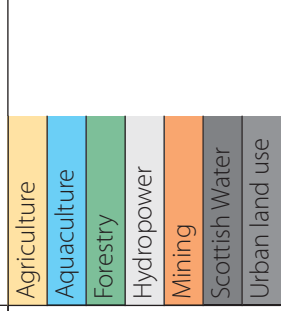
natural scotland
SCOTTISH GOVERNMENT

The river basin management plan for the Scotland river basin district 2009–2015

Chapter 3:
Achieving our environmental objectives

Chapter guide*

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*Appendices for this document are available on the SEPA website at: www.sepa.org.uk/water/river_basin_planning.aspx

Part A - Overview of the programme of measures

1. Introduction

This Chapter sets out how we plan to achieve our objectives for the water environment. It describes the measures we will take to manage pressures on the Scotland river basin district's (the Scotland RBD) waters and the arrangements we have put in place to co-ordinate our work to ensure we achieve our goals.

We have a long and successful track record of protecting and improving the quality of Scotland's waters through action to prevent and reduce pollution. Between 2000 and 2006 alone we reduced the length of rivers in Scotland that were affected by pollution by 37%[1]. Much of this improvement in water quality has been delivered through nationally agreed investment programmes with Scottish Water in sewage collection and treatment. Other significant contributions have included work by the Coal Authority to intercept polluted water from abandoned mines and so prevent it entering rivers.

The programme of measures we will use to achieve our objectives builds on previous pollution reduction and control programmes. For example, it includes SEPA's extensive work with businesses and industry to prevent and control water pollution. It also includes the Scottish Government's:

- ongoing investment planning process to enable Scottish Water to reduce pollution from sewage disposal and to reduce pressures resulting from drinking water supply;
- ongoing work with farmers to reduce pollution from the use of nitrate-containing fertilisers;
- economic incentives for encouraging good farming practice.

However, the breadth of the programme is far greater than that of any previous programmes and the pressures it addresses are not limited to pollution pressures. Among other things, the programme includes measures to control and manage over-abstraction of water, the damming of rivers and building and engineering works that have caused damage to the beds, banks and shores of surface waters.

At its heart is a comprehensive new legislative framework for ensuring action on all the most significant pressures on the water environment. The framework is supported by economic incentives and funding to encourage and support action, and the use of education and advice to promote and facilitate it.

The task now is for us - the Scottish Government, SEPA, designated responsible authorities and all Scotland's other public bodies - is to ensure that our plan for action is put into practice[2]. SEPA will publish an interim report in 2012 describing our success in doing so.

[1] www.sepa.org.uk/science_and_research/data_and_reports/water/water_environment_review_2006.aspx

[2] Where used in this Chapter, "we", "our" and "us" are references to the Scottish Government, SEPA, designated responsible authorities and all Scotland's other public bodies.

2. Managing pressures on the water environment

To achieve our objectives we need to manage pressures on the water environment by preventing increases that would cause deterioration of status and reducing those that are causing water bodies to be at less than good status. Reducing pressures in a sustainable way will enable the water environment to recover and place Scotland in a better position to cope with the effects of climate change.

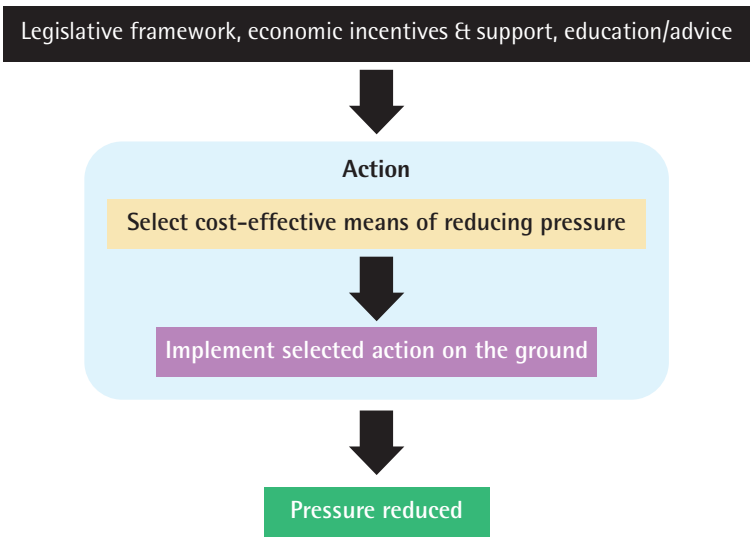
2.1 How we will ensure action

The actions we need to achieve our objectives include reductions in the amount of water being abstracted, further reductions in the quantities of pollutants being discharged and work to restore the banks, beds and shores of surface waters to a more natural condition.

To ensure such actions are taken, we have put in place a new legislative framework, supplemented by economic incentives, funding support and appropriate education and advice (Figure 1).

Those whose activities are putting pressure on the water environment will be responsible for taking the necessary actions to reduce their pressures. There may be several ways they can achieve this. For example, options for reducing water abstraction might include reducing the amount of water wasted through leakage or drawing water from another part of the water environment that is under less pressure. We will work with those required to take action to help them identify the most cost-effective means of reducing pressures.

Figure 1: Process of achieving our objectives by reducing pressures on the water environment



The different means of encouraging and ensuring action are complementary and often most cost-effective when used in combination. Providing education and advice is important to help people understand how to meet legislative requirements. Similarly, economic incentives and funding can enable people to put advice into action where they might not otherwise be able to do so.

Example of how our legislative framework is complemented by education and advice

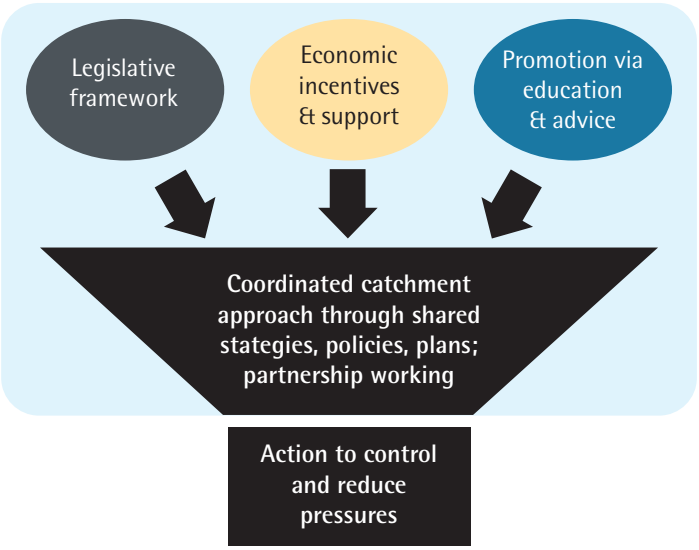
Our legislative framework requires new urban developments to be drained using sustainable urban drainage systems designed to prevent water pollution. For anyone involved in the planning and design of such systems, guidance on these requirements and on different technical options for achieving them is available from SEPA and the Construction Industry Research and Information Association (Ciria)[3].

[3]www.sepa.org.uk/water/water_publications/suds.aspx; www.ciria.org.uk/suds/

2.2 How we will deliver a co-ordinated approach

To make best use of the different mechanisms and to ensure integrated river basin management, the work of different public sector bodies and other private and voluntary organisations needs to be co-ordinated. A joined-up approach is therefore at the heart of our programme of measures and we will achieve it through shared strategies, detailed supplementary plans and partnership working arrangements (Figure 2) for tackling pressures.

Figure 2: Co-ordinating work to encourage and ensure action to control and reduce pressures



The Scottish Government has established a cross-government river basin management planning network to help integrate our objectives for the water environment into decision-making and action across all relevant areas of government policy. The network will provide a forum for continued policy integration as this plan is implemented.

Scottish Ministers have further strengthened the integrated approach by amending legislation applying to:

- marine and coastal activities;
- aquaculture and freshwater fisheries;
- agriculture;
- sustainable transport;
- land use planning;
- sustainable flood management and surface drainage;
- water supply;
- biodiversity conservation;
- bathing waters;
- programmes for tackling pollution by agricultural nitrates.

Our objectives for the water environment will now be integrated into decision-making and action under this legislation.

Further details about how our legislative framework has been designed to ensure an integrated approach can be found in *Implementing the Water Environment and Water Services (Scotland) Act 2003: Promoting an Integrated Approach - A Policy Statement*

Scottish Ministers have also identified a number of responsible authorities[4] to work alongside Scottish Ministers and SEPA to deliver a co-ordinated approach[5]. The designated responsible authorities are:

- British Waterways Board;
- district salmon fisheries boards;
- Fisheries Committee[6];
- Forestry Commission Scotland;
- local authorities;
- national parks authorities;
- Scottish Natural Heritage;
- Scottish Water.

In addition, all other public bodies will take this plan and its objectives into account when doing anything that could affect the water environment.

SEPA has established:

- a national advisory group[7];
- eight area advisory groups[8];
- a rural diffuse pollution management advisory group;
- a fish and fisheries advisory group[9];
- a sustainable urban drainage advisory group[10].

These groups:

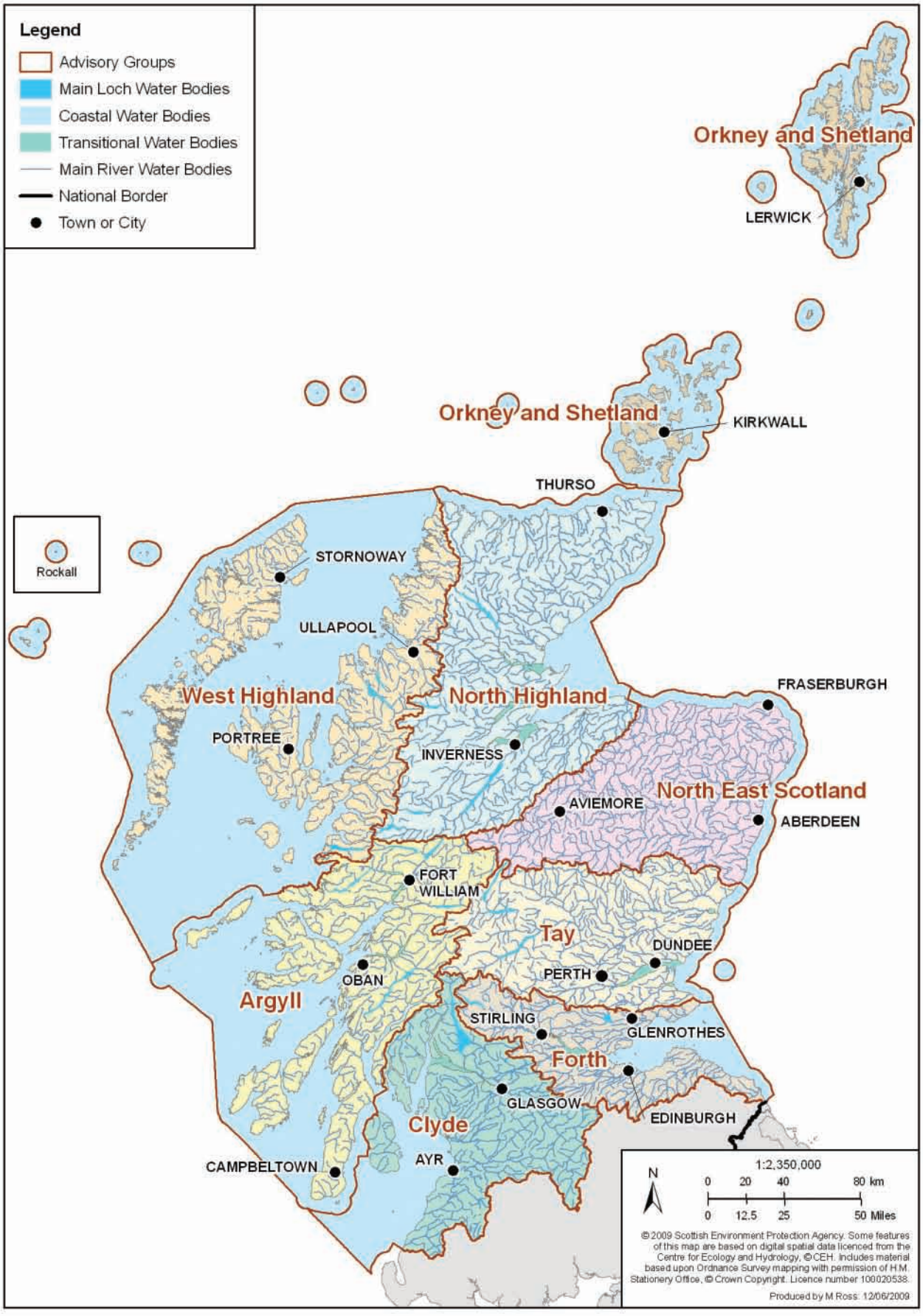
- bring together relevant public bodies, representatives of business sectors that use the water environment, land managers, voluntary environmental organisations and recreational users;
- provide a focus for communication and coordination between the different public bodies and for partnership initiatives between public bodies, the private sector and environmental non-government organisations;
- help secure integration by embedding our goals for the water environment into the plans and policies of their member organisations;
- advise on how the different ways of encouraging and ensuring action might be further developed to increase the cost-effectiveness of our programme of measures.

The area advisory groups operate in different parts of the river basin district (See Map 1). They will continue to assist SEPA with the development of area management plans. The area plans will be completed in the spring of 2010 and will describe:

- the measures needed to manage the pressures on the water environment in each group's area of the river basin district;
- how the members of the area advisory groups will contribute to encouraging and ensuring action at a local level (eg by helping to implement plans for tackling rural diffuse pollution in their area).

[4]www.opsi.gov.uk/legislation/scotland/ssi2008/ssi_20080263_en_1
[5]*Implementing the Water Environment and Water Services (Scotland) Act 2003: The Designation of Responsible Authorities.* A Policy Statement and Regulatory Impact Assessment: Paper 2006/5: March 2006
[6]The Fisheries Committee currently provides advice on the effects of hydro-electric schemes on fish, however, this role is under review.
[7]Further information on the national advisory group can be found on SEPA's website www.sepa.org.uk/water/river_basin_planning.aspx
[8]Further information on the area advisory groups can be found on SEPA's website www.sepa.org.uk/water/river_basin_planning.aspx
[9]The fish and fisheries advisory group includes representatives of district salmon fishery boards, Fisheries Committee, Rivers and Fisheries Trusts of Scotland, Scottish Government, Scottish Natural Heritage and SEPA.
[10]Sustainable Urban Drainage Working Party

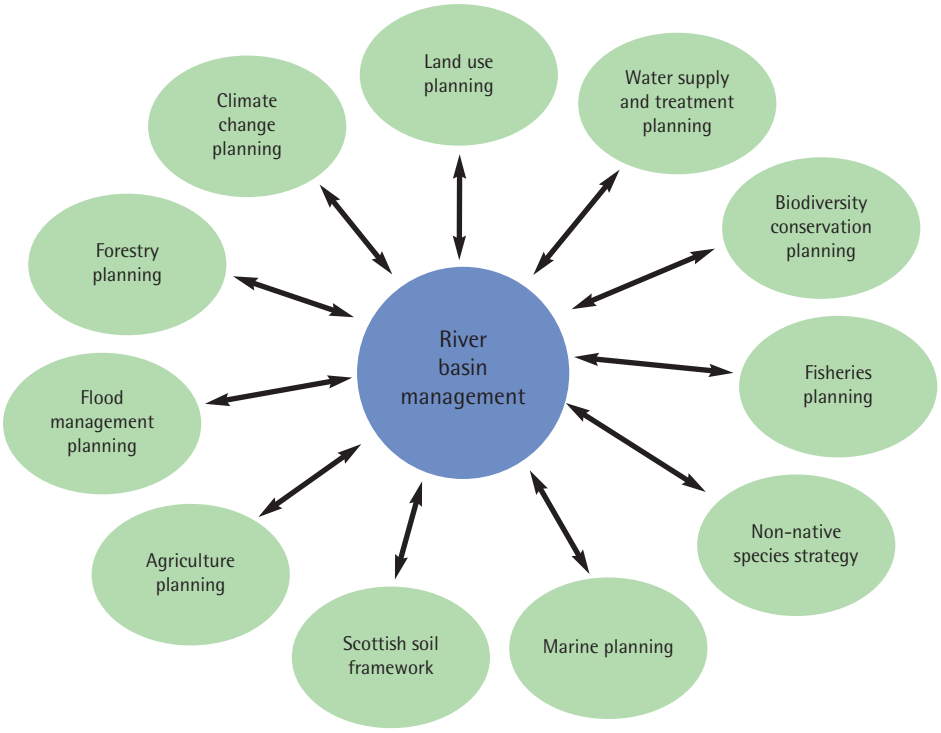
Map 1: The different areas of the Scotland RBD served by the eight area advisory groups



Our integrated approach will help ensure that we maximise the contributions that:

- the wide range of Government and public sector policies and plans relating to land and water management (Figure 3) can make to achieving our objectives for the water environment;
- implementing our programme of measures makes to achieving other objectives (eg for sustainable flood risk management).

