



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex E: Actions appraisal and
justifying objectives

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Decision code rapid link – click on code to access supporting table

A1a	C4a	HT1a	N1a
A1b	DO1a	HT3a	N1b
A2a	DO2a	INNS1a	N1c
A2b	DO2b	INNS2a	N1e
A3a	DO3a	M1a	N1o
A3b	DO3b	M1b	P1a
A5a	DO5a	M1c	P1b
A5b	DO5b	M1d	P1c
A5c	DrWPA1a	M1e	P1d
ANC2a	GC1a	M1f	P1e
ANC2b	GC2a	M1g	P1o
B1a	GC2b	M1h	P2a
B2a	GC3a	M1i	P2b
B2b	GC4a	M1j	P3a
B2c	GC4b	M1k	P5a
B2d	GC4c	M2a	P5c
B2e	GC5a	M2b	PH1a
B2f	GC6a	M2c	PH2a
B2g	GC6b	M2d	PH2b
B2h	GQ1a	M2e	PH3a
B2i	GQ1b	M2f	PH3b
B2j	GQ1c	M2g	PH5b
B2k	GQ1d	M2h	S2a
B2l	GQ2a	M2i	S2b
B2m	GQ2b	M2j	S2c
B2n	GQ3a	M3a	S2d
B2o	GQ4a	M3b	S2e
B2p	GQ5a	M3c	S2f
B2q	GQ5b	M3d	S3a
B2r	HL1a	M3e	S3b
B2s	HL2a	M3f	S3c
B3a	HL4a	M3g	S3d
C1a	HR1a	M3h	S3e
C2a	HR2a	M5a	S3f
C3a	HR4a	MS	T1a

E1 Introduction

This annex describes the process we used to identify and appraise measures and to develop water body objectives for the first cycle of river basin management. It also provides details on the justifications for setting any alternative objectives. In carrying out this process we have been guided by the River Basin Planning Guidance published by Defra and Welsh Assembly Government in 2006 and 2008

(<http://www.defra.gov.uk/environment/water/wfd/management.htm>).

We have also taken account of the Common Implementation Strategy (CIS) Guidance Document Number 20, which provides Member States with guidance on the use of exemptions to environmental objectives

(http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/documentn20_mars09pdf_EN_1.0_&a=d)

The guidance document emphasises the point that the Water Framework Directive (WFD) provides the framework and sets the general direction, but that there is scope for differences in understanding and application. Where we have taken a particular approach to the use of exemptions, we have tried to make the decisions as transparent as possible, offering explanations of the reasons behind use of exemptions either for reasons of disproportionate cost, technical feasibility or natural conditions. We have attempted to phase the implementation of measures to spread the costs of implementation while undertaking demonstrable action in the first cycle.

We will also attempt to identify alternative financing mechanisms to fund necessary and cost-effective action in the first cycle, and in cycles two and three. This might include distribution of costs among polluters and users (where the polluter can be identified), use of the public budget, private investment, EU and international funds etc.

We are also following the CIS guidance in our approach, by ensuring that aggregated information is relevant to the individual water body concerned, whilst acknowledging that this does not necessarily imply that the reasons for justifying an exemption must always be located within the water body for which the exemption is sought.

Article 4.8 of the WFD, and reiterated in the CIS document, also requires us, when applying an exemption to a water body to “ensure that the application does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district and is consistent with the implementation of other Community environmental legislation.” There are various references throughout this annex and plan to ensure this is the case e.g. Birds and Habitats Directives, Nitrates Directive, Bathing Water Directive.

The management of uncertainty will play a large part in the first cycle of river basin management plans as we continue to gather more monitoring data and evidence to establish the cause of water quality failures, or in order to develop the most cost-effective solution. We have taken uncertainty into account in setting objectives and deciding on the appropriate action to take for water bodies. This action is based largely on undertaking further investigations and making most use of new monitoring data to reduce the uncertainties in the future. The types of uncertainty considered in the CIS guidance, include:

- whether, and to what extent, a water body is adversely impacted and what and/or who causes the impact;
- the impact of policies already in place or planned and various trends and developments, including innovation and technical change;

- the effectiveness of measures in addressing an adverse impact on a water body (note that this will have an effect on the certainty of the benefits as well);
- the assessment of the achievement of good status;
- the costs associated with measures;
- the benefits resulting from improvements to the status of water bodies, particularly the calculation of the non-marketable benefits.

These uncertainties may lead to an extended deadline for the reason of technical infeasibility (for example where we do not know the source of a problem) or disproportionate cost (for example where we are not sure a water body isn't already at good status) because of the impact on cost and benefit estimates.

The river basin management plan is subject to economic and environmental assessment. An impact assessment has been produced (<http://www.environment-agency.gov.uk/research/planning/33106.aspx>) which reviews the costs and benefits of implementing the plan. The plan has also been the subject of a Strategic Environmental Assessment, and an environmental report has been produced which looks at the broader impacts that the plan may have on the environment, including the effects the plan may have on climate change. (Annex H sets out how climate change may itself impact on measures that we are able to put forward in the plan). The potential for the plan to have any significant negative effects on Natura 2000 sites has also been assessed by us, in consultation with Natural England and the Countryside Council for Wales.

E1.1 The Water Framework Directive's objectives

The Directive sets out in Article 4 the default environmental objectives that we should aim to meet. In summary, they are:

In relation to surface waters

- prevent deterioration in the status of water bodies;
- by 2015 achieve good ecological and chemical status¹ in all water bodies other than those which are artificial or heavily modified;
- by 2015 achieve good ecological potential and surface water chemical status for artificial and heavily modified water bodies;
- by 2015, achieve the objectives and comply with the standards for protected areas;
- reduce pollution from priority substances and cease discharges, emissions and losses of priority hazardous substances.

In relation to groundwaters

- prevent deterioration in status;
- take all measures necessary to prevent the input of hazardous substances into groundwater and to limit the input of other pollutants to groundwater;
- by 2015 achieve good quantitative and chemical status²;
- reverse any significant and sustained upward trend in the concentration of pollutants resulting from human activities;
- by 2015, comply with objectives and standards for protected areas.

¹ Also known as 'good surface water status': Article 2(18)

² Also known as 'good groundwater status': Article 2(20)

In relation to protected areas

The objectives for protected areas are mostly governed by the other European Community legislation under which they are designated, for example the Habitats Directive. For drinking water protected areas, the objectives are set out in the Water Framework Directive (WFD) itself. The protected areas objectives apply in addition to the requirement to achieve the environmental objectives of the WFD. It is not always possible to link the water body objectives with the protected area objectives as they are not always directly comparable, and in a number of cases, the size and scale of water bodies is not the same as waters identified as protected areas and so are not comparable. Where water body boundaries overlap with protected areas, and the objectives align, the most stringent objective applies. More details on protected areas and their objectives are set out in Annex D.

Alternative objectives

In certain circumstances (set out in Article 4.4 and 4.5 of the WFD) Member States may deviate from achieving the default objectives (e.g. good status by 2015). Objectives which are different from the default objectives are referred to here as alternative objectives.

Use of the alternative objectives is the mechanism which the WFD provides for:

- considering, amongst other things, other environmental, social and economic priorities alongside water management priorities; and
- prioritising action over successive river basin management planning cycles.

The alternative objectives and their conditions are the only relevant considerations when justifying the prioritisation of action under the WFD.

The types of alternative objective are:

- an extended deadline, e.g. achieving good ecological status by 2027;
- a less stringent objective, e.g. achieving moderate ecological status by 2015;
- different objectives for heavily modified or artificial water bodies, e.g. good ecological potential.

Alternative objectives are determined through a process of measures appraisal and objective setting. This process is at the heart of river basin management planning, and includes technical assessments (including consideration of technical infeasibility), economic assessment (to consider issues of disproportionate expense) and public consultation.

We have produced a list of simplified reasons for setting alternative objectives (extended deadlines and/or less stringent objectives). These are shown in Table 1.

Table 1: Reasons for not achieving good status

Reason	Sub-reason	Guidance notes
Technically infeasible	No known technical solution is available	Applies where there is no practical technique for making the necessary improvement. Does not include financial considerations. Techniques which may be under development but which are not yet known to be effective in practice will fall into this category.
	Cause of adverse impact unknown	Applies where a water body is classed as worse than good but the reason (the pressure or the specific source of the pressure) for this failure has not yet been determined. Consequently, a solution cannot feasibly be identified.
	Practical constraints of a technical nature prevent implementation of the measure by an earlier deadline	Includes administrative constraints in terms of commissioning, gaining permission for, and undertaking the necessary works. Does not include constraints due to a lack of legislative mechanisms or of funding.
	Problem cannot be addressed because of lack of action by other countries	<p>Application expected to be very limited in the UK. May possibly be applicable:</p> <ul style="list-style-type: none"> (a) in the international river basin districts shared between Northern Ireland and the Republic of Ireland if the problem cannot be resolved through the established partnership working arrangements for those basins. (b) where problems are caused by aerial deposition of transboundary pollutants and (a) local mitigation cannot solve the problem; and (b) discussions with the other countries have not led to effective action. <p>Where this reason is applied, the Commission must be informed about the issue under Article 12.</p>
Disproportionately expensive	Unfavourable balance of costs and benefits	Attaining the default objective is not worthwhile because the costs of the measure are out of proportion to the benefits, taking into account qualitative as well as quantitative information.

Reason	Sub-reason	Guidance notes
	Significant risk of unfavourable balance of costs and benefits	Applies where there is a sufficiently low confidence that a water body is adversely impacted. In these circumstances, there is a significant risk that putting in place additional measures to attain the objective is not worthwhile (because the default objective may already be achieved), producing no benefits and wasted investments. Potential measures can still be implemented where there is general agreement to proceed even where we have low confidence that a particular water body is adversely affected.
	Disproportionate burdens	Applies where the measure would be: (a) unaffordable to implement within a particular timetable without creating disproportionate burdens for particular sectors or parts of society; or (b) the only solution would be significantly at odds with the polluter pays principle.
Natural conditions	Ecological recovery time	Applies where there is expected to be a delay before the biological quality of the water body recovers. The delay may be due to the time taken for the plants and animals to re-colonise and become established after the hydromorphological, chemical and physicochemical conditions have been restored to 'good'; or the time taken for the habitat conditions to 'stabilise' after improvement works. For example, this may apply to lakes affected by eutrophication.
	Groundwater status recovery time	Applies where the climatic or geological characteristics dictate the rate at which groundwater levels recover or saline (or other) intrusions reverse once over-abstraction has been addressed.

Of these reasons only "Technically infeasible - No known technical solution is available" or "Disproportionately expensive - Unfavourable balance of costs and benefits" could lead to setting a less stringent objective. However, in most cases they could also lead to setting an extended deadline. All other reasons lead to setting an extended deadline.

The CIS guidance document on the use of exemptions states that "disproportionality" is a political judgement, informed by economic information, and an analysis of the costs and benefits of measures necessary to make a decision on exemptions. We have used the principles on the approach to disproportionate cost set out in the CIS document to guide us in our use of exemptions in the plans. These principles include:

- disproportionality should not begin at the point where measured costs simply exceed quantifiable benefits;
- the assessment of costs and benefits will have to include qualitative costs and benefits as well as quantitative;
- the margin by which costs exceed benefits should be appreciable and have a high level of confidence;
- in the context of disproportionality the decision-maker may also want to take into consideration the ability to pay of those affected by the measures and some information on this may be required.

The costs of measures required under other existing Community water legislation (e.g. Nitrates Directive) already agreed when the WFD was adopted cannot be considered when deciding on disproportionate cost.

We will also make a concerted effort to overcome practical issues of a technical nature, so that there is a greater likelihood of finding further technically feasible improvements.

Detailed justification³ for setting alternative objectives for specific water bodies is given in section E2 to E11.

Temporary deterioration in status

In certain circumstances (set out in Article 4.6 of the WFD) a temporary deterioration in status of a water body, caused by exceptional or unforeseen events such as extreme floods, prolonged droughts or accidents, is allowed. The exception does not apply to those effects of extreme floods and prolonged droughts which could reasonably have been planned for and prevented, nor does it apply in the case of accidents which could reasonably have been foreseen.

Droughts

In England and Wales, the main bodies responsible for managing water resources are the Environment Agency, water companies and the Government. All of these bodies have a role in drought management.⁴

Defining and then monitoring indicators helps the Environment Agency and water companies decide when a drought is happening and what actions they need to take. These indicators are often called drought triggers and a range of different triggers are used to identify whether drought actions need to be taken. Triggers can be based on:

- hydrological thresholds: rainfall, rivers levels and flows, reservoir storage, groundwater levels;
- environmental indicators: water quality, ecology;
- levels of customer demand;
- management actions.

As a trigger is approached or crossed, a water company or the Environment Agency will consider whether to implement a pre-determined action or move to the next stage of drought management. The decision to take action will be based on a range of factors, including present and forecast weather conditions and how effective the action would be.

The Environment Agency and water companies prepare for droughts by producing Drought Plans detailing the actions that will be taken if a drought occurs. These actions aim to

³ As required by Article 4.4 or 4.5 of the WFD

⁴ For more details see Environment Agency report “Managing drought in England and Wales”; <http://publications.environment-agency.gov.uk/pdf/GEHO0308BNTR-E-E.pdf>

manage water resources effectively, both for the environment and for public water supply, when they come under pressure by drought.

Droughts usually take a long time to develop and different actions are needed as a drought progresses. The sequence of actions will not always be the same as droughts are all different and need to be managed on an individual basis.

Floods

The Environment Agency is responsible for providing flood forecasting and warnings to the public in England and Wales. This involves monitoring rainfall, river levels and sea conditions. Combined with weather data and tidal reports the Environment Agency provides local area forecasts on the possibility of flooding and its likely severity.

There are four levels of flood warning: three of the codes indicate the severity of the warning (Flood Watch, Flood Warning, Severe Flood Warning) and a fourth is an 'All Clear', meaning the threat has passed.

Severe floods may impact on water body status through effects such as the loss of habitat (e.g. scouring of sediments and instream vegetation), the physical displacement of species or increased inputs of pollutants including sediment. These impacts may be localised and of insufficient magnitude to affect the status of an entire water body.

Water bodies are classified on an annual basis and therefore any deterioration in status due to a severe flood may not be detected until up to a year after the event.

Accidents

The Environmental Damage (Prevention and Remediation) (England) Regulations 2009 and the Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009 bring the Environmental Liability Directive into effect in England and Wales. Under the Regulations, environmental damage of either surface water or groundwater is defined as damage causing a change of water body status,

This means:

- either a deterioration of water status overall, for example the water body as a whole would now be classified as 'poor' rather than 'good'.
- or a deterioration of any of the individual elements or parameters such that the value of that element or parameter is now consistent with a lower status than before. This applies even if the water body is not reclassified as being of lower status. For example, suppose a water body would be good status but for a dam preventing fish migration. Because of the dam, the status is currently poor even though water quality is good. An accident causes pollution of this water body. Water quality is now moderate status. The pollution is, therefore, significant enough on its own to cause a change of status even though the overall poor status – as dictated by the impact of the dam – has not changed. This is environmental damage.

Water bodies are classified on an annual basis and therefore environmental; damage is only likely to be determined if the effects of the accident last for up to a year. Adverse effects that are short-term or limited in their geographical extent are unlikely to amount to environmental damage.

When environmental damage is confirmed, the Regulations include a remediation objective of achieving the same level of natural resources or services that would have existed if the damage had not occurred.

E1.2 Measures and mechanisms - actions to meet our objectives

The term 'measures' in the Water Framework Directive encompasses both on the ground actions and the policy and legislative instruments to achieve these actions. In this plan separate terms are used as follows:

- **Measure** - any action which will be taken on the ground to help achieve Water Framework Directive objectives.
- **Mechanism** - the policy, legislation, financial tools and other relevant means which are used to bring about those actions. Mechanisms include, for example: licensing systems; legislation; economic instruments; codes of good practice; negotiated agreements; promotion of water efficiency; educational projects; research, development and demonstration projects.

Annex F describes the mechanisms that are available for implementing measures. We have a long history of protecting and improving the water environment and there are many existing measures in place that are continuing to help improve the water environment. There are also many measures that are planned for reasons other than the Water Framework Directive. These measures fall under the 'umbrella' of the Water Framework Directive. As part of the measures appraisal process we need to understand how they can help meet the Directive's default objectives.

We have categorised measures in four broad groups to help simplify the river basin management planning process (see table 2 below). This ensures there is a common way of distinguishing between those measures that already exist (not driven by the Water Framework Directive), and those additional measures that we are proposing in order to meet Water Framework Directive objectives. The categories relate mainly to the nature of the driver and not necessarily the measure. As a result, a particular type of measure may appear in more than one category depending on the reason for using it.

Table 2: Categories of measures

M1	Measures already happening (not driven by WFD): Actions already agreed and funded, which may help to meet the objectives of the Water Framework Directive. This group includes the National Environment Programme for Periodic Review 2004 (PR04), the Coal Authority mine water restoration programme, ongoing local initiatives and partnerships measures.
M2	New measures that will happen (not driven by WFD): Actions that will happen irrespective of the Water Framework Directive (usually under other Directives) but which may help to meet the objectives of the Water Framework Directive. This group mainly covers new action for Directives on Freshwater Fish, Urban Waste Water Treatment, Habitats, Nitrates, current and revised Bathing Waters and Shellfish Waters. In some cases, there may be choices over the standards or objective to be achieved, or the date by which the objective is to be met and where further work is needed on the benefits (for example for Guideline Standards in Directives, or for diffuse pollution measures for Natura 2000 sites). In these cases, the measures will be treated, for management purposes, as M3b or M4 ⁵ .

⁵ This is because the process is similar and the benefits affect the attractiveness of other M3b and M4 schemes (and vice versa) but it is important to retain the point that the initial driver is M2.

M3	<p>(a) New measures that will happen – national (driven by WFD): Measures for the Water Framework Directive that only require national decisions. For example, controls on chemicals, fertilisers and the formulation of other products (such as detergents), as well as national general binding rules and codes of practice that apply to specific activities.</p> <p>(b) New measures that will happen – national, river basin district (RBD) targeted (driven by WFD): Measures led nationally that require targeting at the water body or catchment scale. For example, bespoke calculations of permit conditions, targeted use of uniform emission limits, targeted use of diffuse pollution measures (for example England Catchment Sensitive Farming Delivery Initiative new catchments, catchment scale water protection zones).</p>
M4	<p>New measures that will happen – local, RBD agreed (driven by WFD): New measures specifically for objectives of the Water Framework Directive that require no national decisions. For example, a local partnership to create a new wetland, new rivers trusts initiatives or a local awareness/education campaign.</p>

Toolkit of measures

We have compiled a comprehensive list of measures that may be used to deal with particular environmental problems and may be applied locally or across a much wider area, including nationally. They have been referenced to the pressures that give rise to the problems, and the sectors and their activities that are associated with these. We have carried out further work to consider more specifically measures to manage hydromorphological problems.

We used this 'measures toolkit' to help identify or confirm:

- which sectors may be contributing to particular environmental problems and pressures;
- what measures we could use to tackle these;
- what mechanisms exist to bring about this action;
- which existing processes may help to implement these mechanisms;
- what to consider in selecting mechanisms - in some cases the same measure could be implemented via more than one mechanism;
- how to assess and compare the effectiveness of measures.

We were also able to use this to help identify where new or amended delivery mechanisms might be needed.

E1.3 Selecting and appraising measures

Overall process

The measures appraisal process is central to the objective setting process. The process is used to consider whether;

- it is technically feasible to implement measures to achieve a desired objective,
- doing so would be disproportionately expensive (by comparing the costs of the measures with the benefits and other impacts implementing the measure will deliver), and
- whether natural conditions affect the ability or the timing of the achievement of an objective.

The process in principle can be summarised in a number of steps, shown below and diagrammatically in figure 1:

Step one – Identify current (M1) or planned measures (M2) and assess how far these go to meeting default objectives.

Step two – If default objectives are not achieved after step 1, identify potential additional M3 measures.

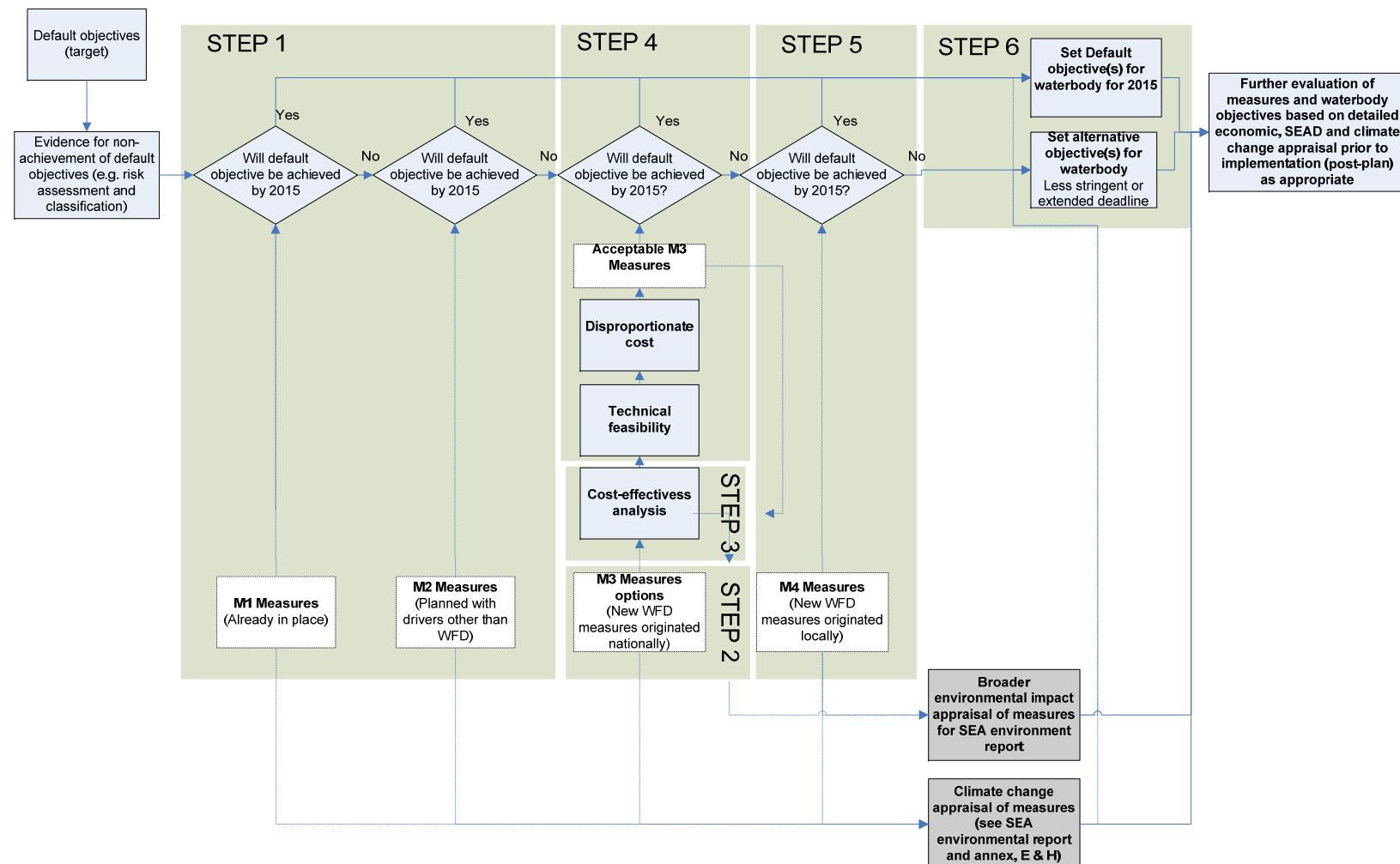
Step three - Identify cost-effective options for M3 measures.

Step four - Appraise cost-effective option(s) for M3 measures to see whether they are currently technically feasible and not disproportionately costly (by comparing the costs of the measures with the benefits and other impacts implementing the measure will deliver) and identify how much further these take us to meeting default objectives.

Step five - If default objectives are not achieved after steps 2-4, identify and appraise M4 measures and evaluate how much further these take us to meeting default objectives.

Step six - Identify and report final water body objectives (default or alternative objectives) and any justifications for alternative objectives. The choice of which alternative objective is set (extended deadline or a less stringent objective) will depend on whether the particular conditions in Article 4.4 and/or 4.5 of the WFD are met. Where the conditions of both Article 4.4 and Article 4.5 are met, we have, in most cases, set an objective of reaching good status by an extended deadline.

Figure 1: Summary of measures appraisal and objectives setting process



In practice the measures appraisal process operated at three different, but overlapping levels:

1. national strategic level led by Defra and Welsh Assembly Government
2. national/river basin district led by the Environment Agency
3. river basin district led by the Environment Agency and the liaison panels

The national strategic level consisted of the Defra and/or Welsh Assembly Government consultations on new or amended powers (delivery mechanisms) to control diffuse pollution and morphology and the preliminary cost effectiveness analysis. These are discussed further below.

The national/river basin district level consisted of the application of a range of existing approaches (e.g. application of routine water quality planning methods to determine new discharge consent limits for sewage treatment works) and the development and application of new methods such as those for the identification and designation of heavily modified water bodies and associated morphological mitigation measures (see Annex I). These approaches are described in sections E2 to E11 of this annex, which gives detailed information on action appraisal for individual pressures.

We also worked with liaison panels⁶ and other stakeholders to identify a range of locally applied measures. This is described in section E12 on the identification and appraisal of M4 measures.

The appraisal process was designed to avoid incurring unnecessary costs in situations where it is not clear that there is a problem, that the cause of the problem is not certain, or that the most cost-effective action to deal with the problem can not yet be determined.

Confidence about status assessments

Surface waters

Our assessments of water body status are accompanied by a description of how certain we can be that the water body is below good status. These assessments can be found in Annex B for each quality element in each water body, and for the overall water body status.

The Environment Agency has used three expressions to describe how certain we are that a water body does not achieve the objective of good status. Although the terms confidence and certainty can be interchangeable, the Environment Agency has taken the decision to use an expression of certainty to describe all surface water classifications.

How certain we are that the water body is less than good status	Threshold
Very certain	≥95% certain that the water body does not meet the objective of good status
Quite certain	≥75 to ≤95% certain that the water body does not meet the objective of good status
Uncertain	>50% to <75% certain that the water body does not meet the objective of good status

⁶ For information on liaison panels see annex L

This description of certainty takes account of the precision of our results. Precision is influenced by natural variation in the data over time, as well as errors in the assessment process. The Environment Agency can assess how the probability of misclassification changes in relation to the amount of sampling for each biological element. This allows us to estimate the most likely levels of certainty we can achieve with a given sampling effort. For example, a diatom sample from spring and autumn will allow no more than a 70% certainty of being at a particular status, but often gives high certainty (>95%) of being somewhere below good status.

In some situations our expression of certainty is based on weight of evidence or expert opinion. There are three examples of this:

- The way different water bodies respond to nutrient enrichment can be complicated. Sometimes we find that the water body does not meet the required standard for phosphorus but the biological community shows no sign of damage. In such situations it would be misleading to say we are very certain that the water body is at less than good status. In other situations, the water body does not meet the required standard for phosphorus, and the biological community – the diatoms and macrophytes – also show signs of damage: The result for each element on its own may be uncertain. But the fact that all elements suggest the same thing – weight of evidence that there is an impact – means that we become more certain that there is a problem. So we modify the overall certainty according to the statistical certainty of each test.
- As our monitoring programme for estuarine and coastal water bodies is new, certainty in our draft classifications for these water bodies is partly based on the amount of data available for each of the classification tools. We say we are uncertain where our data sets are limited. Our marine monitoring programme will continue to provide more data, so the certainty of our assessments in estuarine and coastal waters should steadily improve over time.
- Where expert judgement has been used to provide a classification we can only ever be uncertain in our assessment.

Groundwater status

For groundwater, confidence is reported as a qualitative statement and is used as an indicator for prioritising action. All poor status classifications for groundwater, irrespective of confidence, will require some form of action. This is because the classification criteria for both chemical and quantitative status comprise a rigorous weight of evidence approach.

Confidence in poor status will be reported as either “high” or “low”, depending on the test. These terms are defined as follows:

- “High” confidence will usually mean that competent authorities can proceed immediately to considering restorative action, or, for example, improvement to existing measures, according to procedures in the Directive. In some cases there may be “high” confidence in the poor status, but uncertainty over the measures that should be implemented, and an options appraisal of measures/objectives will be required
- “Low” confidence will usually mean that further investigation should be carried out as a priority to improve confidence and measures taken in the first river basin management planning cycle where appropriate.

It is stressed that the assessment of confidence in status should not be used as the only driver for instigating measures. Good status groundwater bodies may require higher priority attention if they are predicted to fail either the trend objective in the long term or some other measure of the risk of future deterioration in status.

Confidence in good status will be reported as either “high” or “low”, depending on the test. These terms are defined as follows:

- “High” confidence will usually mean that the only requirement is to assess potential future deterioration using surveillance monitoring.
- “Low” confidence is associated with a more limited evidence base, often in groundwater bodies that are at risk. Further operational monitoring will be required to improve the level of confidence.

Further details of how confidence in groundwater status is determined are given in Annex A.

New Water Framework Directive measures & mechanisms

Several Defra/Welsh Assembly Government consultations⁷ have explored the case for new and amended powers and controls that will enable Water Framework Directive objectives to be met⁸. Whilst the cases for some of these additional powers and measures were being finalised in 2009 (including those on diffuse pollution), we were guided in mid 2008 by Defra/Welsh Assembly Government via the River Basin Planning guidance Volume 2 on what assumptions to make regarding their use and availability for the first RBMP. In addition, with the launch of the Defra Water Strategy for England in February 2008 (<http://www.defra.gov.uk/Environment/quality/water/strategy/index.htm>) and in Wales the Environment Strategy for Wales (<http://wales.gov.uk/topics/environmentcountryside/epq/envstratforwales/?lang=en>) further measures were signalled (not necessarily driven by the Water Framework Directive) by the Government, which will help meet Water Framework Directive objectives within the first cycle of river basin management planning.

Measures or mechanisms that have been confirmed following recent consultations have been included in Annex C (Actions to deliver objectives). For example, the use of Water Protection Zones.

However, there are further measures or mechanisms which may also be taken forward during the first planning cycle, and which will consequently improve the ambition of the plan. For example:

- a statutory code of practice to provide guidance on the use and management of septic tanks;
- a possible ban on phosphorus in detergents;
- measures to reduce the impacts from sewer misconnections;
- possible General Binding Rules, based on best practice, which will cover the abuse of the drainage system, commercial washing activities, surface water control plans on construction sites and site management for industrial, institutional and commercial sites;
- using the proposed Floods and Water Bill to reduce risk of diffuse pollution through improved management of surface water drainage.
- potential review of the Oil Storage Regulations

Preliminary Cost Effectiveness Analysis

A national preliminary cost effectiveness analysis (pCEA) exercise was completed in 2007. This considered the scope and scale of measures on a national basis, and their costs and effectiveness for the first round of river basin management plans. The findings of the pCEA meant that very little additional work on cost effectiveness was needed at a more local level.

⁷ Listed in Annex L – Consultation record

⁸ Listed in Annex C – Actions to deliver objectives

Preliminary cost effectiveness analysis

The work was coordinated by Defra, and involved participation from the Welsh Assembly Government, Department of Trade and Industry (as was), the Environment Agency, Ofwat, British Waterways the Department for Communities and Local Government (DCLG), and working groups representing key interested groups.

The assessment considered:

- what should be done in the first planning cycle using consistent national measures, and what happens if we take longer to meet objectives;
- the types and costs of measures to be decided at national or river basin district level, reducing the need for further detailed analysis;
- the overall costs and what is affordable;
- the role of industry and other organisations in implementing measures;
- what measures could be ruled in or out of the first cycle from a national assessment.

The working groups were based on key industry and business sectors, with final reports based on cross-cutting pressures. The groups were tasked with agreeing combinations of measures for addressing pressures on water bodies attributable to the sectors concerned, and providing high level analysis on the cost and effectiveness of these measures. They took into account existing obligations and costs, but also considered what could be achieved with new national measures. It showed that, given the uncertainties associated with classification, source apportionment and the effectiveness of measures, a longer term adaptive approach to river basin management planning will ultimately be more effective and cost-effective than an unphased approach, given current state of knowledge.

www.wfdcrp.co.uk See table of Non Related CRP Outputs - Results of Preliminary Cost Effectiveness Analysis of the Water Framework Directive Revised After Stakeholder Review December 2007.

National Benefits Survey

The UK Collaborative Research Programme into the Water Framework Directive use survey methods to estimate, in monetary terms, the value placed by households on improvements to the water environment brought about by the WFD. In July 2007, 1487 interviews were undertaken in 50 locations throughout England and Wales. From the survey results a range of willingness to pay benefit estimates were produced. These results have been used in the national impact assessment for the WFD (<http://www.defra.gov.uk/environment/quality/water/wfd/documents/RIA-river-basin-v2.pdf>), the river basin district impact assessment that accompanies this plan, and as part of the assessment of costs, benefits and other impacts when assessing disproportionate costs issues at water body level.

Further information on the national benefits survey can be found at www.wfdcrp.co.uk.

Where an alternative objective has been set, the benefits of achieving good status will not be realised. The level of these foregone benefits depends on the current status of the water body. These benefits (in monetary terms) of improving a water body to good status in this river basin district are given in table 3.

Table 3: Monetary benefits of improving a water body to good status in the North West River Basin District

Current status	Benefits (£ per water body per year)
Bad	295,325
Poor	216,863
Moderate	164,555

Ministerial Guidance

The pCEA, national impact assessment and formal public consultation were used by Defra and Welsh Assembly Government to provide guidance to the Environment Agency (<http://www.defra.gov.uk/environment/quality/water/wfd/management.htm>). This guidance included advice to:

- phase implementation to ensure an adaptive, cost-effective and proportionate long term approach meeting all WFD requirements by 2027 or as soon as possible thereafter given feasibility, proportionality and natural conditions and the progressive reduction/cessation of priority substances and priority hazardous substances;
- ensure overall costs (i.e. negative consequences) of action to achieve WFD objectives do not exceed the overall benefits (positive consequences);
- favour the most cost-effective measures;
- make use of alternative objectives, and
- when the conditions of both Article 4.4 and 4.5 are met set objectives with an extended deadline rather than a less stringent objective.

Identification and appraisal of M4 measures

We have identified the gap between the improvements resulting from M1-M3b measures and the achievement of Water Framework Directive default objectives in each water body. Local (M4) measures have been developed to help to close this gap, many of which were developed with liaison panels. A common set of appraisal criteria was developed with liaison panels and a national measures workshop was held in October 2007 to discuss and agree the criteria. This means that each M4 measure was developed, evaluated and recorded in the same way across England and Wales. More information on the identification of M4 measures in this river basin district is given in section E12.

Inclusion of carbon in disproportionate cost assessment in measures appraisal

We have taken initial steps to include the cost of carbon in our disproportionate cost assessments. We have focused on PR09 water quality measures since this is where the most significant additional carbon emissions will occur (as a result of requirements for additional treatment, construction of new works or upgrades to existing works). The majority of other actions are likely to have low impact as they are investigations, partnerships or encouraging best practice management. The potential impact of these can be assessed as the work is progressed. Methodologies and policies are being developed to ensure carbon costs are included in further appraisal work prior to the implementation of measures.

Specific scheme information on the carbon dioxide emissions associated with both building within schemes (embedded carbon) and operation of schemes was obtained from water company final business plans. The figures for embedded and operational carbon were then used to calculate a cost of carbon in the assessment based on Defra guidance. Our findings highlight that the additional carbon emissions are currently too small to make a significant

difference to the disproportionate cost assessment. In future, the shadow price of carbon may be revised upwards and start to have more impact on investment choices in future cycles of river basin management planning.

Consulting on measures

Measures were included for consultation as part of the draft river basin management plan. They were presented in three planning scenarios:

Scenario A included all the known and funded measures that already operate, or are likely to operate. This scenario comprised all M1 and M2 measures that would occur in the absence of the Water Framework Directive (but which are now a core part of the Water Framework Directive and help to achieve the Directive's objectives) and new M3a measures that had been determined through national decisions and processes.

Scenario B represented the estimate of the measures that would be included in the first river basin management plans to deliver the environmental outcomes and support the proposed water body objectives.

Scenario C included all measures in scenario B plus measures that may be worthwhile but where the case had not been confirmed yet. To enable these measures to be implemented, additional information was needed to reduce uncertainty and justify further funding, where appropriate.

Annex L (Consultation and Engagement) lists the many approaches taken for engagement on developing the river basin management plan. These included the active involvement of stakeholders in the pCEA, development of new and amended mechanisms by Defra and Welsh Assembly Government, liaison panels discussing and influencing the planning scenarios and, together with local stakeholders, the development of M4 measures. In addition, the consultation on the draft plan was a key process to gather further information to improve the certainty of the effectiveness and benefits of the measures identified in scenario C and enable some of them to be included in this first plan.

E1.4 Identifying objectives

The measures appraisal process has enabled us to identify the expected outcomes for each of the elements that together define the status of a water body, based on implementing a challenging but realistic set of measures (see Annex C). We have used these expected outcomes to propose default or alternative objectives for each water body (see Annex B).

In carrying out these processes, we have reviewed the programme of measures and:

- for each water body predicted (using modelling and/or expert judgement) the status that each non-biological element will achieve (and by when) when the measures are implemented;
- checked that the measures proposed for different pressures are compatible in terms of timing and benefits - they should not work against each other and ideally should complement each other;
- predicted the status for the biological elements that we would expect to be achieved. These predictions were made by a panel of Environment Agency officers with local, expert knowledge supported by decision rules and a variety of data sets.
- the predicted outcomes have been translated to a set of overall objectives for each water body using the same 'one out all out rules' used in classification. Where any of the

predicted outcomes for the elements of status are not ‘good status by 2015’ we have set alternative objectives. The status objectives⁹ for each water body are shown in Annex B.

For water bodies adversely affected by multiple pressures (e.g. physical modifications to the bed and banks; over abstraction; etc), we have separately assessed the timescale needed to tackle each impact preventing the achievement of good status. We have then combined these assessments to identify the earliest date by which all the conditions needed for good status can be achieved in the water bodies (e.g. for surface waters, the right water quality; flows and levels; structure and condition of the bed, banks, shores; etc). We can then decide if good status can be achieved by 2015.

Improvements in some of the characteristics of these water bodies can be made, and are proportionate to make, earlier than others. This means that water bodies whose overall objective is good status by 2021 or 2027, may nevertheless be subject to significant improvements in the interim.

In identifying objectives, we have used the best information currently available to us. Our initial focus has been on gathering information on water bodies that can be improved by 2015.

There is significant uncertainty about how pressures and technology will change after 2015. Climate change will bring wetter, warmer winters; hotter, drier summers; and more frequent extreme events, including sea level rise, storms, summer droughts, and floods. It is not known how the biology in waters will respond to this. The population in the river basin district is likely to increase, with further urbanisation. Agriculture will respond to the changed climate (both here and abroad), market conditions, financial incentives and regulatory pressures. Technology and other solutions to address the pressures will improve, but the future economic climate (nationally or for particular sectors or groups of society) which will govern the rate at which some new solutions can be introduced is unknown.

Where we have set an objective using an extended deadline, we have generally set an objective of good status by 2027. However, many water bodies will achieve good status by 2021, but given the above uncertainty we are currently unable to say which water bodies these will be.

Investigations will take place to help improve the understanding of the changing pressures on the water environment and the current and future impact they will have on the achievement of good status (and other WFD objectives).

Investigations will also be undertaken to:

- confirm the current status, where this is uncertain;
- gather corroborative evidence of biological problems to justify expenditure where there is low confidence of failure of chemical standards;
- identify the cause of the problem, including its location, the specific activity causing it and/or the pathway by which a pollutant is entering a water body;
- assess whether existing and currently planned actions will resolve the problem;
- identify cost effective solutions;
- find new technical solution or improve the cost effectiveness of current ones;
- assess whether the costs, benefits and other impacts of potential solutions are disproportionate; and
- seek alternative financing mechanism, where current methods of funding solutions could impose a disproportionate burden on a particular sector or part of society.

⁹ Note that all Protected Area objectives are presented in Annex D

In developing the river basin management plans approximately 8,500 investigations have been identified for England and Wales, including further monitoring. The vast majority of these will be undertaken by the Environment Agency and all of these will be completed by the end of 2012. The investigations will focus on resolving what is causing the problem and what the best method to tackle it is. As a result of the evidence they will provide, we will be able to take further action in the first cycle where practicable.

By using the decision codes to cross reference the individual water body tables in Annex B ('Water body status objectives'), with the tables in section E2 to E11 of this annex, the types of investigation that will be carried out for each water body can be identified. The specific timing of each investigation is not yet known. This will be identified when the plan is implemented at the catchment level. More information on specific investigations, including their timing (where known) is given in Annex C ('Actions to deliver objectives').

When investigations are completed the results may lead to:

- the implementation of more of the measures we are already using
- modifications or improvements to the measures we are already using
- the implementation of new measures
- the justification of less stringent objectives

We are confident that a proportion of investigations will lead to improvement action that can be put in place within the first cycle. This will mean that more water bodies than those currently identified will achieve good status by 2015.

Alternative objectives in the North West River Basin District

In this river basin district the majority of alternative objectives we have set are those with extended deadlines. However we have set less stringent objectives in three groundwater bodies where we are reasonably confident that we will be unable to achieve good status by 2027. These groundwater bodies are: Wirral and West Cheshire Permo-Triassic Sandstone (GB41101G202600), Manchester & E Cheshire Permo-Triassic Sandstone (GB41201G101100) and Lower Mersey Basin and N Merseyside Sandstone (GB41201G101700).

All three of these groundwater bodies have been classified as poor status on account of extensive intrusion of saline water (from deeper salt deposits and from estuaries). Historic abstraction of groundwater has been identified as the primary cause. Abstraction for industry has reduced over recent years, however these groundwater bodies still support important groundwater abstractions for public water supply and industries which are essential to the Merseyside economy. Management to prevent further saline intrusion is being implemented through the Catchment Abstraction Management Strategies. Permo-Triassic Sandstone aquifers are slow to respond to changes; studies indicate that extensive reductions in abstraction would be needed in order to significantly reduce the effects of saline intrusion from these three groundwater bodies before 2027 and in view of the very high cost of providing water supplies from alternative sources we believe it would be disproportionately costly to try and achieve good status by 2027.

