones in relation to waters affected by eutrophication due to nitrates from agricultural sources.

To date no waters in England and Wales have been identified as so affected, although 68 NVZs, covering some 600,000 hectares, were designated in 1996, relating to raw drinking water sources with elevated nitrate concentrations. An action programme to control nitrate leaching was introduced within the NVZs in 1998 and enforcement action by the Agency began in early 1999.

Waters are identified and designations by the Government made through a four-yearly review process. Measures to control agricultural nitrate pollution must be introduced within a specified period following designation.

The Agency is assessing certain estuaries and areas of coastal water, as potential candidates for identification as Polluted Waters (Eutrophic) at the next review of NVZ designations in 2001.

1.3 Habitats Directive and SSSI sites agreed for action under the AMP3 National Environment Programme

Under the AMP3 National Environment Programme (for water company investment for 2000-2005), a list of 28 European sites (Special Areas of Conservation and Special Protection Areas) and/or SSSIs has been agreed, where their conservation status is being adversely affected by sewage discharges. As a result of discussions between the Agency, EN/CCW and the water companies, nutrient removal at around 65 nominated STWs is to be required by April 2005 at the latest. The receiving waters are primarily freshwater sites but also include a small number of estuaries. A further list of about 50 STWs is to be subject to further investigation; control action will depend on the outcome of this work.

1.4 Habitats Directive review of consents

The Agency, in collaboration with English Nature and CCW, is undertaking a review of all its environmental licences to determine whether these need to be adjusted to prevent adverse impacts in European sites. In addition, all new licence applications, for activities that may affect such sites, will be subject to the same assessment process. Where nutrient-related impacts such as eutrophication are involved, this may require action to control nutrient inputs.

2. ACTIONS IN RESPECT OF INTERNATIONAL COMMITMENTS

2.1 OSPAR assessment of nutrients entering estuaries

This ongoing monitoring activity is carried out at a list of Harmonised Monitoring points. Nutrients are among a range of parameters that, together with flow, are measured and riverine loadings passing to the sea (in reality to estuaries) are calculated for OSPAR reporting purposes. The regime is defined.

2.2 OSPAR 1998 strategy to combat eutrophication

This activity is in its early stages and requirements have yet to be fully defined. It will involve monitoring and assessment of waters (to determine eutrophication status) and estimation of nutrient contributions from land-based sources. It may potentially require control measures (on STWs and agriculture) if waters are identified as suffering from potential or actual eutrophication problems. It applies to those coastal waters and estuaries around England and Wales subject to a "comprehensive procedure" under the OSPAR strategy. This means all waters other than those agreed as non-problem areas following the application of a "screening procedure". The precise monitoring and assessment requirements have yet to be defined, but for inshore waters, the UK's National Marine Monitoring Plan and EC Directives (UWWT and Nitrates) monitoring programmes are likely to be the main sources of data. The assessment of eutrophication status must be completed by 2002.

2.3 UK BAP Habitat Action plans for meso- and eutrophic standing waters

These are very wide ranging plans, in which we are one of a number of key partners. Activities are in the early stages. They involve national and local level work, much of which is that proposed under the Agency's eutrophication strategy, for example, defining criteria, identifying and prioritising waters, introducing local action plans, and national collaboration to reduce nutrient inputs from key sources. The objective is to classify waters, to protect high-priority waters which are in a favourable condition, to restore other prioritised waters that have been damaged by human activity and to prevent deterioration of water quality and wildlife interest.

ANNEXE 3 - SOURCES OF NUTRIENT INPUTS TO WATER

Nutrient sources can be broadly segregated into two categories: readily identifiable point sources (such as sewage treatment works) and diffuse sources (such as the runoff from agricultural land). The contributions, in any given catchment, of nutrient inputs from different sources, are variable and depend on the nature of the catchment, environmental conditions and the impact of human activities. However, as discussed in the consultative report, approximate national estimates of the relative contributions from the main nutrient sources give a useful indication as to where we might best target control initiatives.

The contributions (in percentage terms) of the main sources of **phosphorus** entering surface waters in the EU (average for 12 countries including the UK) are shown in **Figure 2** (Morse et al, 1993).

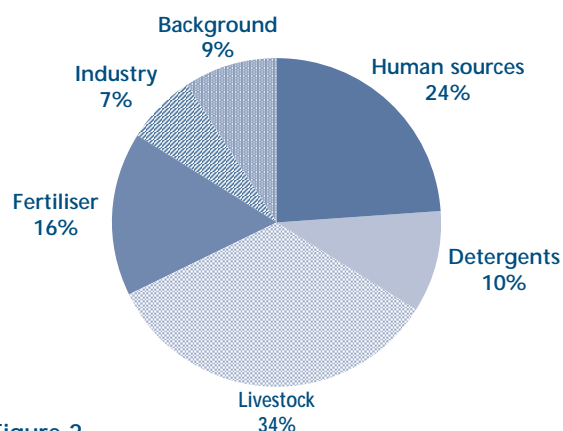


Figure 2.

For **nitrogen**, inputs to fresh waters in Europe come principally from diffuse sources, particularly agriculture, although point sources (usually urban waste water) also contribute significantly in many regions (European Environment Agency, 1998). Nitrate, derived predominantly from agricultural runoff, is the major form of inorganic N in lowland fresh waters in the UK; in upland waters, nitrate levels are generally correlated with atmospheric inputs of N (DoE, 1994). In England and Wales, 70 per cent of the total input of nitrogen to inland surface waters is estimated to come from diffuse sources (agriculture, precipitation and urban runoff, in order of decreasing importance). The remaining 30 per cent comprises sewage and industrial effluents (The Royal Society, 1983). With regard to atmospheric N deposition in the UK, agriculture is the largest source, deriving primarily from ammonia emissions from livestock husbandry, the remainder originating mainly from NO_x emissions from vehicles and power stations (DoE, 1994).

ACRONYMS

AMP3	Asset Management Plan 3
CAP	Common Agricultural Policy
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CCW	Countryside Council for Wales
CLA	Country Landowners Association
CMPs	Catchment Management Plans
DETR	Department of the Environment, Transport and the Regions
EC	European Community
ECAP	Eutrophication Control Action Plan
EEA	European Environment Agency
EHO	Environmental Health Officer
EN	English Nature
EU	European Union
FACTS	Fertiliser Advisers Certification and Training Scheme
FMA	Fertiliser Manufacturers Association
FWR	Foundation for Water Research
IPPC	Integrated Pollution Prevention and Control
LEAF	Linking Environment and Farming
LEAP	Local Environment Agency Plan
MAFF	Ministry of Agriculture, Fisheries and Food
N	Nitrogen
NAW	National Assembly for Wales
NAWAD	National Assembly for Wales Agriculture Department
NFU	National Farmers Union
NGO	Non-governmental organisation
NRA	National Rivers Authority
OECD	Organisation for Economic Co-operation and Development
OSPAR	Oslo and Paris Convention
P	Phosphorus
R&D	Research and development
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STW	Sewage treatment works
TCM	Total Catchment Management
UK	United Kingdom
UKWIR	UK Water Industry Research
UWWT	Urban Waste Water Treatment

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