Figure 3: Two-way integration of river basin management and key plans and strategies



2.3 Identifying cost-effective on-the-ground solutions

We want to ensure we achieve our objectives as cost-effectively as possible and this relies on the most cost-effective on-the-ground solutions being used to reduce pressures. Well-designed solutions will often deliver multiple benefits, keep carbon costs as low as possible and be future proofed against a changing climate. We will work with those responsible for taking action to reduce pressures, encouraging innovation, providing information and advice and allowing them time to explore their different options.

To help future appraisals of the costs and benefits of different options, we have contributed to a collaborative programme for research on river basin planning economics co-ordinated by the UK Government. The programme was established in 2004 and ran to 2008. Its outputs include methods for assessing cost-effectiveness, a database of benchmark costs for a range of different options for tackling pressures and a preliminary cost-effectiveness analysis of possible solutions for addressing the main pressures on the water environment[11].

In the process, we may find that our objectives can be achieved earlier than planned. In other cases, we may find that making the necessary reductions in pressures is not feasible or would be disproportionately expensive and so require us to review our objectives.

Where action on the ground could affect other people's interests or be insufficient to achieve our objectives, we will ensure that there is further public consultation before decisions are made.

[11]Defra, UK - Environmental Protection - Water - Water Framework Directive www.wfdcrp.co.uk/

3. Legislative framework

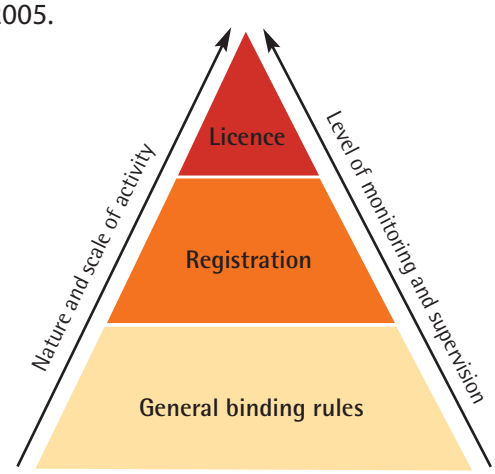
Scottish Ministers have established a comprehensive new legislative framework for controlling significant pressures on the water environment. At the centre of this framework are the Water Environment (Controlled Activities) (Scotland) Regulations 2005. The regulations require prior authorisation for a wide range of activities liable to have an adverse impact on the water environment, including:

- activities liable to cause pollution of the water environment;
- abstraction of water from the water environment;
- the construction, alteration or operation of impounding works (eg dams and associated water diversions) in surface waters;
- carrying out of building, engineering, or other works in rivers and lochs or in the vicinity of those waters and likely to have a significant adverse effect on them[12];
- artificial recharge or augmentation of groundwater.

Before 2006, polluting discharges were controlled by SEPA under the Control of Pollution Act 1974 (CoPA). However, legislative controls on other significant pressures were disparate and incomplete in their coverage. Where they did exist, protection of the water environment was not necessarily their primary purpose. Our new regulatory framework provides a much more streamlined and flexible regulatory control regime than our previous pollution control regime. It also marks a step-change in SEPA's ability to manage pressures on the water environment in a comprehensive, proportionate and cost-effective way.

The regulations provide for three tiers of control: authorisation under general binding rules, registration and licences (see Figure 4). The tiered approach allows the level of regulatory effort to be in proportion to the environmental risk posed by the activity. This, combined with the streamlining of previous disparate legislative controls into a single, cohesive system, makes the new framework a cost-effective means of ensuring improvements.

Figure 4: Tiers of prior authorisation under the Water Environment (Controlled Activities)(Scotland) Regulations 2005.



In 2008 we developed the regulations further with respect to diffuse sources of pollution by introducing a series of general binding rules. These are applicable to a wide range of controlled activities that can give rise to such pollution (eg the application of fertiliser to land used for agriculture or forestry).

The regulations provide SEPA with a flexible framework for ensuring action by those whose activities are placing the water environment under pressure: SEPA can vary conditions of authorisation (eg on how much water can be abstracted) at any time. SEPA can also take economic, environmental and social considerations into account in its decision-making on authorisations. This ensures, for example, that conditions are not imposed that would require action that would be disproportionately expensive.

[12]The carrying out of engineering works in estuaries and coastal waters is controlled through a separate regulatory control regime administered by the Scottish Government.

Further details about the Water Environment (Controlled Activities) (Scotland) Regulations can be found in *The Water Environment (Controlled Activities) (Scotland) Regulations 2005: Policy Statement and Regulatory Impact Assessment*[13].

The Scottish Government has taken a number of other legislative steps to ensure we have a comprehensive and integrated legislative framework for achieving our objectives. Pre-existing environmental legislation that overlaps with the scope of the 2005 Regulations has been aligned with our objectives and with the 2005 Regulations. Further details can be found on the Scottish Government's at:
www.scotland.gov.uk/Topics/Environment/Water/WFD/RegulatoryFramework

The Scottish Government is also planning to streamline and further strengthen our existing legislative framework[14] for controlling impacts on the beds and shores of estuaries and coastal waters. The proposals are set out in the Marine (Scotland) Bill, which was introduced to the Scottish Parliament in April 2009[15].

Some of the most severe impacts on the water environment are the result of pressures remaining from past activities. The integration of our objectives into plans and programmes of work on related land and water management issues (eg flood risk management, biodiversity, forestry and land use planning) will create opportunities to tackle such pressures as part of achieving other policy objectives. However, to ensure action is taken, the Scottish Government is preparing to introduce further legislation. This will provide a tiered set of regulatory powers for SEPA and other bodies enabling them to require restorative action or to take it themselves. Further details of the Government's proposed strategy can be found in *Implementing the Water Environment and Water Services (Scotland) Act 2003: Restoration of the water environment: A Consultation*[16].

Water pollution can sometimes be most cost-effectively tackled at source through controls on what substances can be included in products and on how products are then used. The Scottish Government will continue to work with the UK government on ensuring marketing and use restrictions are put in place where appropriate and cost-effective.

[13] *The Water Environment (Controlled Activities) (Scotland) Regulations 2005: Policy Statement and Regulatory Impact Assessment*
www.scotland.gov.uk/Publications/2005/05/0995747/57525
[14] The existing framework includes the Food and Environment Protection Act 1985 and the Coast Protection Act 1949.
[15] www.scotland.gov.uk/Topics/Environment/16440/marine-bill-consultation
[16] *Implementing the Water Environment and Water Services (Scotland) Act 2003: Restoration of the water environment: A Consultation*
www.scotland.gov.uk/Publications/2008/12/18145403/0

4. Economic incentives and support

Economic incentives and funding encourage and enable voluntary initiatives and ease the burden on those required to take action under our regulatory framework. Voluntary initiatives can make an important contribution to achieving our objectives. Many of those involved in such initiatives have considerable skills and experience in designing projects and of attracting support from the many public and private sources of potential funding.

Examples of economic incentives and funding support that will be used to help achieve our objectives include:

- Rural development contracts under the Scotland Rural Development Programme (SRDP). These provide financial support for voluntary initiatives by land managers and voluntary groups[17], including removal of river embankments, establishment of buffer strips alongside rivers and the creation of wetlands.
- Public funding of investment by Scottish Water to reduce pressures from water abstraction and impoundment for public drinking water supply and from sewage disposal.
- Restoration funding from Scottish Government to enable SEPA to provide financial support for restoration projects to address the impacts of past activities.
- Charges for water use licences issued under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 which vary depending on the scale of the activity and the relative risk posed to the water environment. Small, low risk activities are charged only a small fee by SEPA. Activities undertaken solely to improve the condition of the water environment are not charged at all.

[17]Scotland Rural Development Programme

5. Education and advice

Education and advice raise understanding of what needs to be done and why, encourage action and disseminate good practice. Education is a two way process: land managers, industry and voluntary organisations as well as public authorities all have knowledge and expertise to contribute. We will make sure that we share and apply this knowledge to help achieve our objectives as cost-effectively as possible.

Our initiatives to ensure that action is based on good information and advice include:

- bringing together experts from public bodies, industry and voluntary organisations in SEPA's various advisory groups (see Section 2.2 above);
- collaborating on research into new techniques for improving the water environment;
- consulting on proposed new legislation and guidance;
- publishing good practice guidance. Examples include guidance to farmers[18], forest managers[19], and those undertaking a wide range of other activities that can cause pollution[20];
- providing one-to-one advice to those responsible for pressures on the water environment. Examples include the work of Scotland's Environmental And Rural Services (SEARS) with rural land managers, and the work of SEPA staff with those carrying out, or intending to carry out, controlled activities;
- supporting voluntary groups involved in delivering education and advice;
- facilitating discussions between water users to find and agree solutions (see box below).

Agreements reached between water users on how they can sustainably share the use of the water environment can help us achieve our objectives as cost-effectively as possible. Such agreements allow a number of water users to co-ordinate their activities to better protect the water environment and their own interests. By coming together, they can better understand each other's business needs and, by working with SEPA, the needs of the water environment.

For example, several water users (eg potato farmers) may agree on how to time their abstractions so that they are not all abstracting simultaneously or on how they should contribute to the management of shared water storage ponds that could then support summer abstractions. SEPA will work with water users interested in establishing such agreements and take account of them in setting conditions of authorisation under our legislative framework.

[18]Agricultural Best Management Practices (BMPs) http://apps.sepa.org.uk/bmp/
[19]www.forestry.gov.uk/pdf/FCGL002.pdf/$FILE/FCGL002.pdf
[20]www.environment-agency.gov.uk/netregs/links/63875.aspx

Part B - Summaries of how we are tackling different pressures

6. What you can find in this part of the chapter

The following sections provide more detailed summaries of our planned measures for managing the water and land uses responsible for the most significant pressures on:

- water quality;
- water flows and levels;
- the condition of the beds, banks and shores of surface waters;
- barriers to fish migration.

You will also find a summary of how we plan to prevent the introduction and spread of non-native invasive water plants and animals.

The summaries cover land and water use activities that are either adversely affecting a substantial number of water bodies or posing a significant risk of doing so. Summaries are not provided for land and water uses that affect relatively few water bodies. However, information about the measures applying to all pressures on the water environment are available on the interactive map on SEPA's website at: http://gis.sepa.org.uk/rbmp/

The summaries include information about:

- how management of the pressures will be coordinated;
- the mechanisms that will be used to ensure action is taken;
- examples of expected on-the-ground actions.

The actual combination of on-the-ground actions used will vary depending on what proves to be most appropriate and cost-effective in the case of the water body concerned.

SEPA has undertaken preliminary climate checks of the actions needed to reduce pressures on the water environment. The results of the checks are presented in the summaries below. The assessment gives a general indication of any likely significant implications of the different on-the-ground actions in terms of:

A. greenhouse gas emissions;

B. preparing Scotland for a future climate (eg whether the action will help us better cope economically, environmentally or socially with hotter, drier summers);

C. the action's continued effectiveness under Scotland's predicted future climate.

The considerations on which the preliminary checks were based are described in Table 1 together with keys for interpreting the results. More detailed information on SEPA's assessments of the continued effectiveness of actions under a changed climate is on SEPA's website.[21]

We will use the outcome of the check to advise those taking action on whether a solution is likely to:

- contribute to meeting the challenges of climate change;
- need to be designed with Scotland's future climate in mind if its effectiveness is to be maintained;
- have one or more negative effects in terms of greenhouse gas emissions or preparing Scotland for a future climate. Where such actions are necessary to achieve our objectives, we will work to ensure that their negative effects are minimised as far as possible and balanced by the overall benefits of improving the water environment.

[21]Appendix B of the Environmental Report for the Strategic Environmental Assessment for this plan which can be found at: www.sepa.org.uk/water/river_basin_planning.aspx

Table 1: Considerations on which the preliminary climate check is based

A. Greenhouse gas emissions			B. Preparing Scotland for a future climate			C. Action's continued effectiveness under a changed climate		
• Will the solutions lead to an increase or decrease in greenhouse gas emissions? • Will the action help capture carbon in the soil or in vegetation? • Will the action reduce energy use in the long-term?			**Flood risk** • Will the action increase or decrease flood risks under wetter winters, more intense rainfall and higher sea levels? **Drought** • Will the action help us maintain water uses in periods of drought caused by hotter, drier summers? **Ecosystem services** • Will the action make wildlife more or less resilient to a changed climate? • Will the action help sustain economically important water uses in a changed climate (eg fisheries, tourism, agriculture, etc)? • Will the action enable the water environment to continue to recycle our wastes under a changed climate?			• Will the action remain effective under: – wetter winters and more intense rainfall? – drier summers? – higher sea levels? • If not, can it be easily adapted in the future so that it is effective?		
Key to A			**Key to B**			**Key to C**		
Net emissions reduced	Net emissions increased	No likely significant change either way	Expected to make us better prepared	May make us less able to cope	No likely significant effect	Resilient and unlikely to need adapting or very flexible	Resilient but may need to be adapted or supplemen-ted	Not resilient or easily adapted

As part of the process of developing the programme of measures, SEPA has also undertaken:

- a strategic assessment of the likely positive and negative effects of this plan on the environment as a whole[22]. The results of this assessment are available on SEPA's website[23];
- an assessment of the effects of this plan on sites forming part of the European network for the conservation of plants and animals. The results of this assessment are also available on SEPA's website[24].

[22]This has been undertaken to fulfil the requirements of Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment

[23]www.sepa.org.uk/water/river_basin_planning.aspx

[24]www.sepa.org.uk/water/river_basin_planning.aspx

7. Managing pressures on water quality

This section provides a summary of the measures we will take to ensure that activities that can cause the most significant pressures on water quality are appropriately managed. Similar measures will be taken to address all other activities liable to cause pollution.

Ensuring action to prevent and reduce pollution by toxic pollutants

As well as helping achieve our objectives for protecting and improving the status of water bodies and for protected areas, the programme as a whole will:

- progressively reduce pollution by priority substances and cease discharges, emissions and losses of the most hazardous of these;
- prevent inputs of hazardous substances[25] into groundwater and limit inputs[26] of others to protect groundwater from deterioration[27].

Our programme for achieving our goals for these toxic pollutants includes:

- SEPA's regulation under the Water Environment (Controlled Activities)(Scotland) Regulations 2005 of activities liable to cause pollution;
- SEPA's regulation of hazardous waste management;
- SEPA's work with operators of industrial installations to ensure integrated pollution prevention and control;
- work by local authorities and SEPA to prevent and reduce pollution from contaminated land;
- controls established by the UK Government on the marketing and use of pesticides and other toxic pollutants. For example, the majority of priority substances and other pollutants identified at European-level as posing a particular risk to the water environment are already subject to marketing and use restrictions or complete bans (eg bans on DDT).

SEPA is preparing pollution reduction plans which will provide the focus for coordinating work to prevent and reduce pollution by priority substances and other toxic pollutants.

Accidental pollution incidents

Preventing and reducing the impact of accidental pollution is an important part of our work to protect the water environment. Steps to prevent such incidents are a key objective of the broad legislative framework[28] of environmental protection that is already in place in Scotland.

For activities requiring a permit or licence from SEPA, accident prevention measures are included as conditions of authorisation. SEPA regulates a wide-range of activities through permitting systems, including the controlled activities described in the following sections. Major accidents involving dangerous substances can pose a particularly significant threat to human health and the water environment. SEPA and the Health and Safety Executive ensure that establishments where such substances are present in significant quantities have in place appropriate systems to prevent accidents and contingency plans to reduce impacts should they occur[29].

Our framework of environmental legislation also places responsibilities on those whose activities are not necessarily controlled by permitting systems, such as requirements in relation to the storage of oil[30]. More generally, all those involved in the use, transport or disposal of a wide range of pollutants are under a duty to prevent environmental damage being caused by their activities and liable to remedy any environmental damage should it occur[31].

Comprehensive and targeted guidance is available to help individuals and organisations take the steps required of them to avoid accidentally causing pollution of the water environment[32].