The Lower Mersey Basin groundwater body (GB41201G101700) is also affected by widespread pollution by industrial solvents. This pollution has been caused by the long history of industrial activity in this area. Because of the extensive nature of the pollution and the fact that it has penetrated to great depths there is currently no technical solution that can be applied to effectively clean up the groundwater and return the groundwater body to good status before 2027. This does not mean that we will be doing nothing. Our objective in this

groundwater body, in relation to this problem, is to return it to good status as soon as is practically and technically possible. In the meantime we will be implementing a range of actions to ensure that industrial chemicals are no longer allowed to pollute groundwater. These include pollution prevention campaigns and better regulation.

Table 4 below shows how many times alternative objectives have been set for the different standard reasons within the North West River Basin District (please note that the numbers in the table cannot be summed to give total numbers of water bodies since more than one reason may apply to any particular water body).

Table 4: Alternative objectives for the North West River Basin District

Alternative objective reason	Sub-reason	No. of water bodies in RBD
Technically infeasible	No known technical solution is available	227
	Cause of adverse impact unknown	373
	Practical constraints of a technical nature	0
	Number of water bodies in RBD where technically infeasible has been used	488
Disproportionately expensive	Unfavourable balance of costs and benefits	25
	Significant risk of unfavourable balance of costs and benefits	423
	Disproportionate burdens	4
	Number of water bodies in RBD where disproportionately expensive has been used	431
Natural conditions	Ecological recovery time	2
	Groundwater status recovery time	0
	Number of water bodies in RBD where natural conditions has been used	2
	Total number of water bodies in RBD with an alternative objective (extended deadline and/or less stringent status objective)	501

We have not made use of the WFD article 4.7 exemption for new modifications or new sustainable human development activity in this river basin district.

Use of expert judgement

Our monitoring programmes do not give us assessments for all water bodies. This is because we target our monitoring at water bodies at risk of degradation and because we have a roving monitoring programme that moves from one location to the next on an annual basis. By 2010 our roving monitoring programme will complete its first phase and most water bodies will have been monitored. The remainder are typically small water bodies. Where we lack data we have used expert judgements to provide an initial assessment of the water body (see Annex A). Expert judgement of status was based on risk assessments (see Annex G),

information from Natural England and the Countryside Council for Wales on the condition of Sites of Special Scientific Interest (SSSIs), national expert opinion and information from local Environment Agency staff. In addition for lakes, modelled total phosphorus concentration was compared with the relevant environmental standard for the lake type, then a risk matrix was constructed to determine which lakes were likely to be at good status and which were moderate status (see table 5). Clearly, such status assessments are uncertain.

Classification results based on expert judgement are clearly marked in Annex B.

Table 5: Expert judgement risk matrix for lakes without monitoring data

	Risk Assessment	At Risk	Probably at Risk	Probably not at Risk	Not at Risk	Not Risk assessed
Conservation Condition (SSSI)		7	6	5	4	1
No data or not SSSI	0	Moderate	Moderate	Good	Good	Moderate
Favourable	1	Moderate	Moderate	Good	Good	Good
Unfavourable recovering	2	Moderate	Moderate	Good	Good	Moderate
Unfavourable no change	3	Moderate	Moderate	Moderate	Moderate	Moderate
Unfavourable declining	4	Moderate	Moderate	Moderate	Moderate	Moderate

Objectives for these water bodies are also based on expert judgement. Following a review of the effect of available measures, if the predicted status was still less than good, and given the uncertainty about the current status, we have set an alternative objective of an extended deadline. This is for reasons of 'Technically infeasible; cause of adverse impact unknown' - there has been insufficient time to investigate the causes of the failures (if indeed they do fail) and 'Disproportionately expensive; significant risk of unfavourable balance of costs and benefits' - because although we have used all information available at the time of the assessment, we do not have high confidence that the water bodies are at less than good status.

E1.5 Assessments of the river basin management plan

Impact assessment

The river basin management plan is subject to an impact assessment (IA) which looks at the costs of the reference case and the costs and benefits of implementing the main policy option (<http://www.environment-agency.gov.uk/research/planning/33106.aspx>). In accordance with IA guidance the reference case relates to the baseline of existing policy actions, while the main policy relates to the expected impacts of additional policy actions on both private and public sectors.

Strategic environmental assessment

River basin management plans fall within the scope of the Strategic Environmental Assessment Directive (SEAD). In accordance with this, we have undertaken a strategic environmental assessment and produced an Environmental Report published together with

the draft plan. When finalising the plan we have taken the results of the consultation on the draft plans and the SEAD Environmental Reports into account. The Post Adoption Statement and accompanying Statement of Environmental Particulars published with this river basin management plan, explains how the issues raised during consultation have been addressed and includes an assessment of the changes between the draft plans and the first plans.

Habitats Regulations assessments

Any plan that may have a significant effect on a Natura 2000 site (Special Area of Conservation (SAC) or Special Protection Area (SPA))¹⁰ must be subject to an appropriate assessment of its implications for Natura 2000 sites, in view of the site's conservation objectives.

An assessment of the effects of the draft river basin management plan on Natura 2000 sites, and consultation with Natural England and the Countryside Council for Wales, has informed development of this plan.

The Habitats Regulations Assessment, which considers if this plan may have a significant effect on any Natura 2000 site, has also been undertaken by the Environment Agency. The assessment, conclusions and implications are discussed in Annex C.

A copy of the Habitats Regulations Assessment of this plan is available at <http://www.environment-agency.gov.uk/research/planning/33106.aspx>.

Objectives for Natura 2000 Protected Areas (water dependent SACs and SPAs)

There is no specific date in the EC Habitats and Birds Directives for meeting the objectives for Natura 2000 sites. The Water Framework Directive introduces the 2015 deadline; this applies to the Natura 2000 Protected Areas (water dependent SACs and SPAs).

Where a Natura 2000 Protected Area is also a water body, or forms part of a 'water body' it will also have water body status objectives in Annex B. Alternative objectives may have been applied to the water body status objectives in Annex B. Where a water body is also a Natura 2000 Protected Area, alternative water body status objectives do not mean that the objective of Favourable Conservation Status by 2015 should not be met. The tables in Annex B indicate any water bodies that coincide with Natura 2000 Protected Areas.

The deadline for favourable conservation status may be extended if the Natura 2000 Protected Area is also a 'water body', or forms part of a 'water body'. The objectives for Natura 2000 Protected Areas are detailed in Annex D, and that annex indicates any sites where the objective of favourable conservation status has been extended and provides the reasons and justifications for the extended deadlines. Natural England and the Countryside Council for Wales provided advice on whether the deadlines for favourable conservation status should be extended.

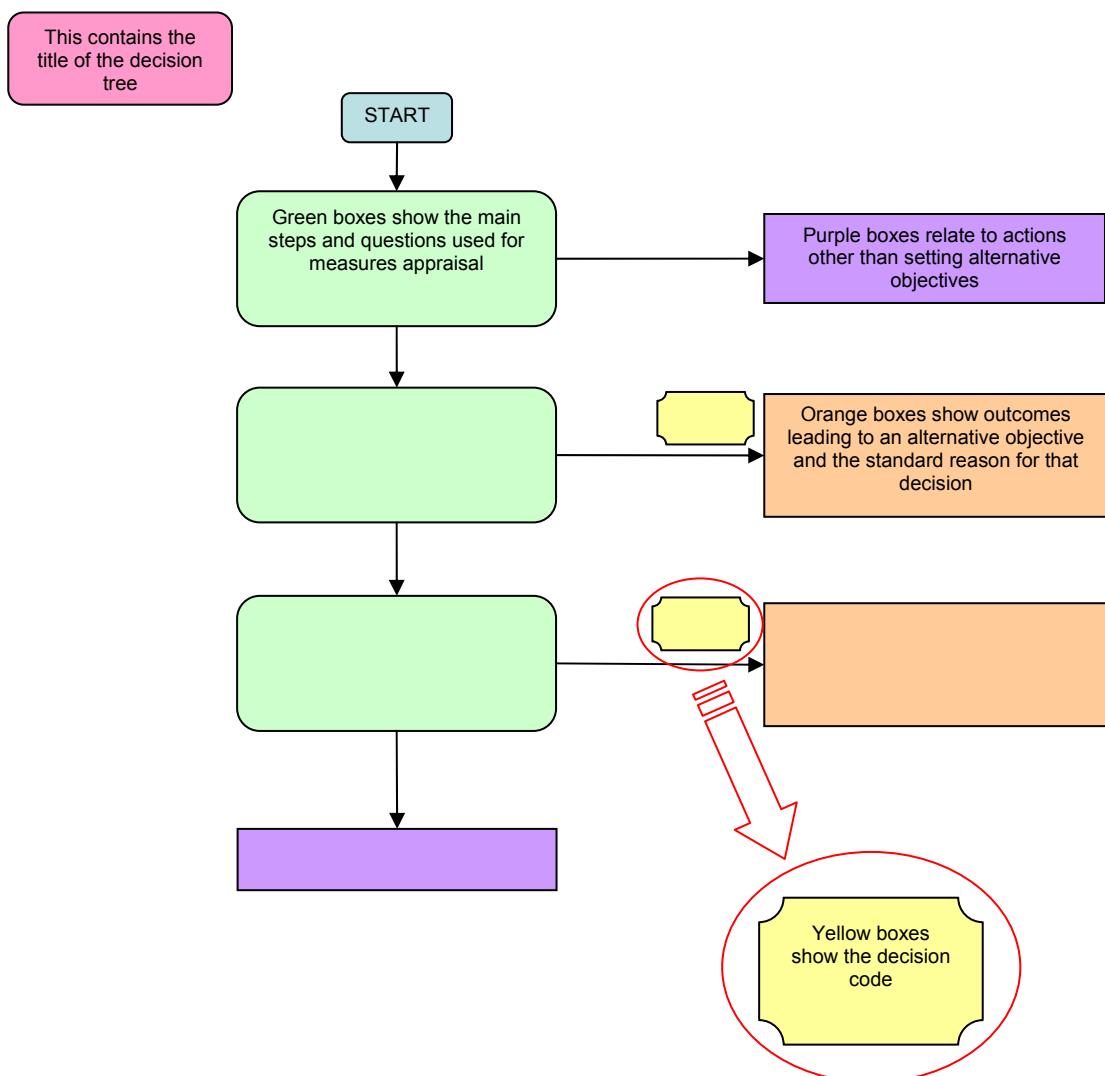
¹⁰ The Regulations also apply to candidate SACs and Sites of Community Importance (SCI). As a matter of policy, the Environment Agency is also applying this approach to potential SPAs and designated Ramsar sites. The Habitats Regulations do not apply as a matter of law or government policy to proposed SACs or proposed Ramsar sites".

E1.6 Detailed information on actions appraisal for individual pressures and justification of alternative objectives

The following sections (E2 to E11) set out detailed information on actions appraisal for individual pressures and include more information on the justification for setting alternative objectives.

Each of these sections includes one or more decision trees. These decision trees show the main steps taken in appraising the measures needed to address a pressure and achieve good status. The trees also set out where decisions can lead to the setting of an alternative objective. A generalised decision tree is shown in Figure 2 below.

Figure 2. A generalised decision tree



Each branch of a tree leading to an alternative objective has a ‘decision code’. These codes are unique to a particular decision tree (e.g. S1 is from the sediments tree, P1 from the phosphorus tree).

For any branch on the decision tree, the information supporting the decision to set an alternative objective may vary. For example, if the source of the pressure varies then the other supporting information (such as possible future measures to address the pressure) may vary too. Therefore the decision code for a particular branch in the tree may have subdivisions e.g. S1a, S1b.

Each decision code therefore records the current progress in appraising measures to tackle a pressure. The tree sets out the steps that remain in the appraisal process once the uncertainty relating to the current step is resolved. The uncertainty will be resolved by carrying out investigations or additional monitoring.

More detailed information about the decisions to set alternative objectives is presented in tables in each of the pressure sections. There is a separate table relating to each decision code. Each table describes the type of investigation required to reduce the uncertainty and allow the appraisal process to progress to the next step in the decision tree. The table also describes the types of measures that may be implemented once the appraisal process is completed. A summary of the information contained in these tables is provided in table 6.

The decision codes also appear in the Annex B water body tables against the relevant classification element (within the justifications column). This provides a cross-reference from the Annex B tables to the supporting information presented in this annex. This cross-referencing between the information in Annexes B and E is shown in Figure 3 below.

Some of the information in the tables in the pressure sections is repeated in different tables several times. This is to allow people who are navigating the plan from Annex B to access a complete set of information in just one pressure table.

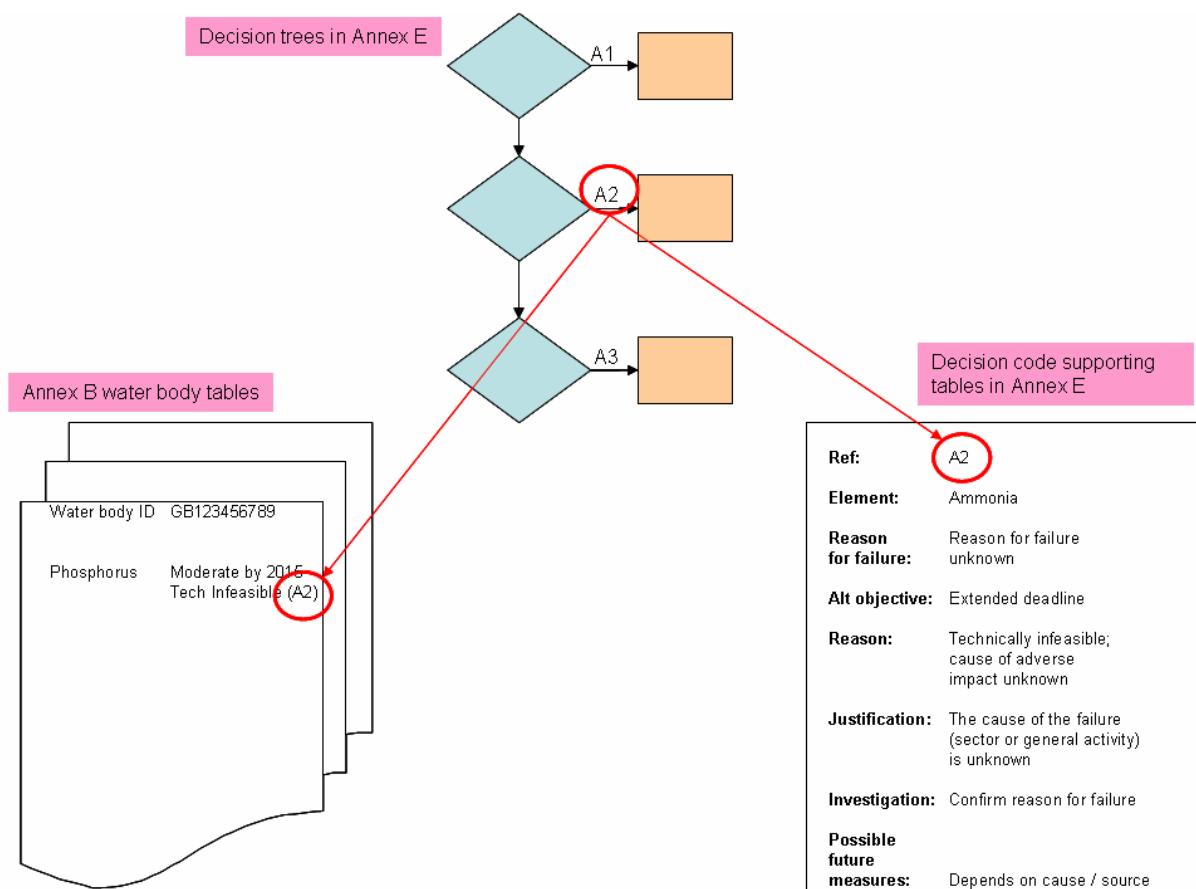
The aim of setting out the information in this way is to make the key decision making processes used in the preparation of this plan as transparent as possible.

Please note that further detailed information for surface water Drinking Water Protected Areas (DrWPAs), including compliance information and objectives, appears in Annex D.

Table 6: **Explanation of supporting tables**

Reference	<i>The decision code(s) e.g. S1a.</i>
Element predicted not to achieve good by 2015	<i>The relevant classification element(s) to which the code applies.</i>
Reason for failure	<i>The reason(s) for failure.</i>
Alternative objective	<i>The type of alternative objective i.e. extended deadline or less stringent objective.</i>
Reason for alternative objective	<i>The reason and sub-reason (as described in table 1) for setting the alternative objective.</i>
Justification for alternative objective	
<p>A one line summary of the justification is given here</p> <p><i>A more detailed explanation of why an alternative objective has been set and the nature of the uncertainty that led to the decision. If relevant, any information on costs and benefits is included here.</i></p>	
Investigation type	
<p><i>The general type of investigation required to resolve the uncertainty and allow the actions appraisal process to proceed to the next step in the decision tree.</i></p>	
Example of investigation	
<p><i>A more detailed description of the type of investigation(s) that might be carried out. Where possible, these investigations will take place before 2013 so that the results are known in time for the formal review of this plan by 2015.</i></p>	
Possible future measures	
<p><i>The types of measures that may be implemented once the actions appraisal process has been completed. Depending on progress, some of these measures may be implemented during the first cycle (i.e. by December 2012).</i></p>	
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive	
<p><i>The types of measures that might be required in order to address the pressure and achieve good status in all water bodies, although these measures are currently thought to be likely to be technically infeasible or disproportionately expensive.</i></p>	

Figure 3 Schematic showing how decision codes provide cross reference between Annex B and Annex E



E2 Assessing biological elements

Biological elements at less than good status

If a biological element in a water body is classified as being at less than good status then the presumption is that this is due to one or more pressures acting on the biology and causing an impact. It is therefore necessary to identify the pressure(s) and then appropriate (feasible and proportionate) measures to reduce or remove the pressure, allowing the biology to recover to good status.

The processes for determining measures to tackle specific pressures are outlined in the subsequent sections in this annex.

However, the first steps in appraising a biological element are generic and these are set out in the decision tree below. These steps include assessing the level of certainty that the biological element really is at less than good status and whether the pressure causing the failure, and the source of that pressure, have been identified with a reasonable level of confidence.

In some cases the pressure that has caused the biology to be at less than good status may already have been tackled but the biology has yet to recover and achieve good status. An assessment must therefore be made on whether additional measures are required or whether, if sufficient time is allowed, the biology will recover to good status without any further action being taken.

Once these steps have all been considered then the need for additional measures to address specific pressures can be assessed using the processes set out in the rest of this annex.

Biological elements in Artificial and Heavily Modified Water Bodies

Some biological elements are sensitive to hydromorphological pressures, with the specific elements varying depending on the water body type.

Lake, transitional and coastal water bodies

In lake, transitional and coastal water bodies designated as Artificial or Heavily Modified, these morphology-sensitive biological elements have not been used to produce ecological potential classifications and are not used in setting the objectives for these water bodies. So even though these elements may be at less than good status, they do not lead to the setting of alternative objectives in these water bodies. Therefore no justification for these elements being at less than good status in 2015 is required in terms of technical feasibility or disproportionate cost.

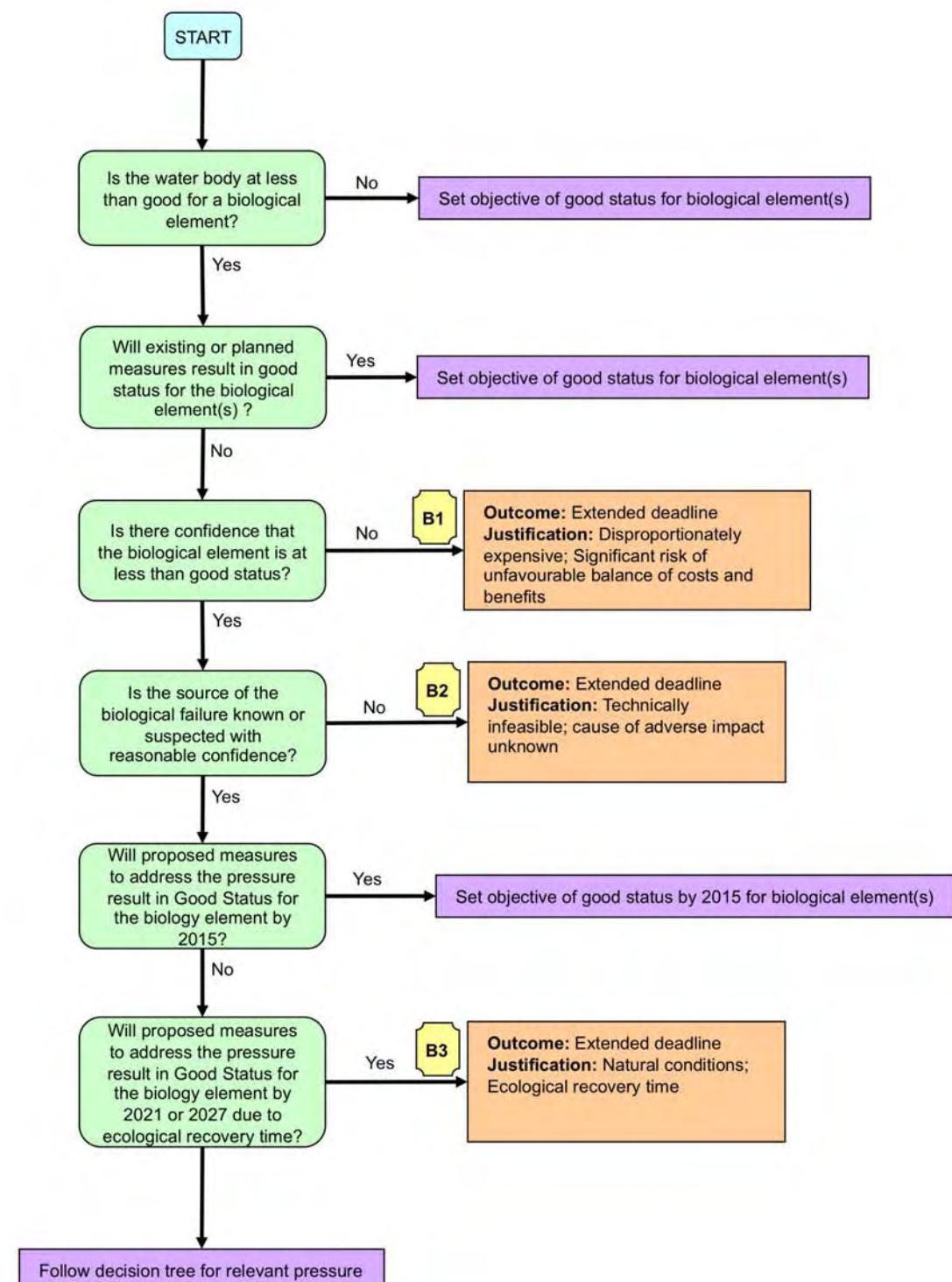
Where these elements are predicted to be at less than good status in 2015 in an Artificial or Heavily Modified Water Body the justification column in the Annex B water body tables will contain "Not required (MS)". The MS decision code refers to 'morphology-sensitive'.

River water bodies

In Artificial or Heavily Modified river water bodies where flow as a supporting condition supports good then, as described above for the other categories of water body, the morphology-sensitive biological elements are not used in classification or objective setting. Where these morphology-sensitive biological elements are predicted to be at less than good status in 2015, the justification column in the Annex B water body tables will contain "Not required (MS)".

However, in Artificial or Heavily Modified river water bodies where the modification is not flow-related and flow as a supporting condition currently does not support good status, then all biological elements available are used in the classification and objective setting for the water body. If the flow in these water bodies is predicted to not support good in 2015 then the justification for any morphology-sensitive biology elements not achieving good status in 2015 will be the same as that assigned to flow as a supporting condition.

Decision tree for
Biological elements



Reference	B1a
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Unknown – uncertain there is a failure/impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive - significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
There is not high confidence that the biology elements have failed	
<p>In these cases the biological elements do not achieve the good status boundary values but with low confidence of failure. Without confidence in a biological failure we cannot reliably consider the pressures and measures. To do so would mean a significant risk of wasted investment on additional measures in already compliant water bodies. It is therefore disproportionately expensive to achieve good status by 2015.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm any failure with certainty, identify the pressures causing the failure and appraise additional measures. Where possible additional measures will be implemented within the first cycle.</p>	
Investigation type	
Investigate to confirm failure and/or impact	
Example of investigation	
<p>Additional monitoring or specifically tailored investigations to improve certainty that there is an impact on the biological elements. Supplementary data could also be used to build sufficient weight of evidence to show that biological populations are impacted.</p>	
Possible future measures	
<p>If the biological populations are impacted then possible future measures will depend on the significance and/or extent of the failure, the identification of the pressure(s) causing the failure and the source of the pressure(s).</p> <p>Possible measures are described in the tables of supporting information for individual</p>	

pressures.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Not possible to identify these at this stage

Reference	B2a
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Unknown – reasons for failure unknown
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The pressure causing the failure is unknown</p> <p>Although the biological element is known to be at less than good status, the pressure causing the impact is not known. It is therefore technically infeasible to identify and appraise appropriate measures, and achieve good status by 2015.</p> <p>Where the failure of good status for a biological element is not also supported by a failure of a standard for a physico-chemical element or priority hazardous substance, it is often not easy to identify the pressure causing the biological failure. In the time available we have not been able to identify the specific pressure(s) causing the impact on biology.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to identify the pressure(s) causing the failure and appraise additional measures. Where possible additional measures will be implemented within the first cycle</p>	
Investigation type	
Investigate cause of failure	
Example of investigation	
<p>Additional monitoring or specifically tailored investigations to identify the pressure(s) causing the impact and the source(s) of the pressure(s). Supplementary data could also be used to build sufficient weight of evidence to identify the pressure and/or source or more detailed analysis of the biological data may help to indicate the likely pressure. For example, by more detailed analysis of the invertebrate data or looking at the diagnostic data associated with the fish classification outputs.</p>	
Possible future measures	
Possible future measures will depend on the identification of the pressure(s) causing the failure and the source of the pressure(s). Possible measures are described in the tables of supporting information for individual pressures.	

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Not possible to identify these at this stage

Reference	B2b to B2s
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	<p>Various pressures and reasons:</p> <p>B2b = suspected fish stocking B2c = suspected copper B2d = suspected cypermethrin B2e = suspected diazinon B2f = suspected iron B2g = suspected mecoprop B2h = suspected toxic chemicals / pollutants B2i = suspected zinc B2j = suspected hydrology (flows) B2k = suspected temperature B2l = suspected ammonia B2m = suspected dissolved oxygen B2n = suspected organic pollution B2o = suspected pH / acidification B2p = suspected morphology B2q = suspected nitrate (DIN) B2r = suspected phosphate B2s = suspected sediments</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The pressure causing the failure is not known with certainty</p> <p>Although a pressure responsible for the impact on the biological element has been suggested, there is low confidence that the pressure has been correctly identified. For example, the pressure may also be an element of classification (such as ammonia) which is currently classified at good status. Further work is therefore needed to confirm that the correct pressure has been identified before work can begin to identify and appraise appropriate measures. It is therefore technically infeasible to achieve good status by 2015.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the pressure(s) causing the failure and appraise additional measures. Where possible additional measures will be implemented within the first cycle.</p>	
Investigation type	
Investigate cause of failure	

Example of investigation
Additional monitoring or specifically tailored investigations to identify the pressure(s) causing the impact and the source(s) of the pressure(s). Supplementary data could also be used to build sufficient weight of evidence to identify the pressure and/or source or more detailed analysis of the biological data may help to indicate the likely pressure.
Possible future measures
Possible future measures will depend on the identification of the pressure(s) causing the failure and the source of the pressure(s). Possible measures are described in the tables of supporting information for individual pressures.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
Not possible to identify these at this stage

Reference	B3a
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Various pressures and sources
Alternative objective	Extended deadline
Reason for alternative objective	Natural conditions - ecological recovery time
Justification for alternative objective	
<p>The biology will not recover to good status until after 2015</p> <p>All necessary measures have or will be put in place to mitigate the pressure causing the biological failure. However, there is expected to be a delay before the biology returns to good status. This may be due to the biological populations taking time to re-colonise or re-establish once the hydromorphological, chemical or physicochemical conditions have been restored to good or the time taken for the habitat conditions to stabilise after improvement works. For example, once a barrier to fish migration has been removed it will take time for fish to migrate into the now accessible area and re-establish populations and therefore good status is not expected to be achieved by 2015.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time for the biology to recover.</p>	
Investigation type	
Monitoring of ecological recovery	
Example of investigation	
Monitoring of biological elements to confirm that populations recover to good status	
Possible future measures	
Not applicable at this stage	
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive	
None	

Reference	MS (Morphology Sensitive)
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Various pressures and sources
Alternative objective	Not applicable
Reason for alternative objective	Not required
Why a justification for alternative objective is not required	
<p>Biological element not included in classification</p> <p>Some biological elements are identified as being sensitive to morphological pressures. The specific elements vary depending on the water body type:</p> <ul style="list-style-type: none"> • rivers = fish, macroinvertebrates and macrophytes • lakes = macrophytes • Trac waters = seagrass, fish and benthic invertebrates <p>As these elements are sensitive to morphological pressures, it is difficult to determine whether these biological elements in Artificial and Heavily Modified Water Bodies are at less than good status due to the effects of morphological changes alone or also the impacts from other pressures.</p> <p>Where indicated by the use of this decision code, these elements have therefore not been included in the classification or objective setting processes for the Artificial and Heavily Modified Water Bodies concerned. In these instances, the status of the morphology-sensitive biological element can not lead to an alternative objective being set.</p>	
Investigation type	
Not applicable	
Example of investigation	
Not applicable	
Possible future measures	
<p>If these morphology-sensitive biological elements are at less than good status in an Artificial or Heavily Modified water body, other drivers may well require action to be taken to improve their status. For example if the water body has a protected area designation.</p>	
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive	
Not applicable	

E3 Abstraction and other artificial flow pressures for surface waters and groundwaters

Introduction

The demands for water from public water supply, industry and agriculture all impact upon the natural flows and water level of most of the surface water and groundwater bodies within England & Wales. As a result, the natural flows of most surface water bodies are affected by upstream abstraction, discharges distribution and in some cases reservoirs and river basin transfers. Most abstractions and discharges have permits, though there are some activities that will be brought into regulation when parts of the Water Act 2003 are implemented. Such water resource systems have evolved over the last 150 years to form one of the most important parts of the infrastructure underpinning our economic development.

The degree that flows have been altered is reflected in the abstraction and flow regulation pressure maps reported in Annex G for surface water bodies within each river basin district.

Water Framework Directive requirements for flow and water levels

The Water Framework Directive (WFD) regards flows and water levels as an important element in supporting the biological classification of surface water bodies and that flows or water levels should be sufficient to support the biological quality elements. However, it gives no direct guidance on flow or water level requirements. The only exception is for those surface water bodies considered to be at high ecological status. For these, flows and levels should reflect totally or nearly totally undisturbed conditions.

For groundwater bodies, the WFD recognises the importance of groundwater in maintaining flows and water levels in springs, rivers and wetlands. This forms an important part of the quantitative classification of groundwater bodies. But again, no direct guidance is given on the management of groundwater required to maintain the flows or water levels in surface water bodies.

Environmental flow indicators to support WFD environmental objectives

To help guide the management of the impacts of abstraction on surface and groundwater bodies we have derived environmental flow indicators. Environmental flow indicators (EFIs) provide the proportion of the flow regime of a water body that can be allowed for abstraction without causing unacceptable impacts on the water environment. They will be applied in England and Wales, enabling us to continue to manage abstraction in an even-handed way.

Our environmental flow indicators are based on UK Technical Advisory Group (UKTAG) flow standards which were derived using expert opinion and also informed by early results from the Environment Agency Catchment Abstraction Management Strategies (CAMS). UKTAG consulted on flow condition limits as part of its technical review of proposals for WFD standards in 2007 and published final standards in 2008 (UK Environmental Standards & Conditions Phase 1 Final Report April 2008). The environmental flow indicators have been applied to the surface water bodies in England & Wales in the light of the experience and information gained from the first Catchment Abstraction Management Strategies (CAMS) completed between 2001 and 2008.

The environmental flow indicators provide an initial base for identifying those impacts of abstraction on surface flows that could limit good ecological status. However, the links between changes to flows or water levels and the ecological responses are poorly

understood. The site-specific variability in the relationships between hydrological parameters (flow rate, velocity, depth, cross-section) and biological conditions mean it is difficult to model these relationships in a generic way that can readily be applied with confidence across England and Wales. As a result there are uncertainties in both the derivation and the application of the environmental flow indicators. These limitations should be borne in mind, and the indicators on their own should not be used to inform decisions on measures to manage abstraction where there are risks that the measure may be disproportionately costly for the uncertain ecological benefits. We plan to review both the derivation and application of the environmental flow indicators to reduce uncertainty and inform revisions in time for second river basin management plans.

Assessing the impact of abstraction on surface water flows and the groundwater quantitative classification

Environmental flow indicators (EFIs) have been applied to surface and groundwater bodies to identify where flows and water levels may not be supporting good ecological status. The results of this exercise are reported in Annex B both as the 'quantity and dynamics of flow' supporting element result for surface water bodies (rivers, lakes and estuaries), and the quantitative classification 'dependent surface water' element for groundwater bodies.

For the screening of abstraction impacts on each of the surface water bodies, the current flow is derived from an estimated natural flow by adjusting for abstractions and discharges. The current flow estimate is then compared with the environmental flow indicator derived for the same water body. Where the current flow is estimated to be greater than the environmental flow indicator, it is likely to support good ecological status. Where the current flow is less than the environmental flow indicator, there is a risk that the flow will be insufficient to support good ecological status. The amount that the flow is estimated to be below or in deficit of the environmental flow indicator can provide an important clue to the scale and ecological significance of the impact. Thus, where the flow deficits are estimated to be greater than 50% of the natural flow, we have a higher confidence that the impact of abstraction on flows may be limiting ecological status.

The process we have used to arrive at outcomes for each water body is presented in the form of decision trees which are included at the end of this section. For example the decision trees show the different outcomes for high or low confidence that abstraction is affecting ecological status. The decision trees for rivers and lakes include consideration of whether the water body is heavily modified and if that modification is for water resource purposes.

The quantitative classification of groundwater bodies includes consideration of the available groundwater resources, together with the impacts of abstraction on river flows and water levels in groundwater fed wetlands, and the stability of saline intrusions. The assessment of the impacts of groundwater abstraction on wetlands and the stability of saline intrusions is based on local site specific knowledge and monitoring results. For these groundwater bodies, and where the assessment of the impacts of abstraction indicates poor status, we can have a relatively high confidence in the classification of poor status. By contrast, the assessment of available groundwater resources includes estimates of the groundwater flow to surface water bodies. Assessments of groundwater abstraction impacts on surface water flows are relative to the environmental flow indicators described above. Because of the uncertainties in this assessment we have low confidence in most results where the available groundwater resources indicate poor status. However in exceptional cases, where the evidence of impact on surface waters is clear, we have assigned high confidence to the poor status assessments for the groundwater balance and the surface water impact. The decision tree for groundwater bodies at poor quantitative status shows the process we have used to arrive at outcomes and actions for each groundwater body.

Before specific measures can be applied, investigations are needed to resolve these uncertainties, both in the assessment and to establish the best solution. The confidence levels expressed for the surface water flow deficits and groundwater classification provide a guide to the need for investigations into where, and the extent that, abstraction may be reducing the flows and levels; the significance of this reduction in either limiting or supporting good ecological status; and the need for measures to manage abstraction. The outcomes on the decision trees will guide what the focus of investigation should be, for example whether the uncertainty is in the hydrological assessment, or in the economic justification of measures. These outcomes are described further in the section 'Additional Measures' below.

Programmes of measures to support WFD environmental objectives

Water resource measures fall into two groups:

- Revision of existing mechanisms and obligations to support WFD objectives.
- Additional measures to be completed in the first and subsequent river basin management plans (RBMPs).

Environmental impacts of abstractions are controlled through the grant and change of abstraction licences. Not all abstraction licences are time limited, and the mechanism of change and the funding of the change for those that are not time limited may be complex.

Existing mechanisms and obligations

Measures to regulate new proposals for abstractions and Water Resource impoundments to prevent deterioration (M1)

The results of the surface water flow screening and groundwater quantitative classification assessments will be used to guide our abstraction licensing system (under the Water Resources Act 1991 and Water Act 2003 - see Annex F for details). These results will be translated into maps to indicate where water is available for additional abstraction (unless there is good local evidence to the contrary). These maps will be published in our future Catchment Abstraction Management Strategies (CAMS) to provide the framework to guide the determination and trading of permits.

Working with Government, we will continue with plans to extend the abstraction licensing systems to all sectors and parts of England & Wales (Water Act 2003). To this end, regulations under the Water Act 2003 will bring exempt abstractions above 20m³ per day within the system of abstraction licensing control. The revised system of abstraction licensing control will be used to ensure that any new abstraction, water resources impoundment or flow regulation proposals do not result in deterioration of ecological status, unless the proposal can be justified as an allowable new modification under Article 4(7) of the WFD.

Most abstractors do not abstract the full amount authorised. We have made assessments against the current abstraction (impacts on the environment now), against predicted abstraction in 2015 (the end of first river basin management plans) and against the full licensed quantity. Predicted increase in actual abstraction is generally small, but the future use of full licensed amounts requires further investigation to assess the potential no-deterioration impacts.

Measures to promote efficient and sustainable water use (M1)

We have included measures to promote efficient and sustainable water use in order to alleviate abstraction pressures on existing resources and the water environment.

Wise and efficient use of water involves us all, as water users and customers of the water companies. For water companies, the requirement and justification of such measures has been included within the draft Water Company Water Resources Management plans required under the Water Industry Act 1991 as amended by the Water Act 2003. Ofwat has set water companies water efficiency targets as part of their ongoing activities which companies will be expected to meet from 2010 onwards. Some water companies have proposed additional water efficiency activities; however, the funding and implementation of these is dependent on final decisions by Ofwat under the water company price review. For this reason some water company actions have not been included in Annex C tables at this stage.

In April 2009 the Environment Agency published its strategy "Water for people and the environment" setting out how we believe water resources should be managed throughout England and Wales to 2050 and beyond. This complements aspects of river basin management plans (RBMPs), but also covers longer term considerations of water demand and supply. Some of the actions on efficient water use set out in the strategy are also listed in Annex C of RBMPs.

For many industries, water efficiency measures are required under Environmental Permitting Regulations (2000). Where justified, permits under these regulations include measures to conserve water use and reduce leakage.

For river basin districts where agricultural water use has a significant impact on water resources we have included measures to promote efficient water use largely by education campaigns, e.g. the NFU "Water Matters" campaign. These are additional to the requirements to demonstrate reasonable need for water and use water efficiently as part of the abstraction licensing process.

The above measures will ensure that the RBMP meets the obligation to promote an efficient and sustainable water use in order to avoid compromising the achievement of the WFD environmental objectives (Article 11 3(c)).

Habitats Directive: Measures to restore existing abstraction to sustainable levels (M2)

Annexes C and D contain water resources measures to achieve our contribution to favourable conservation status of Natura 2000 sites by 2015. The monitoring and site specific investigations at these sites to justify the need for any changes to existing abstraction licences, required as a result of the Habitats Directive, are being completed as part of our current Restoring Sustainable Abstraction programme. Where changes to existing abstraction licences have been identified and justified, the relevant sites have been listed within Annex C as measures for completion by 2015 (although they are regarded as work that would have taken place without WFD).

Many of the abstraction licences identified are held by Water Companies and any reduction in abstraction rates may have to be matched by either the development of alternative supplies or more efficient water use. Most schemes for the delivery of alternative supplies and changes in licences have now been included within the PR09 Water Company plans and, where agreed with by Ofwat, will be funded by Water Companies. Once a scheme has been included within the final plan, and funding has been allocated by Ofwat, we consider that the mechanism has been secured for the delivery of this measure. The successful implementation of the scheme will be followed by a voluntary licence change by the Water Company. It is expected that all such schemes will have the mechanism in place for delivery by 2012.

For all other (mainly non-water industry) abstraction licences, delivery of actions requiring modification of abstraction licences are likely to require the payment of compensation by the Environment Agency. The rate at which these schemes can be progressed will directly relate to our ability to increase abstraction charges to pay compensation. We are aiming to have the process for most licence changes for Habitats Directive sites started by 2012, but plans may require revision once the full costs of licence changes have been assessed against our ability to raise charges via our regional based charging scheme.

Sites of Special Scientific Interest (SSSIs) Investigation of abstraction impacts (M1)

The existing Restoring Sustainable Abstraction programme includes commitments to investigate the impact of existing abstraction that are perceived to be limiting the conservation objectives of Sites of Special Scientific Interest, sites identified in the Biodiversity Action Plan and other locally important conservation sites. This programme of investigations predates, but complements, the requirements of the WFD, and will provide information on what changes in abstraction will need to be made as a part of the programme of measures for future cycles of river basin management plans. Measures currently in Annex C identify when we expect the process to be started.

Additional measures

[Note: codes in square brackets refer to outcomes in the decision trees]

Measures to reduce uncertainty: investigations to determine the ecological significance of reduced flows (M3b)

The 'quantity and dynamics of flow' supporting element results (reported in Annex B), identify those surface water bodies where the net impact of both abstraction and discharges is estimated to have reduced flow below the environmental flow indicators and where there is a risk that flow may be insufficient to support good ecological status. However, the uncertainties in the assessments and the environmental flow indicators make them unreliable in both defining the magnitude and ecological significance of reduced flows without further investigation. Any measures to reduce abstraction impacts based solely on a comparison with the environmental flow indicators may not result in any biological improvement and therefore are likely to be disproportionately expensive. The cost of the modification or cancellation of abstraction licences has been estimated to be between £1.5m to £7m per MI/day reduction in the reliable output. The preliminary cost effectiveness analysis undertaken by Defra estimated the cost of achieving EFIs by 2015 as between £3,600 million and £25,000 million for England and £70 million to £2,100 million for Wales.

In view of the above costs and uncertainties, the following actions will be undertaken, to:

- review both the derivation and application of the environmental flow indicators for all water bodies in England and Wales, with the aim of improving them to inform the revisions to the river basin management plans in 2015.
- undertake site specific investigations to determine both the size and biological benefits of increased flows and to refine the assessment of costs, benefits and other impacts of measures to reduce the impacts of abstraction.

Without these investigations, measures to reduce abstraction could be premature and represent a high risk of being disproportionately expensive.