[25] A list of these substances can be found on SEPA's website at: www.sepa.org.uk/water/water_regulation/regimes/groundwater/discharges.aspx
[26] Direct inputs (ie without percolation through the overlying soils etc) of pollutants into groundwater are not normally permitted under our regulatory framework. However, construction or maintenance works in the ground can come into contact with groundwater and this may result in such direct entry of pollutants. Authorisation of these works under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 requires that they are undertaken in accordance with general binding rules designed to prevent groundwater pollution.
[27] Deterioration includes any significant and sustained upward trend in the concentration of pollutants in groundwater.
[28] www.netregs.gov.uk/netregs/legislation/current/63570.aspx
[29] The Control of Major Accident Hazards Regulations 1999
[30] The Water Environment (Oil Storage) (Scotland) Regulations 2006
[31] For example, under the Environmental Liability (Scotland) Regulations 2009
[32] Examples of guidance can The Water Environment (Oil Storage) (Scotland) Regulations 2006.be found at: www.netregs.gov.uk/netregs/63294.aspx

7.1 Measures to prevent and reduce diffuse pollution from agricultural sources

In Scotland over 6 million hectares of land (more than 75% of the country's land area) are used for agricultural purposes. Around 65% of this land is rough grazing. Improved grassland and land used for crop production accounts for around 30% and tends to be concentrated in the more fertile valleys and land along the east coast and in the south west.

Diffuse pollution from agricultural sources is normally the result of cumulative inputs of pollutants from numerous different sources on farms within the catchments of the affected water bodies. Consequently, tackling diffuse pollution requires concerted action across river catchments. We will ensure this by working with farmers to raise awareness about the requirements for preventing and reducing pollution and to help them identify appropriate actions for doing so.

In developing these programmes of action, we will build on our previous experience of coordinating work to address diffuse pollution problems, such as those used to improve bathing waters including the Ayrshire bathing waters environmental improvement action plan and the Brighouse Bay project.

7.1.1 How we will coordinate our work to encourage and ensure action

SEPA has recently created a new Diffuse Pollution Management Advisory Group (DPMAG), which is a partnership of a range of relevant authorities, land manager representatives and voluntary organisations. The DPMAG will:

- develop a detailed plan for using our legislative, economic and educational mechanisms for tackling diffuse pollution;
- contribute to the plan's implementation and its on-going development.

The Scottish Government has also brought together nine public bodies to form Scotland's Environmental and Rural Services (SEARS)[33]. This partnership will contribute to implementing plans for tackling diffuse pollution by providing coordinated education and advice (awareness raising, training, guidance) to rural land managers. SEPA's SEARS partners will also carry out farm inspections on behalf of SEPA to check that good environmental practice requirements are being met.

7.1.2 How we are ensuring action is taken to prevent deterioration of status

In securing action to prevent deterioration of status, we will take account of expected changes in agricultural land use, including those arising in response to climate change. The legislative, economic and educational mechanisms we will use to help prevent deterioration will include those set out in Table 2 below.

In addition, the Scottish Government will require an assessment of the environmental effects of proposals involving a) the conversion of uncultivated land and semi-natural areas for intensive agricultural purposes and b) the large scale restructuring of rural land holdings involving agricultural land before such proposals are allowed to proceed[34].

7.1.3 How we will ensure action is taken to reduce pollution from agricultural sources

Table 2 below summarises the principal measures for improving the water quality of surface waters and groundwater affected by diffuse pollution from agricultural sources.

Action will be based on a two tier strategy comprising:

- a new national campaign of awareness raising to promote compliance with the requirements of the Water Environment (Controlled Activities)(Scotland) Regulations 2005. The campaign will:
  - be organised and delivered by SEPA, its SEARS partners and members of SEPA's Diffuse Pollution Management Advisory Group. SEPA's area advisory groups will contribute to awareness raising efforts in their local areas;
  - involve a comprehensive programme of guidance and training for land managers on required good environmental practices;
  - include farm inspections to check good practices are being adopted.

[33]The SEARS partners are Animal Health, Cairngorms National Park Authority, Crofters Commission, Deer Commission for Scotland, Forestry Commission Scotland, Loch Lomond and The Trossachs National Park Authority, SEPA, Scottish Government and Scottish Natural Heritage. Further information on SEARS can be found on its website at: www.sears.scotland.gov.uk

[34]Environmental Impact Assessment (Agriculture) (Scotland) Regulations 2006

- additional targeted efforts to improve the management of diffuse pollution within river catchments identified as "priority" catchments because:
  - diffuse pollution from agriculture is preventing the achievement of our objectives;
  - the scale of pollution reduction needed will require planned and targeted actions to be identified in discussion with the farmers concerned.

  The additional efforts will include:
  - enhanced awareness raising of what is required;
  - assistance in identifying pollution hotspots;
  - one-to-one advice on necessary actions.

Agricultural industry bodies such as Scottish Rural Property and Business Association (SRPBA) and the National Farmers Union of Scotland (NFUS) will also continue to play a direct and important role in increasing farmers' awareness of environmental good practice. Examples of existing industry-led initiatives include the Pesticides Voluntary Initiative[35] and the Sheep Dip Pollution Reduction Programme.[36]

Advice provided by SEPA and its SEARS partners will be based on current guidance on good environmental practice requirements including:

- SEARS diffuse pollution information leaflets[37];
- Code of Good Agricultural Practice (PEPFAA code)[38];
- Scottish Best Management Practice Handbook[39];
- Practical Guide to the Water Environment (Controlled Activities)(Scotland) Regulations (2005)[40];
- Scottish Natural Heritage Targeted Inputs for a Better Rural Environment (TIBRE) initiative[41];

[35] www.voluntaryinitiative.org.uk
[36] www.sepa.org.uk/land/agriculture/sheep.aspx
[37] www.sepa.org.uk/water/water_regulation/regimes/pollution_control/diffuse_pollution.aspx
[38] www.scotland.gov.uk/Resource/Doc/37428/0014235.pdf
[39] www.sepa.org.uk/bmp
[40] www.sepa.org.uk/water/water_regulation.aspx
[41] www.snh.org.uk/tibre

Table 2: Summary of our planned measures for reducing agricultural diffuse pollution

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced nutrient inputs to the water environment	**Control at source** manage nutrient (fertiliser) use to minimise losses to the water environment; implement in-field measures to minimise soil erosion and compaction; separate clean and dirty water at farm steadings **Intercept and store/treat** install buffer zones, including woodland planting and wetlands; capture polluted run-off from steadings (eg in constructed farm wetlands); install new slurry storage systems.	Farmers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005; Control of Pollution (Silage, Slurry, and Agricultural Fuel Oil) (Scotland) Regulations 2003. The Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations (2008)	SEPA (SEARS partners help with inspections)
				Scottish Government
			Economic Scotland Rural Development Programme; cross-compliance and good agricultural and environmental condition (GAEC) (Cross-Compliance) (Scotland) Regulations 2004	Scottish Government
			Education and advice education initiatives including: • national awareness raising campaign; • work with farmers in priority catchments; • trial catchment projects; • demonstration farms.	SEPA, members of the Diffuse Pollution Management Advisory Group (DPMAG), Area Advisory Group (AG) members, SEARS partners; Scottish Rural Property and Business Association (SRPBA), National Farmers Union Scotland (NFUS), Scottish Agricultural College (SAC) and other advisory bodies.
Reduced pesticide inputs to the water environment	**Control at source** test and maintain pesticide sprayers; apply integrated crop management techniques to manage reduce pesticide losses to the water environment. **Intercept and store/treat** install buffer strips, biobeds	Farmers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA (SEARS partners help with inspections)
			legislation on the sale and use of pesticides, including: Food and Environment Protection Act 1985 Part III, Plant Protection Products (Scotland) Regulations 2005; Control of Pesticides Regulations 1986	Health and Safety Executive, local authorities, Scottish Government, SEPA
			Economic Scotland Rural Development Programme; Cross-compliance and Good Agricultural and Environmental Condition (GAEC)	Scottish Government
			Education and advice Education and advisory services including: • development and promotion of guidance; • delivery of on-site advice; • Voluntary Initiative for Pesticides[42]; Sheep Dip Pollution Reduction Programme.[43]	SEPA, members of the DPMAG and AAGs and SEARS partners; SRPBA, NFUS, SAC and other advisory bodies.

[42] www.voluntaryinitiative.org.uk
[43] www.sepa.org.uk/land/agriculture/sheep.aspx

Table 2: Summary of our planned measures for reducing agricultural diffuse pollution (continued)

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced inputs of organic waste (organic matter, faecal pathogens, and ammonia) to the water environment	**Control at source** control access of livestock to surface waters; manage waste stores to minimise losses to water environment; prevent pollution hotspots developing at heavily used areas (gates, tracks, feeders etc); manage steading run-off (eg clean and dirty water separation); **Intercept and store/treat** Capture polluted run-off from steadings (eg in constructed farm wetlands); install new slurry storage systems	Farmers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005; Bathing Water Regulations 2008. Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003. **Economic** Scotland Rural Development Programme. Cross-compliance and Good Agricultural and Environmental Condition (GAEC). **Education and advice** • national awareness raising campaign; • work with farmers in priority catchments; • trial catchment projects; • demonstration farms; • trial catchment projects; • demonstration farms.	SEPA (SEARS partners help with inspections) Scottish Government SEPA, members of the DPMAG and AAGs and SEARS partners; SRPBA, NFUS, SAC and other advisory bodies.

7.1.4 How action will be phased

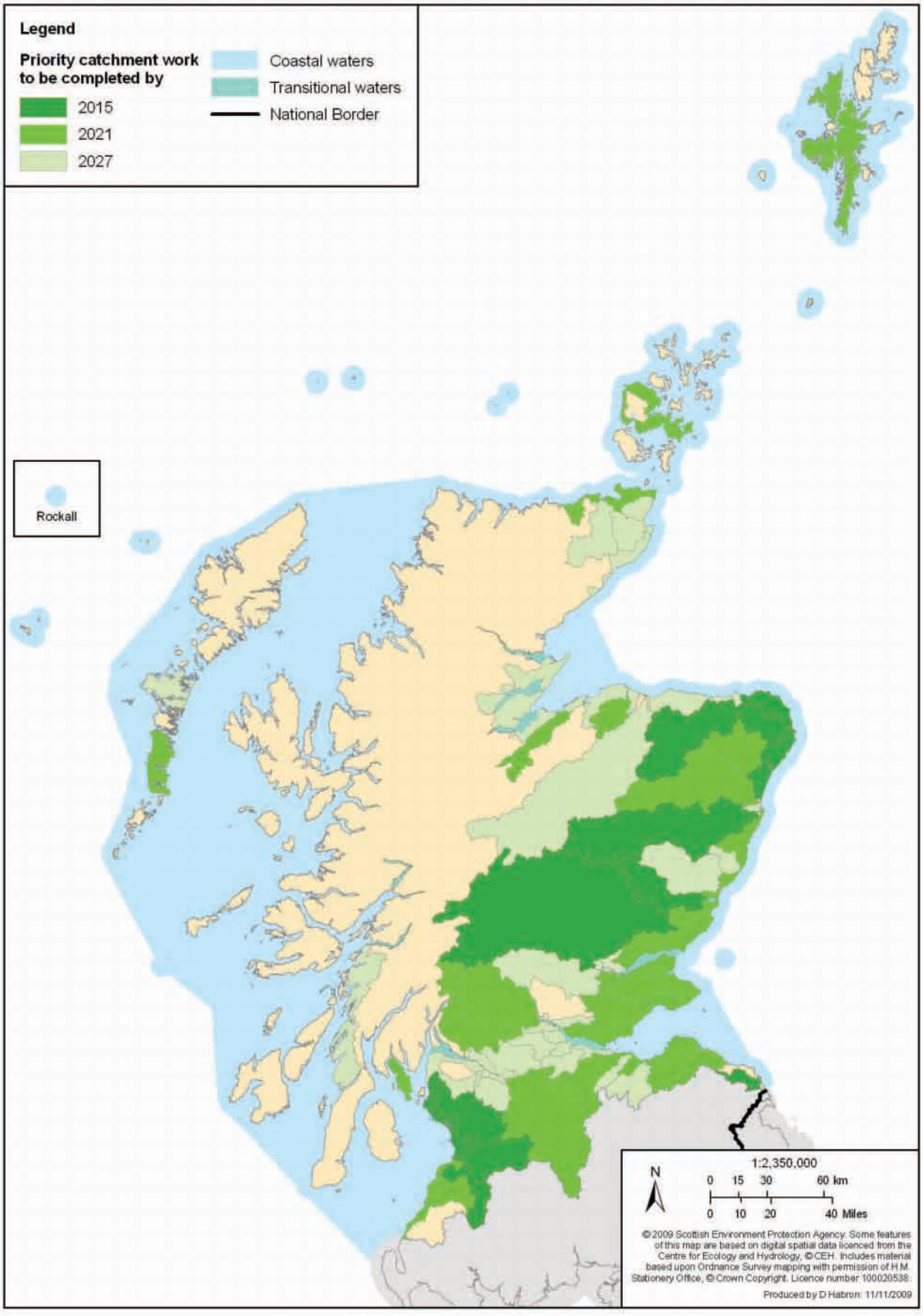
To help us achieve our objectives for 2015, we will concentrate our targeted efforts to encourage and ensure action in the following priority river catchments:

- River Tay
- Buchan streams
- River Ugie
- North Ayrshire streams
- River Dee (Grampian)
- River Deveron
- River Doon
- River Garnock
- River Ayr
- River South Esk
- Eye Water
- River Irvine

SEPA has already started detailed studies of these catchments to identify pollutant sources and possible actions. These studies will form the basis of detailed plans for co-ordinating the work of SEPA, its SEARS partners and other organisations in working with farmers to ensure the appropriate actions are taken.

An additional set of priority river catchments will be targeted between 2015 and 2021 and a further set between 2021 and 2027. SEPA will work with its SEARS partners to monitor and assess the effectiveness of these efforts and the actions taken by farmers. This information will help iteratively improve the effectiveness of our programme of measures for tackling diffuse pollution from agricultural sources. The planned phasing of our programme is illustrated in Map 2.

Map 2: River catchments prioritised for action to reduce diffuse pollution from agricultural sources



The improvements we plan to achieve through the programme of measures described above are summarised in Table 3 below.

Table 3: Planned improvements to the water quality of bodies of water affected by pollution from diffuse agricultural sources

	Number of water bodies improved to achieve good water quality		
	2015	2021	2027
Water bodies in priority catchments	74	107	86

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pollution from diffuse agricultural sources

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action manage inputs to land	Reduced emissions of nitrous oxide and from fertiliser manufacture	Improved soil management - increased rainwater infiltration and retention	Improved soil management - slowed rainwater run-off	-	-	-	Action expected to be resilient
Action intercept and store/treat	Carbon sequestration in buffer zone soils and vegetation	Buffer slows rate of run-off	Water retention in wetlands and groundwater for slow release	Expansion of habitats (ponds, wetlands) increase resilience	-	-	May need to design for future climate (eg higher sea levels; more intense rainfall)
Outcome improved water quality	Reduced drinking water treatment needed downstream	-	-	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

7.2 Measures to prevent and reduce pollution from sewage discharges

The majority of wastewater collection and treatment services in the Scotland RBD are provided by Scottish Water, a publicly owned company. Scottish Water has made substantial investments in wastewater collection and treatment provision over recent years to protect public health and the environment.

There are more than 1,800 public sewage treatment systems in Scotland, of which more than 1,200 are septic tanks for small settlements[44]. Altogether, these systems serve over 96% of the population. The sewerage network also includes well over 3,000 combined sewer overflows (CSOs). These are designed to operate during heavy rainfall when the combined volume of rainwater and sewage in the sewers exceeds the sewers' capacity. Across Scotland as a whole, Scottish Water takes away 1 billion litres of waste water per day from businesses and households.

[44] www.scottishwater.co.uk/portal/page/portal/swe_pgp_about_us/swe_pge_about_us/swe_au_key_facts

Capital investment by Scottish Water in sewers and treatment works is the main means by which we will address the remaining pollution problems associated with the collection and disposal of sewage. However, action to reduce pollution at source will also be an important part of our programme of measures and of particular importance in addressing pollution by toxic pollutants. Both the public and industry can play a key role in helping achieve our objectives through their choices about which products they buy and how they use and dispose of them.

7.2.1 How we will coordinate our work to encourage and ensure action

Public investments in the sewerage network and in treatment works will continue to be coordinated through our national investment planning process for Scottish Water known as "Quality and Standards"[45]. The Scottish Government have issued Scottish Water with Directions for the improvements to be made by 2015[46].

7.2.2 How we are ensuring action is taken to prevent deterioration of status

Scottish Water is a designated responsible authority and will carry out its functions to help secure the achievement of our objectives. The principal legislative, economic and educational mechanisms we will also use to help prevent deterioration will include those set out in Table 4 below.

In addition, SEPA, Scottish Water and local authorities will work with developers to direct development to areas where it can be accommodated by the available sewage collection and treatment facilities without causing deterioration of the water environment. To inform this process:

- SEPA and Scottish Water will continue to work together to identify where development can take place given:
  - the existing sewage collection and treatment facilities;
  - the capacity of the water environment to accommodate further discharges without deteriorating.

  This information will be included in Scottish Water's web-based Strategic Asset Capacity and Development Plan (SACDP)[47].
- Local authorities will work with Scottish Water to identify areas where there is pressure for increased development but insufficient capacity in the sewage collection and treatment facilities to accommodate it and protect the water environment. This information will be taken into account in the Quality and Standards investment planning process.

SEPA will assess the risk to the water environment from the cumulative impacts of discharges from any proliferation of small private septic tanks in rural areas. All such discharges must be authorised by SEPA. Where there are such risks and development is therefore constrained until a public sewerage system is provided, Scottish Water and SEPA will prioritise the settlement for consideration under the Quality and Standards investment programme. For example, as a result of this process Scottish Water will provide first time sewerage for 9 villages by 2010.

7.2.3 How we will ensure action is taken to reduce pollution from sewage discharges

Table 4 below summarises the principal measures that we plan to use to improve the water quality of bodies of surface water affected by pollution resulting from discharges of sewage.

Table 4: Summary of our planned measures for reducing sewage pollution

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced pollutant inputs to the water environment	**Control at source** Reduce, or avoid, pollutant entering waste stream	Trade dischargers to sewer	**Legislative** Pollution Prevention and Control (Scotland) Regulations 2000 Sewerage (Scotland) Act 1968 **Education and advice** trade effluent inspections; pollution prevention guidelines	SEPA Scottish Water Scottish Water, SEPA

[45] www.scotland.gov.uk/Topics/Business-Industry/waterindustryscot/improvingservices
[46] www.scotland.gov.uk/Topics/Business-Industry/waterindustryscot/latest-news/swdirections
[47] www.scottishwater.co.uk/portal/page/portal/SWE_PGP_CONNECTIONS/SWE_CORP_CONNECTIONS/SWE_CORP_STRATEGIC_PLANNING

Table 4: Summary of our planned measures for reducing sewage pollution (continued)

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced pollutant inputs to the water environment	**Control at source** Ensure pollutant is not included in affected product or conditions of use made clear to consumer	Manufacturers and retailers of affected products	**Legislative** Marketing and use legislation	UK Government working with Scottish Government
	Control at source Reduce, or avoid, pollutant entering sewerage system	Households	**Education and advice** Campaigns, advice provision	Scottish Water, SEPA
	Collect and treat Improve quality of final effluent from treatment works [42 works by 2015, 75 works by 2021]; Reduce frequency of operation of sewer overflows [303 overflows by 2015, 232 by 2021]	Scottish Water	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Economic Publically-funded investment programme for Scottish Water (Quality and Standards)	Scottish Government and Water Industry Commission for Scotland[48]
	Collect and treat Separation of rainfall run-off from combined sewer and use of sustainable urban drainage systems	Developers	**Legislative** Town and Country Planning (Scotland) Act 1997	Local authorities
			Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
		Scottish Water and local authorities	Sewerage (Scotland) Act 1968;	Scottish Water
			Economic Publically-funded investment programme for Scottish Water (Quality and Standards)	Scottish Water and Water Industry Commission for Scotland
			local authority funding	local authorities
	Control at source Remove cross-connections between foul sewer (sewage) and surface water drainage systems	Scottish Water, businesses and households	**Legislative** Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Economic Publically-funded investment programme for Scottish Water (Quality and Standards)	Scottish Government and Water Industry Commission for Scotland

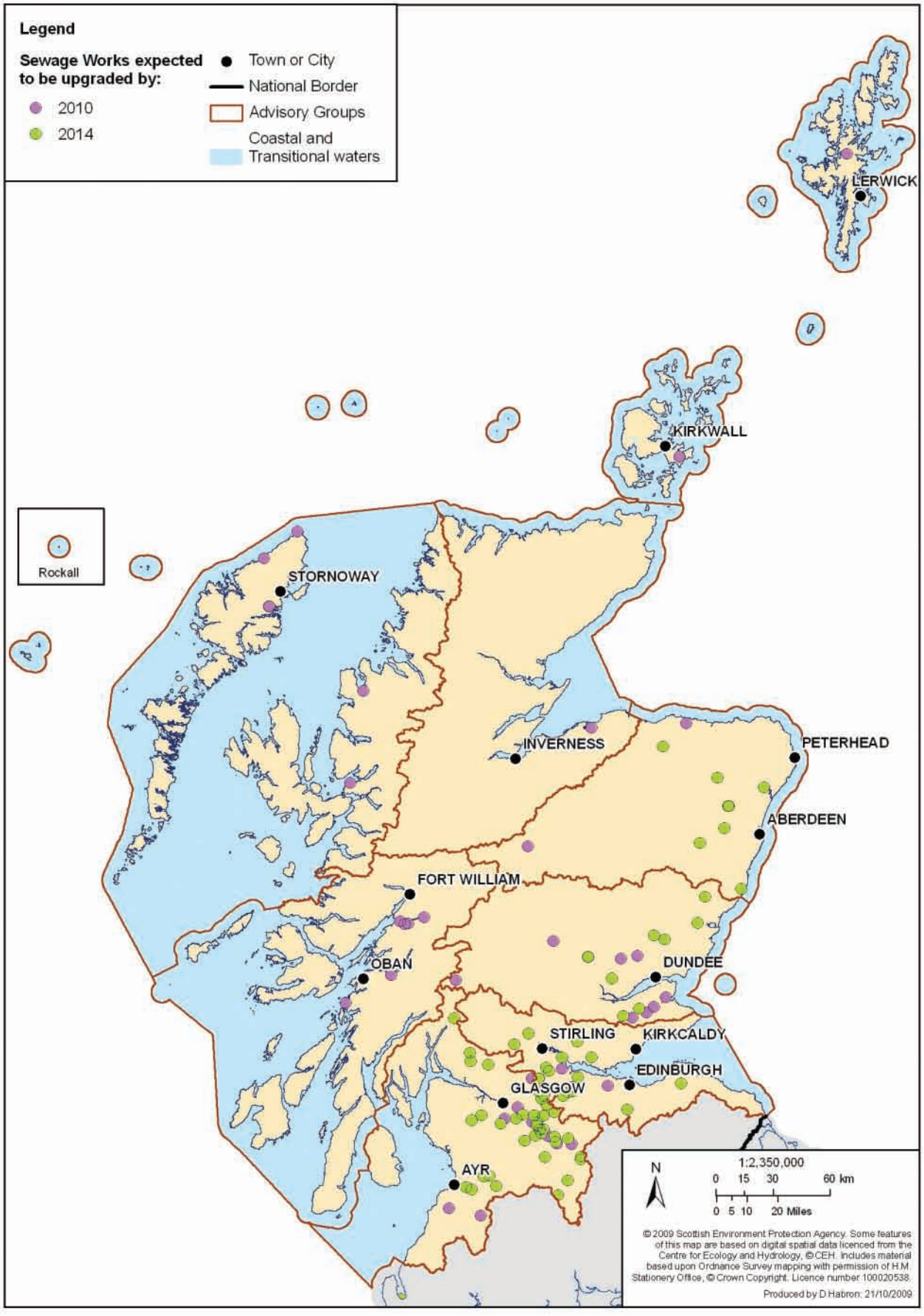
[48] www.watercommission.co.uk/

7.2.4 How action will be phased

Scottish Water is currently implementing actions to improve sewage collection and treatment to be delivered by 2010. It is also working with SEPA to identify detailed on the ground actions to be implemented between 2010 and 2015. The waste water treatment works planned to be improved in this period are shown in Map 3.

Scottish Water and SEPA will also work together to identify the most cost-effective on the ground actions for achieving our objectives for 2021 and 2027. Identifying and timetabling detailed actions for the water bodies of the River Clyde and its estuary in Glasgow will be a major component of this work. This will be informed by the work of the Metropolitan Glasgow Strategic Drainage Partnership which includes SEPA, Scottish Water and local authorities. The sewerage network and treatment works in Glasgow require significant improvement in order to be able to better cope with the volumes of waste water and rainwater they receive. The actions used to solve the problems of the Clyde will have to handle the more intense storms expected to result from climate change. Scottish Water's assessments of different options will inform decision-making in successive Quality and Standards investment programmes.

Map 3: Waste water treatment works planned for improvement by 2015



The improvements we plan to achieve through the programme of measures described above are summarised in Table 5 below.

Table 5: Planned improvements to the water quality of bodies of water affected by pollution from sewage discharges

Number of water bodies improved to achieve good water quality		
2015	**2021**	**2027**
120	77	78

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pollution from sewage discharges

Climate check of:	**A: Greenhouse emissions**	**B: Preparing Scotland for a future climate**					**C: Action's continued effectiveness**
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action reduce pollutant content of sewage at source	Less waste and hence less loss of embedded energy; reduced end-of-pipe treatment	-	-	-	-	-	**Action** expected to be resilient
Action collect and treat: improve sewer network; increase treatment	Energy costs of pumping and treatment - unless tertiary treatment in wetlands	Will benefit flood risk management if involves major upgrades to combined sewers	-	-	-	-	**Action** expected to be resilient
Action collect and treat: separate out rainwater run-off	Reduced pumping; carbon sequestration	Slowed rate of run-off	Water retention for slow release	Expansion of habitats (ponds, wetlands) increase resilience			May need to design for future climate (eg to sea level rise, more intense rainfall)
Outcome improved water quality	-	-	-	reduced stress - increased resilience of sensitive species	reduced stress - helps sustain fisheries, quality for tourism, etc	reduced stress - helps system maintain service	

7.3 Measures to prevent and reduce pollution from mines and quarries

Coal has been mined in Scotland since at least the 12th century and many thousands of mines have been worked since. The last deep mine closed in 2002. Coal is now extracted from the surface using opencast methods. Quarrying for other minerals is undertaken widely throughout the Scotland RBD.

7.3.1 How we will co-ordinate our work to encourage and ensure action

SEPA and the Coal Authority will continue to work together to identify where further action is needed to prevent or reduce pollution from abandoned mines. Local authorities will also continue to assist by facilitating planning consent and making land available for treatment systems.

7.3.2 How we are ensuring action is taken to prevent deterioration of status

Our legislative framework will be used to ensure that ongoing and new mining and quarrying activities do not cause deterioration of status: prior authorisation for any discharges to the water environment from these activities is required from SEPA[49].

Deterioration of surface waters can result if polluted groundwater rises in abandoned mine workings and then discharges into surface waters. The Coal Authority monitors groundwater levels and operates a number of mine water treatment and preventative schemes in order to prevent such discharges. Information on these schemes can be found at: Minewater Schemes Scotland[50].

7.3.3 How we will ensure action is taken to reduce pollution from abandoned mine workings.

Table 6 below summarises the principal measures that we plan to use to improve the water quality of bodies of surface water affected by pollution from abandoned mines or from mine tailings and wastes left as spoil tips on the land. The latter sources are often spread over a wide area and can cumulatively constitute a significant source of diffuse pollution.

Table 6: Summary of our planned measures for reducing pollution from abandoned mines and mining spoil tips

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced discharges into surface waters of polluted minewater from abandoned mines	Treat discharges from abandoned coal mines [eg 9 treatment systems planned for completion by 2015]	Coal Authority	**Legislative** Water Environment (Controlled Activities)(Scotland) Regulations 2005 **Economic** Public funding of Coal Authority remediation schemes	SEPA Government funding of Coal Authority
	Treat discharges from abandoned mines excluding coal mines	Land owners or SEPA	**Legislative** Water Environment (Controlled Activities)(Scotland) Regulations 2005; Restoration legislation (pending) **Economic** Public funds for restoration	SEPA Scottish Government

[49]Water Environment (Controlled Activities) (Scotland) Regulations 2005
[50]www.coal.gov.uk/environmental/scotland/minewaterscotland.cfm

Table 6: Summary of our planned measures for reducing pollution from abandoned mines and mining spoil tips (continued)

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced inputs into surface waters from land contaminated by mine spoil tips	Remediate land and/or treat leachate	Developer of the land (as a condition of planning consent);	**Legislative** Town and Country Planning (Scotland) Act 1997	Local authorities
		Person responsible for the contamination of land, land owners or local authority	**Legislative** Part IIA of the Environmental Protection Act 1990	Local authorities
			Economic Publically-funded investment	Local authorities, Scottish Government

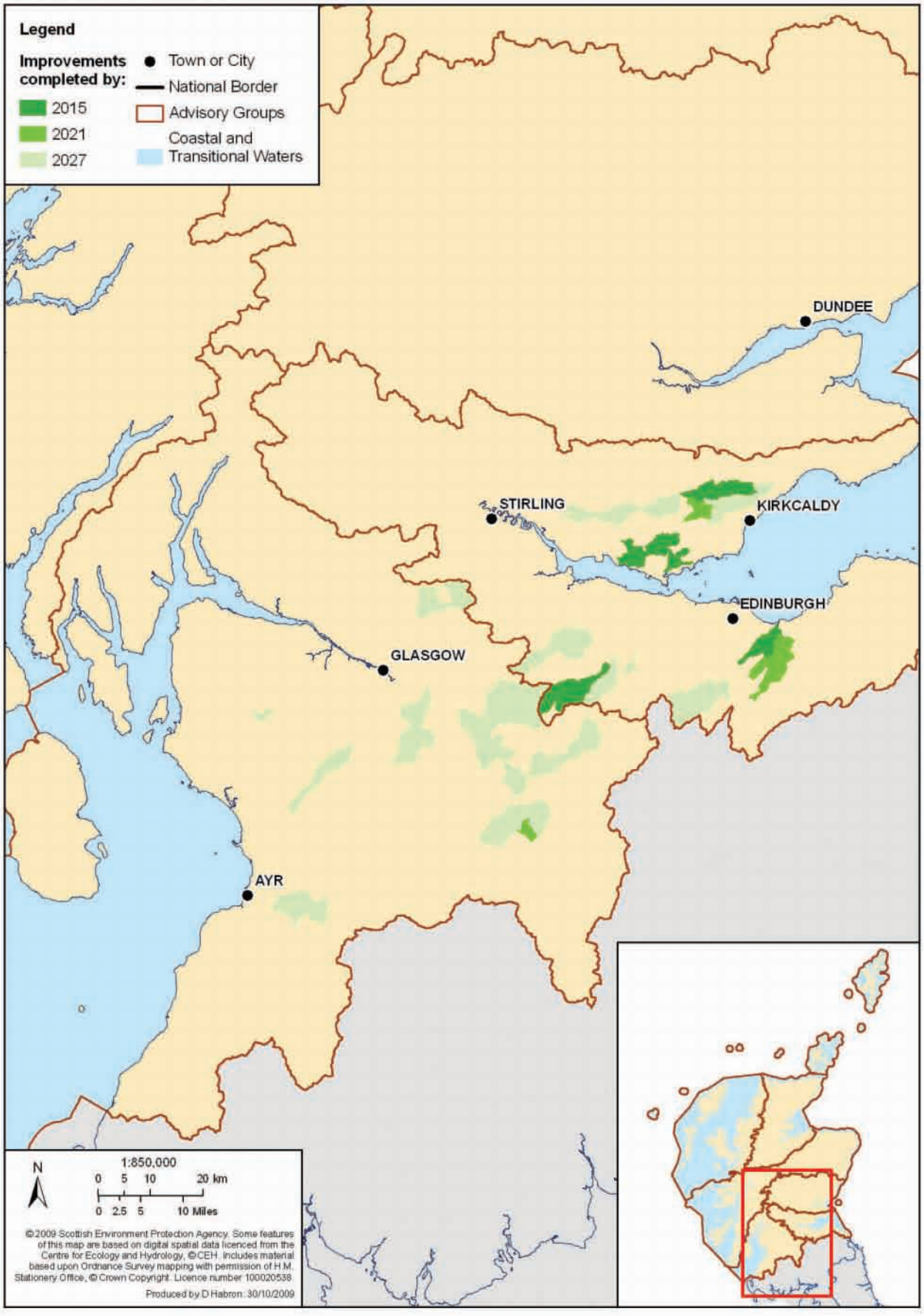
7.3.4 How action will be phased

We have phased our programme of measures for reducing pollution from abandoned mines and from mining spoil tips in line with our planned objectives for the affected water bodies. The phasing of the improvements is summarised in Table 7 and Map 4 below.

Table 7: Planned improvements to the water quality of bodies of surface water affected by pollution from abandoned mines and mining spoil tips

Number of surface water bodies improved to achieve good water quality		
2015	2021	2027
10	6	14

Map 4: Planned schedule of improvements to reduce pollution of surface water bodies resulting from past mining activities



Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pollution from past mining activities

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action treat discharges from mine spoil tips	Carbon sequestration where wetland complexes used for treatment	Slowed rate of run-off	Water retention for slow release	Expansion of habitats (ponds, wetlands) increase resilience	-	-	May need to design for future climate (eg to sea level rise, more intense rainfall)
Action treat discharges from abandoned mines	Energy use in pumping and treatment - unless passive treatment in wetlands is practical	-	-	-	-	-	Action expected to be resilient
Outcome improved water quality	-	-	-	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

7.4 Measures to prevent and reduce pollution from diffuse urban sources

Urban diffuse source pollution results when rainwater falling onto urban areas (roads, pavements, yards and roofs) becomes contaminated with pollutants on those areas, washes into surface water drains and is then discharged from those drains into the water environment.