Site specific investigations will be included within the Restoring Sustainable Abstraction programme with the WFD as a driver. Priority will be given to completing investigations in the first RBMP cycle at those water bodies where we have a high confidence that flow may be limiting good ecological status [Rivers outcome HR3 & HR4]. The results of these will then provide the case for any measures to reduce abstraction to be included in the second cycle

of RBMPs (ending 2021). For the remaining water bodies where current flows are estimated to be below the environmental flow indicator [Rivers outcome HR2], the ecological significance of the impact of abstraction on flow will either be reviewed in the light of further monitoring or be investigated specifically in the second RBMP cycle. This phased, risk based approach was one of the recommendations of the preliminary Cost Effectiveness Analysis completed with Defra in 2007 (Water Resources pCEA 2007).

Measures to reduce uncertainty: investigations on heavily modified water bodies to determine the ecological significance of managed flows (M3b)

The designation of heavily modified water bodies (HMWB) for water supply purposes encompasses valuable and important parts of our water supply infrastructure including:

- Inter-basin water transfers, for example the Ely-Ouse scheme
- Reservoir releases for downstream abstraction, for example the river Dee
- Groundwater pumping to augment flows for downstream abstraction, for example the Shropshire groundwater scheme
- Reservoirs with direct catchment areas, for example Ladybower
- Reservoirs for pumped storage, for example Grafham water
- Semi-natural lakes with dammed outlets, for example Ennerdale

The ecological classification of these groups of HMWBs requires detailed knowledge of how the operation of such schemes may both impact on flows and limit good ecological potential. Some schemes have been constructed and are already operated to mitigate biological impacts. Consequently we have assessed the current status of the HMWB on the presence or absence of feasible mitigation measures (in line with the agreed method used for all ecological potential assessments in the UK). For HMWBs designated for water supply purposes and judged to be below good ecological potential, we have set the alternative objective of an extended deadline. This is on the basis that there is low certainty there is a problem to solve, and the ecological outcome of mitigation measures requires further investigation. The premature implementation of measures could therefore be disproportionately expensive [Rivers outcome HR1 and Lakes outcome HL1].

A programme of work will be undertaken to

- review the benefits and costs of possible mitigation measures and improve the hydrological assessment of HMWBs designated for water supply purposes, with the aim of informing a programme of measures for second cycle river basin management plans (2015)
- undertake site specific investigations to determine both the size and biological benefits of mitigation measures and changing flows to justify the need for measures to achieve good ecological potential

As most of the HMWBs are water company assets, the potential for impact on use must also be considered and this programme of work will be undertaken in partnership with the water companies. Until the above work has been completed a timetable for delivery of the measures cannot be confirmed.

Measures to Reduce Uncertainty: Poor Groundwater Quantitative Status (M3b)

In England there are 17 groundwater bodies at poor quantitative status where we have high confidence in the assessment because there are reported impacts related to groundwater abstraction. Of these, three of the groundwater bodies are in poor status resulting from a long standing saline intrusion, where the benefits of further investigation and restoring the aquifer would be limited. Less stringent objectives are set on the basis that any measures to reduce abstraction would be disproportionately expensive, because of the extreme length of

time for measures to have any effect [Groundwater outcome GQ4]. The remaining 14 groundwater bodies require further investigations to confirm that groundwater abstraction is causing poor status and determine whether or not remedial measures will produce tangible environmental benefits. For these groundwater bodies, we have set alternative objectives with extended deadlines (2027) to allow time for investigations to be completed and appropriate measures implemented [Groundwater outcome GQ3 and GQ5].

For the remaining 89 groundwater bodies in England and Wales assessed at poor status we have relatively low confidence in their assessment [Groundwater outcome GQ2]. For these groundwater bodies we have set alternative objectives of an extended deadline to 2027 to allow time to determine the impact and biological significance of groundwater abstraction on surface water flows and where necessary to justify the need for any changes to the abstraction licences involved. Without this information any measures to reduce groundwater abstraction would be disproportionately expensive because of the uncertainty of biological outcomes. To start this determination we intend to carry out at least a basic level of investigation (desk study) for each of these groundwater bodies.

Measures to Prevent Deterioration: Good Groundwater Quantitative Status (M3b)

In England and Wales there are 30 groundwater bodies at good quantitative status that we have assessed as being at risk of deterioration of one or more quantitative element due to abstraction quantities that have been licensed but not currently used. Some of these are already under investigation. We intend to carry out a basic level of investigation (desk study) for each of these groundwater bodies and where needed consider options for preventing deterioration in status of the quantitative elements.

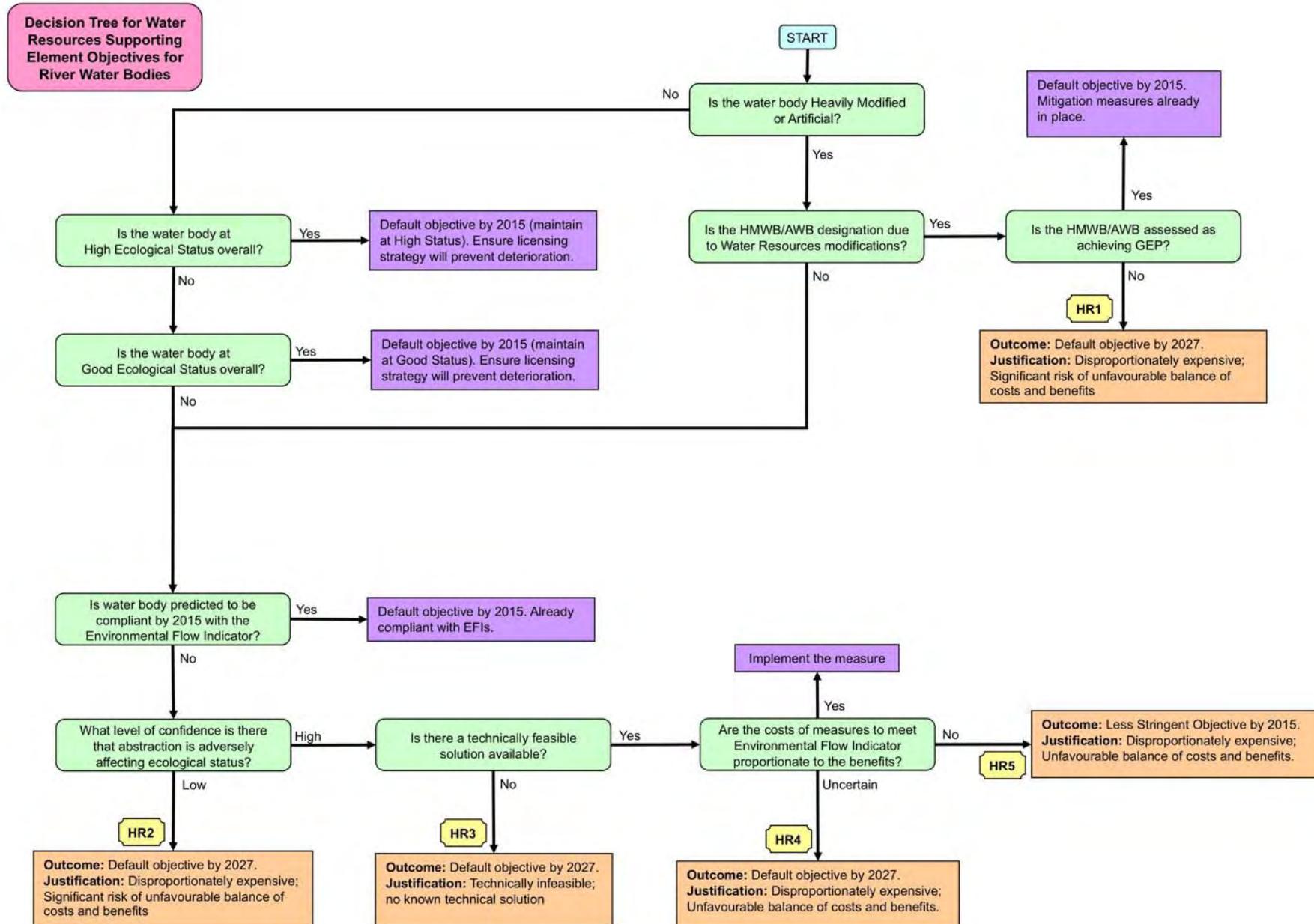
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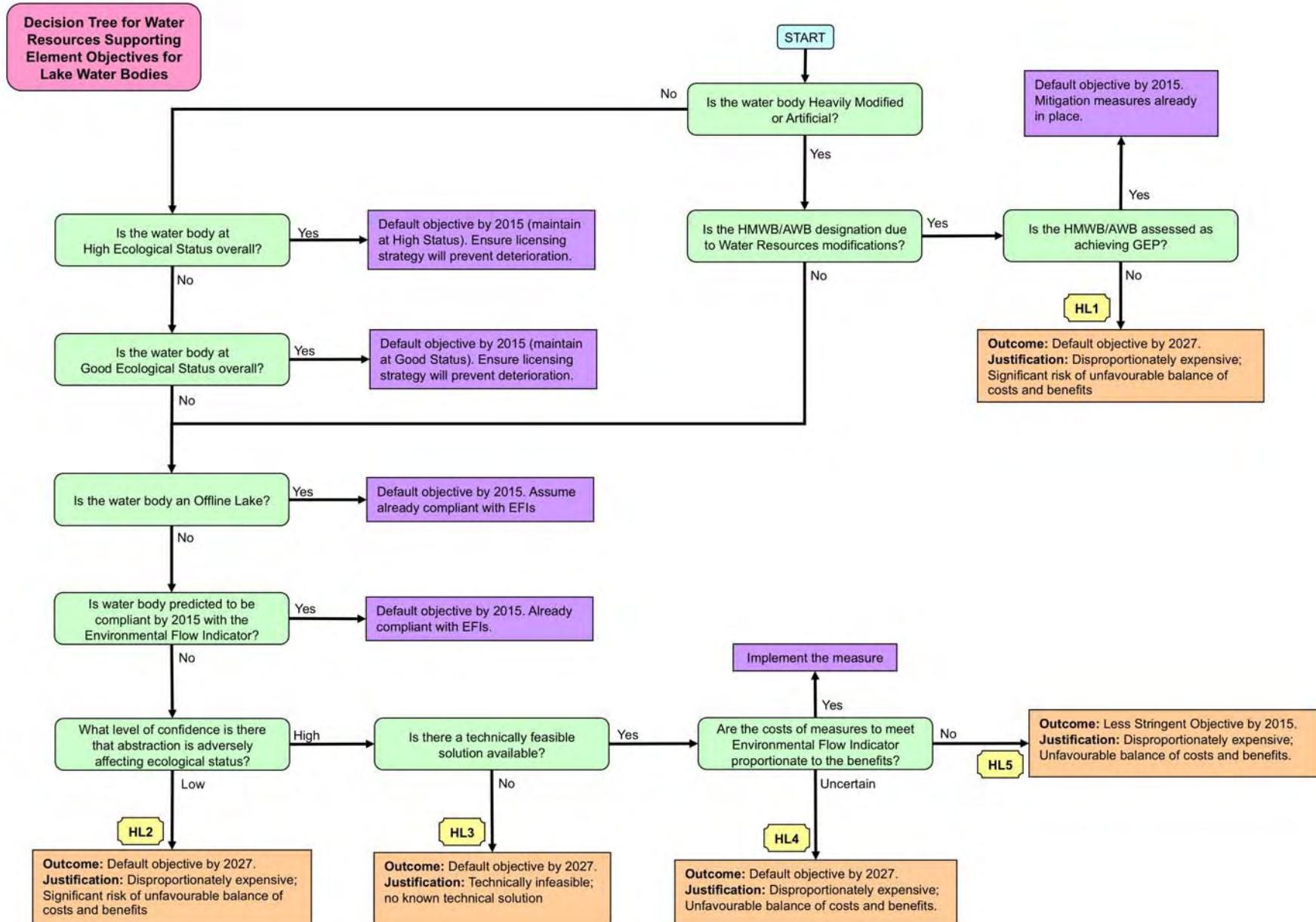
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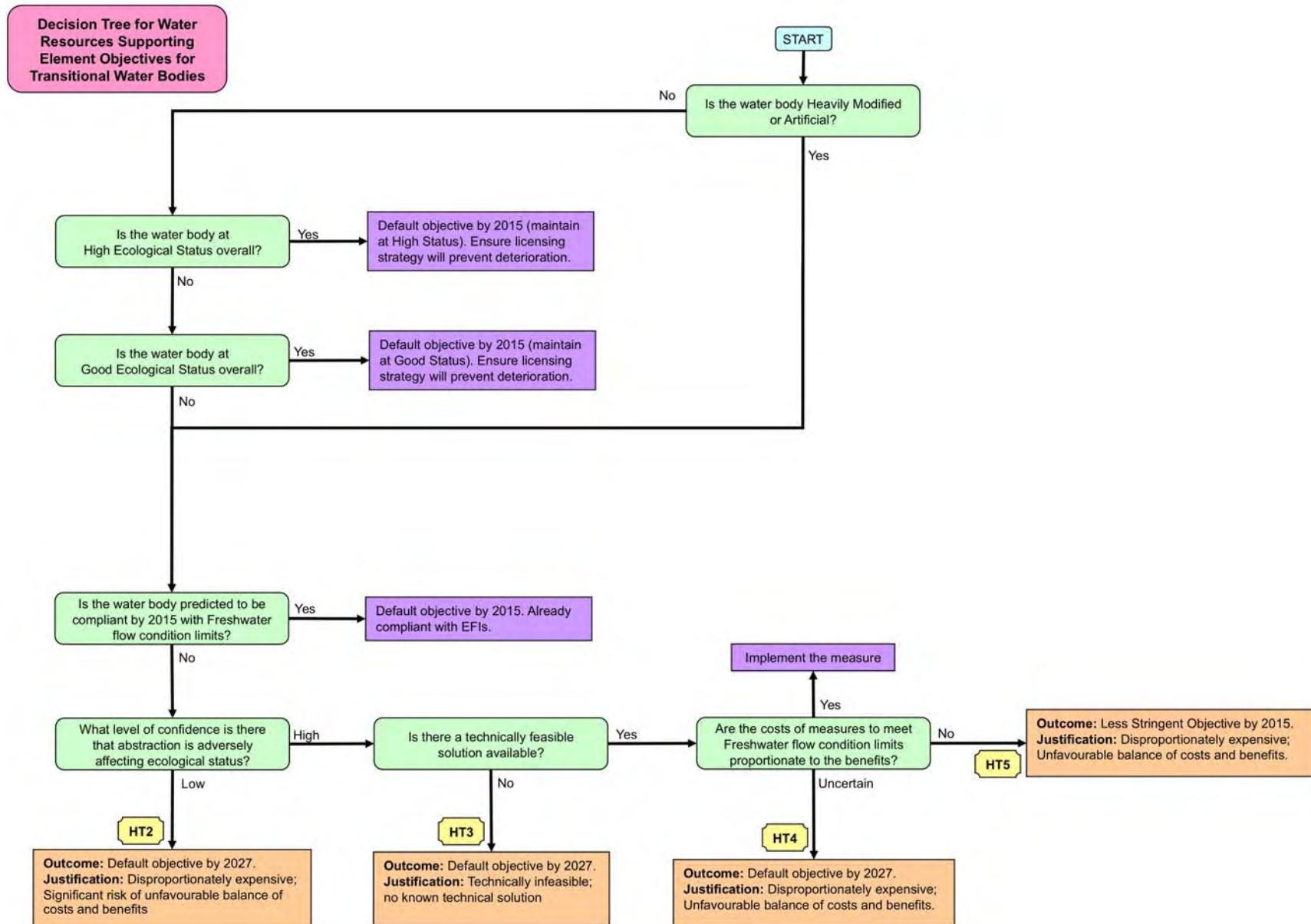
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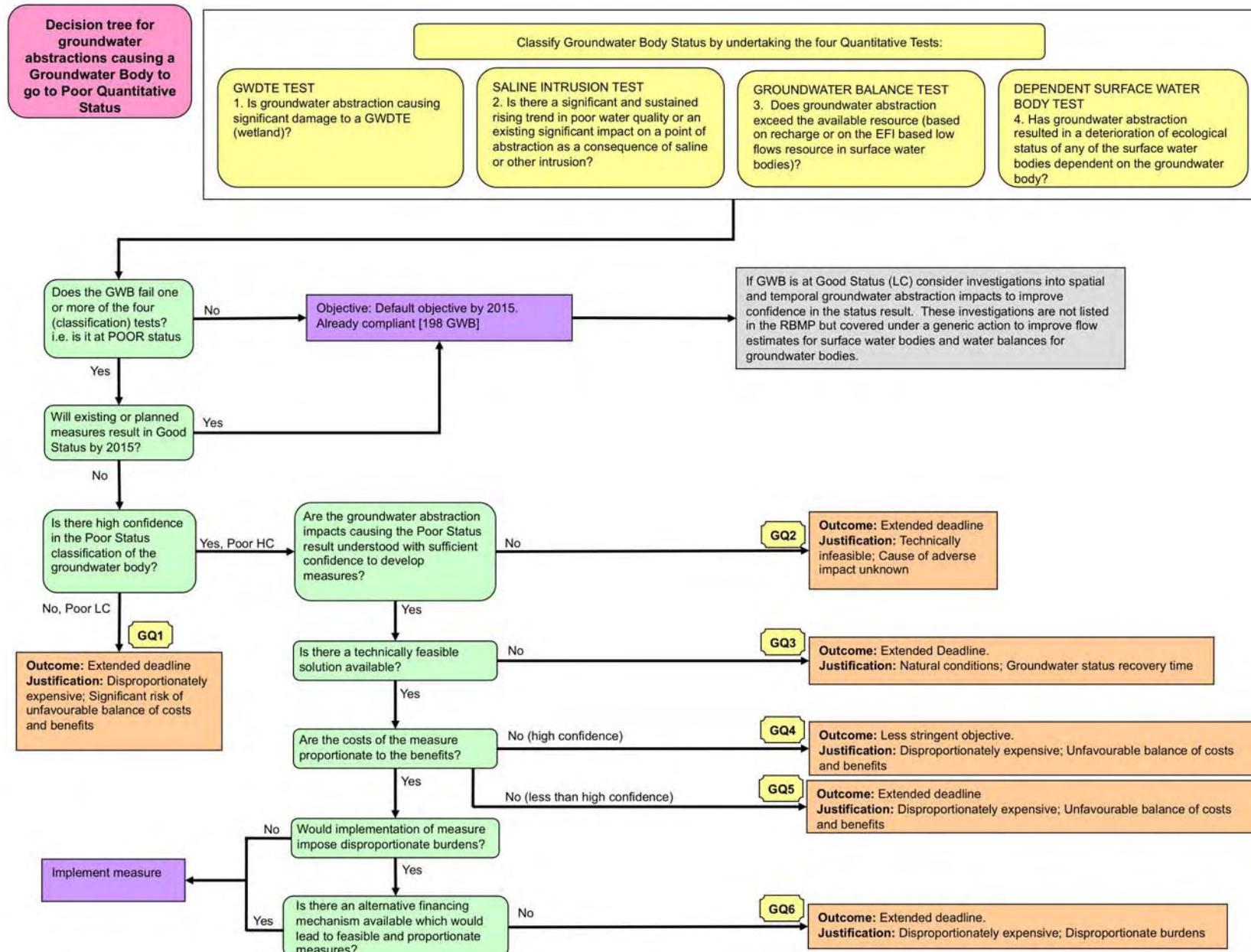
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Reference	HR1a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Suspected - Flow Alteration due to Water Regulation
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
Low confidence that flow regulation is adversely affecting ecological potential	
<p>It is disproportionately expensive to require changes to the flow regime at this time because the assessment of Good Ecological Potential has considered the presence or absence of potential mitigation measures and we have not established the relationship between mitigation measures and river ecology, therefore do not have the information to assess the ecological benefits of these mitigation measures.</p> <p>Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from implementing mitigation measures.</p> <p>Changes in flow regime can be costly as they may reduce resources available for drinking water which needs to be replaced from other sources. For the majority of water bodies in this category, there is a significant risk that there will be either no or low benefits from implementing mitigation measures. However there are a few water bodies in this category where need for change in flow regime has been established following specific investigations to meet Habitats Directive requirements. In these cases only, solutions will be implemented within the timescale of the first RBMP.</p>	
Investigation type	
investigate source of failure	
Example of investigation	
<p>Investigations in HMWBs or AWBs designated due to Water Resources modifications that are not currently achieving Good Ecological Potential will initially focus on the potential mitigation measures that may be appropriate in individual cases and the benefits that will be delivered by additional mitigation. Investigations will also consider the impact of potential mitigation on the primary economic use for which the water body was designated.</p>	

Possible future measures

After investigations, potential mitigation options will be implemented subject to the consideration of the costs and potential benefits of the measures. Mitigation measures are likely to be specific to each water body, however could include changes in management of the flow regime to benefit river ecology.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Fundamental changes in flow regime such as restoring to natural flow regime are likely to be disproportionately expensive because of the high cost of replacement sources of drinking water in the order of £1.5m - £7m per Ml/d.

Reference	HR2a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that abstraction is adversely affecting ecological status</p> <p>It is disproportionately expensive to require changes to the current abstraction regime at this time because our risk assessment (Environmental Flow Indicator threshold compliance) shows that there is only low confidence that abstraction pressure is adversely affecting ecological status.</p> <p>The flow regime is a supporting element in classification. Environmental Flow Indicators have been developed as a screening tool to indicate the level of flow below which Good Ecological Status may not be supported. Where we have low confidence that abstraction pressure is adversely affecting ecology, further studies are required to understand the relationship between flow and ecological status before we can attribute the failure in ecological status to abstraction pressures. Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from taking remedial action to improve flows.</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where abstractions need to be reduced to improve the flow regime in the environment, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that promote efficient and sustainable water use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	
Example of investigation	
Monitoring and modelling to assess the impacts of abstraction pressures on ecological status. This work will include investigation of the hydrological impacts of	

abstraction and review of the flow requirements to support Good Ecological Status.

Possible future measures

Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints. The costs and benefits of measures will however need to be considered, and other measures such as river restoration schemes may prove to be a more cost beneficial way of achieving ecological status improvements.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It is likely that reduction or ending of abstractions to meet Environmental Flow Indicator thresholds in all water bodies will be disproportionately expensive, due to the potential impacts on public water supply and other water users.

The preliminary cost effectiveness analysis undertaken by Defra estimated the cost of achieving EFIs by 2027 as between £3,200 million and £20,000 million for England and £65 million to £980 million for Wales. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	HR4a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Confirmed - Abstraction
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
Likely unfavourable balance of costs and benefits of achieving good ecological status	
<p>An extended deadline is required for all water bodies that are failing to achieve Good Ecological Status, do not meet Environmental Flow Indicator thresholds and where there is a high confidence that abstraction pressure is adversely affecting ecological status. In these water bodies, flows are unlikely to support Good Ecological Status and the costs and benefits of possible remedial measures must be considered</p>	
<p>At this stage, direct measures to reduce abstraction sufficiently to support Good Ecological Status are considered likely to be disproportionately expensive. Costs to reduce or relocate abstractions are typically high, ranging from £1.5m to £7m per Ml/d of abstraction. This leads to considerable uncertainty in the costs of measures in the light of uncertainty in the scale of flow improvement required to support Good Ecological Status. On the benefits side there is also considerable uncertainty. Low flow is rarely the only cause of failure of ecological status and the benefits of improving flow will depend on whether actions to reduce other pressures are taken.</p>	
<p>Further investigation is required to identify proportionately costly solutions.</p>	
Investigation type	
investigate feasible measures	
Example of investigation	
<p>Monitoring and modelling to assess the water body specific impacts of abstraction pressures on ecological status. Investigation will be focussed on assessing the costs and potential benefits of measures in order to identify proportionately costly solutions. Part of this will also involve hydroecological investigation to establish the conditions required to support good ecological status and the scale of measures required in order to achieve this.</p>	

Possible future measures
Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints. The costs and benefits will however need to be considered, and other measures such as river restoration schemes may prove to be a more cost beneficial way of achieving ecological status improvements.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>It is likely that reduction or ending of abstractions to meet Environmental Flow Indicator thresholds in all water bodies will be disproportionately expensive, due to the potential impacts on public water supply and other water users.</p> <p>The preliminary cost effectiveness analysis identified that costs to reduce or relocate abstraction may be in the order of £1.5m - £7m per Ml/d of abstraction. The same analysis estimated the cost of achieving EFIs by 2027 as between £3,200 million and £20,000 million for England and £65 million to £980 million for Wales. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.</p>

Reference	HL1a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Suspected - Flow Alteration due to Water Regulation
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that flow regulation is adversely affecting ecological potential</p> <p>It is disproportionately expensive to require changes to the flow regime at this time because the assessment of Good Ecological Potential has considered the presence or absence of potential mitigation measures and we have not established the relationship between mitigation measures and ecology, therefore do not have the information to assess the ecological benefits of these mitigation measures.</p> <p>Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from implementing mitigation measures.</p> <p>Changes in flow regime can be costly as they may reduce resources available for drinking water which needs to be replaced from other sources. For the majority of water bodies in this category, there is a significant risk that there will be either no or low benefits from implementing mitigation measures. However there are a few water bodies in this category where need for change in flow regime has been established following specific investigations to meet Habitats Directive requirements. In these cases only, solutions will be implemented within the timescale of the first RBMP.</p>	
Investigation type	
investigate source of failure	
Example of investigation	
<p>Investigations in HMWBs or AWBs designated due to Water Resources modifications that are not currently achieving Good Ecological Potential will initially focus on the potential mitigation measures that may be appropriate in individual cases and the benefits that will be delivered by additional mitigation. Investigations will also consider the impact of potential mitigation on the primary economic use of the water body for which it was designated. This will be particularly important for reservoirs designated for public water supply abstraction.</p>	

Possible future measures
After investigations, potential mitigation options will be implemented subject to the consideration of the costs and potential benefits of the measures. Mitigation measures are likely to be specific to each water body, however these could include changes in the rate and range of artificial drawdown to maintain aquatic plant and animal life or minor structural changes such as some types of fish passes.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
Measures that involve major changes to the structure of the impoundment are likely to be technically infeasible or disproportionately expensive due to the disruption of public drinking water supplies.

Reference	HL2a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that abstraction is adversely affecting ecological status</p> <p>It is disproportionately expensive to require changes to the current abstraction regime at this time because our risk assessment (Environmental Flow Indicator threshold compliance) shows that there is only low confidence that abstraction pressure is adversely affecting ecological status.</p> <p>The flow regime is a supporting element in classification. Environmental Flow Indicators have been developed as a threshold to indicate the level of lake outflows below which Good Ecological Status may not be supported. Where we have low confidence that abstraction pressure is adversely affecting ecology, further studies are required to understand the relationship between flow and ecological status before we can attribute the failure in ecological status to abstraction pressures. Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from taking remedial action to improve flows.</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where abstractions need to be reduced to improve the flow regime in the environment, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that reduce water demand and promote efficient use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	

Example of investigation

Monitoring and modelling to assess the impacts of abstraction pressures on ecological status. This work will include investigation of the hydrological impacts of abstraction and review of the flow requirements to support Good Ecological Status.

Possible future measures

Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints. The costs and benefits will however need to be considered, and other measures such as habitat restoration schemes may prove to be a more cost beneficial way of achieving ecological status improvements.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It is likely that reduction in abstraction to meet Environmental Flow Indicator thresholds in the outflowing river of lake water bodies, or to remove other hydrological impacts on the lake level will be disproportionately expensive due to the potential impacts on public water supply and other water users. The preliminary cost effectiveness analysis identified that costs to reduce or relocate abstraction may be in the order of £1.5m - £7m per Ml/d of abstraction.

In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	HL4a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Confirmed - Abstraction
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
Likely unfavourable balance of costs and benefits of achieving good ecological status	
<p>An extended deadline is required for one lake water body in England (Hardley Flood) that is failing to achieve Good Ecological Status, does not meet Environmental Flow Indicator thresholds for lake outflows and where there is a high confidence that abstraction pressure is adversely affecting ecological status. In this water body, flows are unlikely to support Good Ecological Status and the costs and benefits of possible remedial measures must be considered</p>	
<p>At this stage, direct measures to reduce abstraction sufficiently to support Good Ecological Status are considered likely to be disproportionately expensive. Costs to reduce or relocate abstractions are typically high, ranging from £1.5m to £7m per Ml/d of abstraction. This leads to considerable uncertainty in the costs of measures in the light of uncertainty in the scale of flow improvement required to support Good Ecological Status. On the benefits side there is also uncertainty. Alien species are known to be a primary cause of failure of ecological status (for which no measures are readily available) and the benefits of improving flow in this case will be low .</p>	
Investigation type	
investigate feasible measures	
Example of investigation	
<p>Monitoring and modelling to assess the water body specific impacts of abstraction pressures on ecological status. Investigation will be focussed on assessing the costs and potential benefits of measures in order to identify proportionately costly solutions. Part of this will also involve hydroecological investigation to establish the conditions required to support good ecological status (lake outflows and water level regime) and the scale of measures required in order to achieve this.</p>	

Possible future measures

Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints. The costs and benefits will however need to be considered, and other measures such as river restoration schemes may prove to be a more cost beneficial way of achieving ecological status improvements.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It is likely that reduction in abstraction to meet Environmental Flow Indicator thresholds will be disproportionately expensive, due to the potential impacts on public water supply and other water users. The preliminary cost effectiveness analysis identified that costs to reduce or relocate abstraction may be in the order of £1.5m - £7m per MI/d of abstraction.

In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	HT1a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
Low confidence that abstraction is adversely affecting ecological status	
<p>It is disproportionately expensive to require changes to the current abstraction regime at this time because our risk assessment (Environmental Flow Indicator threshold compliance) shows that there is only low confidence that abstraction pressure is adversely affecting ecological status.</p> <p>The freshwater flow regime is a supporting element in classification. Freshwater flow condition limits have been developed as a screening tool to indicate the level of freshwater inflow below which Good Ecological Status may not be supported. Where we have low confidence that abstraction pressure is adversely affecting ecology, further studies are required to understand the relationship between flow and ecological status before we can attribute the failure in ecological status to abstraction pressures. Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from taking remedial action to improve flows.</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where abstractions need to be reduced to improve the flow regime in the environment, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that reduce water demand and promote efficient use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	

Example of investigation

Desk studies to review the hydrological condition. Where required, monitoring and modelling to assess the water body specific impacts of abstraction pressures on ecological status. This work will include investigation of the hydrological impacts of abstraction, the flow requirements to support Good Ecological Status and the feasibility of measures to deliver these flow requirements.

Possible future measures

Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints. The costs and benefits of measures will, however, need to be considered.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It is likely that reduction in abstraction to meet flow condition limits in all inflowing water bodies will be disproportionately expensive, due to the potential impacts on public water supply and other water users. The preliminary cost effectiveness analysis identified that costs to reduce or relocate abstraction may be in the order of £1.5m - £7m per Ml/d of abstraction.

In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	HT3a
Element predicted not to achieve good by 2015	Hydrology
Reason for failure	Suspected - Abstraction
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
Likely unfavourable balance of costs and benefits of achieving good ecological status	
<p>An extended deadline is required for three transitional water bodies in England that are failing to achieve Good Ecological Status, do not meet flow condition limits for freshwater inflows and where there is a high confidence that abstraction pressure is adversely affecting ecological status. In these water bodies, flows are unlikely to support Good Ecological Status and the costs and benefits of possible remedial measures must be considered</p>	
<p>At this stage, direct measures to reduce abstraction sufficiently to support Good Ecological Status are considered likely to be disproportionately expensive. Costs to reduce or relocate abstractions are typically high, ranging from £1.5m to £7m per Ml/d of abstraction. This leads to considerable uncertainty in the costs of measures in the light of uncertainty in the scale of flow improvement required to support Good Ecological Status. On the benefits side there is also considerable uncertainty. Low flow is not the only cause of failure of ecological status in these water bodies and the benefits of improving flow will depend on whether actions to reduce other pressures are taken.</p>	
<p>Further investigation is required to identify proportionately costly solutions.</p>	
Investigation type	
investigate source of failure	
Example of investigation	
<p>Monitoring and modelling to assess the water body specific impacts of abstraction pressures on ecological status. Investigation will be focussed on assessing the costs and potential benefits of measures to reduce abstraction on freshwater inflows in order to identify proportionately costly solutions. Part of this will also involve hydroecological investigation to establish the conditions required to support good ecological status and the scale of measures required in order to achieve this.</p>	

Possible future measures

Possible future measures include reduction in abstraction licence quantities, restrictions on abstraction during particular months, and the imposition of conditions on licences, such as Hands-Off flow constraints.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It is likely that reduction in abstraction to meet flow condition limits in all inflowing water bodies will be disproportionately expensive, due to the potential impacts on public water supply and other water users. The Preliminary Cost Effectiveness Analysis identified that costs to reduce or relocate abstraction may be in the order of £1.5m - £7m per Ml/d of abstraction.

In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	GQ1a
Element predicted not to achieve good by 2015	Saline Intrusion
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that there is a failure in this element of groundwater status</p> <p>It is disproportionately expensive to require changes to the current abstraction regime at this time because there is only low confidence that there is a failure of the saline intrusion element of groundwater status as a result of abstraction pressure.</p> <p>There are a few groundwater bodies where high rates of groundwater abstraction have been associated with the intrusion of poorer quality groundwater - typically close to the coast or estuaries. However the influence of abstraction patterns, climate and sea level variables on continued groundwater quality trends has not yet been characterised with sufficient certainty to define alternative abstraction management interventions.</p> <p>Until the relationship between abstraction and saline intrusion is sufficiently established for a groundwater body, there is a significant risk that there will be either no or low benefits from taking remedial action to improve flows.</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where abstractions need to be reduced to reduce saline intrusion, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that promote efficient and sustainable water use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	

Example of investigation
Investigate the spatial and temporal impacts of groundwater abstraction management regimes, e.g. through groundwater modelling studies or monitoring, possibly associated with signal tests. Also consider the effectiveness of potential abstraction control measures and their associated costs and benefits.
Possible future measures
Change in groundwater abstraction regime – adjust the duration and rate of pumping so as to reduce the impact of saline intrusion.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>The restoration of groundwater quality in aquifers following saline intrusion associated with natural recharge and hydraulic gradients may take 10s, 100s or 1000s of years to achieve. It should be possible in the long term to halt ongoing intrusion through abstraction control measures. However, developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single meg-litre of water each day. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.</p> <p>Rising sea levels also pose a significant threat to GW quality around the coast which is not specifically related to abstraction and may frustrate attempts to protect a sustainable fresh groundwater resource.</p>

Reference	GQ1b
Element predicted not to achieve good by 2015	Impact On Surface Water Ecological Status
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that there is a failure in this element of groundwater status</p> <p>It is disproportionately expensive to require changes to the current abstraction regime at this time because there is only low confidence that there is a failure of the surface water ecological status as a result of groundwater abstraction pressure.</p> <p>For many principal aquifer groundwater bodies (and a few secondary aquifers), high rates of groundwater abstraction are locally or more generally associated with predicted impacts on dependent surface water body flows which are estimated to fall below the Environmental Flow Indicators considered to support Good Ecological Status. However, the spatial and temporal distribution of these flow impacts and their severity are not yet understood with confidence and more work is thereafter required to evaluate the benefits on river ecology of any abstraction reduction.</p> <p>Until these factors are understood sufficiently for a water body, there is a significant risk that there will be either no or low benefits from taking action to reduce groundwater abstractions.</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where groundwater abstractions need to be reduced to improve the flow regime in dependent rivers, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that promote efficient and sustainable water use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	

Example of investigation

In view of the number of groundwater bodies in this category the investigations are likely to be tiered with at least basic level of investigation in the first cycle. Investigations will improve the spatial and temporal characterisation of groundwater abstraction impacts; refine understanding of the likely costs and benefits of abstraction rate reductions in helping to restore flows and thereby achieve ecological status targets; may be integrated alongside consideration of other pollution and habitat pressures to determine the optimum way forward.

Possible future measures

Any future measures need to be based on a better characterised balance between costs and benefits carried out for each water body incorporating all the pressures. Measures may include reductions in abstraction licences, but other measures such as river restoration schemes may prove to be a more cost beneficial way of achieving ecological status improvements.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Large reduction or relocation of groundwater abstractions may be disproportionately expensive because replacement abstractions are very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day. . Even if progressed, some of the higher storage sandstone aquifers respond slowly to changes in abstraction and recovery may not be realised by the desired deadline. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies

Reference	GQ1c
Element predicted not to achieve good by 2015	Water Balance
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that there is a failure in this element of groundwater status</p> <p>It is disproportionately expensive to require changes to the current abstraction regime at this time because there is only low confidence that there is a failure of the water balance element of groundwater status as a result of groundwater abstraction pressure.</p> <p>For many principal aquifer groundwater bodies (and a few secondary aquifers), high rates of groundwater abstraction is estimated to reduce the natural outflow from the groundwater body as a whole by more than the aggregated available low flow resource. This resource is estimated from the Environmental Flow Indicators considered to support Good Ecological Status in all the surface water bodies draining each groundwater body. However, an adequate characterisation of the flow impacts has not yet been achieved and more work is thereafter required to evaluate the benefits on river ecology of any abstraction reduction.</p> <p>Until these factors are understood sufficiently for a water body, there is a significant risk that there will be either no or low benefits from taking action to reduce groundwater abstractions</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where groundwater abstractions need to be reduced to improve the flow regime in dependent rivers, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that promote efficient and sustainable water use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	

Example of investigation

In view of the number of groundwater bodies in this category the investigations are likely to be tiered with at least basic level of investigation in the first cycle. Investigations will improve the spatial and temporal characterisation of groundwater abstraction impacts; refine understanding of the likely costs and benefits of abstraction rate reductions in helping to restore flows and thereby achieve ecological status targets; may be integrated alongside consideration of other pollution and habitat pressures to determine the optimum way forward. Any future measures need to be based on a better characterised balance between costs and benefits carried out for each water body incorporating all the pressures.

Possible future measures

Measures may include reductions in groundwater abstraction licences.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Large reductions or relocation of groundwater abstraction may be disproportionately expensive because replacement abstractions are very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day. Even if progressed, some of the higher storage sandstone aquifers respond slowly to changes in abstraction and recovery may not be realised by the desired deadline. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies

Reference	GQ1d
Element predicted not to achieve good by 2015	Groundwater Dependent Terrestrial Ecosystems (Quantitative)
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that there is a failure in this element of groundwater status</p> <p>It is disproportionately expensive to require changes to the current abstraction regime at this time because there is only low confidence that there is a failure of the dependant terrestrial ecosystem element of groundwater status as a result of groundwater abstraction pressure.</p> <p>There are three groundwater bodies supporting groundwater dependent terrestrial ecosystems (e.g. wetlands) which may be suffering some damage associated with groundwater abstraction, but where the temporal and spatial distribution of groundwater level and flow impacts is not yet well understood. Monitoring and groundwater modelling studies are ongoing or are still being evaluated to improve the confidence in groundwater abstraction impact prediction. Further work is needed to determine the ecological benefits of reducing groundwater abstraction.</p> <p>Until these factors are understood sufficiently, there is a significant risk that there will be either no or low benefits from taking action to reduce groundwater abstractions.</p> <p>In such cases these low expected benefits contrast to potential very high costs of remedial measures. Water is abstracted from the environment to provide drinking water supplies and for use by industry. Where groundwater abstractions need to be reduced to improve the condition of dependant wetlands, alternative abstraction sources need to be developed. Developing new abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day.</p> <p>The only practicable lower-cost actions to reduce the impact of abstraction are those that promote efficient and sustainable water use. In catchments subject to significant abstraction pressures, these are either already in place or will be put in place under this RBMP.</p>	
Investigation type	
investigate to confirm failure and/or impacts	

Example of investigation

Use groundwater modelling plus monitoring to confirm estimates of groundwater abstraction impacts on shallow water table dependent wetland ecological assemblages. Thereafter consider the combinations of abstractions and site management/drainage which could be damaging the wetland, and consider technical feasibility and benefits of potential abstraction control or other measures and their associated costs. Also need to consider the specific wetland ecologies to weigh the costs of the possible measures up against their potential benefits.

Possible future measures

Measures may include reductions in abstraction licences, and/or water level management plan solutions associated with site management interventions,

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Large reductions in abstraction could be disproportionately expensive and possible also ineffective in improving the shallow water level regime which may be more directly influenced by drainage and site management. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies

The condition of the wetlands may be improved by water level management plan measures but not totally restored.