Tackling this source of pollution will require substantial changes in the way urban areas are drained and efforts to reduce the quantity of pollutants deposited on urban surfaces. Since the mid 1990s, sustainable urban drainage systems have increasingly been used to drain new developments. They are designed to avoid pollution of the water environment and include:

- permeable surfaces that allow infiltration of rainwater into the ground, slowing the rate at which it drains to the water environment and trapping and breaking down pollutants;
- swales, filter drains, grass filter strips and other measures that also slow the rate rainwater drains to the water environment and help treat and attenuate the pollutants it has picked up;
- basins, artificial ponds or wetlands that provide a final stage of treatment and an opportunity to enhance amenity and wildlife.

Sustainable urban drainage systems can also be designed to help manage storm water run-off and so reduce flooding risk. Local authorities will consider retrofitting such systems as part of enhanced flood protection schemes and requiring their use for this purpose in new developments as a condition of planning consent.

7.4.1 How we will co-ordinate our work to encourage and ensure action

Local authorities, Scottish Water and SEPA will continue to work together to co-ordinate their efforts to tackle pollution from diffuse urban sources. This will include incorporating sustainable urban drainage systems into local plans and programmes. For example, the Metropolitan Glasgow Strategic Drainage Partnership is promoting the removal of surface water drainage from sewers where sustainable urban drainage systems can be installed. Local authorities are incorporating sustainable urban drainage systems into plans for large-scale regeneration programmes, such as the Clyde Gateway and the Ravenscraig steel works.

Our investments in the drainage systems maintained by Scottish Water will continue to be co-ordinated through our national investment planning process for Scottish Water, Quality and Standards.

The Sustainable Urban Drainage Scottish Working Party[51] (SUDSWP) will continue to provide advice and encourage the use of sustainable urban drainage systems. The Working Party is currently developing technical guidance ('SUDS for Roads') which will include design criteria to help road authorities' engineers reduce pollution from road drainage.

7.4.2 How we are ensuring action is taken to prevent deterioration of status

Since April 2006, all new developments have to be drained by a sustainable urban drainage system[52] if rainwater run-off from the development is to be discharged to the water environment. More generally, pollutants are not permitted to be disposed of into surface water drains or onto any surface that drains into one.

The drainage systems of many urban areas are maintained by Scottish Water or the relevant roads authority. Where they are to be maintained by Scottish Water, new development drainage systems must comply with the technical design standards for sustainable urban drainage systems set out in *Sewers for Scotland 2*[53] published by Scottish Water.

Where a new road is to be publicly adopted, the road authority will require its drainage system to comply with the standards to be published by the SUDSWP in *SUDS for Roads*. If a single drainage system will serve roads and other areas, an arrangement can be made between Scottish Water and the roads authority for its maintenance[54].

The use of sustainable urban drainage systems has been promoted through Planning Advice Note 61, Planning and SUDS[55] and the need for such systems is already incorporated into local authority development plan policies. This is helping ensure that sustainable urban drainage system requirements are taken into account in land use development proposals from the outset.

7.4.3 How we will ensure action is taken to reduce pollution from diffuse urban sources

Table 8 below summarises the principal measures that we plan to us to improve the water quality of bodies of surface water affected by pollution

[51]SUDS Working Party www.sepa.org.uk/water/water_regulation/regimes/pollution_control/suds/suds_working_party.aspx
[52]Water Environment (Controlled Activities) (Scotland) Regulations 2005
[53]www.scottishwater.co.uk/portal/page/portal/SWE_PGP_CONNECTIONS/SWE_CORP_CONNECTIONS/SWE_CONN_SUDS
[54]Sewerage (Scotland) Act 1968
[55]www.scotland.gov.uk/Publications/2001/07/pan61

Table 8: Summary of our planned measures for reducing pollution from diffuse urban sources

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced pollutant inputs into the water environment	**Collect and treat** add to, or replace, conventional surface water drainage systems with sustainable urban drainage systems	Scottish Water	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005 **Economic** Publically-funded investment programme for Scottish Water (Quality and Standards)	SEPA Scottish Government and Water Industry Commission for Scotland[56]
	Collect and treat add to, or replace, conventional surface water drainage systems with sustainable urban drainage systems	Owners and occupiers of business premises	**Legislative** The Building (Scotland) Regulations 2004 **Economic** Scottish Water charges for non-domestic surface water discharges	Local authorities Scottish Water
	Collect and treat add to, or replace conventional surface water drainage systems with sustainable urban drainage systems as part of regeneration of sites	Developers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005 Town and Country Planning (Scotland) Act 1997	SEPA Local authorities, urban regeneration companies
	Collect and treat install treatment for highly polluting discharges (eg from industrial sites)	Scottish Water	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005 **Economic** Publically-funded investment programme for Scottish Water (Quality and Standards)	SEPA Scottish Government and Water Industry Commission for Scotland
	Collect and treat add to or replace road drains with sustainable urban drainage systems	Local authorities, Scottish Government (Transport Scotland)	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005 **Economic** Local authority road funding; Scottish Government road funding	SEPA Roads authorities
	Control at source reduce, or avoid, pollutants entering surface water drainage system by ensuring dirty areas do not drain to surface water drains; chemicals are not disposed of in surface water drains; installing water butts, porous paving, etc	Businesses; households	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005 Various laws relating to abandoned vehicles, vehicle emissions, business waste, dog fouling, fly posting, litter and fly tipping **Education and advice** Visits to business premises by Scottish Water trade effluent control staff, SEPA regulatory staff; education campaigns for general public	SEPA Local authorities Scottish Water, SEPA, local authorities

[56] www.watercommission.co.uk/

7.4.4 How action will be phased

We have phased our programme of measures for tackling pollution from diffuse urban sources in line with our planned objectives for the affected water bodies. The phasing of the improvements is summarised in Table 9 below.

Table 9: Planned improvements to the water quality of bodies of surface water affected by pollution from diffuse urban sources

Number of water bodies improved to achieve good water quality		
2015	**2021**	**2027**
5	1	5

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce urban diffuse pollution

Climate check of:	**A: Greenhouse emissions**	**B: Preparing Scotland for a future climate**					**C: Action's continued effectiveness**
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action install sustainable urban drainage systems	Reduced pumping; carbon sequestration in soils and vegetation	Slowed rate of run-off	Water retention for slow release	Expansion of habitats (ponds, wetlands) increase resilience	-	-	May need to design for future climate (eg to sea level rise, more intense rainfall)
Action treat highly polluting discharges	Possible energy costs of treatment (depending on volume/ strength and flexibility of treatment works)	-	-	-	-	-	Action expected to be resilient
Action reduce inputs into drains	Less waste of embedded energy in pollutants	-	-	-	-	-	Action expected to be resilient
Outcome improved water quality	Reduced drinking water treatment need downstream	-	-	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

7.5 Measures to prevent and reduce pollution from aquaculture sources

Over the past 20 years, commercial aquaculture in Scotland has grown to become one of the country's major economic sectors. The industry is dominated by salmon and trout farming involving the use of freshwaters and coastal waters. Aquaculture activities can cause the following potential pressures:

- release of organic matter and nutrients in fish faeces and uneaten fish food into the water environment;
- release of residues of toxic substances, including veterinary medicines, used to treat diseases and parasites;
- exposure of wild fish populations to sea lice and escapes of farmed fish.

The existing environmental problems caused by marine cage aquaculture are largely a legacy of sites having initially been developed in sheltered sea lochs.

7.5.1 How we will co-ordinate our work to encourage and ensure action

Our work to prevent deterioration of status by steering new aquaculture developments away from sensitive locations will be facilitated by the Scottish Planning Policy SPP22 *Planning for Fish Farming*[57] and the forthcoming consolidated Scottish Planning Policy[58].

The Tripartite Working Group[59] and associated area management groups, which have brought together fish farming interests, wild fisheries interests and the public sector, will continue to negotiate area-based management agreements covering issues such as synchronised production cycles, co-ordinated sea lice treatments and the rotational fallowing of farms or groups of farms.

Measures to manage nutrient pressures resulting from fish farming will be co-ordinated with work to address other sources of nutrient inputs into the water bodies concerned. This work will include work on diffuse agricultural sources described in Section 7.1 and on sewage disposal described in Section 7.2.

7.5.2 How we are ensuring action is taken to prevent deterioration of status

SEPA will use its powers under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 to prevent increased pollution from fish farm developments.

SEPA, local authorities, Scottish Government and Scottish Natural Heritage will work together with fish farmers to ensure that proposals for the expansion of aquaculture activities are appropriately located and managed:

- local authorities will use their planning controls over fish farm developments to ensure that future developments avoid sensitive locations;
- Scottish Government will review and update its location guidance[60];
- SEPA will provide fish farm developers and local authorities with the information on water bodies that have:
  - no capacity or limited capacity for further development;
  - potential capacity for further development.

In providing this information, SEPA will use the latest scientific methods for estimating the capacity of coastal waters[61] and lochs to assimilate nutrient inputs[62].

Where necessary, the Scottish Government will uses its powers under the Aquaculture and Fisheries (Scotland) Act 2007 to ensure that farmed fish are appropriately contained and that sea lice infestation is effectively managed.

7.5.3 How we will ensure action is taken to reduce pollution from aquaculture sources

Table 10 below summarises the principal measures that we plan to us to improve the water quality of bodies of surface water affected by pollution from aquaculture activities.

[57] www.scotland.gov.uk/Topics/Built-Environment/planning/publications
[58] The consolidated Scottish Planning Policy is due to be published by the end of 2009: www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/newSPP
[59] www.scotland.gov.uk/Topics/Fisheries/Fish-Shellfish/workinggroups/twg
[60] www.scotland.gov.uk/Topics/Fisheries/Fish-Shellfish/18716/14465
[61] www.sarf.org.uk/Project%20Final%20Reports/SARF012%20-%20Final%20Report.pdf
[62] www.sarf.org.uk/

Table 10: Summary of our planned measures for reducing pollution from aquaculture activities

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced inputs of nutrients into lochs	**Control at source** use low phosphorus feeds; stock with strains that have high growth rates; reduce stocking levels; relocate all or part of operation to another loch or to onshore tank facilities	Fish farmers	**Legislative** Water Environment (Controlled Activities)(Scotland) Regulations 2005 **Economic** SEPA charging schemes for water use licences	SEPA SEPA
Reduced abundance of sea lice at marine cage sites	**Control at source** synchronise sea lice treatments and fallow periods	Fish farmers	**Legislative** Aquaculture and Fisheries (Scotland) Act 2007 and the Aquatic Animal Health (Scotland) Regulations 2009 **Education and advice** area management agreements	Scottish Government Tripartite Working Group comprising fish farmers, Scottish Government, wild fish interest groups
	Control at source Re-locate operations away from sensitive wild fish migration routes	Fish farmers	**Economic** support for relocation proposals under the Scottish Government re-location scheme[63] or new initiatives developed under the Government's renewed Strategic Framework for Scottish Aquaculture[64]	Tripartite Working Group comprising fish farmers, Scottish Government, wild fish interest groups

7.5.4 How action will be phased

We have phased our programme of measures for tackling pollution from aquaculture sources in line with our planned objectives for the affected water bodies. The phasing of the improvements is summarised in Table 11 below.

Table 11: Planned improvements to the water quality of bodies of surface water affected by pollution from aquaculture sources

Number of water bodies improved to achieve good water quality		
2015	2021	2027
1	1	3

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

[63] www.scotland.gov.uk/Topics/Fisheries/Fish-Shellfish/workinggroups/lrwg
[64] The Fresh Start, renewed Strategic Framework for Scottish Aquaculture, www.scotland.gov.uk/Topics/Fisheries/Fish-Shellfish/18364

Preliminary climate check of planned action to reduce pollution from aquaculture sources

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action control nutrient inputs at source	Lower nutrient use and hence less loss of embedded energy	-	-		-	-	Action expected to be resilient
Action control sea lice infestations	Fish mortality reduced, less wasted medicine	-	-	-	-	-	Action expected to be resilient
Outcome improved water quality	Potential reduced drinking water treatment need downstream	-	-	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

7.6 Measures to prevent and reduce pollution resulting from forestry operations

In Scotland there are over 1.3 million hectares of woods and forests, almost 40% of which are national forests owned by the Scottish Government and managed by Forestry Commission Scotland. Over 90% of the trees in the national forests are coniferous.

The main potential causes of pollution from forestry operations are:

- scavenging of acid gases by large conifer plantations which exacerbates acidification of lochs and rivers;
- inputs of soil particles as a result of soil disturbance during road building, tree planting and clear felling;
- inputs of nutrients (phosphorus) either from fertiliser applications during tree planting or when soils are disturbed during clear felling operations.

7.6.1 How we will coordinate our work to encourage and ensure action

SEPA's Diffuse Pollution Management Advisory Group will help coordinate a national awareness raising campaign about the requirements under our regulatory framework for good environmental practice in managing activities that can cause diffuse pollution (see Section 7.1).

SEPA and Forestry Commission Scotland will continue to work together to assess the effectiveness of restructuring forests (eg in relation to species composition, stocking density and design, locations, open ground etc) in hastening the recovery of water bodies affected by acidification.

To facilitate forest planning, SEPA will provide advice to Forestry Commission Scotland on lochs that have little or no capacity to accommodate further nutrient inputs.

7.6.2 How we are ensuring action is taken to prevent deterioration of status

If not undertaken appropriately, forestry operations (including planting, harvesting and the application of fertilisers and pesticides) can pose a risk to the water environment. We will therefore continue to ensure such operations are undertaken using practices that prevent them causing deterioration of status.

The UK Forestry Standard[65] sets out standards for the sustainable management of all forests and woodlands in the UK. These include compliance with the Forestry Commission's Forests and Water Guidelines[66]. We will use the following mechanisms to prevent forest management from causing deterioration of status:

Education and advice

- Forestry Commission Scotland and SEPA will continue to provide best practice guidance and training to the forest industry on how to protect the water environment during forestry operations based on the Forestry Commission's Forests and Water Guidelines.
- The national awareness raising campaign on diffuse pollution coordinated by SEPA and its Diffuse Pollution Management Advisory Group and delivered with the help of SEARS partners (see Section 7.1) will include information for forest managers on the requirements of our legislative framework.

Economic

- Forestry Commission Scotland will continue to require forest managers to comply with the requirements of the UK Forestry Standard as a condition of receiving grant aid under the Scottish Rural Development Programme.

Legislative

- Forestry Commission Scotland is a designated responsible authority and will exercise its functions in managing Scotland's national forests so as to secure the achievement of our objectives for the water environment.
- Forest managers must comply with the requirements of the Water Environment (Controlled Activities)(Scotland) Regulations 2005. Where necessary, SEPA will use its powers under the Regulations to ensure impacts on the water environment are prevented.
- Forest Plan, Forest Design Plan and felling approvals[67] will only be given to schemes that adhere to requirements of the UK Forestry Standard[68].
- Forestry Commission Scotland will require an assessment of the environmental effects of proposals likely to result in significant environmental impacts and involving:
  - afforestation;
  - deforestation;
  - forest roads;
  - forest quarries

  before such proposals are allowed to proceed[69].

In addition, the sector and other stakeholders will continue to promote certification under the UK Woodland Assurance Standard[70]. The standard requires good practice in managing forestry operations that could affect the water environment, including adherence to the Forests and Water Guidelines.

7.6.3 How we will ensure action is taken to reduce pollution from forestry operations

Forestry operations can contribute to the nutrient pressure on sensitive water bodies. Where relevant, our programme of measures for reducing diffuse source pollution from rural land use (see Section 7.1) will address forestry sources as well as agricultural sources.

In some areas, large scale coniferous forest plantations are exacerbating the acidification of water bodies and delaying their recovery. The current version of the Forestry Commission's Forests and Water Guidelines (2003) already provide guidance on how to restructure forests to help hasten the recovery of water bodies from the impacts of acidification. Forestry Commission Scotland and SEPA will continue to work together to improve understanding of the effectiveness of restructuring. This will include collaboration on a joint monitoring project. The result of the work will be taken into account in revisions of the Forests and Water Guidelines.

[65] www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf
[66] www.forestry.gov.uk/pdf/FCGL002.pdf/$FILE/FCGL002.pdf
[67] Under the Forestry Act 1967, felling licences are required from Forestry Commission Scotland before trees are felled.
[68] www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf
[69] Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999; www.forestry.gov.uk/forestry/infd-5zgkwl
[70] www.ukwas.org.uk/index.html

8. Managing pressures on water flows and levels

This section provides a summary of the measures we will take to protect and improve water flows and levels by managing abstractions and impounding works (ie dams etc).