Reference	GQ2a
Element predicted not to achieve good by 2015	Saline Intrusion
Reason for failure	Suspected - Saline Intrusion
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
Insufficient understanding of the impact to enable development of measures to achieve the objective by 2015	
<p>It is technically infeasible to apply changes to the flow regime at this time because the adverse impact is not understood with sufficient confidence to allow development of remedial actions.</p> <p>There are two GW Bodies in England for which this justification applies with respect to the Saline & Other Poor Water Quality Intrusions test: Tame Anker Mease - PT Sandstone Burton and Kent Romney Marsh.</p> <p>In the Burton Sandstone, poorer quality (high chloride) groundwater exists in the lower parts of the deep confined Permo-Triassic Sandstone aquifer, and almost certainly in the underlying Coal Measures. There is concern that abstraction is resulting in the upwelling of deep saline waters from the deep aquifer. The cause of the salinity problem has been investigated using the groundwater model. Based on the modelling undertaken to date the link between rates of abstraction and associated intrusion has not been adequately established so a definitive solution to mitigating the abstraction pressure has not been identified. An extended deadline is required to consider if a solution is technically feasible by 2027.</p> <p>Saline intrusion from the sea at Romney Marsh associated with abstraction from the Dungeness shingle aquifer remains a problem, even though some restrictions to the abstraction regime have been made. The cause of these ongoing problems is uncertain & further investigations are required to determine whether a technically feasible solution is possible by 2027.</p>	
Investigation type	
investigate source of failure	
Example of investigation	
Investigate the technical feasibility of potential abstraction control measures and their associated costs and benefits	

Possible future measures
Change in groundwater abstraction regime
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>The restoration of groundwater quality in sandstone aquifers (eg PT Sandstone Burton) following saline intrusion associated with natural recharge and hydraulic gradients may take 10s, 100s or 1000s of years to achieve. It should be possible in the long term to halt ongoing intrusion through abstraction control measures.</p> <p>However, replacement abstractions are very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies</p> <p>Rising sea levels also pose a significant threat to GW quality around the coast which is not specifically related to abstraction (e.g. at Romney Marsh) and which may frustrate attempts to protect a sustainable fresh groundwater resource.</p>

Reference	GQ2b
Element predicted not to achieve good by 2015	Groundwater Dependent Terrestrial Ecosystems (Quantitative)
Reason for failure	Suspected - Abstraction groundwater
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
Insufficient understanding of the impact to enable development of measures to achieve the objective by 2015	
<p>It is technically infeasible to apply changes to the flow regime at this time because the adverse impact is not understood with sufficient confidence to allow development of remedial actions.</p> <p>There are two GW Bodies in England for which this justification applies with respect to the "Significant Damage to Wetlands" test: The Worcestershire Middle Severn Sandstone, and the Reigate Lower Greensand. In both cases investigations into groundwater abstraction pressures on SSSI sites are still being undertaken. These are considering the combined impacts of many licence holders such that the technical feasibility of any proposed abstraction reduction related solution is not yet understood with confidence.</p> <p>Abstraction control related measures cannot be planned with confidence and although water level and site management improvements are also being considered, these cannot be confidently predicted to restore the sites from their 'significantly damaged' condition before the extended 2027 deadline.</p>	
Investigation type	
investigate source of failure	
Example of investigation	
<p>Use groundwater modelling plus monitoring to investigate the combinations of abstractions and site management/drainage which could be causing the wetland significant damage, and also to consider technical feasibility of potential abstraction control or other measures and their associated costs and benefits. Also need to consider the water needs of the specific wetland habitats to evaluate the benefits of reducing abstraction and/or changing water levels.</p>	

Possible future measures
Measures may include reductions in abstraction licences, and/or water level management plan solutions associated with site management interventions e.g. Hurcott Pool
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>Large reductions in public water supply abstraction across the groundwater body at a broader scale may be required to realise water table recovery to improve these wetland sites, rather than more localised fixes. However, developing replacement abstractions is very expensive; costing from £1.5m to £7m to provide a single mega-litre of water each day, and such reductions may be disproportionately expensive.</p> <p>The condition of the wetlands may be improved by water level management plan measures but not totally restored.</p>

Reference	GQ3a
Element predicted not to achieve good by 2015	Groundwater Dependent Terrestrial Ecosystems (Quantitative)
Reason for failure	Confirmed - Abstraction groundwater
Alternative objective	Extended deadline
Reason for alternative objective	Natural conditions - ecological recovery time
Justification for alternative objective	
<p>Delayed recovery of the ecology in the dependent terrestrial ecosystem (wetland) means that the objective will not be achieved by 2015</p> <p>It is technically infeasible for this element of groundwater quantitative status to improve to good by 2015 because the plants and animals in the groundwater dependent wetland are unlikely to recover, given the conditions at the site.</p> <p>There is only one groundwater body in England for which an extended deadline is justified by ecological recovery time, even though the groundwater abstraction cause of the problem has been confirmed. This is the failure of the Groundwater Dependent Terrestrial Ecosystems (wetlands) element at the Kent Romney Marsh groundwater body (Dungeness SAC). Investigations under the Habitats Directive have resulted in the application of restrictive conditions to a public water supply licence when groundwater levels are below a certain threshold. However, the ecology of the wetland will take time to adjust to the new regime and the benefits of the scheme may be difficult to demonstrate because of a paucity of baseline monitoring data, and other unrelated pressures on the wetland from climate change and rising sea levels.</p>	
Investigation type	
monitor the effectiveness of measures in place	
Example of investigation	
Monitoring to investigate the link between abstraction pressure and the wetland, including the rate of discernable ecological recovery.	
Possible future measures	
Measures will be implemented in 1st cycle but it will take time for the benefit to be seen. Other measures may be necessary in the future, subject to review of the monitored effectiveness of those already put into action.	

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It is possible that efforts to restore the wetland through modified abstraction controls may be frustrated by saline intrusion associated with sea level rise and will prove to be technically infeasible in the long term.

Reference	GQ4a
Element predicted not to achieve good by 2015	Saline Intrusion
Reason for failure	Confirmed - Saline Intrusion
Alternative objective	Less stringent status objective
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The costs of achieving good status for this element are disproportionate to the benefits</p> <p>In three Permo-Triassic Sandstone groundwater bodies (all in the North West RBD), groundwater abstraction is known to be causing saline intrusion and the impacts are understood with confidence. These groundwater bodies support critical groundwater sources which are essential to the Merseyside economy e.g. for major industry and public water supply.</p> <p>Costs for locating alternative water sources for such supplies would be in the range of £1.5 to 7 million per megalitre per day and the value of the associated recovery of freshwater aquifer would be both limited (i.e. there would be no ecological benefit) and difficult to realise (because it may take 100s or 1000s of years to flush out the saline water under natural gradients).</p> <p>Management to prevent further deterioration is being implemented through the Catchment Abstraction Management Strategy. Sustainability Appraisal has been undertaken and the target status of groundwater resources is not an improvement on the current status.</p> <p>A less stringent objective is therefore justified due to the social and economic cost of reducing abstraction sufficiently to achieve good status, and the limited environmental benefit.</p>	
Investigation type	
Monitoring to prevent further deterioration	
Example of investigation	
<p>Ongoing monitoring of groundwater levels and salinity is essential to avoid further deterioration. Groundwater modelling investigation has also been undertaken to test abstraction scenarios to plan more targeted restrictions on abstraction and guidance on approach to new abstraction licences.</p>	

Possible future measures

Seek to reduce licence quantities as and when they are no longer needed.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Recovery of saline parts of sandstone groundwater body will not occur within desired timescales. All known measures sufficient to achieve good groundwater status for this element are likely to be technically infeasible or disproportionately expensive

Reference	GQ5a
Element predicted not to achieve good by 2015	Water Balance
Reason for failure	Confirmed - Abstraction groundwater
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>There is likely to be an unfavourable balance of costs and benefits of achieving good status of the water balance element</p> <p>This alternative objective has been assigned to a number of Chalk and Sandstone groundwater bodies in England where high rates of public water supply groundwater abstraction reduces the natural outflow from the groundwater body as a whole by more than the aggregated available low flow resource. This resource is estimated from the Environmental Flow Indicators considered to support Good Ecological Status in all the surface water bodies draining each groundwater body. These flow impacts are understood with confidence (e.g. in many cases groundwater modelling studies have been undertaken to characterise and confirm them) and a technically feasible solution for restoring flows is available (i.e. reduce abstraction). However, the cost of such measures is known to be high (in the range of £1.5m to £7m per megalitre per day) and their ecological benefits in terms of restoring baseflow within the dependent surface water bodies are undetermined.</p> <p>Understanding of the most cost beneficial actions to realise ecological improvements needs to be developed further before such action can be planned, so an extended deadline is justified on the basis that achieving good status of this element by 2015 is very likely to be disproportionately expensive.</p>	
Investigation type	
investigate to confirm abstraction impacts and to refine the balance of costs and benefits	
Example of investigation	
Investigations to refine understanding of the likely costs and benefits of abstraction rate reductions in helping to restore flows and thereby achieve ecological status targets will be integrated alongside consideration of other pollution and habitat pressures to determine the optimum way forward. Any future measures need to be based on a better characterised balance between costs and benefits carried out for each water body incorporating all the pressures.	

Possible future measures
Measures may include reductions in groundwater abstraction licences.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
Large reduction or relocation of public water supply abstraction are likely to be disproportionately expensive because replacement abstractions can cost between £1.5m to £7m to provide a single mega-litre of water each day. Even if progressed, some of the higher storage sandstone aquifers respond slowly to changes in abstraction and recovery may not be realised by the desired deadline. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies.

Reference	GQ5b
Element predicted not to achieve good by 2015	Impact On Surface Water Ecological Status
Reason for failure	Confirmed - Abstraction groundwater
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>There is likely to be an unfavourable balance of costs and benefits of achieving good ecological status of the dependent surface waters</p> <p>This alternative objective has been assigned to a number of Chalk and Sandstone groundwater bodies in England where high rates of groundwater abstraction for public water supply are locally or more generally associated with impacts on dependent surface water body flows causing these flows to fall well below the Environmental Flow Indicators considered to support Good Ecological Status. These flow impacts are understood with confidence (e.g. in many cases groundwater modelling studies have been undertaken to characterise and confirm them) and a technically feasible solution for restoring flows is available (i.e. reduce abstraction). However, the cost of such measures is known to be high (i.e. in the range of £1.5 to 7 million per megalitre per day) and their benefits in terms of improving ecological status are undetermined.</p> <p>Understanding of the most cost beneficial actions to realise ecological improvements needs to be developed further before such action can be planned, so an extended deadline is justified on the basis that achieving good status of this element by 2015 is very likely to be disproportionately expensive.</p>	
Investigation type	
investigate to confirm abstraction impacts and to refine the balance of costs and benefits	
Example of investigation	
Investigations to refine understanding of the likely costs and benefits of abstraction rate reductions in helping to restore flows and thereby achieve ecological status targets will be integrated alongside consideration of other pollution and habitat pressures to determine the optimum way forward. Any future measures need to be based on a better characterised balance between costs and benefits carried out for each water body incorporating all the pressures.	

Possible future measures

Measures may include reductions in abstraction licences, but other measures such as river restoration schemes may prove to be a more cost beneficial way of achieving ecological status improvements.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Large reduction or relocation of groundwater abstractions are likely to be disproportionately expensive because replacement abstractions can cost between £1.5m to £7m to provide a single mega-litre of water each day. Even if progressed, some of the higher storage sandstone aquifers respond slowly to changes in abstraction and recovery of dependent surface water flows may not be realised by the desired deadline. In regions where demand for water is high relative to resources, it may not be feasible to locate alternative sources for drinking water without causing deterioration in other water bodies

E4 Ammonia, dissolved oxygen, acidity, nutrients, temperature and faecal pollution in surface waters

We explain in this section how we have assessed what can be achieved in the first cycle of river basin management for the general water quality conditions necessary to support good ecological status. We explain where, for the phased achievement of objectives, deadlines have been extended. These are generally applied where we need to confirm the outcomes of planned actions; or where we need to improve our understanding of current status or causes and effects of pressures to enable us to target appropriate actions.

This section covers nutrients, dissolved oxygen, acidity, temperature and ammonia in surface waters. We explain how we have assessed what can be achieved for other chemical pollutants, sediment and groundwater quality in separate sections.

Development and use of the standards

The water quality conditions necessary to support high and good ecological status, as well as the conditions associated with moderate, poor and bad status, are described by water quality standards. New standards for the Water Framework Directive are developed by the United Kingdom's Technical Advisory Group (UKTAG). The UKTAG is a working group of experts drawn from environment agencies and conservation agencies. The general water quality standards proposed to support healthy communities of aquatic plants and animals are detailed in the phase 1 and phase 2 UKTAG reports¹¹.

The new physico-chemical standards replace or extend established regimes of standards and the policies by which they are used to take action. Existing standards stem from other European directives, or from national initiatives such as the River Quality Objectives¹². Table 7 summarises the general elements for which new standards have been developed to meet the needs of the Water Framework Directive. Other directives and requirements will continue to be important in delivering improvements for these elements. Many of the “designations” under the older directives become Protected Areas under the Water Framework Directive (see Annex D).

Standards are used to assess and control the impact of industry and land use, both urban and rural to protect and improve the environment. They are used to assess where action might be needed and the extent of action required. We use mathematical models to calculate what regulatory action is required to protect water quality, for example permit conditions for discharges. We monitor our waters to check the status being achieved. Complying with these water quality standards should ensure the associated biological status is met.

Where possible, the standards have been developed from extensive data on water chemistry and biology, checking where measured changes in biology are linked to measured changes in water chemistry. They have been developed by technical experts based on current scientific understanding of biological response to water quality building on knowledge from pre-existing standards.

For some elements, particularly nutrients, the biological response is less predictably linked to compliance with the chemical standard than, say, for ammonia or dissolved oxygen. This means there is less confidence that failure of the nutrient standard alone is sufficient to judge

¹¹ The UKTAG Phase 1 and Phase 2 reports on the UK Environmental Standards and Conditions are available from the UKTAG website http://www.wfd.uk.org/UK_Environmental_Standards/

¹² River Quality Objectives apply to all rivers in England and Wales

the risk to the biology. In such cases confidence about the need to improve status would come from supporting evidence that the biology is at risk from eutrophication. We call this an 'indirect' approach to using standards. As well as confirming whether action is needed, the gathering of further biological data will also help in the development of better standards.

Table 7. General chemical and physicochemical quality elements for surface waters

Water category	Quality elements	Indicators for standards proposed by UKTAG	Typology specific
Rivers	1. Thermal conditions	1. Temperature	yes
	2. Oxygenation conditions	2. Dissolved oxygen	yes
	3. Salinity	3. -	
	4. Acidification status	4. pH	no
	5. Nutrient conditions	5. Reactive phosphorus	yes
Lakes	1. Transparency	1. -	
	2. Thermal conditions	2. -	
	3. Oxygenation conditions	3. Dissolved oxygen	yes
	4. Salinity	4. Conductivity	no
	5. Acidification status	5. Acid neutralising capacity	No
	6. Nutrient conditions	6. Total phosphorus	yes (type or site specific)
Estuaries and Coastal Waters	1. Transparency	1. -	
	2. Thermal conditions	2. -	
	3. Oxygenation conditions	3. Dissolved oxygen	yes (salinity dependent)
	4. Nutrient conditions	4. Dissolved inorganic nitrogen	Yes
Fresh waters (Rivers & Lakes)	Ammonia (specific pollutant)	Ammonia	Yes
Saline waters (Estuaries & Coastal)	Unionised Ammonia (specific pollutant)	Unionised Ammonia	No

General approach to directing improvement action

The Water Framework Directive requires us to take action to prevent deterioration of status and where necessary and proportionate, restore waters to good status. Where different options are available the actions taken forward should be those judged to be most cost-effective. The approach is based on risk and on taking action in proportion to what it can achieve (the benefits) and what it will cost. The Water Framework Directive allows "alternative objectives" if the action required is technically infeasible or if achieving good is disproportionately expensive¹³.

To justify actions under the Water Framework Directive we assess:

- whether it is technically feasible to achieve good status;
- what the most cost-effective way of doing this is (based on the range of pressure sources needing to be reduced and the technically feasible options available to address these);
- whether the costs of the proposed actions will be in proportion to the benefits,
- whether the costs would impose a disproportionate burdens for particular sectors or parts of society; and if so
- whether there are alternative funding mechanisms available.

¹³ And all the other requirements of Article 4.4 or Article 4.5 are met

In assessing this we must consider uncertainty and how confident we are about:

- Current status: whether or not we are actually in good status because of failure to meet the water quality standards
- Future status: what status we expect to achieve after current and agreed future actions are completed
- Reasons for failure: why waters fail to meet good status, in particular, for action to meet water quality standards, the relative importance of different sectors and sources of pollution
- Improvement options: how much the sources of pollution can be reduced, through measures that are judged to be technically feasible and not disproportionately expensive.

Status assessment

We have followed the recommendations and proposals from UKTAG¹⁴ on how waters should be classified and how the information provided through classification should be used in the river basin management planning process. This includes how to manage the risk of misclassifying the status of water bodies and how confidence in status classifications should be taken into account in deciding where action to protect and improve the status of water bodies is targeted. The key points are summarised here.

We use monitoring data to assess current status and compliance with water quality standards. Current failure to meet the required standards and status indicates that action might be required to improve status. But we must also consider how confident we are in this assessment. Our status estimates will always be subject to error because monitoring is not done everywhere and all the time, and because our monitoring techniques will never be perfect. The WFD allows for a risk-based approach to monitoring. We therefore risk making an incorrect judgement about the true status. It is important to understand and manage this risk so that we limit the potential to either fail to act because a water body is wrongly reported as better than it is, or to waste resources improving water bodies that are wrongly classed as worse than they are.

For nutrients, the confidence of being less than good status due to risk of eutrophication is assessed not just by failure of the nutrient standard but also using evidence from biological elements which are sensitive to nutrient pressures. The overall confidence is judged on a weight of evidence basis. This takes account of the extent of relevant biological evidence available and the confidence that these elements are less than good. This is in accordance with recommendations from UKTAG and Ministerial Guidance on River Basin Planning.

For lakes, transitional and coastal waters, the confidence of being less than good status based on weight of evidence across nutrients and the relevant impact indicators is assessed using expert judgement. For rivers, the Environment Agency approach is described in the boxed section below. Further information on the UK approach to assessing eutrophication under EU water policies will be available in 2010 through a proposed UKTAG consultation report. This is being produced by a task group of UKTAG and UK Eutrophication Steering Group members to follow the recent publication of EU guidance¹⁵.

Whilst high confidence of eutrophication is needed for consideration of site specific regulatory measures, this does not preclude lower confidence failures leading to the

¹⁴ UKTAG Recommendations on Surface Water Classification Schemes for the purposes of the Water Framework Directive, <http://www.wfd.uk.org/UKCLASSPUB/>

¹⁵ Common Implementation Strategy for the Water Framework Directive: Guidance Document (No. 23) on Eutrophication Assessment in the context of European water policies

http://circa.europa.eu/Public/irc/env/wfd/library?i=/framework_directive/guidance_documents/guidance_document_1/EN_1.0 &a=d

consideration of other types of measures such as national measures or lower cost 'no regrets' measures.

Where we are confident of phosphate failure and this is indicative of some biological impact, (e.g. in alkaline lowland rivers) we will take action to reduce phosphates by such means as providing education or training, routing people to sources of funding or invoking the England Catchment Sensitive Farming Initiative, without waiting for the full information on diatoms and macrophytes that would be necessary to justify targeted regulatory action to control eutrophication such as the designation of a sensitive area under the Urban Waste Water Treatment Directive or of a Water Protection Zone.

Weight of Evidence rules for combining macrophyte, diatom and phosphate in river classification

A. Weight of Evidence (WoE) – macrophyte and phytobenthos quality element

1. The WoE confidence of being worse than good for the combined macrophyte and phytobenthos quality element is the statistical certainty of the worst of macrophytes and diatoms but subject to the modification that this cannot be greater than the certainty shown in Tables 1 and 2 below. These tables summarise the rules for the maximum overall certainty of being less than good, that have been assigned to the overall quality element.

Table 1 Certainty of being less than good in low alkalinity upland river systems
(< 50mgCaCO₃/l or ≥ 80m altitude)

		Macrophyte Class					
		No data	High	Good	Moderate	Poor	Bad
Diatom Class	No data	U	U	U	Q	V	V
	High	U	U	U	Q	V	V
	Good	U	U	U	Q	V	V
	Moderate	Q	Q	Q	V	V	V
	Poor	V	Q	Q	V	V	V
	Bad	V	Q	Q	V	V	V

Table 2 Certainty of being less than good in high alkalinity lowland river systems
(≥ 50mgCaCO₃/l and < 80m altitude)

		Macrophyte Class					
		No data	High	Good	Moderate	Poor	Bad
Diatom Class	No data	U	U	U	Q	V	V
	High	U	U	U	Q	V	V
	Good	U	U	U	Q	V	V
	Moderate	U	U	U	V	V	V
	Poor	Q	Q	Q	V	V	V
	Bad	Q	Q	Q	V	V	V

B. Weight of Evidence – combined certainty for biology and phosphate

2. The overall certainty to assign to the combination of biology classification with phosphate is given in Table 3.

Table 3: Combined certainty for biological and phosphate classification in rivers

		Combined Macrophyte-Phytobenthos QE		
		V	Q	U
Phosphate	Cert not Good	V	Q	U
	V	V	Q	U
	Q	V	Q	U
	U	Q	U	U

U – Uncertain, Q – Quite Certain, V – Very Certain

3. At present we do not have sufficient understanding of the relative sensitivity of the diatom and macrophyte classification tools to determine whether macrophyte status for particular water bodies could be inferred from the status of phosphate and diatoms alone in lowland river systems. We will review the position as the technical knowledge base develops in the run-up to the UKTAG review of nutrient standards in 2012.

Despite site specific uncertainties in monitoring results, regional summaries like "30 per cent of the water bodies in a particular country or river basin district are worse than good status" can be very accurate. This is because the individual risks of misclassifying several hundred water bodies average out. On the other hand a list of named water bodies that are classed as worse than good status will include some water bodies which are, in truth, at good status or better.

Certain types of national measures can be justified to address levels of failure expressed on a national scale in which case we do not need high confidence of failure at specific sites. The costs and benefits would similarly be assessed at a national rather than local scale. Benefits might be, for example, that we expect 3 per cent of waters to move into good status nationally, though we are unlikely to be able to specify which waters these would be. These measures cover, for example, product bans, uniform emission standards on discharges, farmers adopting certain management approaches, and general binding rules. These might aim to improve status, provide a step in the right direction, or help prevent deterioration in status. Measures applied in this way do not require site specific confidence of cause and effect and between action and outcome.

As well as uncertainty in current status we will also have uncertainty about future status. Our approaches to estimating the outcomes of the actions are approximate and the prediction of still being less than good may be pessimistic. We would be particularly uncertain of future status where we anticipate improvements within water bodies where we have low confidence that even the current status is less than good. Estimated outcomes could be from measures within or upstream of the water body. Our ability to estimate the relative importance of pollution sources following improvement actions to all or some of them also gives considerable uncertainty about where future measures might need to be targeted.

Where there is uncertainty about predicted status following improvements we would not tend to justify further action. In these cases we have set alternative objectives with an extended deadline on the grounds that imposing further measures could be wasteful due to uncertainty in whether they are needed and the benefits that could be realised. We will review the success of the planned actions before we look to implement any further high cost actions.

For example, we have not looked for further improvements to those sewage treatment works improved in AMP4 to meet the requirements of the Freshwater Fish Directive. £650 million

will be spent in AMP4 to reduce ammonia discharged from these works. We will review the need for further action at these works if future status assessments confirm that we are failing good status.

Sources of status impacts and measures

Where we are certain that the future status will still fall short of that required, we will assess whether we know enough about the pollution sources contributing to the failure and whether there are technically feasible measures that can be targeted to those sources.

The physico-chemical supporting elements will be affected by natural conditions as well as impacts from human activities. We use information from a number of sources to try and understand why the waters are failing. This includes monitoring, modelling, expert judgement and local knowledge. The most important sources influencing the physico-chemical elements are sewage discharges, industrial discharges, urban drainage and runoff from agricultural land use. These can reach the water environment as point or diffuse sources. Their relative importance varies depending on the element and the location. The physical features and flow conditions, including the impact of abstractions can also be important influencing factors, particularly for dissolved oxygen.

In some cases we do not know what is causing the failure (indeed in thousands of assessments there will always be hundreds of spurious failures caused by statistical uncertainties in monitoring¹⁶).

In some cases we will know the source of the pollution in broad terms but will not yet know enough about the specific sources within this and/or the pathways by which the pollution reaches the water environment to be able to assess detailed actions to address the pollution. This can be the case where pollution is from diffuse sources, such as urban areas or from the agricultural sector, comprising many individually small contributory pollution sources. Their variability spatially and through time also makes them difficult to quantify. This leaves considerable uncertainty about the significance of the various sources and hence the effectiveness of actions to address these. For instance, there can be many sources and pathways for agricultural nutrients to reach water courses to which different options (and feasibility and expense) for reducing nutrient loss could be applied depending on their relative importance.

Where we cannot identify sources, pathways and responsible parties with sufficient confidence we need to undertake further investigations. These will include local investigations as well as national projects, such as those on source apportionment. These ongoing investigations will enable us to assess how best to reduce the sources and quantify the costs and benefits. We have set alternative objectives with an extended deadline on the grounds that it is technically infeasible to apply site specific improvement measures unless we have sufficient knowledge about the sources that need addressing. Applying measures with only weak certainty that they are appropriately targeted would risk wasted investment.

This may apply to all or just some of the sources. Where we have sufficient certainty about some of the sources we will have justified actions to address these even if there is insufficient certainty to address the other sources of pollution. For instance we may have strong enough evidence of site specific impacts from larger sewage works discharges, have calculated what applying nutrient removal technology would deliver and justified that action being taken to reduce the sewage source contribution. If that action is driven purely by the Water Framework Directive the actions and outcomes would have been subject to a disproportionate cost assessment. In some cases the benefits that can be achieved by

¹⁶ And an associated risk of taking action on sites that do not need it.

addressing the known sources are insufficient to justify the costs. In these cases we will use an extended deadline to allow us to improve our understanding of the other sources of pollution to establish whether an improved package of measures to address all sources will be cost-beneficial.

As before national measures (e.g. product bans, uniform emission standards on discharges, farmers adopting certain management approaches) can be justified based on a national scale understanding of the relative importance of different sources without needing detailed location specific knowledge of sources.

The work for the preliminary cost-effectiveness assessment¹⁷, summarised the approaches that are currently feasible and their relative cost-effectiveness.

Actions on Diffuse Pollution

Diffuse pollution has been identified as an issue across England and Wales. It arises from a number of sectors and sources and impacts a variety of water uses including drinking water, bathing, recreation, economically significant species (e.g. shellfish and salmon) and biodiversity, as well as ecological status for the Water Framework Directive.

As discussed above for many of the diffuse sources our knowledge of the detail of sources and pathways is too uncertain to know what measures would be feasible and effective, particularly at a detailed site specific level. For this reason, the measures included in this plan tend to focus on actions planned for other drivers, national measures, and locally targeted actions to control pollution. These measures are also important to help prevent deterioration¹⁸ of the status of water bodies.

Actions include pollution prevention through local education campaigns; voluntary initiatives and the adoption of best practice methodologies; enforcement action and use of anti-pollution works notices; policies on development planning; cross-compliance with Nitrates and Sludge Directives (Nitrate vulnerable zones now cover some 70 per cent of England and 3.6 per cent of Wales); the Silage, Slurry and Agricultural Fuel Oil Regulations; the Groundwater Directive; Existing and enhanced Agri-environment schemes; Codes of Good Agricultural Practice; rectifying misconnections of foul sewer to surface water drains (in some cases delivered through collaborative projects, for example water industry funded initiatives).

Control on the use of phosphates in laundry detergents is a potential future measure that could be implemented in England and Wales. This would contribute to reductions in phosphorus discharged to waters within catchments served by small sewage works (where it is less cost effective to install phosphorus stripping), in catchments that lack mains sewerage, and in catchments with larger works which do not currently have phosphorus removal. By reducing the phosphate reaching sewage works it would also reduce the costs of meeting discharge standards where phosphorus removal is required under the Urban Waste Water Treatment Directive or the Habitats Directive.

In England the Catchment Sensitive Farming Delivery Initiative (ECSFDI) has been an important mechanism to reduce a range of environmental impacts from agriculture. In Phase 2 of the initiative (2008-11) the priority catchments have been expanded from 40 to 50 and have extending the coverage within 7 existing catchments. The ECSFDI will also support 16

¹⁷ Defra and the Welsh Assembly Government carried out this analysis of countrywide measures in England and Wales. It produced an overview of the costs and effectiveness of measures, and the sectors that could be involved in delivering them, ruling out or limiting certain measures as clearly not cost effective at least in the first cycle of river basin management and so focussing effort on the key options. Results are available at <http://www.wfdcrp.co.uk/> including a summary of measures included in the pCEA <http://www.wfdcrp.co.uk/pdf/WFD%20Ministerial%20Guidance%20MeasuresToolkit.xls>

¹⁸ They act as insurance policies against the threat of damage to vital national resources

strategic partnerships outside the priority catchments. The initiative is also undertaking intensive monitoring and evaluation which is accumulating a good knowledge base on the anticipated effectiveness of actions. For example, modelling suggests that phosphorus losses can be reduced by around 5%. This is an average estimate and at a local scale and within sensitive sub-catchments reductions of up to 20% could be achieved.

Revised Water Protection Zones are a mechanism to control agricultural and non-agricultural diffuse pollution in high risk areas. These would enable more stringent pollution control measures to be targeted to all relevant pollution sources. Work is ongoing to trial a methodology for how these zones would be justified and implemented including what types of measures might be applied within them. If similar outcomes can be anticipated through other mechanisms (e.g. voluntary initiatives, pollution prevention, enforcement) escalation of action to Water Protection Zones would only be proposed if status did not improve sufficiently.

Actions by the water industry

Actions requiring investment by the water industry are managed in cycles of planning and investment called Asset Management Plans and are considered as part of the periodic Price Review.

The majority of actions delivered by the water industry are primarily driven by established obligations for water quality, nearly all under other current Directives (M1 and M2 measures). Many of the improvements will also help us achieve Water Framework Directive obligations and are included in the overall outcome estimates to 2015. However, the specific costs and benefits are not subject to further WFD analysis because they are not driven by the Water Framework Directive.

Water industry measures cover actions currently underway in the 4th Asset Management Plan (AMP4) and also those planned for the next investment period from 2010-15. This is the periodic review for 2009 (or PR09¹⁹). The final list of schemes for new requirements under the Water Framework Directive (M3b measures) will be subject to sign off by Ministers in December 2009 as part of the first river basin management plans.

The schemes driven by the Water Framework Directive which have been recommended for funding are those assessed to be cost-beneficial. This assessment was made using scheme specific capital and operating costs from the water company final business plans, including the cost of carbon. Environmental outcomes were expressed as river lengths improving by a particular status change. Schemes were considered in combination where this was relevant to achieving the environmental outcome. The benefits were calculated using information from the national benefits survey undertaken by the UK Collaborative Research Programme²⁰, disaggregated for each river basin district. The assessment and recommendations took account of uncertainties in the ability to estimate outcomes and assign monetary benefits.

There are limits on the effluent quality that it is currently technically feasible to achieve (termed BAT or Best Achievable Technology)²¹. This is the accepted minimum level that we could set as a permit limit. Assessment of the need and ability to go beyond BAT would be based on a site specific assessment to judge technical feasibility and, if feasible, whether it could be justified on the grounds of costs, benefits and other impacts. Based on what is typical in terms of dilution of effluent discharges, BAT is generally not a constraint to

¹⁹ Also referred to as AMP5

²⁰ Final Report to Defra for CRP Project 4b/c The Benefits of Water Framework Directive Programmes of Measures in England and Wales <http://www.wfdcrp.co.uk/pdf%5CCRPSG%204bcd%20Final.pdf>

²¹ This follows the preliminary Cost Effectiveness Analysis. The upper limits are generally 95-percentile standards of 1 mg N/l for ammonia and 5 mg/l for the Biochemical Oxygen Demand and an annual average of 1 mg/l for total phosphorus.

achieving in river standards for ammonia and Biochemical Oxygen Demand but can be for phosphorus. Investigations will continue into technological improvements that would help reduce the sewage contribution to failure of good status standards. Implementation of these could be feasible in future cycles subject to an assessment of the costs, benefits and other impacts.

Schemes driven by the Water Framework Directive to address nutrients were identified where there was sufficient biological evidence to confirm the need for action and where the sewage works was confirmed as a contributory source.

Actions and outcomes

The measures presented in the first river basin management plans are those that we can currently justify. We use models and expert judgement to estimate the outcomes in terms of the future status that we expect these measures to deliver. The predicted outcomes are included in Annex B of this plan. Where we do not think status will reach good by 2015 but we cannot justify any further measures we have set alternative objectives for those elements. We have assigned decision tree codes to explain the reasons as summarised in the decision trees and tables below. These are based on the considerations and sources of uncertainty explained in the previous sections.

The main justifications for setting alternative objectives are:

- Insufficient confidence in the current status or future status to justify the need for improvement action (1a, 1b, 1c, 1d, 1e);
- Confidence of not being good but insufficient confidence in the current or future sources of failure to be able to identify appropriate measures (2a, 2b, 3a, 3b);
- Confidence of not being good, source(s) confirmed, technically feasible measures to address the source(s) but the costs of the measures are not proportionate to the benefits and other impacts (5a, 5b, 5c);

Alternative objectives can be a less stringent objective than good status or an extended deadline in which to seek to achieve good status. Where we have certainty over status and the sources of failure, and justified improvement actions are planned, we may still estimate that status will not reach good. We may also have cases where improvement actions cannot currently be justified on the grounds of disproportionate cost. In these cases we would currently set an extended deadline for achieving good on the grounds that:

- there is uncertainty in our estimates of what can be achieved so an extended deadline allows time to review measured progress and re-evaluate what more might be possible
- methods for assessing effectiveness of measures, outcomes, costs and benefits will continue to improve which will change current judgements about cost-effectiveness and proportionality
- developments in ways of reducing pollution could enable us to achieve more in the future and could also change the balance of costs and benefits

Further work

We have tried to predict the status of water bodies up to 2015 as a result of actions planned and in hand in the first cycle. The planning of further improvements will continue through the first cycle of river basin management.

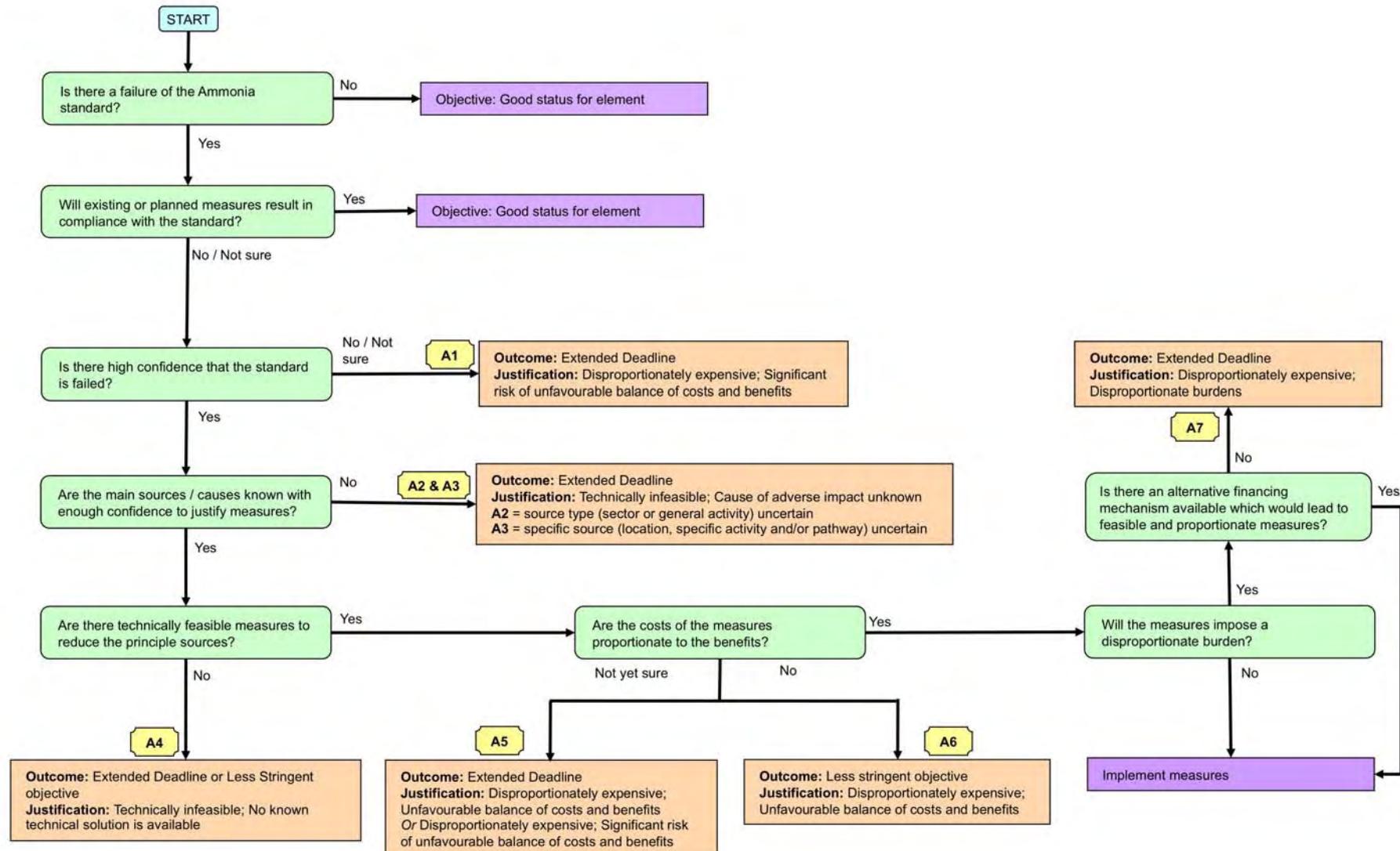
To enable us to identify and justify what further action is needed and quantify the costs and benefits we will be doing work locally and nationally to reduce the uncertainty that remains about:

- Status assessments using new classification tools

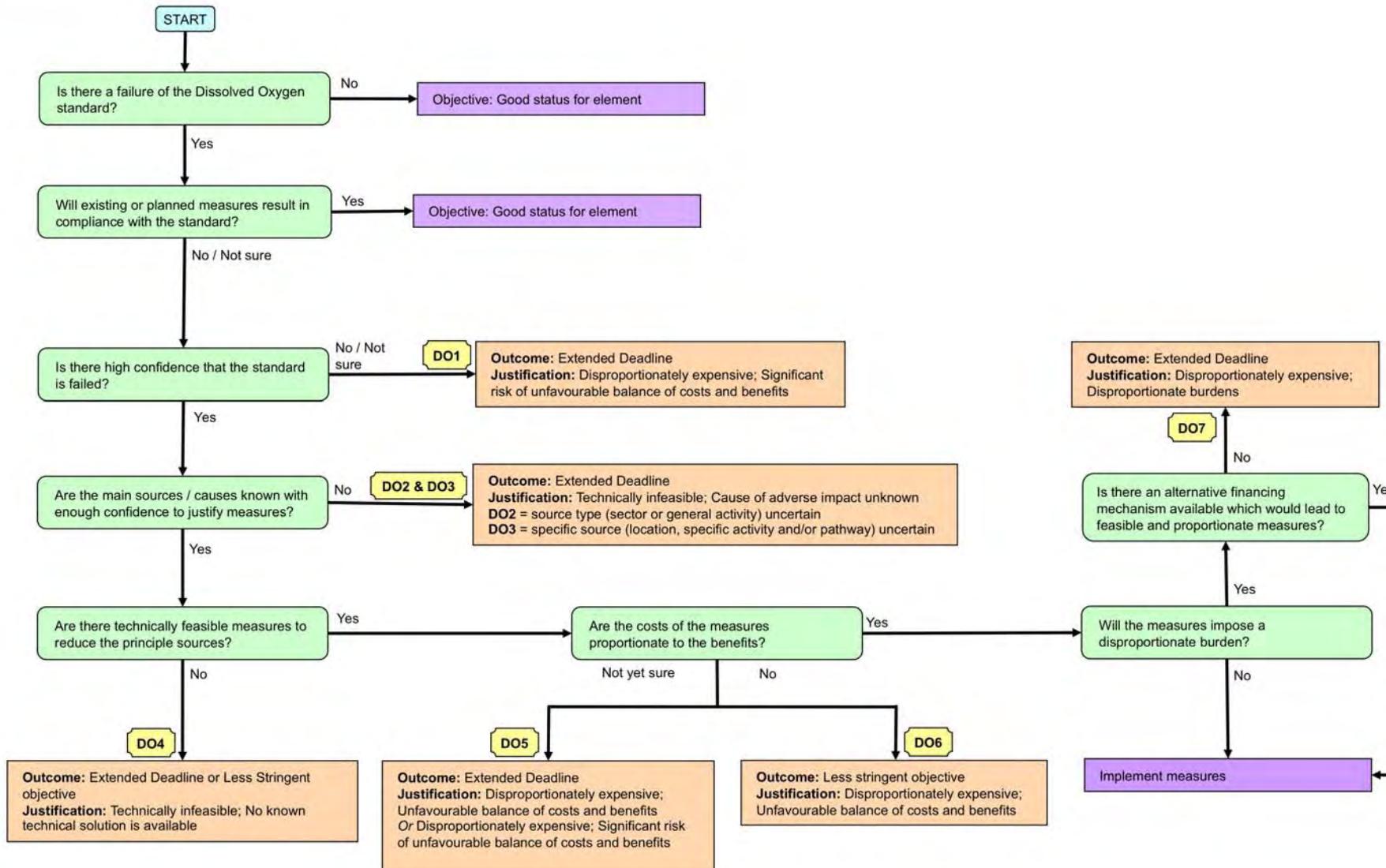
- Whether water bodies are adversely impacted, including adequate biological evidence for sites failing nutrient standards, and the outcome of actions to address Protected Area requirements. This includes monitoring started in 2008 to gather additional biological evidence downstream of sewage treatment works where additional treatment to remove phosphorus would be justified if we were confident there is a risk of damage.
- The reasons waters fail to meet good status, in particular, the relative importance of different sources of pollution
- How much technology and ways of taking action can develop to improve technical capability and cost effectiveness and deliver greater environmental improvement
- Costs and / or benefits and whether improvements to the methodology change the balance of proportionality when appraising measures
- The long-term impacts of climate change
- Whether good status can be achieved with extended deadlines or whether less stringent objectives are required, particularly for nutrients. Currently uncertainty about status due to insufficient biological evidence is the main reason for setting extended deadlines for nutrients. From the monitoring undertaken for this plan it is now clear that there is a link between high levels of phosphate in surface waters and biological failures in the main river type (lowland alkaline rivers). We are already collecting additional biological data in locations where the phosphate standard is exceeded. As a consequence the percentage of water bodies at good or better biological status is likely to reduce from 51 to 46 per cent. We know that it will be very expensive and technically challenging to reduce nutrient levels sufficiently to comply with the nutrient standards. For example, we used our SIMCAT models to estimate the length of river that might improve to good status if phosphate removal to the limit of what is currently judged cost-effective were applied to every sewage works in England and Wales discharging to failing waters. This suggested that compliance might only increase by around 6 per cent. A rough estimate of the cost is £6 billion (based on unit costs provided by the water industry) in total for the 1,800 sewage works (though in practice not all these works would require phosphate removal as certain works would make relatively insignificant contributions to the overall load). By comparison, approximate benefits are estimated to be around £2 billion based on a disaggregated national benefits number, valuing good status at say £30,000 per kilometre per year and assuming no other pressures or elements would place the water in worse than good status.

The further work will be completed in parallel so the future measures can be justified as soon as we have sufficient certainty.