Managing water use in drought conditions

Scotland already experiences periods of hot, dry weather during the summer months and such conditions are likely to increase as the climate changes. SEPA will develop a national drought plan for managing abstractions during periods of extreme low rainfall. The plan will describe the actions required of those abstracting water from the water environment, such as farmers wishing to irrigate their land. The actions will be designed to ensure the protection of the water environment whilst minimising the impact of the drought conditions on economically important activities. SEPA will work with business and industry representatives in developing the plan.

SEPA will also work closely with Scottish Water to ensure that its drought management plan is integrated with drought plans produced by Scottish Water in relation to abstractions for drinking water supply (see Section 8.2 below).

The Scottish Government will also introduce legislation to underpin SEPA's drought planning work and to further strengthen the established legislative framework[71] for managing abstractions during drought conditions.

8.1 Measures to manage pressures on water flows and levels from hydroelectricity generation

There are more than 20 hydropower schemes in the river basin district with an individual installed capacity of 5 megawatts or more. These schemes typically include large water storage reservoirs and often involve water transfers between catchments. The first of these schemes came into operation in the early 1900s to supply electricity for aluminium smelting. However, the majority were commissioned in the1950s and early 1960s. In the last 35 years, one new large scheme has been commissioned in Glendoe near Fort Augustus. Two private electricity companies and one aluminium smelting business run the majority of large schemes.

Smaller run-of-river hydropower schemes are more numerous and most involve no water storage. A significant proportion (around 50 schemes) have been authorised for construction since April 2006. In 2007, the renewable energy generated from hydropower schemes[72] represented over 50% of the total renewable energy generated in Scotland with the proportion generated from wind rising steeply.

The principal pressures on water flows and levels associated with hydropower schemes include:

- changes in the pattern of water flows in the rivers downstream of dams and intakes;
- consequent changes in the natural pattern of sediment erosion, transport and deposition;
- large variations in water levels in water storage reservoirs.

Dams and water intake structures can also act as barriers to fish migration. Our planned measures to address barriers to fish migration are summarised in Section 9 below.

8.1.1 How we will co-ordinate our work to encourage and ensure action

SEPA will continue to work with:

- hydroelectricity generating companies, relevant responsible authorities, other public bodies and interested parties to ensure that the solutions used to improve water flows and levels at individual hydropower schemes achieve the widest possible benefits;
- its Fish and Fisheries Advisory Group and industry representatives on design and operating standards to minimise the impact on the water environment of new hydropower schemes.

[71] Natural Heritage (Scotland) Act 1991

[72] ie including those in the Scottish part of the Solway Tweed River Basin District but excluding the electricity generated by pumped storage schemes.

8.1.2 How we are ensuring action is taken to control deterioration of status

SEPA will work with hydropower scheme operators to ensure that existing schemes are managed so as to avoid causing further deterioration of status. The legislative and educational mechanisms that will be used to prevent deterioration will include those set out in Table 12 below.

In recent years, there has been considerable and growing interest in the development of new hydropower schemes. This interest has been triggered by the combination of the Scottish Government's ambitious targets for renewable energy generation[73] and economically attractive subsidies for smaller hydropower schemes. In 2008, a Scottish Government commissioned study through the Forum for Renewable Energy Development in Scotland identified a further 657 megawatts of financially viable energy capacity[74].

SEPA will seek to strike the right balance between our objectives for the water environment and our objectives for reducing greenhouse gas emissions. Before considering authorising proposed new hydropower schemes under the Water Environment (Controlled Activities)(Scotland) Regulations 2005, SEPA will ensure that:

- all practicable mitigation measures will be taken to minimise the adverse effects of the scheme on the water environment;
- the benefits of the scheme to sustainable development (eg reduced emissions of carbon dioxide) outweigh the benefits of preventing deterioration of status;
- the benefits of the scheme cannot be realised by other means representing a significantly better environmental option and not entailing disproportionate cost.

SEPA will work with local authorities, Scottish Natural Heritage and representatives of the hydropower sector[75] to provide advice to developers to help them identify whether potential schemes are likely to satisfy prior authorisation conditions.

8.1.3 How we will ensure action is taken to reduce pressures on water flows and levels from hydropower schemes

Table 12 below summarises the principal measures that we plan to use to improve the water flows and levels in bodies of surface water affected by hydropower schemes.

Table 12: Summary of our planned measures for reducing pressures on water flows and levels from hydropower schemes

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced water abstraction and impoundment impacts on water flows and levels	Provide improved flow to affected rivers by: integrating operation of scheme to optimise river flows; changing pattern of abstraction (at run-of-river schemes); reducing net abstraction.	Hydropower scheme operating companies	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Education and advice Guidance on mitigation measures to limit adverse impacts on ecological quality	SEPA with advice from its Fish and Fisheries Advisory Group; output from joint research by Scottish and Southern Energy; SEPA, Scottish Natural Heritage, Macaulay Land Use Research Institute.

8.1.4 How action will be phased

We have phased our programme of measures for improving water flows and levels affected by hydropower schemes in line with our planned objectives for the water bodies concerned. The phasing of the improvements is summarised in Table 13 below.

[73] *Renewables Action Plan* www.scotland.gov.uk/Publications/2009/07/06095830/0
[74] www.scotland.gov.uk/Resource/Doc/917/0064958.pdf
[75] eg through SEPA's participation in the micro-hydro sub-group of the Forum for Renewable Energy Development in Scotland..

Table 13: Planned improvements to the water flows and levels of bodies of water affected by hydropower schemes

Number of water bodies improved to achieve good condition water flows and levels		
2015	2021	2027
31	4	82

Large hydropower schemes are generally complex with multiple reservoirs and water intake structures. Identifying the best on-the-ground solutions for reducing the adverse impacts on the water environment of these schemes requires the collection and assessment of detailed information. SEPA is working with the electricity companies to identify cost-effective solutions to address the most significant impacts of four of Scotland's major hydropower schemes. The schemes are the:

- Tummel scheme;
- Ness scheme;
- Conon scheme;
- Galloway scheme (shared with the Solway Tweed river basin district).

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pressures from hydropower schemes on water flows and levels

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action Provide improved river flows by integrated operation of scheme; changing pattern of abstraction	Unless new generator installed on dam and powered by additional releases	-	-	-	-	-	Action expected to be resilient
Action Provide improved river flows by reducing net abstraction	Less water for generation - may be compensated	-		-	-	-	Action expected to be resilient
Outcome improved water flows and levels	-	-	More water in rivers and flows maintained for longer	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

8.2 Measures to manage pressures on water flows and levels from public drinking water supply

The nationally owned company, Scottish Water, supplies drinking water to some 2.2 million households and 130,000 business customers in Scotland. To do so, it abstracts water from more than 550 different sources. Of these sources, around 40% are river sources, 40% are loch and reservoir sources and 20% are groundwater sources or springs. Scottish Water operates around 300 water treatment works with a total output of over 2,000 million litres per day.

The principal pressures on water flows and levels associated with public drinking water supplies include:

- reduction in flows in rivers resulting from abstractions from lochs, rivers and groundwater, with the largest impact being during periods of dry weather when river flows are already low;
- changes in the volume and pattern of water flows in the rivers downstream of reservoir dams with consequent changes in the natural pattern of sediment erosion, transport and deposition in the rivers;
- large variations in water levels in water storage reservoirs.

Dams and water intake structures can also act as barriers to fish migration. Our planned measures to address barriers to fish migration are summarised in Section 9 below.

Use of water in the home has been progressively increasing over many years although this increase in demand has been partly counteracted in some parts of Scotland by a reduction in demand from declining heavy industries and manufacturing industries.

8.2.1 How we will coordinate our work to encourage and ensure action

Investments in the public drinking water supply network will continue to be coordinated through our national investment planning process for Scottish Water, Quality and Standards[76]. The Scottish Government has issued Directions to Scottish Water for improvements that are required to 2015[77].

This process will be informed by Scottish Water's first comprehensive long-term Water Resource Plan[78], which has been produced in collaboration with SEPA.

SEPA and Scottish Water will also continue to work together to identify where there are currently constraints on how much new development can be accommodated in an area given:

- the capacity of Scottish Water's abstraction, treatment and distribution network facilities;
- the capacity of the water environment to provide more water without deteriorating.

8.2.2 How we are ensuring action is taken to prevent deterioration of status

Scottish Water is a designated responsible authority and will carry out its functions to help secure the achievement of our objectives. The principal legislative, economic and educational mechanisms we will also use to help prevent deterioration include those set out in Table 14 below.

SEPA, Scottish Water and local authorities will provide advice to developers on where development can be accommodated within the existing capacities of the water purification and distribution network and the water environment. Where development is constrained by lack of capacity, Scottish Water will identify the need for further investment (eg in leakage reduction, etc) and this will be taken into account as part of the Quality and Standards investment planning process.

Drinking water supplies for many rural communities and some larger settlements are drawn directly from rivers. This makes them vulnerable to relatively short periods of dry weather. Scottish Water will put in place drought plans for all vulnerable schemes including large schemes serving large populations. These plans will set out the steps it will take to maintain drinking water supplies as drought threatens and develops whilst avoiding or minimising deterioration of the status of the water environment. The steps will include reducing non-essential uses and enhancing leakage reduction. The plans will be updated regularly to take account of demographic change and improved understanding of the effects of climate change.

SEPA's understanding of risks to the water environment is based in part on information included in abstraction authorisations. SEPA is working with Scottish Water to check actual abstraction volumes against this information as well as to quantify leakage. This process will help SEPA better assess whether any proposed future increases in water abstraction pose a risk of deterioration.

[76] www.scotland.gov.uk/Topics/Business-Industry/waterindustryscot/improvingservices
[77] www.scotland.gov.uk/Topics/Business-Industry/waterindustryscot/latest-news/swdirections
[78] www.scottishwater.co.uk/portal/page/portal/SWE_PGP_INVESTMENT/SWE_PGE_INVESTMENT/WHAT_PLAN_RES

8.2.3 How we will ensure action is taken to reduce pressures from public drinking water supply

Table 14 below summarises the principal measures that we plan to us to improve the water flows and levels in bodies of water affected by drinking water supply.

Table 14: Summary of our planned measures for reducing pressures on water flows and levels for drinking water supply

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced water abstraction and impoundment impacts on water flows and levels	**Reduce demand** reduce leakage rates in water supply network to enable reduced water abstraction;	Scottish Water	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Economic Publically-funded investment programme for Scottish Water (Quality and Standards)	Scottish Government, and Water Industry Commission for Scotland[79]
	Improve water use efficiency to enable reduced abstraction	Businesses and households	Scottish Water charging scheme for business customers	Scottish Water
			Education and advice Scottish Water Customer Support; guidance and publicity on industrial best practice Vision in Business for the Environment of Scotland (VIBES) competition on industrial best practice Information for customers on how to use water efficiently particularly in at risk areas	Scottish Water, SEPA
	Increase supply capacity integrate and optimise relative use of different sources; increase capacity of existing source (eg install storage for peak demands, increase reservoir capacity); develop additional sources	Scottish Water	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Economic Publically-funded investment programme for Scottish Water (Quality and Standards)	Scottish Government and Water Industry Commission for Scotland

8.2.4 How action will be phased

We have phased our programme of measures for improving water flows and levels affected by drinking water supply in line with our planned objectives for the water bodies concerned. The phasing of the improvements is summarised in Table 15 below.

[79] www.watercommission.co.uk/

Table 15: Planned improvements to the water flows and levels of bodies of water affected by drinking water supply

Number of water bodies improved to achieve good condition water flows and levels		
2015	**2021**	**2027**
26	16	60

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pressures from drinking water supply on water flows and levels

Climate check of:	**A: Greenhouse emissions**	**B: Preparing Scotland for a future climate**					**C: Action's continued effectiveness**
				Ecosystem services			
		Flood risk	Drought	Biodiversity	Economic	Recycling wastes	
Action reduce leakage rates in water supply network	Less water unnecessarily treated and pumped	-	-	-	-	-	May need to be supplemented due to increased demand
Action increase water use efficiency	Less water treated and pumped	-	-	-	-	-	May need to be supplemented due to increased demand
Action Increase supply capacity	Uncertain - depends on whether pumping and purification treatment would increase or decrease	Integrated system has flexibility to store flood waters	-	-	-	-	May need to design for changed rainfall pattern and increased demand
Outcome improved water flows and levels	-	-	More water in rivers - flows maintained for longer	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

8.3 Measures to manage pressures on water flows and levels from agricultural irrigation

Irrigation of fruit and vegetable crops (particularly potatoes) is commonly undertaken on farms along east and north east coastal areas of the river basin district during dry periods in the growing season.

Some of the streams and small rivers from which the water is abstracted in these relatively low rainfall areas have limited capacity to support large scale abstractions during dry weather. As many as 20 farmers may be taking water from the same river catchment at any one time. An individual abstraction can take up to as much as 2,000 m^3 per day, an amount sufficient to meet the domestic needs of around 10,000 people.

8.3.1 How we will co-ordinate our work to encourage and ensure action

SEPA will work with other public bodies and industry associations to provide co-ordinated advice to farmers on, for example, how to reduce water demand.

SEPA will also work with farmers in river catchments with multiple abstractions for irrigation to encourage and support the development of coordinated solutions.

8.3.2 How we are ensuring action is taken to prevent deterioration of status

SEPA will work with farmers to ensure that existing irrigation abstractions are managed so that they do not cause deterioration of status. The principal legislative, economic and educational mechanisms that will be used to prevent deterioration will include those set out in Table 16 below.

SEPA's understanding of risks to the water environment is based in part on information provided by farmers and included in their abstraction authorisations. SEPA will work with farmers to improve understanding of the timings and volumes of water abstracted for irrigation and then check this against information in the relevant authorisations. This will enable SEPA to better assess the risk of deterioration posed by any proposed increase in water abstraction.

8.3.3 How we will ensure action is taken to reduce pressures from agricultural irrigation

Table 16 below summarises the principal measures that we plan to us to improve the water flows and levels in bodies of water affected by water abstraction for agricultural irrigation.

Table 16: Summary of our planned measures for reducing pressures on water flows and levels from agricultural irrigation

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Reduced water abstraction impacts on water flows and levels	**Reduce demand** improve water use efficiency (eg better match irrigation levels to crop needs, reduce leakage); manage soil to increase its water holding capacity; sow crops/crop varieties with lower water needs **Change timing of abstraction** stagger timing of abstractions in river catchments with multiple abstractions; abstract water into constructed ponds during wet weather and use the stored water for irrigation during dry weather **Use alternative source** obtain water from other sources (eg groundwater) and integrate use of different sources	Farmers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Education and advice Guidance and advice on reducing demand, constructing storage ponds etc	SEPA, other relevant public bodies, farming advisors and industry associations
			Economic Scotland Rural Development Programme funding for storage ponds	Scottish Government

8.3.4 How action will be phased

We have phased our programme of measures for improving water flows and levels affected by irrigation abstractions in line with our planned objectives for the water bodies concerned. The phasing of the improvements is summarised in Table 17 below.

Table 17: Planned improvements to the water flows and levels of bodies of water affected by irrigation abstractions

Number of water bodies improved to achieve good condition water flows and levels		
2015	**2021**	**2027**
14	22	63

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pressures from irrigation abstractions

		B: Preparing Scotland for a future climate					
				Ecosystem services			
Climate check of:	**A: Greenhouse emissions**	Flood risk	Drought	Biodiversity	Economic	Recycling wastes	**C: Action's continued effectiveness**
Action reduce demand	Less water pumped due to more efficient use; improved carbon sequestration in soils due to good soil management	-	More water stored in soils for slow release	-	-	-	Action expected to be resilient and flexible as climate changes
Action change timing of abstraction	-	-	-	Expansion of habitats (storage ponds) increases resilience	-	-	May need to design ponds for increased demand
Action provide supply from other sources	Uncertain - depends on whether pumping increases or decreases	-	-	-	-	-	Action expected to be resilient and flexible as climate changes
Outcome improved water flows and levels	-	-	More water in rivers in dry weather	Reduced stress - increased resilience of sensitive species	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

9. Barriers to fish migration and pressures on beds, banks and shores

Barriers to fish migration can be created by dams and weirs used to facilitate abstractions for purposes such as hydroelectricity generation or drinking water supply. They may also be caused by dams and weirs that have ceased to be used for such purposes or by other engineering structures, such as badly designed river culverts.

Pressures on the beds, banks and shores of surface waters may be the result of:

- one-off activities, such as many building or engineering works (eg construction of docks and breakwaters to form a port or harbour, dense forestry planting on river banks[80]);
- ongoing or periodically repeated activities, such as livestock grazing and other agricultural land management practices on banks and shores or maintenance engineering works, such as dredging;
- wider land and water management activities (eg soil tillage, control of river flows at dams, etc) that change the amount of sediment reaching the water environment and the normal processes of sediment erosion, transport and deposition within the water environment.