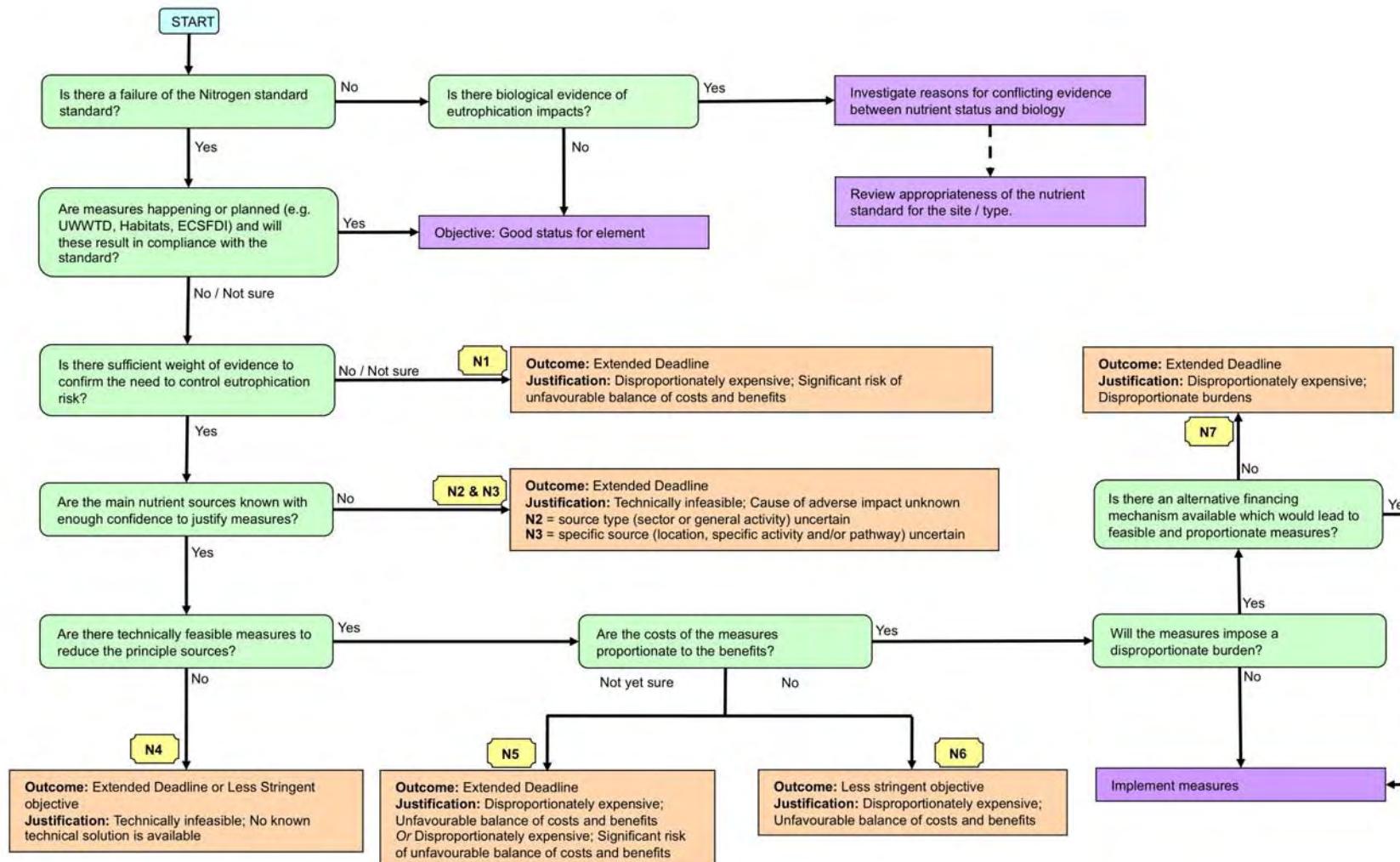
Decision tree for
Ammonia



**Decision tree for
Dissolved Oxygen**

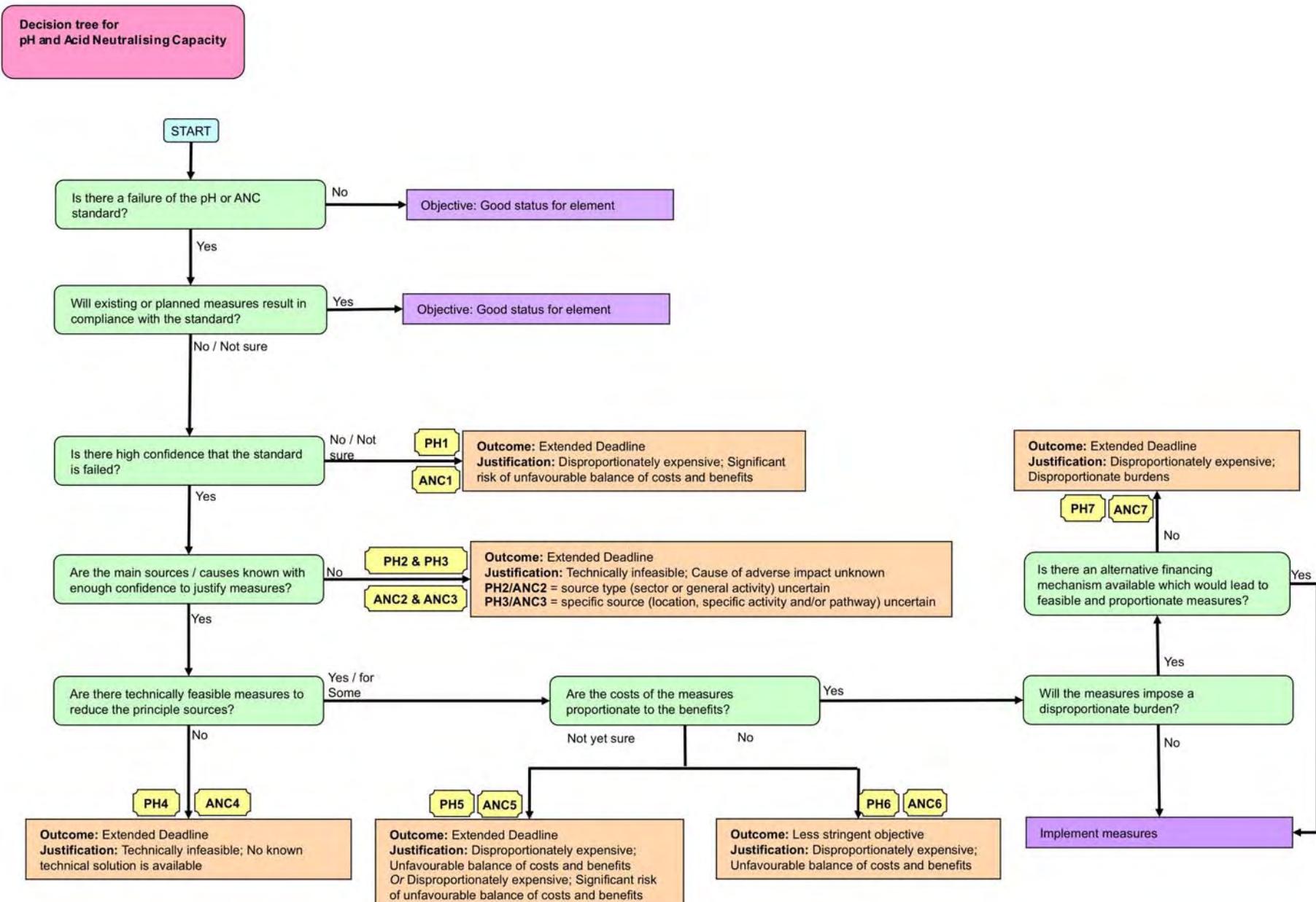


Decision tree for Dissolved Inorganic Nitrogen (ecological status objectives) in Transitional and Coastal Waters^{1,2}

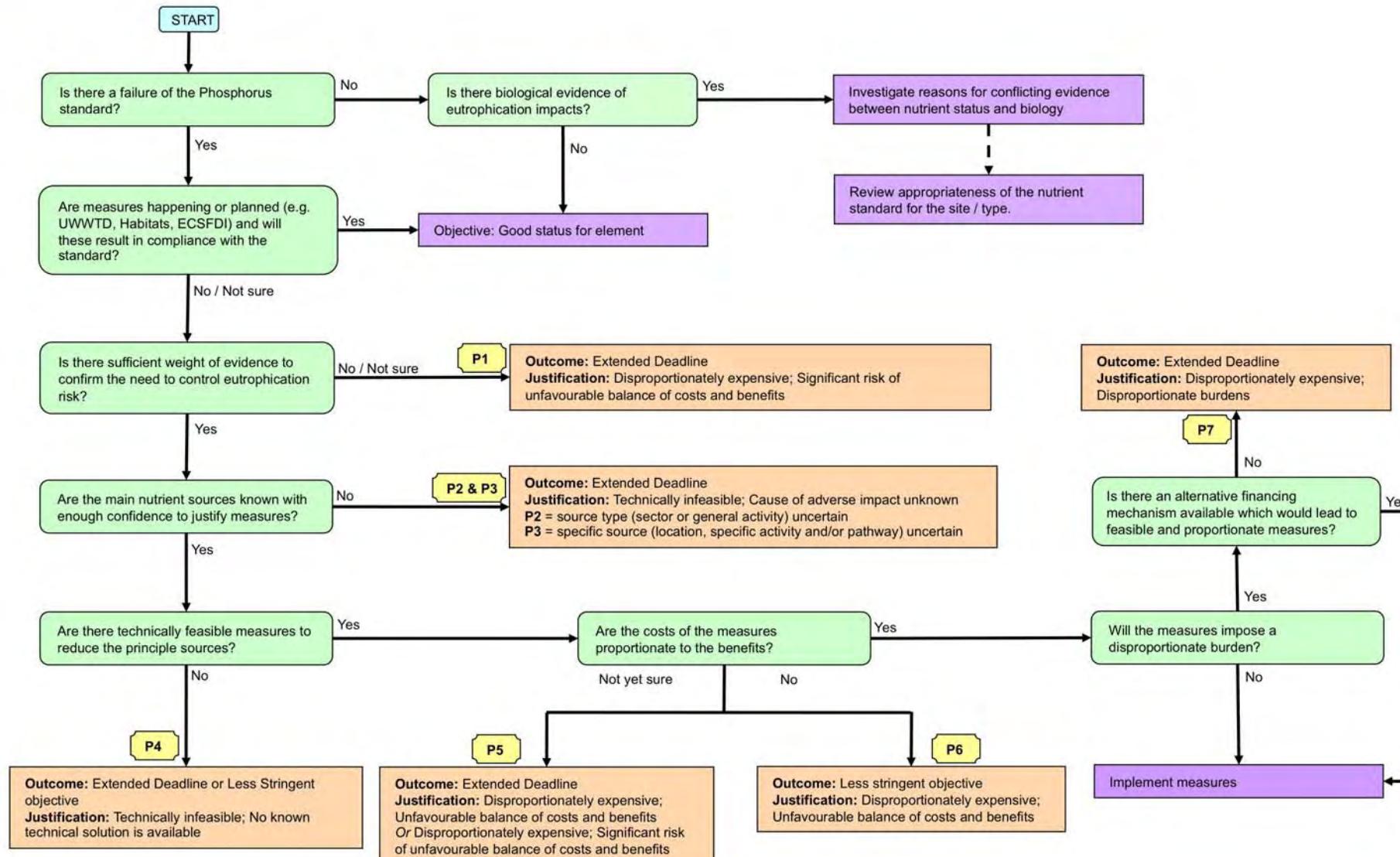


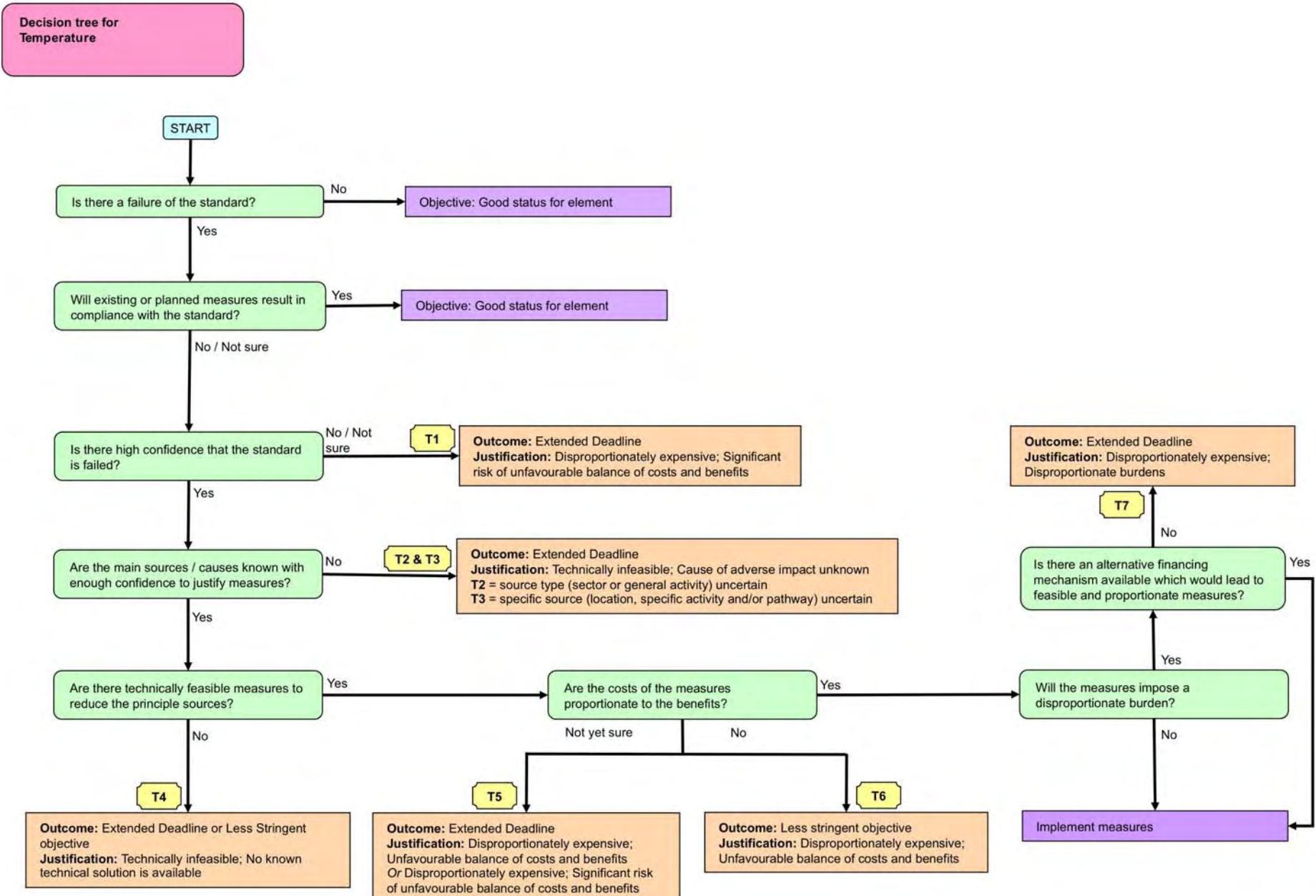
¹ A Water Framework Directive standard for nitrate in rivers and lakes has yet to be established

² Measures to address nitrate will also be carried out in certain Protected Areas (Nutrient Sensitive Areas designated under the Nitrates and Urban Waste Water Treatment Directives and Natura 2000 sites designated under the Habitats and Birds Directives)



**Decision tree for
Phosphorus (ecological status
objectives)**





Reference	A1a, DO1a, PH1a, T1a
Element predicted not to achieve good by 2015	A1a = Ammonia DO1a = Dissolved Oxygen PH1a = pH T1a = Temperature
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>There is not high confidence that the standard is failed</p> <p>For these water bodies we do not have the statistical confidence that the standard is failed; the water body may be compliant. Without confidence in a failure we cannot reliably consider sources and measures. To do so would mean a significant risk of wasted investment on measures in already compliant water bodies. In the first cycle we will carry out further investigations to confirm any failure with certainty, identify sources and appraise additional measures. Where possible additional measures will be implemented.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. One of the main sources of ammonia is discharges from municipal sewage treatment works. These works can also discharge significant loads of organic material that can result in a reduction in dissolved oxygen levels in receiving water bodies. Removing ammonia and organic material from sewage is expensive requiring structural changes to the works and ongoing operational costs for energy, maintenance and the disposal of sludge. The preliminary cost effectiveness analysis estimated that to put additional treatment capacity on all sewage treatment works for water bodies at risk of not achieving WFD standards would cost £304 to £848 million/year depending on how much ammonia was removed. Even where the need to control ammonia is confirmed, there is still a significant risk that removing ammonia from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference A5c). Of the 34 cases assessed, 21 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. Actions are in most instances expensive and need to be justified in terms of addressing real failures.</p> <p>As part of the recent review of water prices for the water industry (PR09), we looked for cases where, irrespective of compliance with established environmental standards, further improvements to the quality of discharges would deliver local benefits sufficient to justify the costs of improvement. One case was found. This is in the Thames RBD where 5 sewage works will be improved for the benefit of the</p>	

Thames Estuary.

There are no ongoing actions in or upstream of the water body that are estimated to bring improvements in the status in this water body.

Investigation type

Investigate to confirm failure and/or impact

Example of investigation

Additional monitoring to confirm status and the need to take additional action.

Monitoring and modelling work to identify the relative sources of ammonia, dissolved oxygen, pH or temperature in the catchment.

If the need for additional action is confirmed, identification of the most cost effective combination of measures necessary to achieve good ecological status.

Possible future measures

Possible future measures will depend on confirmation of being at less than good status and the identification of sources that contribute to this status. If the need to take additional action and the sources are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented. These measures may include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It will be disproportionately expensive to install ammonia removal technology on all municipal sewage treatment works in England and Wales.

It is likely that installing additional ammonia removal technology on many works will be disproportionately expensive. To reduce ammonia to 1 mg/l at all works where this may be necessary would cost £848 million/year across England and Wales.

Reference	A1b
Element predicted not to achieve good by 2015	Ammonia
Reason for failure	<p>Suspected - point source water industry sewage works</p> <p>Suspected - point source water industry storm discharge (incl. CSO)</p>
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Improvement work to sewage discharges is happening or is planned in the water body but the extent of the improvement is uncertain</p> <p>For these water bodies we currently have the statistical confidence that the standard is currently failed. However, we know there is current or planned work to improve sewage treatment works or storm sewage discharges in the water body. These committed improvements will take place before 2015. We are uncertain of the extent of the improvement and the associated confidence of meeting good status. Further action will not be pursued until the outcome is established through future monitoring. This is because we have low confidence that future quality would fail the standard. Without confidence in a failure we cannot reliably consider further measures. To do so would mean a significant risk of wasted investment on measures in already compliant water bodies. In the first cycle we will carry out further investigations to confirm any failure with certainty, identify sources and appraise additional measures. Where possible additional measures will be implemented.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. Removing ammonia from sewage is expensive requiring structural changes to the works and ongoing operational costs for energy, maintenance and the disposal of sludge. The preliminary cost effectiveness analysis estimated that to put additional treatment capacity on all sewage treatment works for water bodies at risk of not achieving WFD standards would cost £304 to £848 million/year depending on how much ammonia was removed. Even where the need to control ammonia is confirmed, there is still a significant risk that removing ammonia from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference A5c). Of the 34 cases assessed, 21 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. Actions are in most instances expensive and need to be justified in terms of addressing real failures.</p>	

Investigation type
Investigate to confirm failure and/or impact
Example of investigation
<p>Additional monitoring to confirm status following the implementation of planned measures and to confirm the need to take additional action.</p> <p>If necessary, monitoring and modelling work to identify the relative sources of ammonia.</p> <p>If the need for additional action is confirmed, identification of the most cost effective combination of measures necessary to achieve good ecological status.</p>
Possible future measures
<p>Possible future measures will depend on the outcome of planned measures and confirmation of being at less than good status and the identification of sources that contribute to this status. If the need to take additional action and the sources are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented. These measures may include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).</p>
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>It will be disproportionately expensive to install ammonia removal technology on all municipal sewage treatment works in England and Wales.</p> <p>It is likely that installing additional ammonia removal technology on many works will be disproportionately expensive. To reduce ammonia to 1 mg/l at works where this may be necessary would cost £848 million/year across England and Wales.</p>

Reference	A2a, DO2a, PH2a, ANC2a
Element predicted not to achieve good by 2015	<p>A2a = Ammonia</p> <p>DO2a = Dissolved Oxygen</p> <p>PH2a = pH</p> <p>ANC2a = Acid Neutralising Capacity</p>
Reason for failure	Unknown - reasons for failure unknown
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The cause of the failure (sector or general activity) is unknown</p> <p>Ammonia, substances affecting dissolved oxygen, pH and acid neutralising capacity (ANC) are released into the environment from a wide range of sources including urban and agricultural land use, industry and domestic release to sewers. For water bodies where the sources of the pollution is not known, or not known in sufficient detail to be able to identify and appraise measures (including identification of the person who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p> <p>For over 20 years we have routinely (usually annually) assessed compliance with water quality standards (such those for the freshwater fisheries directive and river quality objectives) and tried to identify the activities releasing the substances and causing the failure of the standards. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections. Despite this, the sources of some of these old failures remains unknown.</p> <p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for ammonia, dissolved oxygen, pH and ANC. Where these substances did not have standards under the old compliance schemes, or where the standards for the water framework directive are tighter than before, we have identified new failures. In the time available, we have not been able to identify the sources and their relative contributions for each of the new failures.</p>	
Investigation type	
Investigate reason for failure.	

Example of investigation

The significance of locally relevant sources will be assessed through additional monitoring, site visits, desktop studies and modelling (e.g. using SIMCAT models) to identify and apportion causes of failure. The most cost effective combination of measures necessary to achieve good ecological status will be identified. Investigations will include local studies as well as using information and understanding from national source apportionment projects and ongoing work to improve our understanding of the effectiveness of measures. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriate measures to be identified for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the sources that contribute to the failure. Measures may include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Uncertain until the sectors or general activities causing the failure is known.

Reference	A2b, DO2b, PH2b, ANC2b
Element predicted not to achieve good by 2015	<p>A2b = Ammonia</p> <p>DO2b = Dissolved Oxygen</p> <p>PH2b = pH</p> <p>ANC2b = Acid Neutralising Capacity</p>
Reason for failure	Suspected - point and/or diffuse source
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The cause of the failure (sector or general activity) is not known with certainty</p> <p>Ammonia, substances affecting dissolved oxygen, pH and acid neutralising capacity (ANC) are released into the environment from a wide range of sources including urban and agricultural land use, industry and domestic release to sewers. For water bodies where the source of pollution causing the failure is suspected, but we do not have strong enough evidence to confirm it, it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p> <p>For over 20 years we have routinely (usually annually) assessed compliance with water quality standards (such those for the freshwater fisheries directive and river quality objectives) and tried to identify the activities releasing the substances and causing the failure of the standards. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections. Despite this, the sources of some of these old failures remain suspected and not confirmed by evidence.</p> <p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for ammonia, dissolved oxygen, pH and ANC. Where these substances did not have standards under the old compliance schemes, or where the standards for the water framework directive are tighter than before, we have identified new failures. In the time available, we have not been able to confirm the sources and their relative contributions for each of the new failures.</p>	
Investigation type	
Investigate source of failure.	

Example of investigation

The significance of locally relevant sources will be assessed through additional monitoring, site visits, desktop studies and modelling (e.g. using SIMCAT models) to identify and apportion causes of failure. The most cost effective combination of measures necessary to achieve good ecological status will be identified. Investigations will include local studies as well as using information and understanding from national source apportionment projects and ongoing work to improve our understanding of the effectiveness of measures. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriate measures to be identified for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the sources that contribute to the failure. Measures may include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Uncertain until the sectors or general activities causing the failure is confirmed.

Reference	A3a, DO3a, PH3a
Element predicted not to achieve good by 2015	A3a = Ammonia DO3a = Dissolved Oxygen PH3a = pH
Reason for failure	Confirmed - diffuse source agricultural
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The specific agricultural source (location, specific activity and/or pathway) of the failure is unknown</p> <p>Although agriculture is known to be causing the problem, until the specific source(s) is known in sufficient detail to be able to identify and appraise measures (including identification of the person who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p> <p>For over 20 years we have routinely (usually annually) assessed compliance with water quality standards (such those for the freshwater fisheries directive and river quality objectives) and tried to identify the activities releasing the substances and causing the failure of the standards. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections. Because of this work we know agriculture is causing the problem but the specific source is yet to be identified.</p> <p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for ammonia, dissolved oxygen, pH and ANC. Where these substances did not have standards under the old compliance schemes, or where the standards for the water framework directive are tighter than before, we have identified new failures. In the time available, we have been able to identify agriculture as the source but have yet to identify the specific source.</p>	
Investigation type	
Investigate source of failure.	

Example of investigation

The significance of locally relevant agricultural diffuse sources will be assessed through additional monitoring, site visits (including tracing studies), desktop studies and modelling to identify and apportion the sources of failure. The most cost effective combination of measures necessary to achieve good ecological status will be identified. Investigations will include local studies as well as using information and understanding from national source apportionment projects and ongoing work to improve our understanding of the effectiveness of agricultural measures. There are a number of national projects being planned to do further testing and evaluation (including field trials) of feasible and cost effective means of reducing agricultural pollution, including ongoing work within the Catchment Sensitive Farming catchments in England and Demonstration Catchment work in Wales. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriately targeted measures to be identified for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the more detailed identification of source contributions and investigations into the feasibility and relative effectiveness of measures.

Measures might include for example:

- More local partnership projects to support farmers to change practice
- Increased roll-out (in terms of duration and geographic extent) of Catchment Sensitive Farming advisory initiatives in England, and in Wales expansion of the Environment Agency's Catchment Co-ordinator Initiative
- Widen the measures and activities included in agri-environment initiatives (e.g. rural sustainable drainage systems)
- Widen the measures and activities that are included in the Common Agricultural Policy funded initiatives (e.g. increase soil resource protection measures in current approach to cross-compliance, or whatever may follow in future)
- Establish and/or extend existing national partnerships that provide advice and support to land managers to improve practice
- Increased Environment Agency-led pollution enforcement campaigns (including use of anti-pollution works notices)
- where appropriate designation of Water Protection Zones

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	A3b, DO3b, PH3b
Element predicted not to achieve good by 2015	A3b = Ammonia DO3b – Dissolved Oxygen PH3b = pH
Reason for failure	Confirmed - non-agricultural diffuse source
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The general activity causing the failure is known but the specific source (location, specific activity and/or pathway) is unknown</p> <p>Although the sector or general activity (for example, contaminated land, urban run-off, industrial estate, housing) causing the problem is known, until the specific source(s) is known in sufficient detail to be able to identify and appraise measures (including identification of the person who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p> <p>For over 20 years we have routinely (usually annually) assessed compliance with water quality standards (such those for the freshwater fisheries directive and river quality objectives) and tried to identify the activities releasing the substances and causing the failure of the standards. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections. Because of this work we know the general activity causing the problem but the specific source is yet to be identified.</p> <p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for ammonia, dissolved oxygen, pH and ANC. Where these substances did not have standards under the old compliance schemes, or where the standards for the water framework directive are tighter than before, we have identified new failures. In the time available, we have been able to identify the general activity as the source but have yet to identify the specific source.</p>	
Investigation type	
Investigate source of failure	

Example of investigation

The significance of locally relevant non-agricultural diffuse sources will be assessed through additional monitoring, site visits (including tracing studies), desktop studies and modelling to identify and apportion the sources of failure. The most cost effective combination of measures necessary to achieve good ecological status will be identified. Investigations will include local studies as well as using information and understanding from national source apportionment projects and ongoing work to improve our understanding of the effectiveness of measures. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriately targeted measures to be identified for implementation in this or subsequent river basin management planning cycles.

There may also be techniques that are under development but have not been proved effective in practice. Further investigations to progress this work (e.g. through controlled laboratory experiments, field trials or pilot plants) may result in feasible measures being identified for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the more detailed identification of source contributions and investigations into the feasibility and relative effectiveness of measures.

Measures might include for example:

- More local partnership projects with key partners e.g. Highways Agency, local authorities, Business Groups to change practice and reduce the risk of non-agricultural diffuse pollution.
- Establish Urban Catchment Officers in England and Wales to give advice to SMEs, local authorities and those responsible for managing roads to help prevent non-agricultural diffuse pollution (similar to England Catchment Sensitive Farming Delivery Initiative)
- Increased pollution enforcement campaigns (including use of anti-pollution works notices).
- Increased roll-out of Water Protection Zones
- Development of General Binding Rules for particular high risk activities and sectors (e.g. construction sector)
- Establish and/or extend existing national partnerships that provide advice and support to improve practice (e.g. Amenity Forum pesticide initiative)
- Prohibitions on the use of amenity fertilisers
- Extend the geographic scale and pace of roll-out of work to correct misconnections of foul sewers to surface water drains
- Targeted retro-fitting of Sustainable Urban Drainage systems in all new developments and all re-developments
- Targeted land use change e.g. prohibition of development in priority areas

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale land use change e.g. prohibition of development in large parts of England and Wales that are particularly sensitive to non-Agricultural diffuse water pollution
- Wide scale remediation of sites contaminated from historic uses

Reference	A5a, DO5a
Element predicted not to achieve good by 2015	A5a = Ammonia DO5a = Dissolved Oxygen
Reason for failure	Confirmed - point source water industry
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The discharge(s) contributing to the failure is known but it is uncertain if the costs of the measure(s) are proportionate to the benefits</p> <p>Although the sewage treatment works or storm sewage discharges contributing to the failure are known, until further site specific appraisal is done, it is uncertain if the cost of implementing the improvement measure(s) is proportionate. It is therefore disproportionately expensive to implement further measures at this time and an extended deadline for achieving good ecological status is required.</p> <p>Removing ammonia and organic material from sewage is expensive requiring structural changes to the works and ongoing operational costs for energy, maintenance and the disposal of sludge. The preliminary cost effectiveness analysis estimated that to put additional treatment capacity on all sewage treatment works for water bodies at risk of not achieving WFD standards would cost £304 to £848 million/year depending on how much ammonia was removed. Even where the need to control ammonia is confirmed, there is still a significant risk that removing ammonia from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference A5c). Of the 34 cases assessed, 21 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. Actions are in most instances expensive and need to be justified in terms of addressing real failures.</p> <p>For some water bodies the need for schemes had not been identified within the timescales for PR09 planning. At some sites the earlier classifications did not show the standards were failed with high confidence and so improvement schemes were not identified. The final classifications now show such failures. In the time available, we have been able to identify the sewage discharge(s) contributing to the failure. However, it has not been possible to identify the costs of the required measures and identify potential benefits and other impacts that improving the discharges will deliver.</p> <p>If this further appraisal confirms that it is disproportionately expensive to achieve good ecological status by 2015, these water bodies will be re-categorised with reference 5c. If measures are shown to be proportionate we will look to progress measures as soon as practicable. These future measures may need to be phased, particularly if they depend on action to address other sources.</p>	

Investigation type
Investigate proportionate measures
Example of investigation
Investigations will establish whether it is cost-beneficial to implement measures at the water industry sources. These investigations would also need to confirm the significance of other sources to ensure we identify the most cost-effective combination of measures and that this combination is not disproportionately expensive. This will be assessed mainly through modelling but may require some additional monitoring.
Possible future measures
Possible future measures could include enhanced treatment of sewage discharges, improvements to intermittent discharges, and action to address other sources, depending on their relative significance. Development of new techniques and practices could also provide more effective measures which achieve a better balance of costs, benefits and other impacts..
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
Measures that are likely to be technically infeasible or disproportionately expensive will depend on the substance in question and the source of the substance. The preliminary cost effectiveness analysis (pCEA) evaluated the technical feasibility and costs associated with available and potential measures. For example, it is technically feasible to install additional ammonia removal technology on all municipal sewage treatment works in England and Wales. However, it is likely that installing ammonia removal technology on many works will be disproportionately expensive. To reduce ammonia to 1 mg/l at works where this may be necessary would cost £848 million/year across England and Wales.

Reference	A5b, DO5b, PH5b
Element predicted not to achieve good by 2015	A5b = Ammonia DO5b = Dissolved Oxygen PH5b = pH
Reason for failure	Confirmed - point source, non-water industry
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The discharge contributing to the failure is known but it is uncertain if the cost of the measure is proportionate to the benefit</p> <p>Although the discharge contributing to the failure is known, until further site specific appraisal is done, it is uncertain if the cost of implementing the improvement measure is proportionate. It is therefore disproportionately expensive to implement further measures at this time and an extended deadline for achieving good ecological status is required.</p> <p>For some water bodies the earlier classifications did not show the standards were failed with high confidence and so improvement schemes were not identified. The final classifications now show such failures. In the time available, we have been able to identify the sewage discharge(s) contributing to the failure. However, it has not been possible to identify the costs of the required measures and identify potential benefits and other impacts that improving the discharges will deliver.</p>	
Investigation type	
Investigate proportionate measures	
Example of investigation	
<p>Investigations will establish whether it is cost-beneficial to implement measures at the sources. These investigations would also need to confirm the significance of other sources to ensure we identify the most cost-effective combination of measures and that this combination is not disproportionately expensive. This will be assessed mainly through modelling but may require some additional monitoring.</p> <p>If this further appraisal confirms that it is disproportionately expensive these water bodies would be re-categorised (similar to reference 5c). If measures are shown to be proportionate we will look to progress measures as soon as practicable. These future measures may need to be phased, particularly if they depend on action to address other sources.</p>	

Possible future measures

Possible future measures could include enhanced treatment of discharges, remediation of contaminated land, and action to address other sources, depending on their relative significance. Development of new techniques and practices could also provide more effective measures which achieve a better balance of costs, benefits and other impacts.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Wide scale, precautionary tightening of discharge consents for ammonia and/or BOD for most point sources through England & Wales

Reference	A5c
Element predicted not to achieve good by 2015	Ammonia
Reason for failure	Confirmed - point source water industry sewage works
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The discharge causing the ammonia failure is known and a site specific appraisal has shown the improvement measure available to be currently disproportionately expensive</p> <p>Through our PR09 planning work we identified the sewage treatment works causing the ammonia failure. We identified the costs of the required measure and identified potential benefits and other impacts that improving the discharges will deliver. This showed the measure to be currently disproportionately expensive.</p> <p>These appraisals used:</p> <ul style="list-style-type: none"> - site specific costs provided by Ofwat following submission of water company final business plans; - site specific information on embedded carbon and operating carbon emissions to calculate carbon costs; - environmental outcomes recorded as length of river improved to meet WFD objectives; - benefits based on the NERA National Benefits Survey (Collaborative Research Project 4b/c); - additional local benefits identified after consultation with RBD liaison panels. <p>Our PR09 appraisal of the costs and benefits of ammonia removal schemes, assessed 34 cases, 21 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. The 13 schemes that were assessed as having a favourable balance of costs, benefits and other impacts will improve 12 water bodies and 128 kilometres of river.</p> <p>Technological improvements may make the improvement needed less costly and / or the estimated benefits may change significantly with better information. An extended deadline for achieving good ecological status is therefore required.</p>	
Investigation type	
Investigate proportionate measures	

Example of investigation

At these sites the assessments will be reviewed as further information becomes available that might change the balance of costs, benefits and other impacts. This might come from: an improved understanding of the relative importance of other sources such that combined action becomes cost-beneficial; benefits may be valued more highly; benefits may increase if outcomes become more certain; advancements in treatment technology may reduce the cost of the measures and/or improve the outcome that can be realised.

If measures are shown to be proportionate we will look to progress measures as soon as practicable. These future measures may need to be phased, particularly if they depend on action to address other sources.

Possible future measures

Possible future measures could include improvement treatment for sewage discharges as well as action on other source contributions, depend on the relative significance of these (and other) sources. Development of new or novel techniques to reduce pollution for both any or all of the significant sources could also provide more effective measures which achieve a better balance of costs, benefits and other impacts.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Measures that are likely to be technically infeasible or disproportionately expensive will depend on the source of ammonia. The preliminary cost effectiveness analysis (pCEA) evaluated the technical feasibility and costs associated with available and potential measures.

For example, it is technically feasible to install ammonia removal technology on all municipal sewage treatment works in England and Wales. However, it is likely that installing ammonia removal technology on many works will be disproportionately expensive. To remove ammonia to 1 mg/l at works where this may be necessary would cost £848 million/year across England and Wales.

Reference	P1a, N1a
Element predicted not to achieve good by 2015	P1a = Phosphate or Total Phosphorus N1a = Dissolved Inorganic Nitrogen
Reason for failure	Unknown and/or uncertain there is a failure/impact and source not confirmed
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>There is currently insufficient weight of evidence to confirm the need to control eutrophication risk using site specific and potentially expensive regulatory action</p> <p>Guidance on river basin management planning issued by Defra and Welsh Assembly Government requires that, for failures of nutrient standards, evidence of whether the biology is truly impacted should be taken into account when considering the case for improvement actions. However where we are confident of phosphate failure and this is indicative of some biological impact (e.g. in alkaline lowland rivers) we will take action to reduce phosphates by such means as providing education or training, routing people to sources of funding or invoking the England Catchment Sensitive Farming Initiative, without waiting for the full information on diatoms and macrophytes that would be necessary to justify targeted regulatory action to control eutrophication such as the designation of a sensitive area under the Urban Waste Water Treatment Directive or of a Water Protection Zone.</p> <p>The Environment Agency has established a programme of gathering additional biological data in locations where the phosphate standard is exceeded including the monitoring of macrophytes and phytoplankton. This includes monitoring to gather additional biological evidence downstream of sewage treatment works where additional treatment to remove phosphorus would be justified if we were confident there is a risk of damage.</p> <p>For these water bodies the sources of nutrient are not yet confirmed.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. The major source of phosphorus is discharges from municipal sewage treatment works. Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see table reference P5c). Of the 51 cases assessed, 15 were assessed as</p>	

being not justified because of the unfavourable balance of costs, benefits and other impacts.

As part of the recent review of water prices for the water industry (PR09), we looked for cases where, irrespective of compliance with established environmental standards, further improvements to the quality of discharges would deliver local benefits sufficient to justify the costs of improvement. None were found.

There are no ongoing actions in or upstream of the water body that are estimated to bring improvements in the status in this water body. In 2010 we will report to River Basin Liaison Panels on those water bodies where new knowledge of the links between phosphate and biology has resulted in a change to our assessment and hence the detail of the actions we are taking to improve their status.

Investigation type

Investigate to confirm failure and/or impact

Example of investigation

Additional biological monitoring (in particular for macrophytes in rivers and lakes) to understand cause and impact and, where necessary, to confirm status. This has already started. For example, we have already started monitoring downstream of some sewage treatment works to gather additional biological evidence to potentially justify additional treatment to remove phosphorus.

Where required, from 2010 investigative monitoring will be implemented to confirm the significance of all marginal phosphate failures and, where necessary, gather further biological evidence.

Monitoring and modelling work will also be undertaken to identify the relative sources of nutrients in the catchment.

Where the need for additional action is confirmed by, for example, the indication of impacts on macrophyte and phytoplankton (diatoms) in rivers and lakes we will move quickly to the identification of the most cost effective combination of measures necessary to achieve good ecological status.

Through the UK Technical Advisory Group on the WFD, the Environment Agency is working to improve the understanding of the links between phosphate, diatoms and macrophytes in rivers and lakes to inform the future review of nutrient standards, monitoring plans and the level of evidence needed to justify the use of different control mechanisms.

Possible future measures

Restrictions on phosphorus in detergents.

The major sources of nutrients are discharges from sewage treatment works and agricultural activities. If the need to take additional action and the sources of the nutrient are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as the England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions), and action to address misconnections.

The Environment Agency is now working with the main farming groups to understand better the main ways in which phosphate from land enters and is transported in water bodies. We will also look at what the advice and incentives available through agri-environment schemes and the England Catchment Sensitive Farming Delivery Initiative can do to reduce phosphate pollution of water and wetlands alongside the industry led campaign for the Farmed Environment.

In parallel with this approach, the Environment Agency will continue to develop work on regulatory measures, such as designating Water Protection Zones (WPZs) if voluntary approaches are shown not to work in a particular area, or where higher environmental standards are needed in for example protected areas, so that we are ready and able to ensure progress is made before 2015. The work to identify the ways in which phosphate enters water bodies and the means of reducing this will inform the measures that might be applied in WPZs which can only be effective if the means of control have been clearly identified.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Sewage treatment works discharges:

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that between 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It will cost between 157-7408 £/kg to remove phosphorus from these smaller works.

Agricultural activities:

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P1b, N1b
Element predicted not to achieve good by 2015	P1b = Phosphate or Total Phosphorus N1b = Dissolved Inorganic Nitrogen
Reason for failure	Unknown - uncertain there is a failure/impact and source not confirmed
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>There is currently insufficient weight of evidence to confirm the need to control eutrophication risk using site specific and potentially expensive regulatory action</p> <p>Guidance on river basin management planning issued by Defra and Welsh Assembly Government requires that, for failures of nutrient standards, evidence of whether the biology is truly impacted should be taken into account when considering the case for improvement actions. However where we are confident of phosphate failure and this is indicative of some biological impact (e.g. in alkaline lowland rivers) we will take action to reduce phosphates by such means as providing education or training, routing people to sources of funding or invoking the England Catchment Sensitive Farming Initiative, without waiting for the full information on diatoms and macrophytes that would be necessary to justify targeted regulatory action to control eutrophication such as the designation of a sensitive area under the Urban Waste Water Treatment Directive or of a Water Protection Zone.</p> <p>The Environment Agency has established a programme of gathering additional biological data in locations where the phosphate standard is exceeded including the monitoring of macrophytes and phytobenthos. This includes monitoring to gather additional biological evidence downstream of sewage treatment works where additional treatment to remove phosphorus would be justified if we were confident there is a risk of damage.</p> <p>For these water bodies all or some of the nutrient sources are known.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. The major source of phosphorus is discharges from municipal sewage treatment works. Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see table reference P5c). Of the 51 cases assessed, 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other</p>	

impacts.

As part of the recent review of water prices for the water industry (PR09), we looked for cases where, irrespective of compliance with established environmental standards, further improvements to the quality of discharges would deliver local benefits sufficient to justify the costs of improvement. None were found.

There are no ongoing actions in or upstream of the water body that are estimated to bring improvements in the status in this water body. In 2010 we will report to River Basin Liaison Panels on those water bodies where new knowledge of the links between phosphate and biology has resulted in a change to our assessment and hence the detail of the actions we are taking to improve their status.

Investigation type

Investigate to confirm failure and/or impact

Example of investigation

Additional biological monitoring (in particular for macrophytes in rivers and lakes) to understand cause and impact and, where necessary, to confirm status. This has already started. For example, we have already started monitoring downstream of some sewage treatment works to gather additional biological evidence to potentially justify additional treatment to remove phosphorus.