Engineering modifications to beds, banks and shores may be made for a variety of purposes, including flood defence, land drainage, navigation and urban development. Land uses and water uses have changed since some of the engineering modifications to the Scotland RBD's water bodies were made and the modifications may no longer serve any purpose. Changes to bank and shore vegetation are typically an indirect consequence of land use activities, such as agriculture and forestry or of engineering changes.

Given enough time and space, natural processes (where not significantly affected by wider land and water management activities) will usually lead to improvements in the condition of beds, banks and shores once pressures from ongoing activities have been sufficiently reduced.

The rate of self-recovery will vary widely depending on, among other things, the energy of water flows in the water environment and the resistance of engineered structures. For example, higher energy rivers such as those in upland areas may recover relatively quickly. In contrast, lower energy, lowland rivers may not recover in the foreseeable future unless action is taken to speed the recovery process along. As a consequence, the on-the-ground actions we need to achieve our objectives will vary and include:

- passive interventions where on-going activities maintaining the pressures are simply reduced or stopped;
- low-level interventions to mitigate impacts and assist self-recovery processes by, for example, removing or modifying hard engineering structures, such as culverts or bank and shoreline reinforcements;
- high-level interventions where more natural bed, bank and shore characteristics are re-engineered in part or in full.

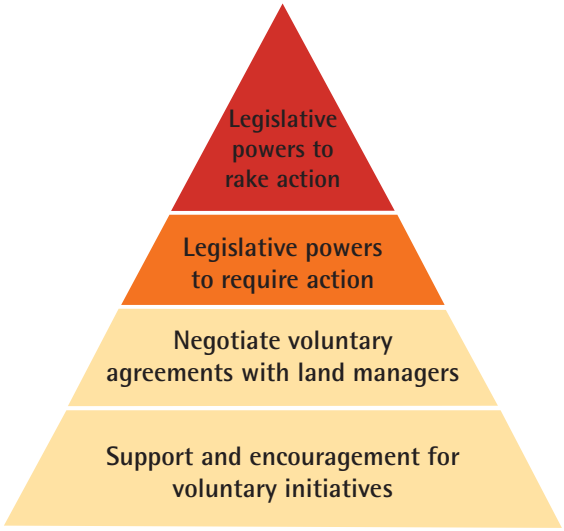
9.1 Overall coordination of our work to encourage and ensure action

SEPA will provide overall coordination of our work to protect and improve the beds, banks and shores of surface waters. It will:

- apply the tiered approach identified in the Scottish Government's proposed restoration framework[81] (see Figure 5 below);
- coordinate the preparation and implementation of a detailed plan for putting the framework into practice, based on a catchment approach;
- work with other public bodies and other organisations to help ensure implementation of the plan delivers multiple benefits (eg biodiversity conservation objectives; fishery management plan objectives[82]; biosecurity plan objectives[83]);
- work with its area advisory groups to encourage and support voluntary initiatives;
- coordinate the targeting of available restoration funding provided by the Scottish Government with other sources of public and private funding (eg under the Scotland Rural Development Programme) to ensure the efficient use of funds.

[81] www.scotland.gov.uk/Publications/2008/12/18145403/0
[82] www.rafts.org.uk/projects/fisheriesmanagementplanning.asp
[83] www.invasivespeciesscotland.org.uk/biosecurity_programme/rafts_biosecurity_programme.asp

Figure 5: Scottish Government's proposed restoration framework



To help achieve our planned improvements for 2015, SEPA will focus the funding available on encouraging, supporting and ensuring:

- fish passage at barriers to fish migration other than barriers caused by dams that are the responsibility of a water user (eg Scottish Water, hydroelectricity generating companies, etc) or a public body;
- improvements to the beds and banks of rivers that will deliver multiple benefits and, in particular, complement efforts by farmers in priority catchments (see Section 7.1 above) to reduce diffuse pollution.

9.2 Managing pressures on bank and shore vegetation

9.2.1 How we will coordinate our work to encourage and ensure action

Many of the actions to improve bank and shore vegetation will contribute to tackling diffuse pollution from agriculture and deliver wider benefits by improving biodiversity and helping to mitigate the effects of climate change. Our objectives for improving bank and shore vegetation will be integrated into our programme of measures on rural diffuse pollution (see Section 7.1).

The management of forests and woodlands in Scotland is guided by the UK Forestry Standard and its supporting guidelines[84].

As part the overall coordinated approach described in Section 9.1 above, SEPA and Forestry Commission Scotland will continue to work together to ensure our objectives for the water environment are integrated into:

- forest design plans for national forests and forest plans for private forests;
- decisions on public funding support under the Scotland Rural Development Programme for private forest management;
- awareness raising, the development of best practice guidance and the provision of training for the forest industry.

[84] www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf

9.2.2 How we are ensuring action is taken to prevent vegetation changes on banks and shores that would cause deterioration of status

Forestry Commission Scotland is a designated responsible authority and will carry out its functions in managing the Scottish forests to help secure the achievement of our objectives. The principal legislative, economic and educational mechanisms that will be used to prevent deterioration will include those set out in Table 18 below. In addition:

- SEPA, Forestry Commission Scotland and their SEARS partners will ensure that forestry management activities and agricultural land management activities are undertaken in accordance with the Water Environment (Controlled Activities)(Scotland) Regulations 2005;
- Forestry Commission Scotland will continue to require forest managers to comply with the latest version of the Forests and Water Guidelines as a condition of receiving funding support;
- Forest Plan, Forest Design Plan and felling approvals[85] will only be given to schemes that conform to the sustainable forest management practices required by the UK Forestry Standard[86];
- Forestry Commission Scotland will require an assessment of the environmental effects of proposals likely to result in significant environmental impacts and involving:
  - afforestation;
  - deforestation;
  - forest roads;
  - forest quarries

  before such proposals are allowed to proceed[87].
- the Scottish Government will require an assessment of the environmental effects of proposals involving:
  - the conversion of uncultivated land and semi-natural areas for intensive agricultural purposes;
  - the large scale restructuring of rural land holdings involving agricultural land

  before such proposals are allowed to proceed[88].

9.2.3 How we will ensure action is taken to reduce pressures from vegetation changes on banks and shores

Table 18 below summarises the principal measures that we plan to us to improve bank and shore vegetation in bodies of surface water.

Table 18: Summary of our planned measures for improving bank and shore vegetation

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Improved bank and shore vegetation	**Pressures from forestry**			
	Enable recovery with low-level intervention Removal of non-native conifers from banks and shores in national forests; establish well structured vegetation cover to form a buffer zone along banks and shores (eg native tree planting)	Forestry Commission Scotland	**Legislative** Water Environment and Water Services (Scotland) Act 2003 Restoration legislation (pending)	Forestry Commission Scotland, SEPA

[85]Under the Forestry Act 1967, felling licences are required from Forestry Commission Scotland before trees are felled.
[86]www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf
[87]Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999; www.forestry.gov.uk/forestry/infd-5zgkwl
[88]Environmental Impact Assessment (Agriculture) (Scotland) Regulations 2006

Table 18: Summary of our planned measures for improving bank and shore vegetation (continued)

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Improved bank and shore vegetation	**Pressures from forestry**			
	Removal of non-native conifers from banks and shores in privately owned forests; establish well structured vegetation cover to form a buffer zone along banks and shores (eg native tree planting)	Private forest managers	**Education and advice** Guidelines and training (eg Forests and Water Guidelines) **Economic** Public funding of Forestry Commission Scotland; Scotland Rural Development Programme	Forestry Commission Scotland Scottish Government
	Pressures from rural land management (other than forestry)			
	Enable recovery with passive intervention Prevent or limit livestock access to banks and shores (eg fencing); leave a buffer between the water environment and cultivated land	Land managers; voluntary groups, SEPA, district salmon fishery boards	Legislative Water Environment (Controlled Activities) (Scotland) Regulations 2005; Restoration legislation (pending)	SEPA
			Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 Wildlife and Countryside Act 1981	District salmon fisheries boards
	Enable recovery with low-level intervention Remove dense stands of invasive non-native plants (eg rhododendron) from banks and shores; establish well structured vegetation cover on banks and shores (eg native tree planting)		**Economic** Scotland Rural Development Programme; Restoration funding administered by SEPA; Scottish Natural Heritage community grant schemes Fishery management planning funds administered by rivers and fishery trusts	Scottish Government; Scottish Natural Heritage; Rivers and Fisheries Trusts of Scotland and member trusts
			Education and advice Guidelines[89], training, awareness raising;	Local authorities, national park authorities, SEPA and its SEARS partners, Area Advisory Group member organisations; Rivers and Fisheries Trusts of Scotland and member trusts

[89]eg SEPA's Good Practice Guide Riparian Vegetation Management available at: www.sepa.org.uk/water/water_regulation/guidance/engineering.aspx

Table 18: Summary of our planned measures for improving bank and shore vegetation (continued)

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Improved bank and shore vegetation	**Pressures from urban land management**			
	Enable recovery with passive intervention Where possible create a green buffer zone between water environment and the built environment when re-developing or re-generating urban areas; establish well structured vegetation cover to form a buffer zone along banks and shores (eg native tree planting).	Developers	**Legislative** Town and Country Planning (Scotland) Act 1997 Water Environment (Controlled Activities) (Scotland) Regulations 2005	Local authorities, urban regeneration companies SEPA
	Enable recovery with low-level intervention Remove dense stands of invasive non-native plants (eg rhododendron) from banks and shores; establish well structured vegetation cover to form a buffer zone along banks and shores (eg native tree planting)	Voluntary groups, local authorities, land owners, SEPA, district salmon fishery boards	**Legislative** Restoration legislation (pending) Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 Wildlife and Countryside Act 1981 **Economic** Local authority funds on public land; Restoration funding administered by SEPA; Scottish Natural Heritage community grant schemes; fishery management planning funds administered by rivers and fishery trusts **Education and advice** Guidelines[90], training, awareness raising, demonstration sites	SEPA District salmon fisheries boards Local authorities, Scottish Government; Scottish Natural Heritage; Rivers and Fisheries Trusts of Scotland and member trusts Local authorities, national park authorities, Scottish Natural Heritage, SEPA, Area Advisory Group members, River Restoration Centre[91] Rivers and Fisheries Trusts of Scotland and member trusts

[90]eg netregs guidance for businesses on invasive weeds: www.netregs.gov.uk/netregs/63095.aspx; Environment Agency *Knotweed code of practice* www.environment-agency.gov.uk/static/documents/Leisure/japnkot_1_a_1463028.pdf

[91]www.therrc.co.uk/

9.2.4 How action will be phased

We have phased our programme of measures for improving banks and shores vegetation in line with our planned objectives for the water bodies concerned. The phasing of the improvements is summarised in Table 19 below.

Table 19: Planned improvements to bank and shore vegetation

Action	Number of water bodies improved to achieve good bank and shore vegetation		
	2015	2021	2027
Action to improve bank and shore vegetation	6	40	47

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to reduce pressures on bank and shore vegetation

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Actions and outcome - improved bank and shore vegetation	Increased carbon sequestration in vegetation and soils	Banks and shores more resistant to erosion and slow flood waters down	-	Better food supply + shading reduces thermal stress; expansion of bank and shore habitats; healthy vegetation likely to be more resistant to invasion by non-native species	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	Actions expected to be resilient

9.3 Managing engineering pressures

9.3.1 How we will co-ordinate our work to encourage an ensure action

As part the overall co-ordinated approach described in Section 9.1 above, SEPA and local authorities will continue to work together to ensure that our objectives for controlling and reducing engineering pressures on beds, banks and shores (and pressures from urban development on bank and shore vegetation - see section 9.2 above) are integrated into:

- land use planning and development control decisions;
- flood risk management plans and practices;
- coastal zone management plans.

SEPA is also responsible for preparing flood management plans for the Scotland RBD. It will work with local authorities to identify opportunities for improving beds, banks and shores through sustainable flood management approaches. These may include removing man-made structures that can exacerbate flooding and allowing flooding of undeveloped floodplains to reduce peak water levels in downstream urban areas.

9.3.2 How we are ensuring action is taken to prevent engineering works from causing deterioration of status

Our legislative framework will be used to ensure that proposed new engineering works do not cause deterioration of status. Prior authorisation for any engineering works affecting rivers and lochs is required from SEPA[92] and for any affecting estuaries and coastal waters is required from Scottish Ministers. In addition:

- SEPA will continue to provide good practice guidance on designing and undertaking building and engineering works[93];
- local authorities and national parks authorities will seek to protect and conserve areas adjacent to surface waters (eg "green corridors") from further building and engineering works. They will also work with SEPA to ensure that developers are aware of what will be required in the way of good practice to avoid deterioration of status where engineering works are necessary.

New flood protection measures may be necessary to protect human health and maintain human safety as Scotland's climate changes. As one of its duties under the Flood Risk Management (Scotland) Act 2009, SEPA will work with local authorities to ensure that:

- flood risk is managed in the most sustainable way, using a range of techniques, including natural techniques;
- where engineering works that will cause deterioration of status are necessary, all practicable mitigation measures are taken to minimise the deterioration.

9.3.3 How we will ensure action is taken to reduce pressures from building and engineering works on beds, banks and shores

Table 20 below summarises the principal measures that we plan to us to reduce the adverse impact on beds, banks and shores of surface water caused by past building and engineering works.

Table 20: Summary of our planned measures for reducing pressures on beds, banks and shores from past engineering works

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Improved condition of beds, banks and shores	**Pressures from rural land management**			
	Enable recovery with passive intervention Modify, reduce or stop maintenance works (eg dredging)	Rural land managers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
	Enable recovery with low-level intervention Move embankments further away from banks and shores; reduce pressures from hard engineering structures on beds, banks and shores (eg improve design, use softer engineering techniques, remove)	Voluntary groups, local authorities, land owners, SEPA, district salmon fishery boards	**Legislative** Flood Risk Management (Scotland) Act 2009 Restoration legislation (pending) Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003	Local authorities, SEPA SEPA District salmon fishery boards

[92]Water Environment (Controlled Activities) (Scotland) Regulations 2005
[93]www.sepa.org.uk/water/water_regulation/guidance/engineering.aspx

Table 20: Summary of our planned measures for reducing pressures on beds, banks and shores from past engineering works (continued)

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Improved condition of beds, banks and shores	**Pressures from rural land management**			
	Enable recovery with high-level intervention Re-engineer more natural bed and bank features (eg recreate meanders in straightened rivers)	Voluntary groups, local authorities, land owners, SEPA, district salmon fishery boards	**Economic** Scotland Rural Development Programme; restoration funding administered by SEPA; funding for flood protection measures Scottish Natural Heritage community grant schemes	Scottish Government; local authorities; Scottish Natural Heritage
			Education and advice Demonstration sites; good practice guides, awareness raising	SEPA and its SEARS partners, members of Area Advisory Groups, River Restoration Centre
	Pressures from urban land management			
	Enable recovery with passive intervention Modify, reduce or cease maintenance works (eg dredging)	Local authorities, port managers	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Food and Environment Protection Act 1985	Scottish Government
			Education and advice Good practice guidance	SEPA, Scottish Government, industry associations
	Enable recovery with low-level intervention Move embankments further away from banks and shores; reduce pressures from hard engineering structures on beds, banks and shores (eg improve design, use softer engineering techniques, remove) **Enable recovery with high-level intervention** Re-engineer more natural bed and bank features (eg recreate meanders in straightened rivers)	Voluntary groups, local authorities, land owners, SEPA, district salmon fishery boards	**Legislative** Flood Risk Management (Scotland) Act 2009	Local authorities, SEPA
			Restoration legislation (pending)	SEPA
			Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003	District salmon fisheries boards
			Economic Restoration funding administered by SEPA; funding for flood protection measures, Scottish Natural Heritage community grant schemes	Scottish Government, local authorities, Scottish Natural Heritage
			Education and advice Good practice guidance[94], awareness raising	SEPA, local authorities, national park authorities, members of Area Advisory Groups, River Restoration Centre

9.3.4 How action will be phased

We have phased our programme of measures for reducing engineering pressures in line with our planned objectives for the water bodies concerned. The phasing of the planned improvements is summarised in Table 21 below.

[94]eg SEPA's guide to sustainable watercourse management in the urban environment www.sepa.org.uk/water/water_regulation/guidance/engineering.aspx

Table 21: Planned improvements to the physical characteristics of beds, banks and shores

Action	Number of water bodies improved to achieve good bed, bank and shore characteristics		
	2015	2021	2027
Action to reduce engineering pressures	55	117	202

Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned actions to reduce engineering pressures

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
		Flood risk	Drought	Ecosystem services			
				Biodiversity	Economic	Recycling wastes	
Action reduce maintenance	Less maintenance reduces energy usage	-	-	Expansion of bank, shore and floodplain habitats increases resilience	-	-	Action expected to be resilient
Action low and high level interventions	Short-duration increased energy usage during intervention	-	-	Expansion of bank, shore and floodplain habitats increases resilience	-	-	Action expected to be resilient[95]
Outcome improved bed, bank and shore physical characteristics	-	River flows slowed and re-connected with un-developed flood plains	-	Reduced stress - (eg narrowing of over-wide channels) increases resilience of sensitive species	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	Reduced stress - helps system maintain service	

9.4 Managing barriers to fish migration

9.4.1 Coordinating measures to prevent and reduce obstacles to fish migration

As part of the overall coordinated approach described in Section 9.1 above, SEPA will work with:

- its Fish and Fisheries Advisory Group and industry representatives to improve understanding of good practice techniques for enabling fish passage;
- the Scottish Government to integrate the objectives of Scotland's eel management plan[96] and the planned actions on barriers to fish migration;
- Scottish Water to ensure our national investment planning process for Scottish Water, Quality and Standards[97], takes account of the improvements needed to fish passage at dams used for public drinking water supply;
- district salmon fishery boards and the rivers and fisheries trusts to coordinate efforts to remove barriers to fish migration.

[95]Assumes that consideration is given to future rainfall patterns (eg more frequent intense storms) when designing action for engineering modifications serving a flood protection function.
[96]www.scotland.gov.uk/Topics/marine/Fisheries/Salmon-Trout-Coarse
[97]www.scotland.gov.uk/Topics/Business-Industry/waterindustryscot/improvingservices

9.4.2 How we are ensuring action is taken to prevent creating barriers to fish migration

SEPA will work with Scottish Water, hydroelectricity generating companies and other operators of reservoirs to ensure that provisions for fish passage at existing dams are maintained in working order. It will also require developers to ensure that any new dams, weirs or other engineering works are designed and operated to enable fish passage before those works are permitted to be undertaken.

The principal legislative, economic and educational mechanisms that will be used to prevent deterioration in fish passage will include those set out in Table 22 below.

9.4.3 How we will ensure action to ensure fish passage at existing barriers

Table 22 below summarises the principal measures that we plan to us to remove barriers to fish migration.

Table 22: Summary of our planned measures for ensuring fish passage at existing barriers to migration

Improvement required	Examples of on the ground actions	Who will take action on the ground	Mechanisms to encourage and ensure action	Lead responsibility for ensuring action
Improved fish access to rivers and lochs	**Dams and weirs being used to facilitate abstraction for hydroelectricity generation, drinking water supply or other purposes, or to control water flows and levels (eg for flood management)**			
	Install and operate provisions for fish passage (eg fish passes)	Hydro-electricity generation companies; Scottish Water; other operators of dams used for abstraction or controlling water flows and levels (eg drinks industry)	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA
			Economic Publically-funded investment programme for Scottish Water (Quality and Standards)	Scottish Government and Water Industry Commission for Scotland
			Education and advice Good practice guidelines	SEPA, Fish and Fisheries Advisory Group
	Dams and weirs not being used to facilitate abstraction or to control water flows and levels and other barriers (eg some culverts)			
	Install provisions for fish passage (eg fish passes); remove weir or other structure causing the barrier	Voluntary groups, local authorities, land owners, SEPA, district salmon fishery boards	**Legislative** Water Environment (Controlled Activities) (Scotland) Regulations 2005; Restoration legislation (pending)	SEPA
			Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003	District salmon fishery boards
			Flood Risk Management (Scotland) Act 2009	SEPA, local authorities
			Economic restoration funding administered by SEPA; funding for flood protection measures, fishery management planning funds administered by rivers and fishery trusts	Scottish Government, local authorities; Rivers and Fisheries Trusts of Scotland and member trusts
			Education and advice Good practice guidelines, awareness raising	SEPA, Fish and Fisheries Advisory Group, District Salmon Fishery Boards, Rivers and Fisheries Trusts of Scotland and member trusts, Area Advisory Group members

9.4.4 How action will be phased

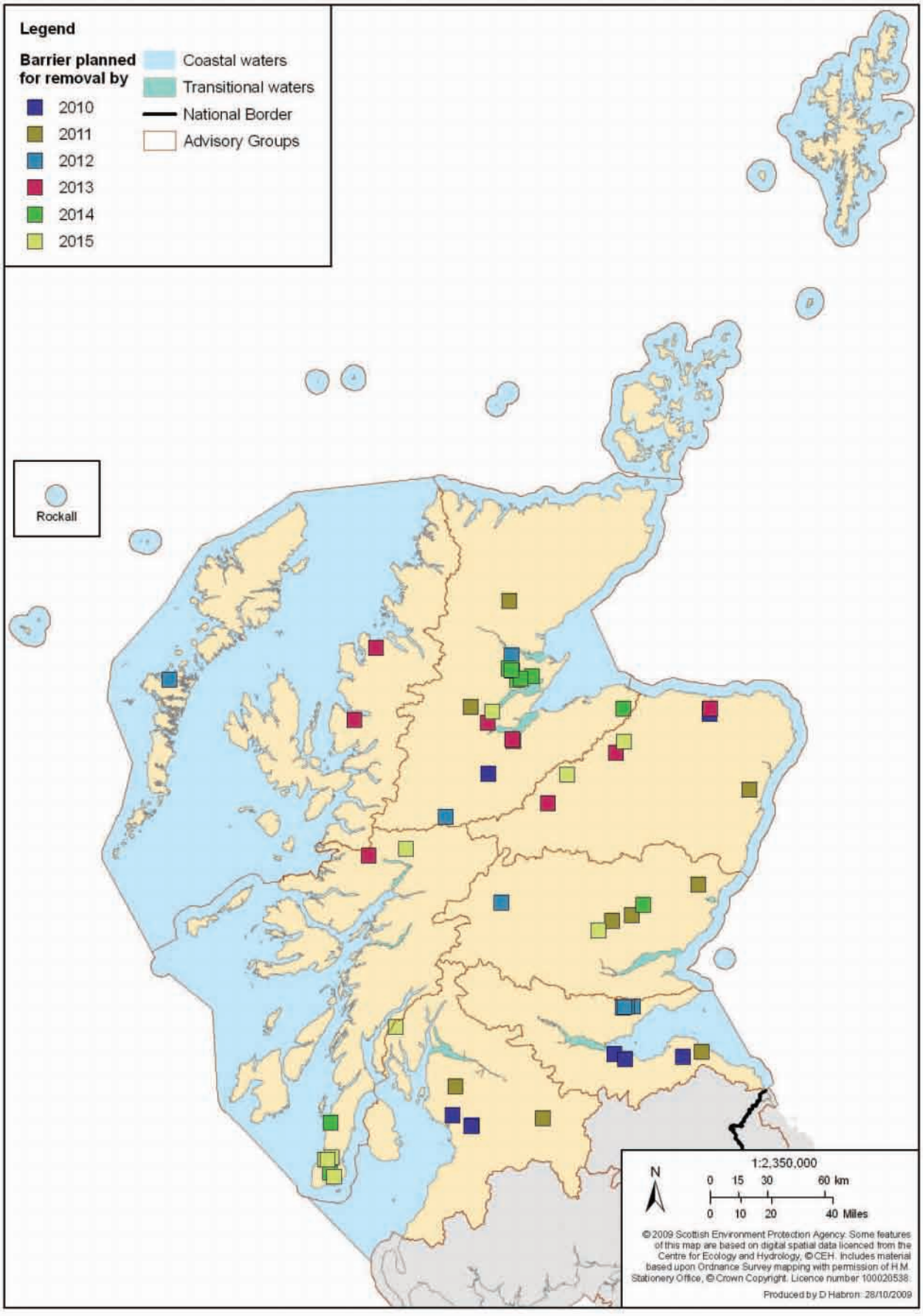
We have phased our programme of measures for ensuring fish passage at existing barriers to fish migration in line with our planned objectives for the water bodies concerned. The phasing of the improvements is summarised in Table 23 below.

Table 23: Planned improvements to migratory fish access to rivers and lochs

Action	Number of water bodies improved to enable good access to migratory fish		
	2015	2021	2027
All action to improve fish migration	91	67	126
Action to improve fish migration at dams used for hydropower generation or drinking water supply	11	1	11
Action to improve fish migration at other barriers	82	67	121

Map 5 below indicates existing barriers to fish migration at which SEPA plans to ensure fish passage using Government restoration funding where necessary. SEPA may substitute action at these barriers with action at others where further investigations identify that addressing other barriers would provide greater benefits or otherwise be more cost-effective.

Map 5: Existing barriers to fish migration targeted for action by 2015



Our preliminary climate check of the likely range of on-the-ground actions is summarised below. The precise combination of actions used will vary.

Preliminary climate check of planned action to ensure fish passage at existing barriers

Climate check of:	A: Greenhouse emissions	B: Preparing Scotland for a future climate					C: Action's continued effectiveness
				Ecosystem services			
		Flood risk	Drought	Biodiversity	Economic	Recycling wastes	
Action install fish passes	Short-duration increase in energy usage during construction	-	Possible increased flow releases from water storage reservoirs to operate fish pass	-	-	-	Action expected to be resilient
Action remove non-operational dams, weirs and other structures	End of on-going maintenance requirements reduces energy usage	May reduce flood risk by preventing water backing up (eg at culverts)	-	-	-	-	Action expected to be resilient
Outcome improved access for migratory fish	-	-	-	Expanded fish populations increases resilience	Reduced stress - helps sustain wild fisheries, quality for tourism, etc	-	

10. Managing the risks posed by invasive non-native water plants and animals

Many of the invasive non-native water plants and animals already established in Scotland's water environment were introduced, deliberately or accidently, through activities such as horticulture and fisheries. These plants and animals can have a potentially significant impact on the ecological quality of the water environment, wild fisheries, aquaculture and recreation. Complete eradication of established populations can often be costly and difficult and, for some species, may not be possible. Preventing introductions is therefore of primary importance in our strategy for managing the risks posed to the status of the water environment.

Many of the actions described in this section will also be used to help manage the risks posed by invasive non-native land plants. Such plants can adversely affect the natural structure and condition of vegetation on the banks and shores of water bodies. Section 9.2 above provides details of our planned actions to prevent and reduce their impacts.

10.1 How we will co-ordinate our work to encourage and ensure action

Action to encourage and ensure action across England, Scotland and Wales will continue to be co-ordinated through the Invasive Non-Native Species Framework Strategy for Great Britain (GB Strategy)[98]. The government administrations will provide the overall lead in implementing the strategy. Further information about co-ordination in Great Britain can be found on the website of the GB non-native species secretariat[99].

The UK Technical Advisory Group on the Water Framework Directive (UKTAG) is responsible for providing technical guidance on the implementation of the Water Framework Directive in the United Kingdom. UKTAG will continue to provide up-to-date scientific advice on the non-native water plants and animals posing the greatest risk to the ecological quality of surface waters[100].

In Scotland, the Scottish Working Group on invasive non-native species coordinates the overall response of public sector bodies to all invasive non-native species, including water plants and animals. Information about the remit and membership of the group can be found on the Scottish Government's website[101].

10.2 How we are ensuring action is taken to prevent invasive non-native water plants and animals from causing deterioration of status

To prevent deterioration of status, we will seek to:

- prevent the introduction of invasive non-native plants and animals into the water environment;
- detect any introductions as early as possible and take action to try to rapidly eradicate the species before they become established;
- where possible, contain the spread of established populations of invasive non-native species, including those that that rapid action could not eradicate.

[98] http://nonnativespecies.org/documents/Invasive_NNS_Framework_Strategy_GB_E.pdf
[99] www.nonnativespecies.org/
[100] www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5332/alien_tag_table
[101] www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/InvasiveSpecies/ConsultationandResponse

10.3 Legislative framework

The Scottish Government is preparing to introduce further legislation[102] to strengthen the existing legislative framework provided under the Wildlife and Countryside Act 1981, the Aquaculture and Fisheries (Scotland) Act 2007, the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 and the Import of Live Fish (Scotland) Act 1978. The Wildlife and Countryside Act makes it an offence to:

- release any animals not ordinarily resident and not regular visitors to Great Britain into the wild;
- release (or in the case of plants, cause to grow) any species of animal or plant listed in the Act.

The legislative framework relating to fish provides that no non-native species of live fish or fish eggs can be introduced into rivers or lochs without the consent of Scottish Ministers.

10.4 Education and advice about preventing introductions

Education and awareness-raising is important to help people understand the threat posed by introductions of non-native plants and animals and their responsibilities under Scotland's legislative framework for preventing such introductions. We will improve education and awareness through:

- an information and awareness raising campaign organised under the GB Strategy;
- information and awareness raising programmes coordinated by the member organisations of the Scottish Working Group, including:
  - work co-ordinated by Scottish Natural Heritage as part of the Species Action Framework[103], which includes implementation plans for North American signal crayfish (*Pacifastacus leniusculus*), New Zealand pygmyweed (*Crassula helmsii*) and wireweed (*Sargassum muticum*);
  - local awareness raising work by the member organisations of SEPA's area advisory groups;
  - implementation of local biodiversity action plans coordinated by local authorities and local biodiversity action plan partnerships.

The work of voluntary organisations will also continue to be an important and effective means of getting the message across about non-native species and the steps people can take to avoid their introduction and spread. We will coordinate our work to raise awareness with those of voluntary organisations.

The Rivers and Fisheries Trusts of Scotland's invasive species and biosecurity programme is supporting the development of biosecurity plans[104] by its 20 member trusts. These plans will provide the focus for work undertaken by fishery trusts to raise awareness and provide advice about how to avoid introductions of invasive non-native species. The Scottish Government, SEPA, Scottish Natural Heritage and other relevant public bodies will work in partnership with the trusts in implementing the plans.

Many infestations result from people removing plants that have out-grown their ponds and dumping them in nearby waterways. Plantlife is running a campaign in Scotland called "Pond Alert" to raise awareness of invasive non-native aquatic/pond plants[105].

10.5 Other action to prevent deterioration of status

Measures to prevent introductions may not always be completely successful. The effects of climate change, such as increased sea temperature, may increase threats: some invasive non-native water plants and animals may be better able to successfully invade the water environment and otherwise benign non-native species may become invasive.

Where introductions do occur, rapid action is important to try to eradicate the introduced plant or animal before it becomes established and threatens the status of surface waters. This requires early detection of introductions through surveillance and monitoring.

[102] See Scottish Government consultation on the Wildlife and Natural Environment Bill at www.scotland.gov.uk/Publications/2009/06/17133414/0
[103] www.snh.org.uk/speciesactionframework/
[104] www.invasivespeciesscotland.org.uk/biosecurity_programme/rafts_biosecurity_programme.asp
[105] www.plantlife.org.uk/uk/assets/saving-species/saving-species-publications/Pond-Alert--Scotland-2006.pdf

SEPA, Scottish Natural Heritage, other responsible authorities and the fishery trusts (as part of their biosecurity plans - see box above), will continue to work together to provide and improve early detection.

We will apply the same principles and standards of behaviour and vigilance in relation to species that are native to some parts of Great Britain but which could cause deterioration of status if introduced to parts of the Scotland RBD where they are not native.

The new legislative provisions that the Scottish Government is preparing to introduce will further develop the roles and responsibilities for coordinating early detection work and subsequent rapid response action.

10.6 How we will ensure action is taken to reduce pressures from invasive non-native water species

A number of water bodies in the Scotland RBD are at less than good status because of infestations of the North American signal crayfish. Work led by Scottish Natural Heritage to try to eradicate populations from small ponds in the catchment of the River North Esk was successful in one of the affected ponds. However, there remains no known effective technique for eradicating populations of North American signal crayfish from river water bodies.

To achieve our objectives for protected areas for the conservation of plants and animals, action is needed to control and, where possible, eradicate the invasive non-native water plants, Canadian pondweed (*Elodea canadensis*) in 4 protected areas and Nuttall's pondweed (*Elodea nuttalli*) in 1 protected area. This action will be led by Scottish Natural Heritage. Where reducing pollution would assist by making conditions less favourable for the invasive plants, the action to remove them will be co-ordinated with planned measures to tackle pollution.

Information and advice on techniques for controlling and eradicating invasive non-native water plants and animals is published by the Environment Agency[106], Scottish Natural Heritage[107] and the Rivers and Fisheries Trusts of Scotland[108]. The Scottish Government, Scottish Natural Heritage and SEPA will continue to undertake, support and encourage further research focused on increasing the effectiveness of control and eradication methods.

[106] www.environment-agency.gov.uk/static/documents/Leisure/GEHO0307BLZO-e-e(1).pdf
[107] www.snh.org.uk
[107] www.invasivespeciesscotland.org.uk/biosecurity_programme/invasive_non_native_species.asp