Where required, from 2010 investigative monitoring will be implemented to confirm the significance of all marginal phosphate failures and, where necessary, gather further biological evidence.

Monitoring and modelling work will also be undertaken to identify the relative sources of nutrients in the catchment.

Where the need for additional action is confirmed by, for example, the indication of impacts on macrophyte and phytoplankton (diatoms) in rivers and lakes we will move quickly to the identification of the most cost effective combination of measures necessary to achieve good ecological status.

Through the UK Technical Advisory Group on the WFD, the Environment Agency is working to improve the understanding of the links between phosphate, diatoms and macrophytes in rivers and lakes to inform the future review of nutrient standards, monitoring plans and the level of evidence needed to justify the use of different control mechanisms.

Possible future measures

Restrictions on phosphorus in detergents.

The major sources of nutrients are discharges from sewage treatment works and agricultural activities. If the need to take additional action and the sources of the nutrient are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as the England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions), and action to address misconnections.

The Environment Agency is now working with the main farming groups to understand better the main ways in which phosphate from land enters and is transported in water bodies. We will also look at what the advice and incentives available through agri-environment schemes and the England Catchment Sensitive Farming Delivery Initiative can do to reduce phosphate pollution of water and wetlands alongside the industry led campaign for the Farmed Environment.

In parallel with this approach, the Environment Agency will continue to develop work on regulatory measures, such as designating Water Protection Zones (WPZs) if voluntary approaches are shown not to work in a particular area, or where higher environmental standards are needed in for example protected areas, so that we are ready and able to ensure progress is made before 2015. The work to identify the ways in which phosphate enters water bodies and the means of reducing this will inform the measures that might be applied in WPZs which can only be effective if the means of control have been clearly identified.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Sewage treatment works discharges:

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that between 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It will cost between 157-7408 £/kg to remove phosphorus from these smaller works.

Agricultural activities:

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P1c, N1c
Element predicted not to achieve good by 2015	P1c = Phosphate or Total Phosphorus N1c = Dissolved Inorganic Nitrogen
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>There is not sufficient weight of evidence to confirm the need to control eutrophication risk and there are ongoing or planned improvement actions</p> <p>Guidance on river basin management planning issued by Defra and Welsh Assembly Government requires that for failures of nutrient standards that the biology is truly impacted when considering the case for improvement actions. For these water bodies there is no or insufficient biological data or other evidence to justify taking additional measures to control the risk of eutrophication. From the monitoring undertaken for this plan it is now clear that there is a link between high levels of phosphate in surface waters and biological failures in the main river type (lowland alkaline rivers). We are already collecting additional biological data in locations where the phosphate standard is exceeded. This includes monitoring started in 2008 to gather additional biological evidence downstream of sewage treatment works where additional treatment to remove phosphorus would be justified if we were confident there is a risk of damage.</p> <p>There are ongoing actions within or upstream of the water body (either at sewage treatment works and / or through actions on agriculture in the catchment). Some of these actions are driven by eutrophic designations under the Urban Waste Water Treatment Directive and / or the Nitrates Directive. The ongoing actions will reduce nutrient levels and lead to some improvement in status. We are uncertain of the extent of the improvement and further action would not be pursued until the outcome was established through future monitoring. This is because we have low confidence that future quality would fail the standard. Without confidence in a failure we cannot reliably consider further measures. To do so would mean a significant risk of wasted investment on measures in already compliant water bodies. Our priority in the first cycle will be to carry out further investigation to confirm any failure with certainty, identify sources and additional potential measures. This will also need to consider biological response times.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. The major source of phosphorus is discharges from municipal sewage treatment works. Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring</p>	

structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference P5c). Of the 51 cases assessed, 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts.

As part of the recent review of water prices for the water industry (PR09), we looked for cases where, irrespective of compliance with established environmental standards, further improvements to the quality of discharges would deliver local benefits sufficient to justify the costs of improvement. None were found.

Investigation type

Investigate to confirm failure and/or impact

Example of investigation

Additional biological monitoring to confirm status. This has already started. For example, in 2008 we started monitoring downstream of some sewage treatment works to gather additional biological evidence to potentially justify additional treatment to remove phosphorus.

Monitoring and modelling work to review the relative sources of nutrients in the catchment.

If the need for additional action is confirmed, identification of the most cost effective combination of measures necessary to achieve good ecological status.

Possible future measures

Ban on phosphorus in detergents.

The major sources of nutrients are discharges from sewage treatment works and agricultural activities. If the need to take additional action and the sources of the nutrient are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Sewage treatment works discharges:

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the

works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.

Agricultural activities:

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P1d
Element predicted not to achieve good by 2015	Phosphate or Total Phosphorus
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Improvement work is happening or is planned in the water body but the extent of the improvement is uncertain</p> <p>Guidance on river basin management planning issued by Defra and Welsh Assembly Government requires that for failures of nutrient standards that the biology is truly impacted when considering the case for improvement actions.</p> <p>For these water bodies there is currently sufficient weight of evidence (including biology classification) to confirm the need to control eutrophication risk. However, we know there is current or planned work within or upstream of the water body at sewage treatment works and /or on agriculture in the catchment. These actions will reduce nutrient levels and lead to some improvement in status. We are uncertain of the extent of the improvement and further action would not be pursued until the outcome was established through future monitoring. This is because we have low confidence that future quality would fail the standard. Without confidence in a failure we cannot reliably consider further measures. To do so would mean a significant risk of wasted investment on measures in already compliant water bodies. Our priority in the first cycle will be to carry out further investigation to confirm any failure with certainty, identify sources and additional potential measures. This will also need to consider biological response times.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. The major source of phosphorus is discharges from municipal sewage treatment works. Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference P5c). Of the 51 cases assessed, 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts.</p>	

Investigation type
Investigate to confirm failure and/or impact
Example of investigation
<p>Additional biological monitoring to confirm. This has already started. For example, in 2008 we started monitoring downstream of some sewage treatment works to gather additional biological evidence to potentially justify additional treatment to remove phosphorus.</p> <p>Monitoring and modelling work to review the relative sources of nutrients in the catchment.</p> <p>If the need for additional action is confirmed, identification of the most cost effective combination of measures necessary to achieve good ecological status.</p>
Possible future measures
<p>Ban on phosphorus in detergents.</p> <p>The major sources of nutrients are discharges from sewage treatment works and agricultural activities. If the need to take additional action and the sources of the nutrient are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented.</p> <p>Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).</p>
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>Sewage treatment works discharges:</p> <p>It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.</p> <p>It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.</p> <p>Agricultural activities:</p> <ul style="list-style-type: none"> • Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales • Wide scale reversion of agricultural land to woodland over large parts of England

and Wales

- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P1e, N1e
Element predicted not to achieve good by 2015	P1e = Phosphate or Total Phosphorus N1e = Dissolved Inorganic Nitrogen
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The water body is within a site currently being investigated as a candidate for designation as a sensitive area eutrophic (and / or in Transitional / Coastal waters a polluted water eutrophic)</p> <p>That review will confirm whether the site is at risk of eutrophication, not at risk, or needs further investigation. If it is at risk basic measures under UWWTD &/or Nitrates Directive would then be applied.</p>	
Investigation type	
Investigate to confirm failure and/or impact	
Example of investigation	
<p>Conclusion of the review as a candidate sensitive area / polluted water, which could require further investigation if evidence is inconclusive. Investigations would also look at whether other measures in combination with the basic measures under UWWTD / Nitrates Directive could be justified in terms of costs, benefits and other impacts. The investigative work would be through a combination of modelling and potentially further monitoring.</p>	
Possible future measures	
<p>Conclusion of the review as a candidate sensitive area / polluted water will confirm if the water body is at risk from eutrophication. If so basic measures required by those designations would then be applied. Progressing measures to address other sources, for example agricultural phosphorus, would depend on their relative contribution and whether these were justified in terms of costs, benefits and other impacts. Into the future developments in technology and our understanding of the effectiveness of measures could provide enhanced measures.</p>	

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Sewage treatment works discharges:

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.

Agricultural activities:

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P1o, N1o
Element predicted not to achieve good by 2015	P1o = Phosphate or Total Phosphorus N1o = Dissolved Inorganic Nitrogen
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
There is not sufficient weight of evidence to confirm the need to control eutrophication risk	
<p>Guidance on river basin management planning issued by Defra and Welsh Assembly Government requires that for failures of nutrient standards that the biology is truly impacted when considering the case for improvement actions. For these water bodies biological data for nutrient sensitive elements is suggesting good or better status so there is low certainty that there is a risk of eutrophication even though nutrients are exceeding the standard. Where we are not confident of failing good status we would not use regulatory powers to pursue costly site specific measures on the grounds that we would only anticipate low or uncertain benefits which would not be proportionate to the costs.</p> <p>It is disproportionately expensive to implement further measures at this time. An extended deadline for achieving good ecological status is therefore required. The major source of phosphorus is discharges from municipal sewage treatment works. Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference P5c). Of the 51 cases assessed, 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts.</p>	
Investigation type	
Investigate to confirm failure and/or impact	
Example of investigation	
Investigate reasons for conflicting evidence between nutrient status and biology. This could lead to a review of the appropriateness of the nutrient standard for the site	

/ type. Site would also be kept under review against risk of deterioration.

Possible future measures

Ban on phosphorus in detergents.

The major sources of nutrients are discharges from sewage treatment works and agricultural activities. If the need to take additional action and the sources of the nutrient are confirmed, further measures (subject to further assessment of cost, benefits and other impacts) will be implemented.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Sewage treatment works discharges:

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.

Agricultural activities:

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P2a
Element predicted not to achieve good by 2015	Phosphate or Total Phosphorus
Reason for failure	Unknown - reasons for failure unknown
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible: cause of adverse impact unknown
Justification for alternative objective	
The cause of the failure (sector or general activity) is unknown	
<p>Phosphorus is released into the environment from a range of sources including municipal sewage treatment works and agricultural land use. For water bodies where the sources of the nutrients are not known, or not known in sufficient detail to be able to identify and appraise measures (including identification of the person who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p>	
<p>For over 15 years we have routinely (usually every four years) reviewed water bodies to control eutrophication or the risk of eutrophication where the predominant release of nutrients has been from municipal sewage treatment works. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections.</p>	
<p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for phosphorus. We have identified new failures. In the time available, we have not been able to identify the sources and their relative contributions for each of the new failures.</p>	
<p>The water body is not predicted to improve as a result of any planned actions upstream.</p>	
Investigation type	
Investigate reason for failure	
Example of investigation	
<p>The significance of locally relevant potential point and diffuse sources will be assessed through additional monitoring, site visits, desktop studies and modelling to identify and apportion causes of failure (sources and pathways) and develop a cost-effective combination of measures. These will include local investigations as well as using information and understanding from national source apportionment projects</p>	

and ongoing work to improve our understanding of the effectiveness of measures, particularly for agricultural sources. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriate measures to be identified for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the identification of nutrient source contributions. In general the principle sources are sewage and agriculture so measures could include additional regulatory controls on these sources within the limits of what is currently technically possible, or which becomes possible through developments in technology and our understanding of the effectiveness of measures.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

For any future designations under the Urban Waste Water Treatment Directive and/or the Nitrates Directive basic measures as required by those Directives would then be applied. Similarly for any requirements identified to meet Habitats Directive objectives.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Uncertain until the sectors or general activities causing the failure is confirmed.

Reference	P2b
Element predicted not to achieve good by 2015	Phosphate or Total Phosphorus
Reason for failure	Suspected – point and/or diffuse source
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible: cause of adverse impact unknown
Justification for alternative objective	
The cause of the failure (sector or general activity) is not known with certainty	
<p>Phosphorus is released into the environment from a range of sources including municipal sewage treatment works and agricultural land use. For water bodies where the sources of the nutrients are suspected, but we do not have strong enough evidence to confirm it, it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p>	
<p>For over 15 years we have routinely (usually every four years) reviewed water bodies to control eutrophication or the risk of eutrophication where the predominant release of nutrients has been from municipal sewage treatment works. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections.</p>	
<p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for phosphorus. We have identified new failures. In the time available, we have not been able to identify the sources and their relative contributions for each of the new failures.</p>	
<p>For a few water bodies the code P5a has also been applied with P2b. This indicates that actions have been completed following designation as a sensitive area eutrophic under the Urban Waste Water Treatment Directive but no further actions are ongoing. Relative sources are now given as suspected, these need to be confirmed to establish whether there are further feasible and cost-beneficial actions that can be taken on the remaining source from sewage discharges and/or that from other sources.</p>	
Investigation type	
Investigate source of failure	

Example of investigation

The significance of locally relevant potential point and diffuses sources will be assessed through additional monitoring, site visits, desktop studies and modelling to identify and apportion causes of failure (sources and pathways) and develop cost-effective combinations of measures. Investigations will include local studies as well as using information and understanding from national source apportionment projects and ongoing work to improve our understanding of the effectiveness of measures, particularly for agricultural sources. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriate measures to be identified for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the identification of nutrient source contributions. In general the principle sources are sewage and agriculture so measures could include additional regulatory controls on these sources within the limits of what is currently technically possible, or which becomes possible through developments in technology and our understanding of the effectiveness of measures.

Examples of such measures include additional regulatory controls on point sources, including sewage treatment works and storm sewage discharges; actions to address diffuse sources, e.g. extension of schemes such as England Catchment Sensitive Farming Delivery Initiative, better targeting of agri-environment schemes, pollution prevention (through the adoption of best practice methodologies, local education campaigns and voluntary initiatives); control at source (e.g. through additional use restrictions).

For any future designations under the Urban Waste Water Treatment Directive and/or the Nitrates Directive basic measures as required by those Directives would then be applied. Similarly for any requirements identified to meet Habitats Directive objectives.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Uncertain until the sectors or general activities causing the failure is confirmed.

Reference	P3a
Element predicted not to achieve good by 2015	Phosphate or Total Phosphorus
Reason for failure	Confirmed - diffuse source agricultural
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The specific agricultural source (location, specific activity and/or pathway) of the failure is unknown</p> <p>Although agriculture is known to be causing the problem, until the specific source(s) is known in sufficient detail to be able to identify and appraise measures (including identification of the person who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015. An extended deadline for achieving good ecological status is therefore required.</p> <p>For over 15 years we have routinely (usually every four years) reviewed water bodies to control eutrophication or the risk of eutrophication where the predominant release of nutrients has been from municipal sewage treatment works. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections.</p> <p>In 2008 and 2009 (as part of the classification work for the draft and first river basin management plans) we assessed compliance with the new standards for phosphorus. We have identified new failures. In the time available, we have not been able to identify the sources and their relative contributions for each of the new failures.</p> <p>WFD biology classification indicates certainty of being less than good from the weight of evidence across nutrient sensitive elements. Nutrient sources include confirmed diffuse agricultural as a broad source. However, further investigation is required to establish the specific agricultural sources and the pathways by which they reach the water environment to establish whether there are feasible measures that can be applied and if these are cost-beneficial. This would enable appropriate targeting of measures alone or in combinations. General measures on agriculture are not expected to deliver much improvement in status. Applying site specific measures without a good understanding of whether these are actually being targeted at the most significant sources risks wasted investment. Lack of knowledge limits our ability to develop the most cost-effective combination of measures, and to ensure costs are proportionate to benefits and other impacts.</p>	

Investigation type
Investigate feasible measures
Example of investigation
<p>The significance of locally relevant agricultural diffuse sources will be assessed through additional monitoring, site visits (including tracing studies), desktop studies and modelling to identify and apportion the sources of failure. The most cost effective combination of measures necessary to achieve good ecological status will be identified. Investigations will include local studies as well as using information and understanding from national source apportionment projects and ongoing work to improve our understanding of the effectiveness of agricultural measures. There are a number of national projects being planned to do further testing and evaluation (including field trials) of the most effective means of reducing agricultural nutrient pollution, including ongoing work within the Catchment Sensitive Farming catchments in England and Demonstration Catchment work in Wales. Modelling will also be used to assess the likely outcome from the actions in order to appraise the costs, benefits and other impacts. This will allow appropriately targeted measures to be identified for implementation in this or subsequent river basin management planning cycles.</p>
Possible future measures
<p>Possible future measures will depend on the more detailed identification of source contributions and investigations into the feasibility and relative effectiveness of measures.</p> <p>Measures might include for example:</p> <ul style="list-style-type: none"> • More local partnership projects to support farmers to change practice • Increased roll-out (in terms of duration and geographic extent) of Catchment Sensitive Farming advisory initiatives in England, and in Wales expansion of the Environment Agency's Catchment Co-ordinator Initiative • Widen the measures and activities included in agri-environment initiatives (e.g. rural sustainable drainage systems) • Widen the measures and activities that are included in the Common Agricultural Policy funded initiatives (e.g. increase soil resource protection measures in current approach to cross-compliance, or whatever may follow in future) • Establish and or extend existing national partnerships that provide advice and support to land managers to improve practice • Increased Environment Agency-led pollution enforcement campaigns (including use of anti-pollution works notices) • where appropriate designation of Water Protection Zones
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<ul style="list-style-type: none"> • Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales • Wide scale reversion of agricultural land to woodland over large parts of England and Wales • Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	P5a
Element predicted not to achieve good by 2015	Phosphate or Total Phosphorus
Reason for failure	Confirmed - point source water industry
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The discharge(s) contributing to the failure is known but it is uncertain if the costs of the measure(s) are proportionate to the benefits</p> <p>Although the sewage treatment works or storm sewage discharges contributing to the failure are known, until further site specific appraisal is done, it is uncertain if the cost of implementing the improvement measure(s) is proportionate. It is therefore disproportionately expensive to implement further measures at this time and an extended deadline for achieving good ecological status is required.</p> <p>Removing phosphorus from sewage is expensive (8 to 7408 £/kg of P removed depending on the size of the works and the treatment technology used) requiring structural changes to the works and ongoing operational costs for chemicals, energy and sludge disposal. Even where the need to control the risk of eutrophication is confirmed, there is still a significant risk that removing phosphorus from sewage treatment works is disproportionately expensive because of the balance of costs and benefits (see tables reference P5c). Of the 51 cases assessed, 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. Actions are in most instances expensive and need to be justified in terms of addressing real failures.</p> <p>For some water bodies the need for schemes had not been identified within the timescales for PR09 planning. At some sites the earlier classifications did not show the standards were failed with high confidence and so improvement schemes were not identified. The final classifications now show such failures. In the time available, we have been able to identify the sewage discharge(s) contributing to the failure. However, it has not been possible to identify the costs of the required measures and identify potential benefits and other impacts that improving the discharges will deliver.</p> <p>If this further appraisal confirms that it is disproportionately expensive to achieve good ecological status by 2015, these water bodies will be re-categorised with reference 5c. If measures are shown to be proportionate we will look to progress measures as soon as practicable. These future measures may need to be phased, particularly if they depend on action to address other sources.</p>	

Investigation type
Investigate proportionate measures
Example of investigation
Investigations will establish whether it is cost-beneficial to implement measures at the water industry sources to justify inclusion into water industry investment programmes. These investigations would also need to confirm the significance of other sources of phosphorus to establish whether it is feasible to address these and deliver combined action that is cost-beneficial. This will be assessed mainly through modelling but may require some additional monitoring .
Possible future measures
Possible future measures could include further phosphorus removal for sewage discharges as well as action on agricultural sources, depending on the relative significance of these (and other) sources. Development of new techniques and practices for both of these sources could also provide more effective measures which achieve a better balance of costs, benefits and other impacts.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
<p>It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.</p> <p>It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.</p>

Reference	P5c
Element predicted not to achieve good by 2015	Phosphate or Total Phosphorus
Reason for failure	Confirmed - point source water industry sewage works
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The discharge causing the phosphorus failure is known and a site specific appraisal has shown the improvement measure available to be currently disproportionately expensive</p> <p>Through our PR09 planning work we identified the sewage treatment works causing the phosphorus failure. We identified the costs of the required measure and identified potential benefits and other impacts that improving the discharges will deliver. This showed the measure to be currently disproportionately expensive.</p> <p>These appraisals used:</p> <ul style="list-style-type: none"> - site specific costs provided by Ofwat following submission of water company final business plans; - site specific information on embedded carbon and operating carbon emissions to calculate carbon costs; - environmental outcomes recorded as length of river improved to meet WFD objectives; - benefits based on the NERA National Benefits Survey (Collaborative Research Project 4b/c); - additional local benefits identified after consultation with RBD liaison panels. <p>Our PR09 appraisal of the costs and benefits of phosphorus removal schemes assessed 51 cases, of which 15 were assessed as being not justified because of the unfavourable balance of costs, benefits and other impacts. The 36 schemes that were assessed as having a favourable balance of costs, benefits and other impacts will improve 25 water bodies and 268 kilometres of river.</p> <p>Technological improvements may make the improvement needed less costly and / or the estimated benefits may change significantly with better information. An extended deadline for achieving good ecological status is therefore required.</p>	
Investigation type	
Investigate proportionate measures	

Example of investigation

At these sites the assessments will be reviewed as further information becomes available that might change the balance of costs, benefits and other impacts. This might come from: an improved understanding of the relative importance of other sources such that combined action becomes cost-beneficial; benefits may be valued more highly; benefits may increase if outcomes become more certain; advancements in treatment technology may reduce the cost of the measures and/or improve the outcome that can be realised.

If measures are shown to be proportionate we will look to progress measures as soon as practicable. These future measures may need to be phased, particularly if they depend on action to address other sources.

Possible future measures

Possible future measures could include further phosphorus removal for sewage discharges as well as action on agricultural sources, depending on the relative significance of these (and other) sources. Development of new techniques and practices for both of these sources could also provide more effective measures which achieve a better balance of costs, benefits and other impacts.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

It will be disproportionately expensive to install phosphorus removal technology on all municipal sewage treatment works in England and Wales. To do so would cost up to £6billion and result in benefits of approximately £2billion. Removing phosphorus requires more energy and so has a carbon impact. Depending on the size of the works and the treatment technology used it is estimated that 16-1426 tonnes of additional carbon are produced per tonne of phosphorus removed.

It is likely that installing phosphorus removal technology on many of the works serving less than 250 people will be disproportionately expensive. It cost between 157-7408 £/kg to remove phosphorus from these size works.

E5 Groundwater quality

Pressures affecting groundwater quality

The main pressures affecting groundwater quality are significant point sources of pollution (from a wide range of chemicals) and diffuse pollution from nutrients, mines and minewaters, pesticides, and urban sources. There are also abstraction pressures which can cause saline intrusion.

The most important and overarching groundwater quality objective is pollution prevention (the prevent or limit objective - see below). In this case, measures are not driven solely by failures, but also by pressures. Because of the large size of most groundwater bodies and the scale of status assessment it is possible to have pockets of polluted groundwater within a good status body. The prevent or limit objective aims to avoid such local pollution and prevent deterioration. Thus an important target for measures is good quality groundwater that is subject to significant risks (i.e. pressures) even though it may not yet be at poor status.

Environmental objectives for groundwater quality

The WFD contains the following environmental objectives for groundwater quality:

Prevent or limit objective

This applies to all groundwater, not just groundwater bodies, and applies at the point of discharge to groundwater. Comprehensive measures to meet the prevent or limit objective (PoL) will in time result in achievement of all other environmental objectives for groundwater. Note: the old Groundwater Directive (80/68/EEC) adopted a similar approach to groundwater protection but its scope was limited in terms of dealing with diffuse sources of pollution. The WFD and the new Groundwater Directive (2006/118/EC) seek to remedy this situation.

For deliberate discharges of pollutants to groundwater, we meet the PoL objective through the use of regulatory regimes. Pollution prevention measures for non-deliberate inputs of pollutants to groundwater are wider ranging, including both direct and indirect regulation, and the provision of advice to operators. Our approach to implementing all these measures is described in Groundwater Protection: Policy and Practice (GP3) (<http://www.environment-agency.gov.uk/research/library/publications/40741.aspx>) .

No deterioration in status

This will be achieved through effective implementation of PoL measures. Upward trends in pollutant concentrations could lead to deterioration in status. We will identify these trends where they are significant, and implement measures to reverse them. Good status groundwater bodies, where there is a significant deterioration in quality that could eventually lead to poor status, are a high priority for action (see below).

If PoL measures are effective, then good status will be maintained. However, in many aquifers there will be a significant time lag between a change in activities on the land surface and a corresponding change in groundwater quality, due to the time taken for water to percolate to the water table. For this reason, it is possible that groundwater status could deteriorate temporarily before any improvement measures become fully effective.

Achieve good chemical status

Where a groundwater body is at poor chemical status, effective PoL measures should eventually restore the body to good chemical status. However, where historical (often unregulated) activities have resulted in land contamination and have affected groundwater, it may not be possible to meet this objective by the 2015 deadline and therefore alternative

objectives will be set. Where PoL measures are not being effective our action would be to review the measures, and tighten existing controls as necessary and where feasible. Unless historic land contamination is widespread or affects a particularly important receptor it is unlikely to affect status. Where it does, it may be feasible to remediate contaminated land and groundwater using a combination of the existing planning and land contamination regulatory regimes. However, in many cases complete remediation may not be technically feasible or cost effective and we may have to rely on natural processes of degradation to take their course over many years and, where necessary, set alternative objectives for groundwater bodies in the medium term.

Trends

A significant and sustained upward trend in pollutant concentrations is one which is statistically and environmentally significant. For a trend to be environmentally significant it must be one that, if not reversed, could lead to a failure of one or more environmental objectives within 12 years (two river basin management planning cycles). There is no fixed period for achieving trend reversal as this will depend on local environmental conditions. The trend objective is failed when measures are not put in place to achieve trend reversal. We will use PoL measures to achieve reversal of trends, but this reversal may not be immediate due to the delayed response in groundwater. Wherever possible, measures must be implemented in time to avoid any future failure of environmental objectives.

Protected Areas

There are two Protected Areas of particular concern for groundwater quality:

1. Drinking Water Protected Areas (DrWPA) – the measures needed to deliver this objective are subject to specific assessment for the plan, described below.
2. Nitrate Vulnerable Zones (NVZs) – the action plans that apply are basic measures for this plan, and have therefore not been subject to any specific further assessment.

Achieving the objectives for DrWPAs is also a requirement for meeting good chemical status for groundwater bodies. Another is that there shall be no significant damage to Groundwater Dependent Terrestrial Ecosystems (GWDTE). Some, but not all GWDTEs are Protected Areas designated under other community legislation.

Priority of objectives

There is an inherent priority in the groundwater quality objectives based on the timescales for implementation, spatial scale of application and the ability to use alternate objectives/exemptions. This determines their significance for protecting groundwater quality, and therefore our priorities for meeting them. A prioritised list of our groundwater quality objectives is set out in Table 9, with our highest priority objective first.

Table 9. Prioritised list of groundwater quality objectives

Groundwater Objectives	Alternatives available	Time scale for achieving	Spatial scale for action
1. Prevent or limit	None, but some exemptions	Short	Local (all groundwater)
2. Protected Area Objectives	Possible time extensions where not set by other Directives	Other directives - Short DWPA – Medium	Medium - the protected area
3. No deterioration in status	None	Medium	Large (groundwater bodies)
4. Trend reversal	None – Measures must be implemented and working by 2015	Long	Medium
5. Achieve good status by 2015	Time extensions, Less stringent objectives	Medium	Large (groundwater bodies)

Current compliance with the status objective

We assessed the status of the 304 groundwater bodies in England and Wales using the five chemical status tests. The methodology for assessing chemical status can be found on the UKTAG website²². Each test addresses one of the quality elements that defines good groundwater chemical status. The results below show the number of groundwater bodies that are at poor status for each of the tests:

- Saline Intrusion = 11
- Surface Water Ecological Status = 54
- General Chemical Assessment = 48
- Drinking Water Protected Area = 53
- Groundwater Dependent Terrestrial Ecosystem = 2

After combining these results on a ‘one out all out’ basis, 124 groundwater bodies (41%) are at poor chemical status. Because of the way chemical status is assessed under the Directives, it is not feasible to give an overall statistical confidence in the status assessments.

We also found that 81 groundwater bodies (27%) had a statistically (at the 90% confidence level) and environmentally significant upward trend in pollutant concentrations.

Development of measures

As described above, the current (pre implementation of WFD and new Groundwater Directive) approaches to protection and improvement of groundwater quality have been laid out in our Groundwater Protection Policy (GP3). For deliberate discharges we use all existing permitting and other relevant regimes that are applicable to groundwater. The main examples are Water Resources Act consents, Environmental Permitting Regulations permits and Groundwater Regulations authorisations.

For non-deliberate inputs of pollutants to groundwater the controls are both regulatory and advisory, the main measures being Groundwater Regulations notices, Anti-pollution Works notices, Nitrate Vulnerable Zones, Local Authority land use planning, codes of practice, guidance notes, memoranda of understanding/operating agreements, Voluntary Initiative (for pesticides), England Catchment Sensitive Farming Delivery Initiative and day to day site specific advice. These are all targeted using a risk-based approach that will be supported by groundwater quality monitoring. This monitoring will assess the effectiveness of measures.

In this section we do not go into further detail regarding the development of specific measures, apart from those that particularly apply to groundwater quality (i.e. Drinking Water Protected Areas, Source Protection Zones, Safeguard Zones, and Water Protection Zones).

Measures appraisal process

As a general guide, the measures that are prioritised should address the objectives and priorities noted in the objectives table above. Whilst measures should be considered to address poor status, it is equally a priority to consider measures in groundwater bodies that are currently good but which are deteriorating in quality. Such deterioration will compromise both the no deterioration in status and trend reversal objectives and may be an indication

²² See Paper 11b(i) from the *UK Technical Advisory Group on the Water Framework Directive* titled ‘Groundwater Chemical Classification for the purposes of the Water Framework Directive and the Groundwater Daughter Directive’ 2007

http://www.wfdruk.org/stakeholder_reviews/stakeholder_review_1-2007/stakeholder_reviews/stakeholder_review_1-2007/sr1-2007-gwreports/

that existing prevent or limit measures are ineffective and need to be tightened up. We will therefore develop measures to address deterioration in groundwater quality.

Groundwater occurs under all of the land surface and groundwater bodies have been designated for around 90% of the land surface in England & Wales (85% in England and 99% in Wales). Many measures designed to deal with surface water issues will also have an impact on groundwater. Many of the “new” measures required to meet the groundwater objectives of the WFD involve more widespread or more intensive application of existing measures (for example, pollution prevention inspections and remedial action).

As noted above, prevent or limit measures are effectively the first and most important line of defence in protecting groundwater quality but they will also make a substantial contribution to meeting some surface water objectives. We already implement PoL measures but these are often less effective for diffuse sources of pollution. New WFD measures for groundwater quality therefore will tend to focus on diffuse sources.

The first step in our measures appraisal process was to centrally collate a list of existing and planned national measures. Local hydrogeologists then considered the effectiveness of these national measures as part of the appraisal process. They then considered what additional local measures could be put in place to meet the environmental objectives in each groundwater body. This was done using an expert judgement approach. Any measures that were considered to be disproportionately expensive were not included in the plan. All measures were then reviewed nationally to ensure consistency across river basin districts.

Development of predicted outcomes

We have identified predicted outcomes for the first three cycles of river basin management planning for each groundwater body. This was done by local expert hydrogeologists following the process set out in the Groundwater Quality Decision Tree (included at the end of this groundwater section). As part of this process they took into account the effectiveness of existing and planned local and national measures, and the recovery time of each groundwater body.

Status in future river basin management planning cycles

We anticipate that of the 124 groundwater bodies (112 in England and 12 in Wales) at poor chemical status nationally, 2 will recover to good status by 2015, a further 4 will recover to good status by 2021 and a further 113 (including all those in Wales) will recover to good by 2027. Because groundwater generally has a long residency time (the time water spends underground) groundwater bodies take a long time to respond to measures and return to good status.

There are 5 groundwater bodies that we anticipate will take longer than 2027 to recover. This is because there is currently no known technical solution to deal with the problem. Wherever we are unsure how long recovery will take we have initially assumed that the body will be good by 2027. In the second RBMP we will be able to provide a more robust assessment of likely recovery time as we will have more monitoring data and more knowledge on the effectiveness of our measures. It is possible therefore that in the next river basin management plan we will predict that more groundwater bodies will take longer than 2027 to recover to good status.

Justification of alternative objectives

Our assessment predicted that it was disproportionately expensive to get many poor status groundwater bodies to good status by 2015. The justification we used was ‘disproportionately expensive – unfavourable balance of costs and benefits’. This justification was used to justify time extensions to 2021 or 2027 on groundwater bodies that had been impacted by a wide range of pressures, including high nitrate concentrations. A key driver

behind this assessment is that, as noted earlier, groundwater quality responds very slowly to most measures in most groundwater bodies, particularly with respect to diffuse pollutant sources. Although technically feasible, measures to directly remediate groundwater quality are normally disproportionately expensive or have other undesirable environmental outcomes. By extending the deadline to 2021 or 2027, less costly measures can be used that utilise land use change in place of direct groundwater remediation schemes.(e.g. pump and treat schemes). Therefore over a longer time period the cost of meeting good status is much lower, and therefore the benefits are likely to outweigh the costs in many groundwater bodies. Specific examples of where this justification was used can be found in supporting tables for GC4a, GC4c and GC4d, at the end of this section.

There were also a significant number of groundwater bodies where it was technically infeasible to get to good status by 2015. This was particularly the case for groundwater bodies where further investigations were needed. In these cases we used the justification technically infeasible - cause of adverse impact unknown. For example, we used this justification where elevated phosphate concentrations had caused a groundwater body to go to poor status, but we need further investigation to improve our understanding of the Source-Pathway-Receptor conceptual model. Specific examples of where this justification has been used can be found in the supporting table for GC1a.

We also used the technically infeasible - no known technical solution is available justification on a small number groundwater bodies that had gone to poor status. Specific examples of where this justification has been used can be found in the tables for GC2a, GC2b, and GC3a.

The natural conditions - groundwater status recovery time justification was used on a small number of groundwater bodies that could not get to good by 2015. Specific examples of where this justification has been used can be found in tables GC6a and GC6b.

Finally the 'disproportionately expensive – disproportionate burdens' justification was used on a small number of groundwater bodies that could not get to good by 2015. This justification was only used where a phased Coal Authority scheme was being implemented. An example of where this justification has been used can be found in table GC5a.

Drinking Water Protected Areas (DrWPAs)

All groundwater bodies in England & Wales meet the criteria for DrWPAs and have been so designated.

We propose a tiered risk-based approach to the protection of drinking water abstractions and for compliance with Article 7 of the Water Framework Directive (see table 10 below).

At Tier 1 we would continue to apply to the existing protection measures under our Groundwater Protection Policy.

At Tier 2A we would seek to use additional voluntary measures in non-statutory Safeguard Zones.

At Tier 2B we propose to use Water Protection Zones (WPZs).

If all existing voluntary measures have been tried and exhausted, or we can show they will not work, a WPZ would be proposed. Voluntary measures include CSF, VI and agri-environment schemes.

A WPZ is a legislative mechanism to deliver statutory measures to control water pollution over and above existing statutory powers. The use of WPZs is enabled under section 93 of Water Resources Act, 1991. Defra is undertaking amendments to the Act to improve the order-making process to make it more transparent, and these changes are planned to come into force by December 2009. A Water Protection Zone Order defines both the area and the specific measures designed to deal with identified water quality problems within it. We will put forward a proposed WPZ designation which will be subject to consultation (including an Impact Assessment), with a decision being taken by Defra's Secretary of State before the Order, if approved, is laid before parliament.

WPZs can be applied as areas within the catchments of abstraction sources for drinking water to deal with specific point or diffuse source problems. In this instance they would be based on existing Groundwater Source Protection Zones.

In all cases the assessment of which tier of protection is appropriate will be preceded by a review of Environment Agency and water company data, including monitoring data, data used for characterisation under the Water Framework Directive, and the results of the water company risk assessments under the amended Water Quality (Water Supply) Regulations – “Water Safety Plans”.

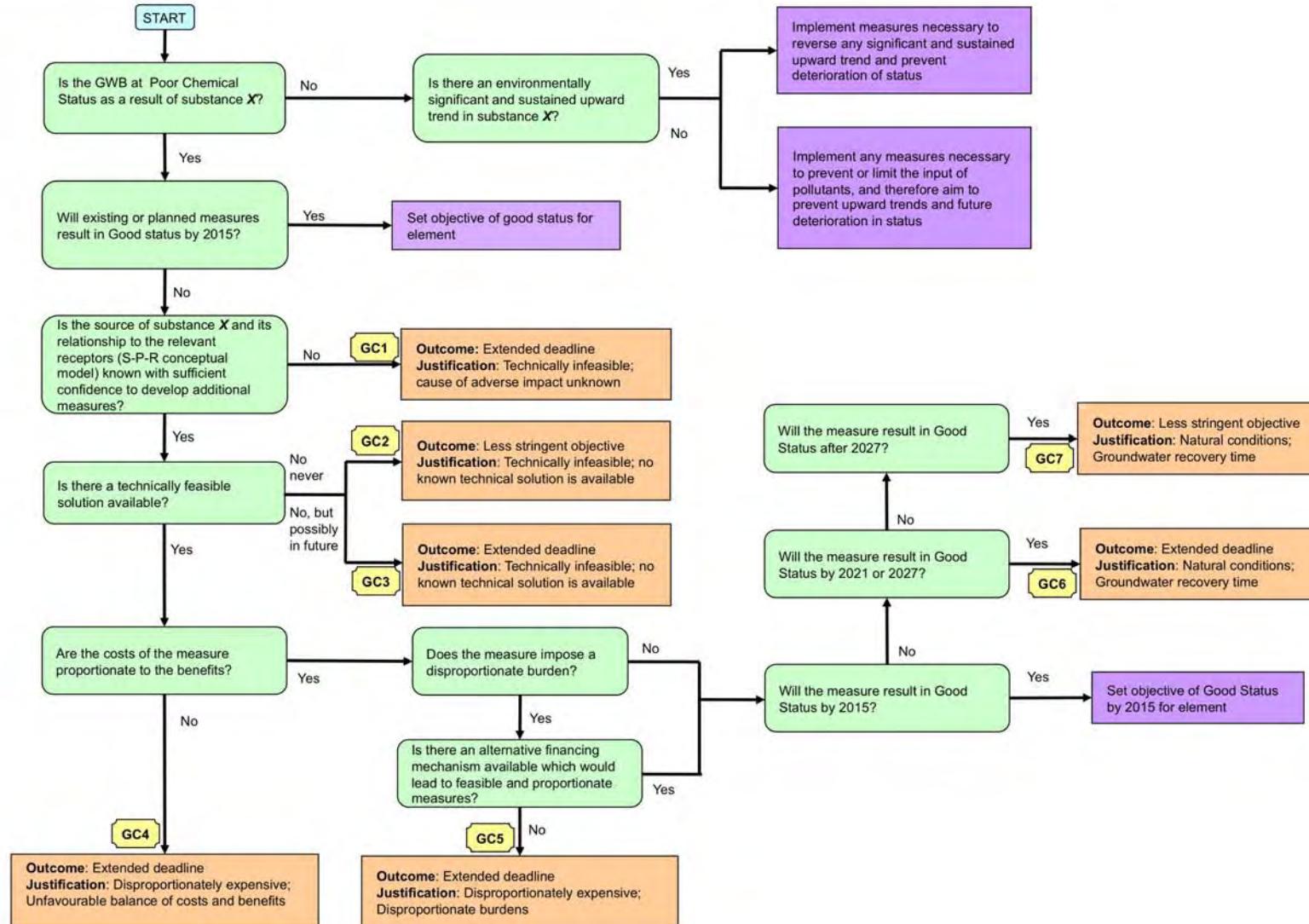
Table 10. Tiered risk-based approach to the protection of drinking water abstractions and for compliance with Article 7 of the Water Framework Directive

Tier	Description	Controls
1	General protection of the DrWPA (i.e. the whole groundwater body)	We will continue to apply the policies in accordance with our Groundwater Protection Policy (GP3). Existing Groundwater Source Protection Zones ²³ would remain as a non-legislative tool to influence external stakeholders and focus our policies.
2A	Specific non-statutory protection (Safeguard Zones)	Our assessments indicate that certain abstractions are likely to require additional measures to avoid failing the Article 7.3 objective, but that there may be low confidence in the assessment, or we consider that non-statutory measures are sufficient. This may include targeted enforcement action to reinforce the GP3, voluntary agreements or campaigns. Non-statutory Safeguard Zones would be based upon existing Groundwater Source Protection Zones, modified locally as necessary.
2B	Water Protection Zone designation	Would be considered where an abstraction is failing to meet Article 7.3 [or likely to if current trends continue] with a high degree of confidence and all existing voluntary measures have been tried and exhausted, or we can show they will not work. In such cases we may seek a Water Protection Zone Order if we can show that applying additional statutory measures is likely to work and will provide a cost effective solution. In this case, a separate application will be made and a public consultation carried out for each one. A more detailed investigation will be made of the causes of failure within the catchment and the remedial options.

²³ We define SPZs for each groundwater abstraction for human consumption. Zone 1 (SPZ1) is the area closest to the abstraction, representing the highest risk to the source. Zones 2 and 3 are progressively larger. Risk-based Policies to prevent pollution are applied within these zones.

Decision tree for all substances causing a Groundwater Body to go to Poor Chemical Status

Note: Saline Intrusion is covered by the decision tree for groundwater abstractions



Reference	GC1a
Element predicted not to achieve good by 2015	Drinking Water Protected Area General Chemical Assessment Impacts on wetlands Impacts on surface water
Reason for failure	Suspected - point and diffuse sources from agriculture, land contamination and disused mines The failures are caused by various substances including phosphate, pesticides, chlorinated solvents, metals, ammonia, nitrate and bromate
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The source of the substance and its relationship to the relevant receptors is understood with insufficient confidence to develop measures to meet good chemical status by 2015</p> <p>Suspected sources (sectors and general activities) causing the failure of good chemical status have been identified. However, until the sources have been confirmed and the relationship to the relevant receptors (using a conceptual source-pathway-receptor model) better understood, the identification and application of measures (including who needs to implement them) to reduce the pollution is not possible. It is therefore not technically feasible to achieve good status by 2015. An extended deadline for achieving good chemical status is therefore required.</p> <p>A phased investigation programme will be implemented which will enable us to develop a robust Source-Pathway-Receptor conceptual model. This will help to indicate whether measures can be implemented to enable the groundwater body to get to good status.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
<p>Develop a robust Source-Pathway-Receptor conceptual model, which includes a detailed assessment of the source of the pollution. Assess possible future measures to get the body to good status. Undertake an options appraisal on these measures, including an assessment of disproportionate cost. Develop a pollution action plan at the latest by 2012.</p>	

Possible future measures
It is not yet clear what future measures are needed.
Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive
It is not yet clear what future measures would be required to achieve 100% good chemical status by 2027.

Reference	GC2a
Element predicted not to achieve good by 2015	General Chemical Assessment
Reason for failure	<p>Confirmed - diffuse source contaminated land</p> <p>The failures are caused by chlorinated solvents</p>
Alternative objective	Less stringent status objective
Reason for alternative objective	Technically infeasible: no known technical solution
Justification for alternative objective	
<p>No known technically feasible solution is available</p> <p>The failure is caused by chlorinated solvents (TCE and DCE) resulting from the long history of industrial activity affecting a number of locations in the groundwater body. Because of the extensive nature of the pollution and the fact that it has penetrated to great depths there is currently no technical solution that can be applied to effectively clean up the groundwater and return the groundwater body to good status before 2027.</p> <p>Future entry of these pollutants will be prevented or limited so that no further deterioration will take place. This will be achieved through a range of measures including pollution prevention campaigns, environmental permitting and application of industry codes of practice (for solvents). The measures will ensure that there will be the least possible deviation from good status in the future and any adverse trends in pollutant concentrations reversed.</p>	
Investigation type	
No further investigations are planned.	
Example of investigation	
No further investigations are planned.	
Possible future measures	
All necessary measures are in place. However, additional measures will be explored if our monitoring shows that the groundwater body is not recovering as expected.	

Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive

No technically feasible measures are available.

Reference	GC2b
Element predicted not to achieve good by 2015	Impacts on surface water General Chemical Assessment
Reason for failure	Confirmed - Disused mines point and/or diffuse source The failure is caused by metals (e.g. Iron, Zinc, Lead, Cadmium, Copper)
/Alternative objective	Less stringent status objective
Reason for alternative objective	Technically infeasible: no known technical solution
Justification for alternative objective	
No known technically feasible solution is available	
<p>In these groundwater bodies the reason for not achieving good status is because the groundwater has become polluted as a result of the extensive long-term coal and/or metal mining activity in the area. Because the source of pollution is widespread and below ground, there is currently no technical solution that can be applied to return the groundwater body to good status before 2027.</p> <p>Measures are being put in place to treat the polluted mine water discharges at the point of entry to the failing surface water bodies. This will reduce the pollution, and risk of failure, of associated surface water bodies. It will ensure that there will be the least possible deviation from good groundwater status in the future and any adverse trends in pollutant concentrations reversed.</p>	
Investigation type	
Investigate technically feasible solutions.	
Example of investigation	
Further investigations will take place into these discharges from abandoned metal and coal mines. The objective will be to determine the most cost-effective remedial options.	
Possible future measures	
Minewater remediation schemes on discharges that have been identified as being a high priority. These will prevent or limit further inputs of pollutants to the water body or impacts on receptors. The measures will ensure that there will be the least	

possible deviation from good status and adverse trends in pollutant concentrations will be reversed.

Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive

Implementation of minewater remediation schemes for all discharges.

Reference	GC3a
Element predicted not to achieve good by 2015	Drinking Water Protected Area
Reason for failure	Confirmed - agricultural source The failure is caused by the pesticide bentazone
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: no known technical solution
Justification for alternative objective	
No known technically feasible solution is available	
<p>Extensive investigations into the pesticide (bentazone) pollution have been carried out over many years. Monitoring has shown that the concentrations of bentazone in the groundwater are decreasing. Even though all surface inputs have stopped, the rate of decline is not sufficient to achieve good status by 2015. A detailed review of all possible remedial options was carried out in 2008/9. This study has shown that it is not possible to remediate the bentazone pollution. This is mainly because a clearly defined source of the bentazone pollution could not be found, even though extensive investigations have been carried out. In situ remediation of bentazone pollution that is distributed throughout the aquifer is not technically feasible. There is therefore no known technical solution to meet good status by 2015. Groundwater monitoring will be carried out to ensure that the groundwater body meets good status by 2027.</p>	
<p>The abstracted drinking water is currently treated to remove bentazone to ensure that drinking water standards are achieved</p>	
Investigation type	
Monitoring	
Example of investigation	
Groundwater monitoring to confirm falling trend in bentazone concentrations and improve the conceptual understanding of the source-pathway-receptor linkages.	
Possible future measures	
We propose continual monitoring of the abstraction to confirm a falling trend in bentazone, combined with pollution prevention measures in the catchment.	

Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive

We anticipate that good status will be reached by 2027. No new measures beyond those listed above are required.

Reference	GC4a
Element predicted not to achieve good by 2015	Drinking Water Protected Area General Chemical Assessment Impacts on wetlands
Reason for failure	Confirmed - diffuse source agricultural Failures are caused by nitrate and/or ammonia
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The costs of the measures required to achieve good status are not proportionate to the benefits</p> <p>In order to meet the objective of good status by 2015 groundwater remediation schemes would probably be required. Although technically feasible, measures to directly remediate groundwater quality are normally disproportionately expensive as they are likely to cost hundreds of millions of pounds per groundwater body. They may also have other undesirable environmental outcomes, such as exacerbating climate change. The main benefit of such remediation would be the reduction in the nitrate removal treatment costs for water abstracted for drinking water supplies.</p> <p>The typical installation costs for nitrate treatment are £4m (plus significant on-going operational cost). Even where there are several individual abstractions requiring treatment the benefits of a remediation scheme for the whole groundwater body cannot be justified on the basis of the significant (orders of magnitude) difference between benefits and costs. It is therefore disproportionately expensive to meet good status by 2015.</p> <p>Measures are in place (e.g. Nitrate Vulnerable Zone action programme, agri-environment measures, cross-compliance e.g. soil protection reviews, Code of Good Agricultural Practice or England Catchment Sensitive Farming Delivery Initiative) that will reduce nitrate levels. However, at a catchment scale the level of reduction in relation to the objective is uncertain and additional measures may prove necessary in some catchments. Because of the variable and often long recovery time associated with these aquifers (from several years to many decades) the full benefit of measures may not be seen for some time.</p> <p>As the deadline is extended to 2027, less costly measures can be used to achieve good status. These include Nitrate Vulnerable Zone action programmes, England Catchment Sensitive Farming Delivery Initiative, water company lead catchment management schemes, Safeguard Zones, Water Protection Zones, targeted set-aside and targeted measures with agri-environment schemes. The benefits of these</p>	

schemes are likely will outweigh the costs over a longer time horizon.

Investigation type

Investigate feasible measures and monitor impacts of existing measures

Example of investigation

Review the impact of recent land management changes using the latest groundwater monitoring data and potentially specialist models where appropriate. Undertake further research into potential future measures.

Possible future measures

Preparation of pollution action plan to guide further pollution prevention activities, Nitrate Vulnerable Zone action plans, England Catchment Sensitive Farming Delivery Initiative, water company lead catchment management schemes, Safeguard Zones, Water Protection Zones, targeted set-aside, targeted measures with agri-environment schemes.

Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive

Widespread move to a low nitrogen input land management system (e.g. forestry or low N input grassland). In certain aquifers with a slow response it is likely that groundwater remediation would also be needed.

Reference	GC4b
Element predicted not to achieve good by 2015	Impacts on surface water General Chemical Assessment
Reason for failure	Confirmed - Disused mines point and/or diffuse source The failures were mainly caused by metals (e.g. Lead, Copper, Zinc, Cadmium)
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The costs of the measures required to achieve good status are not proportionate to the benefits</p> <p>Remediation of all non-coal mines in this groundwater body by 2015 would rely on established technologies such as those employed at Wheal Jane in Cornwall. These technologies, whilst proven, consist of chemical dosing which is costly, energy intensive and unsustainable in the long-term. The treatment system at Wheal Jane cost over £5m to construct (almost double this in options appraisal, feasibility and design) and about £1m per year to operate. Many such schemes may be needed in each groundwater body. It is therefore likely to be disproportionately expensive to employ this treatment technology on the scale needed to meet good status by 2015. However, recent trials of innovative technologies have indicated that passive treatment may be viable and the benefits are likely to outweigh the costs. We are planning to carry out further studies to pilot these technologies in the first planning cycle.</p> <p>To meet good status by 2015 established technologies would have to be used. Therefore it is currently disproportionately expensive to meet this objective.</p>	
Investigation type	
Investigate feasible measures	
Example of investigation	
Investigate the use of innovative passive treatment technologies and their suitability for application at different sites (technology transfer)	

Possible future measures

Possible use of innovative passive treatment technologies. Recent trials of these technologies have indicated that passive treatment may be viable and cost effective. We will carry out studies to pilot these technologies in the first river basin management cycle.

Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive

Implementation of minewater remediation schemes for all discharges.

Reference	GC4c
Element predicted not to achieve good by 2015	Impacts on surface water
Reason for failure	Confirmed - point source land contamination The failures were due to chlorinated solvents
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The costs of the measures required to achieve good status are not proportionate to the benefits</p> <p>Although the clean-up of the pollution sources is expected to be completed by 2015, natural flushing of the groundwater pathway to the affected watercourse is expected to take several more years. In order to meet good status by 2015 extensive groundwater remediation would be needed. This could be done for example through installing pump and treat systems. Such systems are likely to cost over £1m to install and operate. These systems will also increase CO₂ emissions through additional energy consumption. In this case the additional benefits of such systems are low as the additional benefits would only accrue for a few years. It will not be disproportionately expensive to meet good status by 2021 as this can be done using lower cost conventional technologies, without resorting to a pump and treat groundwater remediation scheme.</p> <p>Therefore there an extended deadline for achieving good status of 2021 is required.</p>	
Investigation type	
Monitoring	
Example of investigation	
Groundwater monitoring to confirm that the measures are working.	
Possible future measures	
Clean-up of the source. This is expected to be complete by 2013.	

Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive

None

Reference	GC5a
Element predicted not to achieve good by 2015	Surface water test General quality test
Reason for failure	Confirmed - Disused mines point and/or diffuse source The failures were mainly caused by metals (e.g. Iron)
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: disproportionate burdens
Justification for alternative objective	
<p>The costs of the measures are proportionate to the benefits but would impose a disproportionate burden if implemented by 2015</p> <p>A phased Coal Authority scheme is being implemented in this groundwater body to restore the body to good status. Treasury has agreed that the funding for these schemes will be phased over three river basin management planning cycles to 2027 due to affordability issues. To bring forward the implementation date of all these minewater remediation schemes would also cause considerable practical difficulties, for example gaining permission for, and undertaking the necessary works. This phased approach will allow time to investigate and implement the most cost effective solution in each case, and it will also allow learning to take place. Our PCEA study has shown that a phased approach is likely to significantly reduce the overall cost of the whole programme. It would therefore impose a disproportionately burden to meet good status by 2015. Achieving good status by 2027, with the highest priority sites tackled by 2015, is a proportionate and cost effective response to the problem.</p> <p>Affordability is one area where there is limited guidance available at a European level and hence additional care must be taken in justifying exemptions to ensure that they follow the spirit of the Directive and its objectives. Although the adoption of the WFD entails obligations for member states to make available the necessary means for implementation, this needs to be moderated by the option available to member states to phase the implementation (through extended deadlines) of measures to spread the costs of implementation (while taking clear and demonstrable action in the first cycle).</p> <p>To apply a time extension on grounds of affordability consideration should be given to the availability of alternative financing mechanisms, the consequences of non-action and steps taken to resolve affordability in the future. We have considered all of these factors as part of justifying this alternative objective.</p>	

Investigation type
Further investigate feasible measures and their applicability at individual sites
Example of investigation
Investigation and prioritisation of minewater remediation schemes to achieve maximum environmental benefit.
Possible future measures
Minewater remediation schemes
Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive
Immediate implementation of minewater remediation schemes for all discharges.

Reference	GC6a
Element predicted not to achieve good by 2015	Drinking Water Protected Area General Chemical Assessment
Reason for failure	Suspected - point and diffuse sources from agriculture and amenity use The failure was caused by the pesticides atrazine and simazine
Alternative objective	Extended deadline
Reason for alternative objective	Natural conditions - groundwater status recovery time
Justification for alternative objective	
The measures will not result in good status by 2015 but will by 2027	
The pesticides causing these failures (atrazine and simazine) are now banned. These pesticides have historically been extensively used for both agriculture and amenity use. Despite the ban the groundwater body will still take a number of years to recover because of the long residence time of water within these aquifers.	
Investigation type	
Monitoring	
Example of investigation	
Groundwater monitoring to confirm that the measures are working.	
Possible future measures	
Continued monitoring. No additional measures are required.	
Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive	
None.	

Reference	GC6b
Element predicted not to achieve good by 2015	General Chemical Assessment
Reason for failure	Groundwater status recovery time The failure has been caused by ammonia and sulphate
Alternative objective	Extended deadline
Reason for alternative objective	Natural conditions - groundwater status recovery time
Justification for alternative objective	
The measures will not result in good status by 2015 but will by 2027	
These failures have been mainly caused through over abstraction. This over abstraction has pulled deep connate water containing ammonia and sulphate into the aquifer. As several large abstractions have now ceased, we anticipate that this groundwater body will recover naturally by 2027.	
Investigation type	
Monitoring	
Example of investigation	
Groundwater monitoring to confirm that the measures are working.	
Possible future measures	
None, other than monitoring.	
Measures required to achieve 100% Good Chemical Status by 2027 that are likely to be technically infeasible or disproportionately expensive	
None.	

E6 Biological pressures (biota removal and fish stocking)

Fish removal and stocking

Fish removal for recreational, personal consumption or commercial purposes may have the potential to affect fish stocks' achieving 'Good Ecological status' (GES). Equally, sustainable cropping may be entirely compatible with GES, or an alternative objective may be appropriate where a high economic benefit is being sustained by the fish removal activities.

In most recreational fisheries it has become popular to either practice catch and release or to re-stock to maintain the fish population. Byelaws and orders can be introduced to enable the Environment Agency, or Sea Fisheries Committees, to limit fish removal and our policies are being set to ensure the Water Framework Directive (WFD) objectives are supported by this means. Many fish species have a great capacity to reproduce and support significant cropping as a sustainable catch. This capacity may often be reduced as increasing environmental pressures come to bear and thereby reduce population resilience.

Our prime commercial freshwater fisheries where fish are removed, are for salmon, sea trout and for eels and these are subject to detailed Species Action and Management Plans to sustain the stocks. 'No deterioration' can be achieved by not exceeding sustainable cropping levels. Our Salmon Action Plans and Eel Management Plans are based on these accepted principles and are designed to deliver the WFD standards.

Defra and Welsh Assembly Government have recently reviewed who should take the lead role for managing fisheries in estuarine and coastal water bodies and other marine waters. In Wales, Welsh Assembly Government will be responsible for managing sea fisheries but is likely that the Environment Agency will be asked to manage estuarine waters. In England, new inshore fisheries and conservation authorities will be set up. The Environment Agency will sit on these committees.

Sustainable fishing practices and application of controls by the Sea Fisheries Committees could ensure sustainable cropping is not exceeded, helping to achieve 'Good ecological status'. However, the near-shore waters and estuaries have been found to be important juvenile production areas for many species and their sensitivity in this context is only now becoming clearer as new science emerges.

Weed removal

Weed cutting on rivers is practised primarily for flood risk management, recreational fishery or navigation reasons. It is a common feature of chalk streams where macrophyte growth is usually very strong. Loss of channel capacity and the associated rise in water levels can pose a significant flood risk if not managed. The chalk based regions of the South and East of England are mainly where this takes place. Sustainable cropping regimes are mostly instituted to ensure the overall ecology is not harmed in what are often Protected Areas. When applied correctly the practice can enhance the resilience of the plants to flood flows and other environmental pressures. Where this is the case, alternative objectives would not be expected.

Weed removal is also widely practised in the slow flowing, often nutrient rich drainage channels common across many of our low-lying wetlands and drained areas. Their characteristics can often lead to prolific macrophyte growth, threatening both their prime purpose of drainage or wetland, but also their recreational and amenity value for fishing and navigation. In most cases drainage channels are designated as artificial water bodies, with their principal use being the drainage of water. Where macrophyte growth is affecting this

principal use, weed removal may continue within the context of achieving Good Ecological Potential; where not, then alternative objectives will be required to allow it to continue to prevent economic loss from flooding.

Weed removal is partially regulated by Water Quality regulations. Consents will be set to ensure WFD standards are achieved. Consultation with Natural England will be sought due to the SSSI and SAC designations often applying to such waters.

Weed removal in still waters is not currently regulated other than where herbicide application is consented or an impact would affect another owner or site downstream.

Determining outcomes

The impacts of biota removal and fish stocking are most likely to be noticed as changes in those elements of the biological classification that are directly affected i.e. macrophytes and fish. Excessive stocking of some species of cyprinids in lakes, might lead to a characteristic switching in community type from a clear water, macrophyte dominated community to a "muddy" water, phytoplankton dominated community. We therefore need to diagnose the effect of these pressures through symptomatic changes in biology. .

We have collated information on the 'Reasons for Failure' linked to the observed impacts in biological populations, as seen through the WFD classification tools. From this analysis there is little evidence that biota removal or fish stocking have a significant adverse effect. However, there is evidence of an impact of fish stocking at a few N2K sites where action will be taken.

Where we do not know why a fish or macrophyte classification is less than good, we will undertake investigative monitoring to determine the cause of the impact. If in time, we find that biota removal and fish stocking are affecting the achievement of good status we will undertake an appraisal of the costs, benefits and other impacts of the fishery or weed removal activity to determine whether an alternative objective for that water body is justified, or whether additional measures are required to achieve good status.

Priorities for Action

Statutory Measures which will happen irrespective of WFD (M2)

Fish removal:

- Salmon Action Planning (SAPs)
- ILFA (Import of Live Fish Act) consents and controls
- NLO's (net limitation orders) on commercial salmonid nets
- National 'season' and methods Byelaws
- European Eel Fishery Regulations

Weed removal:

- Discharge Consents on weed cutting and herbicides
- National Alien Species Strategy
- Natural England consents for most relevant waters due to SSSI designations

Other measures likely to be required (M3a, M3b and M4)

Fish removal:

- Implement SAPs stock management actions – M3a
- Consent Enforcement and NLO applications – M3a

- National Byelaw on Coarse fish removal – M3a
- Resource to implement European Eel Fishery Regulations – M3b
- National Spring Salmon Byelaws – M3a
- Signal Crayfish management Plan – M3b
- Regional Exploitation control Byelaws where required – M3b
- Marine Bill for NLO procedure improvement, privileged fixed engine regulation, emergency byelaw powers, Byelaw consents for fish removal - M3a

Weed removal:

- Resources to implement Alien Species Strategy and prompt species eradication programmes – M3b
- Weed cutting standards to be a required element of consents – M4

E7 Invasive non-native (or alien) species pressures

Introduction

Invasive non-native (or “alien”) species are not specifically mentioned in the Water Framework Directive. However, the directive requires us to assess other “significant anthropogenic impacts on the status of surface waters”. The presence of most invasive species is the result of human activity and it is widely recognised that their presence may affect ecological status. There are on-going discussions at the EU level on how best to deal with invasive non-native species within the Water Framework Directive (WFD).

In this section we explain how we have assessed what can be achieved for surface waters under the first cycle of river basin management; we also explain what can't be achieved and why.

Invasive non-native species are one of the biggest threats to the ecology of our water bodies and, even if action is taken, they may prevent us from meeting the objectives of no deterioration and good ecological status in many water bodies.

The impact from non-native species will increase over coming years as established species continue to spread. Increased trade and travel has already led to a dramatic increase in the arrival of new species into Europe, and we can expect some of these to arrive in England and Wales. Climate change may favour the spread and increase the impact of non-native species. For example, if average temperatures rise, invasive non-native species may migrate northwards from Europe. At the same time, species that are already here but presently benign, may become invasive. If native species are put under increasing pressure by climate change, then the relative impact of invasive non-native species on them might increase.

Highly invasive species are likely to become established and cause problems in any habitat in which they appear. Their propensity to spread rapidly means that prevention is generally the only effective way of dealing with problems, as once they are established, control is likely to be prohibitively expensive or technically infeasible and unsuccessful. Managing non-native plants, particularly in the early stages of establishment is more likely to be effective, but only if legislation continues to permit herbicide use in or near water. Identifying those “environmentally liable” is almost impossible. In some cases, action to control invasive non-native species through chemical, biological or physical means could cause environmental damage itself.

As an example of the invasive non-native species problem, the North American signal crayfish, *Pacifastacus leniusculus*, is established in many water bodies in England and Wales and has caused the widespread extinction of native crayfish populations. In some parts of the Thames, these crayfish have almost eliminated many larger invertebrate species and thereby have had a direct impact on ecological status. There is currently little prospect of eliminating this species. The key measure is to prevent its spread into new areas. Alternative objectives may be required for some water bodies where serious infestations already exist on the basis of both technical feasibility (no known technical solution is available) and disproportionate cost (unfavourable balance of costs and benefits).

Apart from the cost in biodiversity terms, invasive non-native species can also create a huge economic cost to a wide range of sectors, probably of the order of several billion pounds annually in Britain. For example, it is expected to cost £70 million to deal with invasive weeds such as Japanese knotweed on land destined to host the infrastructure of the 2012 London Olympics. Invasive non-native species pose a particular threat to flood risk management; invasive non-native plants may block channels and the Chinese mitten crab burrows into

flood and coastal defence works causing extensive damage. Many organisations (e.g. Highways Agency, rail authorities, local authorities, agencies, British Waterways, Rivers Trusts and others) spend millions of pounds per year attempting to control a few key species. The Environment Agency alone spends around £2 m per annum. The general public is engaged through their concern for the impacts on their fisheries and conservation interests, through its wide coverage in the media and, to a lesser extent, by becoming involved in control measures through voluntary organisations (e.g. BTCV and Wildlife Trusts).

Given that invasive non-native species have such a broad economic impact, it is particularly important that we assess the wider economic benefits that would be achieved by any invasive non-native species measures considered for river basin management plans.

The importance of this issue is reflected by the development of the “Invasive Non-Native Species Framework Strategy for Great Britain” (May 2008) by the Government (www.nonnativespecies.org). While we will ensure that this strategy will deliver WFD objectives, its scope is much broader; it covers terrestrial ecosystems and deals with the economic, conservation and health impacts of invasive non-native species.

The risk of invasive non-native species to WFD objectives

There is no environmental standard for invasive non-native species. While the presence of certain invasive non-native species is known to have an impact on ecology, their impact on ecological status as we measure it is generally unknown and unclear.

However, for a few species we do know, or can deduce, that they have an impact on ecological status and we know that the further spread of those species is likely to adversely affect ecological status. A formal assessment of the ecological impact of each invasive non-native species of concern and an assessment of the cost-effective measures for their control is a key measure that has started as part of the action plan for the “Invasive non-native species framework strategy for Great Britain”.

A summary of the WFD Article 5 risk assessment for alien species is given in Table 11 and is based on the best available data on the distribution of the ten species of particular concern. The risk assessment is a significant under-estimate of the pressure because the list of species of concern is now greater (see below) and the available data on the distribution of those species is poor.

Table 11. Summary of the Risk Assessment for Alien (Invasive Non-Native) Species

Number of water bodies at risk from alien (invasive non-native) species				
Risk Category	Lakes	Rivers	Transitional	Coastal
Number of water bodies	763	6114	135	93
At Risk	0	0	0	0
Probably at Risk	39	1205	50	43
Probably Not at Risk	380	4509	73	48
Not at Risk	0	0	0	0
Not assessed	344	400	12	2

To deal with the different levels of uncertainty identified above UK WFD Technical Advisory Group (UKTAG) have put relevant species into three groups:

- **high impact** (invasive non-native species known to be invasive and documented as causing harm);

- **low impact** (a low probability of becoming invasive and field observations over many years have indicated low impact)
- **unknown impact** (probability of becoming invasive is unknown and a full risk assessment is required).

A summary of the outcome of this process is given in table 12.

Table 12. Summary of UKTAG high, low and unknown impact taxa.

Impact group	Number of plant species	Number of animal species	Total
High	14	14	28
Low	9	15	24
Unknown	22	48	70
Total	45	77	122

(“Revised classification of alien species according to their level of impact”, UKTAG, June 2009).

This system of grouping invasive non-native species according to their risk is used to influence the classification of water bodies as follows:

“A water body will be classed as worse than high status if there is evidence that one or more species of high impact has become established over a significant spatial extent of the water body.

A water body will be classed as worse than good status if there is evidence that an alien species on the high impact list is causing the biological quality elements to deviate more than slightly from their reference conditions. The evidence used to assess whether the impacts of listed alien species are incompatible with good status will be obtained from biological quality element monitoring results where suitable data are available. Where those data are unavailable (e.g. because of the limitations of the biological classification tools), the evidence may be derived from risk analyses. In the latter case, if the risk analyses indicate that status is worse than good, the status assigned on the basis of the alien species assessment will be moderate.”

We have applied this assessment using available information on the distribution of invasive non-native species. However, the result will underestimate the impact of invasive non-native species as the available data is poor in the extent of its coverage and does not consider projected risks resulting from new invasive species and changing patterns of current invasive species (e.g. further spreading etc). The availability of reliable information on the current and changing distribution of invasive non-native species would improve our confidence when we determine the reasons for failure in ecological status at a particular water body. Developing a central data repository for invasive non-native species is therefore a key measure that we have begun.

What can be achieved in the first cycle?

Early action to prevent invasive non-native species becoming established is much more cost-effective and sustainable than the long-term control of a well-established species because eradication is generally technically infeasible and/or disproportionately expensive.

By the end of the first cycle of river basin management (2015) our aim is that through concerted actions there has been no deterioration in the ecological status of water bodies due to pressure from invasive non-native species.

Therefore our planning assumptions are:

- A default objective of no deterioration.
- For Natura 2000 sites an objective of favourable conservation status by 2015 (Further details of invasive non-native species measure appraisal for these sites is located at Annex D).
- For all sites at risk of not achieving good status due to invasive non-native species we are generally setting alternative objectives (lower objectives) on the basis of technical feasibility (no known technical solution is available) or disproportionate cost (measure not worthwhile).
- Ongoing work may identify that it is possible to act on some species to improve status in some water bodies. Therefore alternative objectives (lower objectives) will be reviewed such that good status or extended deadlines are set in future cycles of river basin management.
- The main concerted effort to tackle this pressure will come through the 'Invasive Non-Native Species Framework Strategy and Action Plan for Great Britain' (May 2008). Our activity will be within the scope of this framework.
- We commit to the concerted actions under the Invasive Non-native Species Framework action plan that we are certain will benefit the ecology of aquatic ecosystems.

Outline measures

Given the nature of the invasive non-native species, actions taken in isolation at a water body scale are unlikely to work (due to re-invasion from elsewhere) unless they are part of a concerted national effort. So all of the measures for invasive non-native species in river basin management plans (including M4 measures) sit within the Invasive non-native species action plan for Great Britain and many of the measures below will be delivered by that action plan.

Measures

- The GB Programme Board will commission standard risk assessments to identify the highest impact species (published at <http://www.nonnativeSpecies.org/>) and identify priority invasive species for mitigation and control action at GB and/or national levels
- Through the use of working groups or lead bodies draw up Individual Species Action Plans for species identified as presenting particular risk levels, to minimise the risks associated with them
- Make appropriate use of existing legislative powers, for example, to prohibit the sale of species which present the highest risk. (other examples: Salmon and freshwater fish act (S30); Import of live fish act; Environment Agency Fisheries byelaws; Convention on biological diversity; NERC Act; Habitats Directive; IMO convention on ballast water)
- Establish a central repository for holding data on invasive non-native species distribution and ensure that data flows on to it.
- Draw together a database of projects to facilitate better information sharing and to make the best of opportunities for partnership working and other resource synergies
- Contribute to the development of any EU level initiatives to improve legislation and controls relating to the threat posed by invasive non-native species
- Set up and maintain a website on invasive non-native species issues which links to agencies, NGOs and others working on invasive non-native species. This will form a key source of information on governmental action and progress, and on other programmes and initiatives taking place within GB
- Increase awareness of the importance of the 'preventative approach' in addressing the threats posed by invasive non-native species
- Continue to raise awareness with the public of the risk of transferring non-native species accidentally

- Establish National Invasive Non-Native Species Forums to plan, prioritise and coordinate action.
- Develop a national early warning system with contingencies for rapid response control measures to eradicate new invasions
- Integrate invasive non-native species control measures across all policy areas
- Provide advice and training on identification, control and disposal of invasive non-native species to all relevant groups
- Develop and implement codes of practice to reduce the spread of invasive non-native species caused incidentally by the practice of all relevant sectors (e.g. Code of practice for the management of Japanese Knotweed on development sites)
- Reduction of extent of invasive non-native species by operations (e.g. FRM maintenance programme; other direct works either alone or in partnership with others; reduction in N and P by water quality programme; PSA targets; UKBAP)
- Seek sustainable and cost-effective methods for managing established invasions, such as biological control.
- Support established local fora by providing advice and guidance

Additional measures for 2009

Additional measures have been funded for the period June 2009 to March 2010 as follows:

- Research into novel control methods
- Eradication and control at selected SSSIs and Natura 2000 sites
- Control and eradication of topmouth gudgeon (*Pseudorasbora parva*), the African clawed-toad (*Xenopus laevis*), fathead minnow (*Pimephales promelas*) and water primrose (*Ludwigia grandiflora*) at selected sites
- Local trials to control floating pennywort (*Hydrocotyle ranunculoides*)
- Work to raise awareness of the issue amongst the public and target groups
- Control actions by selected local fora

Measures excluded.

Once established, it is not technically feasible or it is disproportionately expensive to control some invasive non-native species in the wider environment (although intensive and expensive measures may be considered to be feasible and not disproportionately expensive at protected areas where the benefits are greater).

For example, using existing methods it is technically infeasible (no known technical solution is available) to control signal crayfish at sites where they are established.

Research has estimated that in Wales alone, it will cost £76 million for an eradication programme for Japanese knotweed using existing methods. There is a high risk that the programme would have been unsuccessful and the benefits in terms of delivering good ecological status are unclear. So this is considered disproportionately expensive (unfavourable balance of costs and benefits).

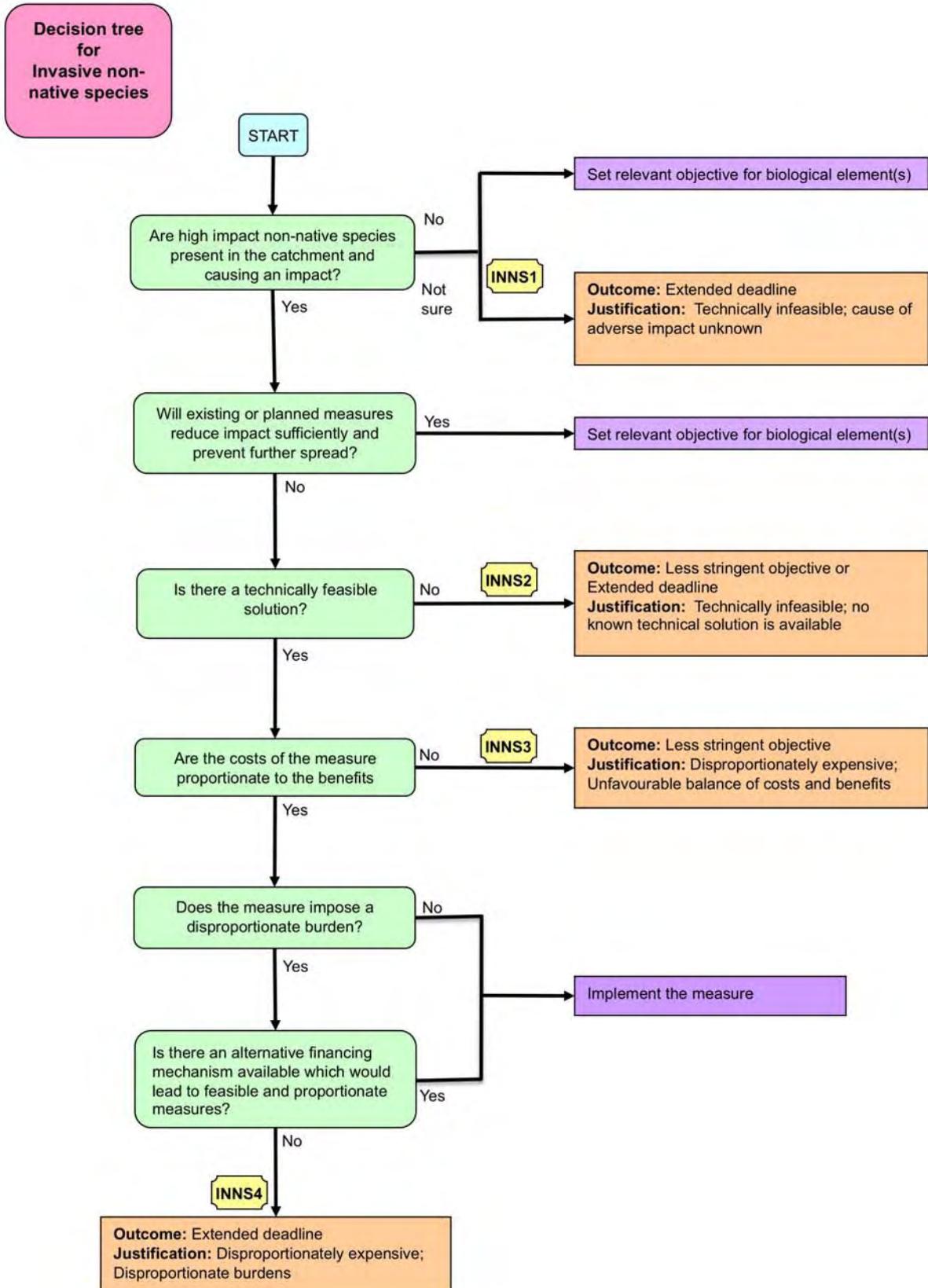
However, we will seek opportunities to encourage, or support, collaborative research into novel control methods (such as biological control agents).

Setting objectives for individual water bodies

The measures outlined above are, with few exceptions, strategic actions at the national or regional scale as this is the only efficient and effective way to deal with this pressure. However, objectives have to be set at the water body scale.

The decision tree below outlines how we will make decisions on what objective to set for individual water bodies, where we have information on invasive non-native species.

The starting point is an initial assessment of the species present and the impact they are causing on ecological status. Currently, we have this information available for very few water bodies. This is because, until we had undertaken the risk assessment and other work in preparation for the WFD, we had not appreciated the nature of the pressure and its likely impact on ecological status. Therefore, it will be a priority to improve the information base over the first cycle of the river basin management plan; improved information on the distribution of species will come from our own monitoring and data collected by the GB Strategy data repository; improved information on the impact will come from an analysis of our own biological data and that has begun.



Reference	INNS1a
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Suspected – Alien Species
Alternative objective	Extended Deadline
Reason for alternative objective	Technically infeasible – cause of adverse impact unknown
Justification for alternative objective	
<p>Low confidence that the high impact invasive non-native species present in the catchment are causing an impact</p> <p>High impact invasive non-native species are present in the catchment, but it is not known whether or to what degree they are having an impact and causing the biological element(s) to be at less than good status.</p> <p>Until the impact of the invasive non-native species can be confirmed, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>The biological tools to assess good ecological status have only just been developed. Our understanding of how and to what degree the presence of invasive non-native species in a catchment impact on the biological elements of ecological status is not yet well developed. We have already started R&D work to improve our understanding and diagnosis techniques (see below).</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm that established invasive non-native species are causing the observed impact and to identify and implement measures.</p>	
Investigation type	
Investigate to confirm the cause of the impact	
Example of investigation	
<p>Initially, we will undertake R&D to develop a method of using data from existing monitoring programmes to characterise the impacts of high-risk invasive non-native species; if successful this will allow better diagnosis of the problem at a local level. We have demonstrated the impact of the Signal Crayfish on the River Kennet taking this approach.</p>	

If this approach is unsuccessful, we will undertake scientific monitoring designed specifically to detect the impact of particular species; this may include field experiments involving manipulation of the densities of invasive non-native species or their exclusion.

Possible future measures

There are only a few technically feasible methods for removing established populations of most of the invasive non-native species. These include application of biocides, mechanical removal and biological control agents. Many of these techniques have limited effectiveness, and in some cases will not be cost beneficial because of the negative impact they have on other species, or their use is not acceptable to interested stakeholders.

Research is being undertaken into more cost effective control techniques including the identification and testing of biological control agents (e.g. for Himalayan balsam and giant hogweed) and trials of the mechanical removal of floating pennywort.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Uncertain until we understand the cause of the adverse impact.

Reference	INNS2a
Element predicted not to achieve good by 2015	Biological elements
Reason for failure	Confirmed – Alien Species
Alternative objective	Extended Deadline
Reason for alternative objective	Technically infeasible – no known technical solution is available
Justification for alternative objective	
<p>There is no effective method of control or eradication available for some established non-native species.</p> <p>Established invasive non-native species are likely to be causing the biological element(s) to be at less than good status but no known technical solution is available. Because no technical solution is available it is not technically feasible to achieve good status by 2015.</p> <p>As an example, Signal crayfish <i>Pacifastacus leniusculus</i>, is established in many water bodies in England and Wales and has been shown to drastically reduce the abundance of many larger invertebrate species and thereby has had a direct impact on ecological status. Intensive trapping of Signal crayfish in rivers has been shown to be ineffective or even harmful; biocide may be effective in eradicating new populations locally to limit their spread but its application is restricted due to site-specific issues such as drinking water supplies and livestock watering; R&D indicates that the use of crayfish pheromones does not make trapping a more effective control method.</p>	
Investigation type	
Investigate technically feasible solutions	
Example of investigation	
<p>R&D to seek sustainable and cost-effective methods for managing established invasions. This type of research generally has a high to moderate risk of failure. Recent research has identified a host-specific biocontrol agent for (<i>the bug Aphalaroida</i>) Japanese knotweed (<i>Fallopia japonica</i>) that, subject to Government approval for its release, could reduce the impact of Japanese knotweed.</p> <p>Research is being undertaken to identify and test further biological control agents (e.g. for Himalayan balsam (<i>Impatiens glandulifera</i>) and giant hogweed (<i>Heracleum mantegazzianum</i>)) and to trial the mechanical removal of floating pennywort (<i>Hydrocotyle ranunculoides</i>).</p>	

Possible future measures
Sustainable and cost-effective methods for managing established invasions.
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
No known solution is currently available.

E8 Morphology pressure

Introduction

Hydromorphology is a term used in the Directive to describe, in combination, the hydrologic and geomorphological processes and attributes of rivers, lakes, estuaries and coastal waters. For rivers, hydromorphology considers not only the form and function of the channel but also its connectivity, which defines its ability to allow upstream and downstream migration of aquatic organisms and maintain natural continuity of sediment transport through the fluvial system. The Directive requires surface waters to be managed in such a way as to safeguard their hydrology and geomorphology so that ecology is protected. In doing so, the Directive recognises the key role water resources and habitats play in supporting healthy aquatic ecosystems.

This section deals with the morphology and continuity (or connectivity) aspects of hydromorphology. Details of the methods and standards used to risk assess morphological pressures and to designate and classify water bodies as artificial or heavily modified can be found in Annexes G, I and A are also available on the UKTAG website (<http://www.wfd.uk.org/>)

The purpose of the section is to detail the approach we have taken to the identification and planning of morphological improvement measures and subsequent objective setting process for surface water bodies.

Current data quality and availability

Water bodies have been risk assessed for pressures on morphology and subsequently designated as artificial and heavily modified using nationally available datasets. These datasets provide information on both direct modifications to water bodies (i.e. presence of modifications for flood protection purposes using the Environment Agency's national flood and coastal defence database, NFCDD) and on wider catchment scale pressures (i.e. areas of intense urbanisation derived from wider land use datasets).

The designation process, detailed in Annex I, looks at all modifications that affect the water body. Considering the scale and number of water bodies and available data it is not at present possible to provide detail of individual modifications to each water body.

For the river basin management plans, all designations and classifications have been reviewed by local Environment Agency staff who are familiar with each water body. Where possible, they have been discussed with other bodies for example, Internal Drainage Boards, the Ports and Inland Navigation Sector and Water Companies.

Currently, data on hydromorphological quality and associated pressures and impacts can be found in a number of Environment Agency national and regional datasets. A common attribute of most of these databases is that the data is not arranged in a manner that is sympathetic to WFD requirements. This makes assessing the status of a water body difficult particularly from the hydromorphological perspective.

There is also a range of data that is held outside of the Environment Agency. For example a number of operators such as local authorities, Internal Drainage Boards, British Waterways and Water Companies hold data on engineering assets managed for flood risk management, navigation or water supply/storage purposes. The coverage and availability of such data

varies across from organisation to organisation and where possible we utilised such data when undertaking water body assessments.

We have already initiated a project to develop a centralised and fully supported database for all morphological data for delivery within the first cycle of river basin management.

Evidence base for morphology

The Environment Agency has reviewed the scientific evidence for linking specific hydromorphological pressures to ecological impacts for rivers, lakes and transitional and coastal waters

These reviews reveal some difficulties in attributing ecological impacts to particular hydromorphological changes. The impacts of a change are often complex and depend not just on the nature of the modification but also on the aquatic environment – so the same modification in different sites is likely to result in different ecological impacts. In addition, impacts might be felt a considerable distance from the site of the modification, and/or some time after the modification takes place, and the cumulative effects of different impacts are not always clear and are unlikely to be simply additive.

The risk assessment and designation process are based on the spatial extent of modification within a water body or adjacent land, and assumes a direct link between pressure and risk of failure. However there is uncertainty, resulting from limited scientific evidence, about the specific impacts that morphological pressures have on biology. This results in uncertainty in the extent to which these pressures (and associated measures) are relevant in terms of achieving Water Framework Directive objectives.

The Environment Agency has already started to work with stakeholders to improve the evidence base in the first river basin management cycle and are developing a number of catchment trials and pilots to:

- trial the effectiveness of restoration and mitigation measures
- collect additional data to determine cause and effect relationships between pressures and impacts on biology
- develop mechanisms to plan and deliver measures through catchment based partnerships.
- investigate the benefits and other impacts of mitigation measures

These investigations, details of which are provided under the programmes of measures in Annex C, will enable us to focus those measures where we have high confidence that they will deliver improvements to ecological status or potential.

Whilst this is a long term activity it is expected that significant progress will have been made in time to support morphological assessments and programmes of measures for the second cycle of river basin management planning.

Designation of artificial & heavily modified waters

In some cases where the hydromorphology of a water body has been physically altered it may be difficult for the water body to meet good ecological status. If, in order to achieve good status, it would require changes to a water body's hydromorphology that would have significant adverse effects on the water body 'use' i.e. the social or economic activity responsible for those modifications, then it can be designated as artificial or heavily modified (UKTAG, 2008). The WFD also requires that the current 'use' cannot be provided by a significantly better environmental option.

Relevant 'uses' and human activities are defined as navigation (including port facilities, or

recreation), activities for the purposes of which water is stored (such as drinking-water supply, power generation or irrigation), water regulation, urbanisation, flood protection, land drainage, the wider environment (e.g. sites designated for conservation), and other important sustainable human development activities.

In England and Wales a two-stage approach has developed to apply the Article 4(3) tests to those water bodies provisionally identified as artificial water body or heavily modified. The two stage process followed the principles outlined in the Common Implementation Strategy guidance document no.4 (European Commission, 2003). The process comprised of a rapid designation of 'obvious' artificial and heavily modified water bodies and a further detailed assessment of those water bodies that could not be designated in the rapid designation stage. Full details of the methods used to designate water bodies as artificial or heavily modified can be found in Annex I.

A core part of the designation process involved assessing if restoration to good ecological status would impact on water body use and whether water body modifications associated with the use represent the best environmental option. Such assessments were undertaken within the constraints of the available data and evidence. Given these data and evidence limitations a number of principles were adopted:

- 1) Designation has been based where possible on existing asset data. For example, for flood risk management activities, the Environment Agency's National Flood and Coastal Defence Database has been used. The assumption is that all assets contained within this dataset provide a current 'use' i.e. they contribute to flood protection.
- 2) During the designation process, where modifications were extensive and deemed significant then it was assumed that restoring the water body to GES would have a significant adverse impact on the use and benefits provided by these modifications. In many cases the exact ecological benefit/s of whole scale removal or alteration of modifications are uncertain and the costs of undertaking such activities are likely to be disproportionately costly.
- 3) Assets built in more recent times which were subject to requirements to assess environmental implications generally provide the 'best environmental option'. For example all flood and coastal risk management (FCRM) schemes are subject to assessment under the Environmental Impact Assessment (EIA) Regulations therefore ensuring that the best environmental option is promoted. Work is being undertaken to update EIA regulations and FCRM project appraisal guidance to take account of new WFD requirements to ensure all future activities take full account of water body status and objectives identified in the river basin management plans.
- 4) Through a programme of trials and data collection the hydromorphological evidence base is being developed. As results emerge, action will be taken to implement measures which are shown to have ecological benefits and which are not disproportionately costly. This investigation work will further ensure that limitations are addressed in time for the review of artificial and heavily modified water body designations required for the second cycle of river basin management.

Identification of good ecological potential for artificial & heavily modified waters

To determine the ecological potential of artificial and heavily modified water bodies the Environment Agency has applied the methodology²⁴ recommended by UKTAG²⁵.

²⁴ http://www.wfd.uk.org/tag_guidance/Article%20_11/POMEvNStd/gep_guidance_final

²⁵ The UK Technical Advisory Group on the Water Framework Directive established by the UK government administrations and comprising representatives from SEPA, the Environment Agency, the Northern Ireland Environment Agency, SNH, Natural England, Countryside Council for Wales and the Department for the Environment & Local Government in the Republic of Ireland.

The methodology is based on an approach known as the 'alternative approach' by UKTAG²⁶. This approach was agreed between Member States and the European Commission under the Common Implementation Strategy for the Water Framework Directive²⁷. More details on the method can be found in Annex A and the supporting document at <http://www.wfd.uk.org/UKCLASSPUB/>.

It has not been possible to differentiate between water bodies whose hydromorphological characteristics are consistent with good ecological potential and those whose characteristics are consistent with maximum ecological potential. Consequently, the hydromorphological characteristics of such bodies are identified as being consistent with 'good or maximum' ecological potential collectively. The Directive does not require these classes to be differentiated for reporting purposes.

This 'alternative approach' will be reviewed and updated for each river basin management planning cycle as methods and understanding improve. The reviews will take account of experience of applying the guidance, information from environmental monitoring programmes, research projects on the impacts resulting from physical modifications, and information on the effectiveness and practicability of different mitigation measures.

The decision on where measures are applied within water bodies is not part of the classification process; this is addressed as part of the programme of measures and the wider river basin management planning process.

Identification and development of measures

A review has been undertaken of the range of restoration and mitigation measures to address hydromorphological pressures. This includes both catchment and water body or sub-water body scale measures. Relevant measures have been incorporated into a morphology measures toolkit containing information on the range of measures options available and details of estimated scale of effect, ecological benefits, & cost-effectiveness. This toolkit has assisted with the prioritisation of measures for promotion in the first river basin management cycle (up to 2015) and will be employed in future river basin management.

The toolkit has three components:

- Pressures: This contains a list of hydromorphological pressures, and the measures that are likely to help mitigate the impacts of these pressures.
- Measures: This worksheet contains a list of specific measures, each of which is accompanied by a brief description. Measures are grouped into 11 broad categories, see table below.
- Evaluation tool: This worksheet contains a detailed description of each measure and an assessment of their effectiveness in delivering hydromorphological improvements.

Details of broad measures categories and specific measures and potential measure categories (M1 – M4) are provided in table 13.

²⁶ This is an alternative to that identified in CIS guidance. The alternative approach is considered less uncertain and more pragmatic than the more theoretical CIS approach

²⁷ http://circa.europa.eu/Members/irc/env/wfd/library?l=/framework_directive/thematic_documents/hydromorphology_technical_reportpdf_EN_1.0_&a=d (please note you will be asked to create an account when you first access this site)

Table 13: Broad measures categories and specific measures for addressing hydromorphological pressures (from Environment Agency Morphology measures toolkit)

Measure type	Specific measure	Description [inc. measure category, M1, M2, M3, M4]
Working with Physical Form and Function	Removal of hard engineering structures (e.g. naturalisation)	Remove existing hard structures (e.g. concrete bank protection, concrete beds, sea walls) to allow natural processes to re-establish [M3a, M4]
	Managed Realignment of flood defences	Breach, remove or set back existing flood defences and allow previously defended areas to become inundated, recreating coastal and estuarine flood zones and/or restoring connectivity with floodplain [M3a]
	Managed Retreat	Allow the coastline to erode naturally (applies to defended and undefended coastline) [M3b]
	Recreate a sinuous river channel (re-meandering)	Recreate a sinuous channel in artificially straightened river reaches to provide an approximation of a natural planform [M3b]
	Narrow over-wide channels	Instigate narrowing of over-wide channels using structures and/or vegetation to encourage sedimentation along channel margins [M3b]
	Create low flow (2-stage) channels in over-widened/over-deepened channels (increase morphological diversity)	Create low-flow channel in over widened channel (could be meandering, through use of deflectors) [M3b]
	Reconnect and restore historic aquatic habitats	Reconnect cut off meanders and abandoned secondary channels to increase water conveyance and habitat quality, and restore backwater habitats by removing encroaching vegetation [M3b]
	Recreation of gravel bars and riffles using permanent and/or temporary bed structures (increase morphological diversity)	Install structures to encourage sediment accretion and localised diversity in channel bedforms [M3b]
	Bank reprofiling (rehabilitation)	Reduce bank slopes to reduce erosion, encourage stabilisation and improve marginal habitat [M3a, M3b, M4]
	Cliff reprofiling	Reduce angle of cliff slope to reduce erosion, encourage stabilisation and improve marginal habitat [M3b]
	Beach reprofiling	Modify profile of beach [M3b]
	River bed raising or lowering (regrading)	Regrade bed to raise levels in over-deepened channels of lower levels in over-widened channels [M3b]
	Beach Recharge	Introduce sediment (e.g. from dredging) to areas where erosion is a problem [M3b]
	Replenishment of mobile sediments	Introduce sediment from the mobile load (fine sediments, gravel), e.g. to recreate bars and riffles [M3b]
	Adopt strategic options and policies promoting natural recovery	Apply policies to encourage natural recovery of water bodies (e.g. promote removal of unnecessary structures) [M3a]

Measure type	Specific measure	Description [inc. measure category, M1, M2, M3, M4]
	Use of engineering techniques to assist natural recovery	Assist natural recovery of water body with use of sympathetic engineering techniques (e.g. replacement of hard defences) [M3a, M3b]
Structural Modification	Replace existing structures with new structural designs to minimise impact hydromorphological impact (avoid like for like)	Use improved design when replacing structures (e.g. use clear-span bridges instead of pierced structures) [M3a]
	Replace hard defence with soft engineering	Replace existing hard structures with soft / bioengineered solutions [M3a, M3b, M4]
	Modify existing structures	Modify existing structures to reduce pressure (e.g. add culvert, reverse sluice, lower defence, alter dimensions, change orientation or profile) and/or to allow free passage of wildlife [M3b, M4]
	Construct breach or spillways	Install structures that allow controlled release of water through existing defences [M3b]
	Implement Tidal Exchange Systems	Insertion of pipes in sea defences to allow controlled exchange of tidal water with the purpose of increasing elevation of land behind defences [M3b]
	Reinstate natural outfall level	Allow release from impounding structures once water reaches natural level of outfall [M3b]
	Install fish pass	Install fish pass to allow free passage around structure [M3b]
	Use soft engineering techniques	Use soft engineering techniques instead of hard engineering (e.g. timber piling, coir matting, willow mattresses, fibre rolls, grassed composites, fabric cell revetments with pockets for vegetation establishment, and open cell lattice revetments with gaps for planting) [M3b]
Operations and Maintenance	Cessation of maintenance	Cease maintenance of structures to allow natural conditions to develop [M3b]
	Develop/review appropriate dredging strategy (timing, selective dredging, phasing, extent, technique)	Develop dredging strategy that minimises hydromorphological damage [M3a]
	Develop/review appropriate vegetation management plans	Develop vegetation management strategy that minimises hydromorphological damage [M3a]
	Change technique to manage and minimise disturbance to morphology (access and operation)	Minimise damage by adopting controlled management procedures for all works on water body (e.g. limited access points, working from one bank only, use of floating pontoons whilst recharging sediment, use of silt curtains and low turbidity suction dredgers whilst dredging, and use low-impact vegetation management techniques such as hand picking, selective cutting, boat-mounted apparatus, and long-reach excavators) [M3a]
	Retain marginal vegetation	Retain habitats in marginal zones to reduce erosion and maintain bank stability [M3b, M4]

Measure type	Specific measure	Description [inc. measure category, M1, M2, M3, M4]
	Control or eradicate invasive species causing hydromorphological impact	Remove non-native invasive species that can cause hydromorphological as well as ecological damage (e.g. signal crayfish and Japanese knotweed cause structural damage; Himalayan balsam and giant hogweed enhance winter erosion). Allow natural recovery, or assist natural recovery, e.g. by spraying seed mix on cleared areas [M3a]
	Install silt, sand or gravel traps	Remove excess sediments through use of suitable sediment traps [M3a, M3b, M4]
	Strategic placement of dredged material (e.g. creation of shallow water zones or gravel bars)	Use dredged materials to improve hydromorphological quality (e.g. creation of shallow water zones or gravel bars) [M3b, M4]
	Phased dewatering of navigation channels whilst maintenance takes place	Drain non-adjacent sections prior to undertaking maintenance works to minimise morphological and ecological impacts (phased dewatering) [M3b]
	Change operational regime of weirs and locks	Restore more natural discharge regime (natural variations to rainfall rather than controlled variations), e.g. by opening locks and weirs [M4]
Land management	Removal of stock	Remove livestock from areas of concern - use of a carefully chosen 'sacrifice field' where damage will have the least impact [M3b, M4]
	Reduce stocking densities	Reduce numbers of livestock in areas of concern or during wet conditions to limit damage to soil structure and reduce sediment yield [M3a]
	Reduce grazing time (daily and/or over the season)	Limit grazing time in areas where erosion or soil compaction may be a problem [M4]
	Introduction of stock-proof fencing (reduce bank side erosion)	Reduce bank erosion by restricting livestock access [M3b]
	Improve river crossings for livestock and farm access	Reduce damage to water body by installing bridges for livestock and farm machinery [M4]
	Establish/relocate feed and water troughs to reduce erosion	Create drinking ponds to provide livestock with water and reduce trampling of river and lake banks [M4]
	Cultivate land for crop establishment in spring rather than autumn	Cultivate land early to minimise erosion and establish ground cover in winter [M3a]
	Adopt minimal cultivation systems	Establish crops which require minimal cultivation, to minimise soil erosion, runoff generation and compaction by farm machinery [M3b]
	Cultivate and drill across slope	Cultivate in line with contours to reduce channelling of runoff [M4]
	Leave autumn seedbeds rough	Leave rough vegetation to protect seedbeds which are vulnerable to erosion [M4]
	Avoid tramlines over winter	Avoid use of tramlines in arable fields to minimise erosion during the winter, e.g. by cultivating winter cereals without the use of tramlines or by establishing paths for spraying once the crops have become established [M4]
	Loosen compacted soil layers	Break up compacted soil to increase infiltration and reduce surface runoff and sediment yield [M4]

Measure type	Specific measure	Description [inc. measure category, M1, M2, M3, M4]
	Establish in-field sediment buffer strips	Leave uncropped areas (grass or natural vegetation) as a barrier to surface water and sediment runoff [M3b]
	Cease maintenance of field drainage systems	Allow sediment and vegetation to build up in field drainage systems to reduce conveyance to water bodies [M3a]
	Re-site gateways away from high-risk areas	Move gateways away from areas where soils erosion, compaction and runoff are problems [M4]
	Re-route informal vehicle and livestock access ways across slope	Move pathways across slope to minimise erosion through creation of downslope flow pathways [M4]
Water Management	Introduce minimum flow limits	Prevent flows falling below a specified level (below which hydromorphological quality may be impaired) [M4]
	Introduce compensatory flows (not just at low flow levels)	Maintain flow levels by introducing flow from other water bodies [M3a]
	Regulate abstraction and discharge	Regulate abstraction and discharge to maintain flow regimes and avoid unnecessary high or low flows [M3a]
	Reduce abstraction	Encourage use of efficient sustainable irrigation systems and raw water storage areas [M1]
	Implementation of SUDS	Implement Sustainable Urban Drainage Systems - permeable rather than impermeable surfaces, buffer strips to manage runoff, etc. [M3a, M3b, M4]
	Establish and maintain artificial (constructed) wetlands for use as sediment traps	Create areas of wetland vegetation in suitable areas to help retain sediment and associated contaminants (grants available for farmers) [M3a]
	Water efficiency planning (domestic, business, industry, agriculture)	Improve efficiency of water usage - limit abstraction and maintain river flows [M3a]
Habitat Creation	Introduce riparian vegetation/green corridors	Introduce riparian vegetation to reduce water and sediment in wash, provide shade, introduce organic material and provide habitat [M3b]
	Introduce lakeside vegetation	Introduce lakeside vegetation to reduce water and sediment inwash, provide shade, introduce organic material and provide habitat [M3b]
	Encourage saltmarsh recovery	Encourage recovery of saltmarsh vegetation to protect coast from erosion [M3b]
	Create reed fringes	Create reed fringes around water body to dissipate wave energy and reduce erosion [M4]
	Create compensation habitats	Create habitats to replace those that are lost or damaged, e.g. aquatic, riparian, offline pond (with no direct connections to other water bodies) [M3b]
	Create shallow margin in front of hard defence	Create shallow margin habitats in front of existing defences using soft engineering techniques/double row piling to encourage vegetation in slow flow areas [M3b]

Measure type	Specific measure	Description [inc. measure category, M1, M2, M3, M4]
Development Control and Planning	Update policy and process guidance to take account of morphology	Ensure that existing guidance and instructions are updated in order to avoid or minimise hydromorphological impacts [M3a]
	Limit further development of the bank and/or near-shore zone	Limit new development in areas adjacent to a water body, to minimise hydromorphological pressures and impacts [M3b]
	Avoid or limit development in the floodplain	Prevent unnecessary floodplain development to minimise hydromorphological pressures and impacts [M1]
	Regulation of in-channel structures	Regulate construction, maintenance and operation of in-channel structures, to minimise hydromorphological pressures and impacts [M1]
	Regulation of development in the marine environment	Regulate development in the coastal and marine environment to minimise hydromorphological pressures and impacts [M1]
	Develop and apply a set of General Binding Rules for riparian/lakeside landowners	Develop and apply General Binding Rules, covering best practices for all riparian agricultural activities (livestock and agriculture) [M3a]
Navigation	Encourage reduction of boat wash impacts through traffic management in sensitive areas	Restrict access in sensitive areas or at sensitive times, e.g. by setting annual movement limits
	Limit number of mooring permits available	Employ limits to reduce no of vessels mooring to reduce pressure
	Restrict speed	Introduce speed limits to reduce morphological damage, e.g. from boat wash. Should be 3mph in most constricted and sensitive areas
	Lateral zoning to concentrate boats within a central channel	Confine boats to centre of channel to reduce boat wash effects on banks, e.g. through use of marker posts or buoys
	Avoid or prevent mooring in sensitive areas	Careful planning of mooring facilities to avoid and/or prevent sensitive sites [M4]
	Design moorings for ecological benefit	Employ design to promote ecological benefit and reduce impacts of scour [M3b]
	Encourage use of environmentally friendly vessel design	Introduce shallow draft vessels with shrouded props, modified hulls and speedometers to reduce the hydromorphological impacts of boat movement [M4]
Science	Improve understanding of responses to hydromorphological pressures	Undertake research into the hydromorphological responses resulting from land management pressures [M3a]
	Trial existing mitigation measures	Undertake trials and pilot studies of suitable mitigation measures and monitor effectiveness [M3a, M4]
	Develop and trial new mitigation measures	Use research to inform the development of mitigation measures [M3a, M4]
Monitoring and Appraisal	Hydrological Monitoring	Monitor flow characteristics in rivers, lakes, estuaries and coasts, to identify trends and improve modelling capabilities [M3a, M4]
	Morphological Monitoring	Monitor water levels in rivers, lakes, estuaries and coasts, to identify trends and improve modelling capabilities [M3a, M4]
	Hydrological Appraisal	Monitor changes in shoreline patterns [M3a, M4]
	Morphological Appraisal	Monitor sediment composition - particle size distribution, sources, etc. [M3a, M4]

Measure type	Specific measure	Description [inc. measure category, M1, M2, M3, M4]
Education	Education on use of guidance	Training for regulators and developers on correct use of guidance notes [M3a, M4]
	Education on identifying opportunities for delivering mitigation measures	Training for regulators on identification of opportunities for hydromorphological improvement within new developments [M3a, M4]
	Educate landowners on sensitive management practices	Educate landowners on hydromorphologically-sensitive management practices, possibly with reference to existing guidance (Environment Agency 2003 <i>Best Farming Practices: Profiting from a good environment</i> Defra 2005 <i>Controlling soil erosion</i>) [M3a]
	Education and awareness raising of impacts of navigation	Information to raise awareness of impacts of bankside, shoreline, offshore activities to water body users [M3b]

Planning and delivery of measures

The Environment Agency and other organisations already undertake a range of activities that contribute to the delivery hydromorphological improvement measures. Examples include current flood risk and coastal management activities, water resources management and involvement in a wide range of catchment and local habitat restoration activities.

Mitigation measures that would contribute to delivery of good ecological status or potential have been identified and prioritised in current Environment Agency capital programmes.

The Environment Agency's Medium Term Plan (MTP) identifies actual and projected spending on Flooding and Coastal erosion Risk Management (FCRM) projects over a rolling five-year period. The MTP provides a means of identifying funded projects that will incorporate mitigation measures into the project design and final construction phase. Information about the schemes identified in the MTP was used to identify where water bodies may benefit from these mitigation measures and where ecological classification may be improved.

This 'mitigation measures' alignment exercise focuses on:

- River, coastal, estuarine and lakes water bodies that were designated as either heavily modified or artificial and were failing good ecological potential due to mitigation measures not being in place.
- MTP (schemes with funding allocation for years 2009 to 2012).
- MTP schemes that will provide the mitigation measures identified in the classification process as currently 'not in place'.
- Schemes involving the replacement or enhancement of existing assets, rather than new schemes.

This process has identified over 400 mitigation measures, within 67 water bodies that will be in place as a direct result of FCRM funded schemes over the next three or so years. These schemes will help improve the ecological quality of water bodies currently classified as Moderate Ecological Potential (ModEP) or poorer and progress the objective of achieving Good Ecological Potential (GEP).

It is the intention that these planning mechanisms will be fully aligned with the river basin management planning process from cycle 2 onwards.

The Environment Agency has also worked with other organisations, for example the Association of Rivers Trusts (ART) to identify relevant improvement measures that are being undertaken by others to ensure these contribute to the delivery of water body improvements. We will continue to work with partners to identify and align these measures during the first cycle of river basin management.

It is not always possible to identify who should take action to achieve the objective of good ecological status or potential. For example, where we have historic structures or activity where it is no longer clear who was involved and/or who was legally responsible. This is especially difficult where the structures were put there legally under a different legal and regulatory regime, perhaps even required by Government; and/or where the ownership or use of the structure has changed over time. As many past damaging activities were delivered and funded through legally compliant schemes, and as it is difficult to identify responsible parties, it is unlikely that reliance on the 'polluter pays' principle will deliver the extent of restoration works necessary to comply with the requirements of the Directive.

The Environment Agency is currently working with Defra & Welsh Assembly Government to address any “gaps” in existing legislation which were identified during the Defra & Welsh Assembly Government consultation ‘Mechanisms to deliver Water Framework Directive requirements on hydromorphology’, (December 2007). These include proposals for a power to restore the morphology condition of surface water bodies.

Objective setting

The following assumptions have been made when setting objectives for morphology:

1. Where a water body is currently classified at good ecological status or potential then it will have a predicted outcome of good ecological status or potential by 2015.
2. Where a water body is currently classified at moderate ecological status/potential or below and measures have been identified from the above activities and programmes that are planned and funded and assessed as taking the water body to good ecological status/potential, then these have been given objectives of good ecological status or potential by 2015.
3. Where a water body is currently classified at moderate ecological status/potential or below and no measures have been identified from the above activities OR those that have been assessed as not enough to achieve good ecological status/potential by 2015, then these have been given an objective of good status/potential by 2027, the justification for this extended deadline is outlined below.

The decision tree below provides details of the decisions made for determining water body objectives for morphology. It explains how the extended deadlines to reach good ecological status or potential have been assigned to water bodies and the justification behind these decisions. This applies to all water bodies including those that are artificial or heavily modified. The decisions are based on identified reasons for failure; these reasons are related to the pressures which are preventing the water body from reaching good. As hydromorphology is often controlled by a complex set of interrelating pressures some water bodies have more than one reason for failure.

In some cases it will not be possible to achieve good ecological status or potential even if all morphological improvement measures and/or mitigation measures identified are in place. For example other pressures such as diffuse pollution may be preventing achievement of the required ecological status. And without action to address these other pressures, good ecological status/potential will not be achieved. Actions will be taken to tackle the other pressures such as diffuse pollution.

The evidence base for hydromorphology needs to be improved and therefore uncertainty plays a key role in justification of measures, examples can include uncertainty over:

- the exact ecological impact of the particular pressure
- the source of the morphological pressure
- the effectiveness of the measure

In these cases further investigation will be required to reduce this uncertainty so that we can improve our confidence in some measures in time for the second cycle of river basin management.

Setting objectives on the basis of an extended deadline allows improvements to be prioritised over successive planning cycles whilst not imposing disproportionate burdens on those who have to pay for them. Further investigation during the first cycle of river basin management will provide more information on the cost and benefit of measures. Improving the evidence base will also give us greater confidence in the applicability and effectiveness (technical feasibility) of improvement measures.

The implementation of morphological measures will be based on the consideration of:

1. the confidence of the classification
2. the spatial extent of adverse impacts
3. the scale of improvements and mitigation required and hence the costs and the extent of technical planning and preparation required
4. planned asset refurbishment or replacement schedules
5. consideration of other pressures acting on the water body

Measures that are less likely to be disproportionately expensive are:

- Measures to reduce uncertainty – these include measures to improve understanding of the pressure and the relationship between pressure and impact.
- Measures delivering significant improvements - at no or low cost e.g. making barriers to migration passable to migratory species, and reducing maintenance where this allows a degree of natural recovery and does not jeopardise the use.
- Win-wins - such as measures which have economic as well as environmental benefits (for example, beneficial use of dredged material).
- Measures which will deliver improvements for other pressures - as well as for morphology for example, some of the measures for morphology based on agricultural land will also help tackle water resources, sediment and nutrients pressures.

Table 14 below provides examples of measures likely to be considered not disproportionately costly and those likely to be considered disproportionately costly in the first cycle of river basin management planning.

Table 14. Hydromorphological measures and disproportionate cost

Hydromorphological improvement measures considered	
Likely not to be disproportionately costly	Likely to be disproportionately costly
Measures to reduce uncertainty – improving pressure data, science on pressure/impact relationship and testing/piloting measures.	Wholesale restoration or removal of flood and coastal defences, and other engineered or reinforced channels.
Making barriers to migration passable.	Removal of major infrastructure, bridges and culverts under buildings.
Reducing maintenance to allow natural recovery.	Some sediment management for the ports and navigation sector.
Protection of the riparian zone e.g. anti-livestock fencing to allow natural recovery from overgrazing.	Hull design or other modifications to vessels.
Developing or amending dredging / disposal strategies for maritime navigation.	
Blocking grips and drains to restore upland wetland source areas	

Further investigation during the first cycle of river basin management will provide more information on the cost and benefit of measures. Where a water body is currently classified at moderate ecological status/potential or below and all the measures identified are disproportionately costly when compared to the benefits realised, then a revised less stringent objective may be set for that water body for the second cycle of river basin

management onwards. The option to set a less stringent objective will only be used where a reasonable alternative cannot be found (as illustrated in decision tree below).

The effectiveness of morphological improvement measures is dependent on the existence of other pressures. It is rare that a water body will be subject only to morphological pressures – typically other pressures such as diffuse pollution from agriculture or towns, or point source pollution will also be acting to limit ecological status or potential. In cases where morphology is not the only limiting pressure, measures for morphological improvement would not necessarily see a corresponding improvement to the overall water body quality until further measures are implemented to improve the other pressures. Phasing morphological measures to reflect the implementation of measures to deal with other pressures will allow the maximum environmental improvement and a more efficient use of resources.

Managing future modifications

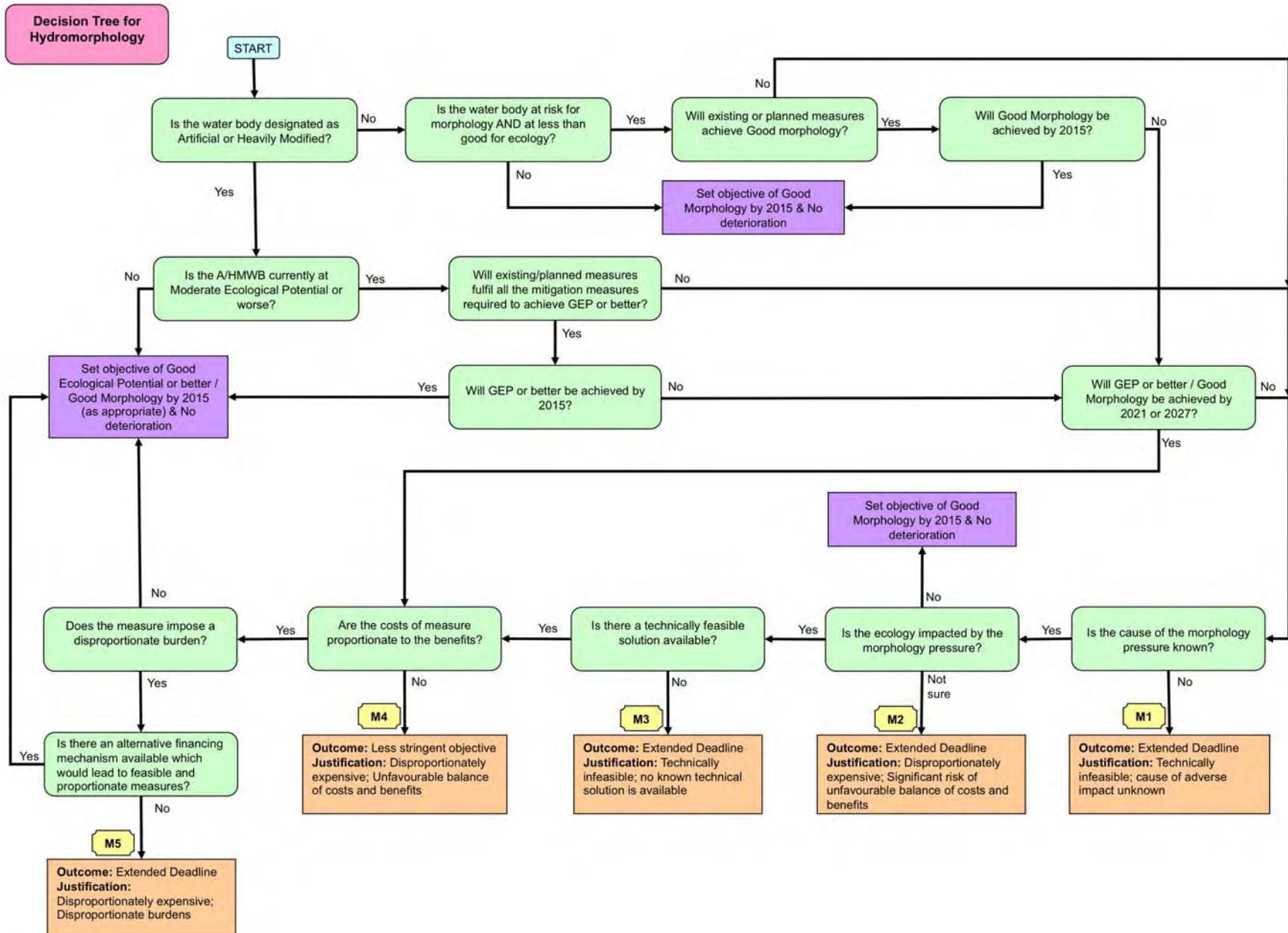
The Water Framework Directive requires an assessment of all new physical modifications to ensure they do not cause deterioration in the status or potential of a water body or prevent a water body from meeting its ecological objective.

Article 4.7 of the Directive sets out the circumstances under which a deterioration in water body status or failure to meet ecological objectives as a result of a new physical modification is permitted. Deterioration in status or failure to meet ecological objectives as a result of a new physical modification will only be permitted where the following conditions are met:

- a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;
- b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;
- c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the water body
- d) ecological objectives are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and
- e) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

All new physical modifications will be assessed in terms of their impact on the overall status of a water body and ability of that water body to meet its ecological objective. The baseline status of each water body against which deterioration will be assessed is set out as the classified status in this river basin management plan (see Annex B).

Article 4.7 assessment has been a requirement since December 2006. All new physical modifications occurring in water bodies between December 2006 and March 2009 that were likely to have caused a deterioration in status or prevented a water body from meeting its water body objectives are reported in Annex B of this plan.



Reference	M1a to M1k
Element predicted not to achieve good by 2015	Morphology
Reason for failure	<p>M1a = Suspected - physical modification flood protection</p> <p>M1b = Suspected - physical modification land drainage</p> <p>M1c = Suspected - physical modification urbanisation</p> <p>M1d = Suspected - physical modification barriers to fish migration</p> <p>M1e = Suspected - physical modification flood and coastal erosion protection</p> <p>M1f = Suspected - physical modification water storage and supply (including for power generation)</p> <p>M1g = Suspected - physical modification wider environment</p> <p>M1h = Suspected - physical modification inland navigation</p> <p>M1i = Suspected - physical modification recreation</p> <p>M1j = Suspected - physical modification other sustainable human use</p> <p>M1k = Unknown - reasons for failure unknown</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The cause of the morphological pressure is unknown</p> <p>We suspect that the reason for failure is caused by one or more morphological pressures but we lack enough evidence to confirm this is true.</p> <p>Morphological pressures may derive from a complex combination of multiple physical modifications and/or management activities each of which may have a different impact on water body biology. It is not always immediately possible to identify the specific source of the pressure and so the cause of the adverse impact on biology remains unknown. It is not technically feasible to implement appropriate morphological improvement measures until the cause of the adverse impact has been determined.</p> <p>Where the source of the morphological pressure remains unknown, further investigation is required to confirm the nature and extent of the pressure. Work is underway in the Environment Agency to develop a comprehensive, up to date database on morphological pressures to help identify sources of impact.</p>	

Once the source of the pressure is identified, we will need to assess whether designation as an artificial or heavily modified water body is required.

An extended deadline for achieving water body objectives is therefore required to allow time to undertake investigations to confirm the source of the morphological pressure and to enable identification and implementation of appropriate measures.

Investigation type

Investigate source of failure

Example of investigation

Where the source of the morphological pressure remains unknown, further investigation is required to confirm the nature and extent of the pressure. Desk based studies will gather further information on the water body, morphological modification and management activities. The Environment Agency is developing a comprehensive database on morphological pressures to help this process. Appraisal of this information will determine what the morphological pressures are. Where there is low confidence that the pressures have been correctly identified or a lack of adequate data, further detailed field study is required.

Field studies to characterise the morphological pressures could include, amongst others:

- River Habitat Survey/Habitat mapping
- Catchment sediment dynamics survey
- Biological surveys
- Hydrological/hydraulic modelling
- Cross sectional surveys
- Depth, Velocity, Substrate surveys

Possible future measures

Once we are able to identify the specific source of the pressure within the water body, we will then be able to choose an appropriate morphological improvement measure. The following list provides examples of possible improvement measures that could be employed once investigations have confirmed the pressure source:

- Remove barriers to fish passage
- Enhancement/Restoration schemes
- Restoration of natural flows through habitat management & removal of impediments to flow
- Revised sediment management strategies
- More widespread use of Sustainable Urban Drainage Systems
- Codes of Practice / General Binding Rules for operational activities/boat traffic
- Management of the physical impacts of commercial inshore fisheries
- Increased habitat enhancement via flood risk and coastal management capital and maintenance activities

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wholesale restoration or removal of flood and coastal defences, and other engineered or reinforced channels.
- Removal of major infrastructure, bridges and culverts under buildings.
- Hull design or other modifications to vessels.
- Removal of all barriers to migration

Reference	M2a and M2b
Element predicted not to achieve good by 2015	Morphology
Reason for failure	M2a = Suspected - physical modification commercial fin fisheries M2b = Suspected - physical modification commercial shell fisheries
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that morphological pressures are adversely affecting biology</p> <p>There is significant risk that it is disproportionately expensive to implement measures to improve hydromorphological conditions at this time because we have an incomplete understanding of the relationship between morphology pressures and biological impacts.</p> <p>Within transitional and coastal waters in particular the ecological impacts that can be directly attributed to commercial fisheries operations are not well understood. In some cases we know the source of the morphological pressure but are not able to quantify the exact nature and extent of the impact on biology. Morphological pressures are rarely if ever the sole pressure exerted on the water environment. As different pressures can act in combination to cause failure to achieve good status or potential it is difficult to relate individual modifications or management actions to identified ecological impacts.</p> <p>Where we have low confidence that commercial fin or shell fisheries pressure is adversely affecting biology (and to what extent), further studies are required to understand the relationship between the pressure and biology before we can attribute the failure in ecological status to morphological pressures. Until this link is sufficiently established for a water body, there is a significant risk that there will be either no or low benefits from taking remedial action to reduce the morphological pressure.</p> <p>In these cases we will improve our understanding of these pressure-impact relationships. By doing so we will improve our understanding of which specific measures will deliver greatest benefit to the specific biological elements that are most impacted.</p>	
Investigation type	
Investigate source of failure & relationship with ecological impact	

Example of investigation

A study is being undertaken to develop a methodology to assess the level of morphological risk that commercial fisheries activities could pose. This will be done by integrating information on fisheries activity with information on habitat sensitivities. It will include quantification of the pressure, evaluation of impacts across habitat types and the spatial distribution of the effects. Its purpose is to determine the levels or types of fishing activity that could compromise good ecological status or potential.

This information will then be used to determine what (if any) are the most appropriate measures to reduce or mitigate the impacts of ongoing commercial fisheries activities, or else the most appropriate measures to improve hydromorphological and biological quality.

Possible future measures

This will depend upon the outcome of the study, but may include the development and uptake of best practice guidance.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Not possible to identify measures at this stage

Reference	M2c to M2j
Element predicted not to achieve good by 2015	Morphology
Reason for failure	<p>M2c = Confirmed - physical modification wider environment M2d = Confirmed - physical modification other sustainable human use M2e = Confirmed - physical modification flood protection M2f = Confirmed - physical modification urbanisation M2g = Confirmed - physical modification land drainage M2h = Confirmed - physical modification water storage and supply (including for power generation) M2i = Confirmed - physical modification recreation M2j = Confirmed - physical modification inland navigation</p>
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>Low confidence that morphological pressures are adversely affecting biology</p> <p>Where we know that morphological pressures are adversely affecting biology but we have low confidence in the nature or extent of impacts, further studies are required to understand the relationship between the pressure and biology. Until this link is sufficiently established for a water body there is a significant risk that there will be either no or low benefits to the biology from taking remedial action to reduce the morphological pressure.</p> <p>Within some water bodies our assessments have confirmed the presence and cause of morphological pressures, which have been identified as the reason for failure. However, the exact nature and extent of impacts on the biological quality elements as a consequence of these known morphological pressures is not always clear. In these cases we need to improve our understanding of these pressure-impact relationships. By doing so we will improve our understanding of which specific measures will deliver greatest benefit to the specific biological elements that are most impacted.</p> <p>In addition, in many cases morphological pressures are not the only pressures on the water environment and these can act in combination to exert a negative impact on ecological status. In these cases it is important to understand if there is a key limiting pressure that should be the focus of early action as this will deliver greatest benefit to</p>	

the biology. Where morphology is not the limiting pressure there is likely to be very limited benefit to the biology relative to the cost of taking action.

Investigation type

Investigate nature and extent of ecological impact

Example of investigation

Where there is a lack of adequate data or low confidence in our understanding of the ecological impacts of known morphological pressures more detailed study is required. These more detailed site or water body scale studies will provide better understanding of the morphological and biological condition, using a range of different survey, monitoring and modelling techniques.

Where required, analysis of morphological pressures and other relevant information to determine the significance of morphology in relation to other pressures on the water environment, for example water quality issues, relative to ecological status.

The improvement of our evidence base will enable successful delivery of hydromorphological measures that address the ecological impacts in a way that is more targeted and not disproportionately expensive.

Possible future measures

There are a wide range of measures that could be delivered in future to address known hydromorphological pressures, including:

- Modification of existing structures
- Development and implementation appropriate sediment or vegetation management strategies
- Cessation of maintenance or changing maintenance operations
- Modification or removal of barriers to fish passage
- Restoration or enhancement of morphological conditions and habitat

The justification for their future use will depend on analysis of the technical feasibility of delivery in consideration of local conditions within each specific water body and analysis of the costs and benefits of that action.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wholesale restoration or removal of flood and coastal defences, and other engineered or reinforced channels.
- Removal of major infrastructure, bridges and culverts under buildings.
- Hull design or other modifications to vessels.
- Measures which are not proven to be technically successful or applicable at the scale or under the conditions of particular water bodies .
- Removal of all barriers to migration

Reference	M3a to M3h
Element predicted not to achieve good by 2015	Morphology
Reason for failure	<p>M3a = Confirmed - physical modification flood protection</p> <p>M3b = Confirmed - physical modification urbanisation</p> <p>M3c = Confirmed - physical modification land drainage</p> <p>M3d = Confirmed - physical modification water storage and supply (including for power generation)</p> <p>M3e = Confirmed - physical modification ports and harbours</p> <p>M3f = Confirmed - physical modification flood and coastal erosion protection</p> <p>M3g = Confirmed - physical modification inland navigation</p> <p>M3h = Confirmed - physical modification recreation</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: no known technical solution
Justification for alternative objective	
<p>Technical solutions to address the ecological impact caused by the physical modification are under development and their effectiveness is not yet known</p> <p>There is a known morphological pressure (a physical modification) and an observed biological impact but uncertainty surrounds the effectiveness of the measure(s) available to reduce that impact.</p> <p>There are a range of morphological improvement measures available to mitigate and reduce biological impacts from physical modification. However, we do not always have a high level of confidence in the outcome and effectiveness of these improvement measures in relation to the specific biological quality elements. Many of the morphological improvement measures are yet to be proven in terms of their effect on biology at the water body scale. Similarly, the effectiveness of morphological improvement measures across differing environmental conditions, for example, different river types, remains unknown.</p> <p>A programme of research is underway to improve our confidence in the applicability, feasibility and success of a range of morphological improvement measures. Extending the deadline for achieving objectives will allow time to complete these investigations to confirm the effectiveness of morphological improvement measures.</p> <p>For artificial and heavily modified water bodies, mitigation measures have been identified as necessary in order to achieve GEP. The feasibility of these measures</p>	

requires further examination. Mitigation measures defined from the ecological potential classification process are derived from a generic list that deals with pressures and impacts on a broad scale. To ensure that the measures are technically feasible in each individual water body, local conditions and requirements must be considered. Mitigation measures must also be looked at in combination to identify their effect where there are multiple pressures and impacts present in the water body.

Investigation type

Investigate feasibility of measures

Example of investigation

Where we have low confidence in how effective the morphological improvement measures are in bringing biological improvements, further investigations are underway. Investigations are taking the form of catchment trials, testing of measures and monitoring the success of measures in bringing biological improvements.

The biological improvement brought about by morphological improvement measures in some water bodies may be different where different physical conditions prevail. Certain measures may be effective in some water bodies and not others. The above trials and investigations will help determine situations in which specific measures are likely to be applicable and suitable.

Possible future measures

Once investigations have established the effect of morphological improvement measures this will inform the choice of measure to be implemented in order to meet WFD objectives. Some possible measures are listed below:

- Removal of barriers to fish passage.
- River enhancement/restoration schemes
- Restoration of natural flows through habitat management & removal of impediments to flow.
- Revised sediment management strategies
- More widespread use of Sustainable Drainage Systems.
- Codes of Practice / General Binding Rules for operational activities/boat traffic.
- Opportunistic habitat enhancements on the back of capital and maintenance works

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wholesale restoration or removal of flood and coastal defences, and other engineered or reinforced channels.
- Removal of major infrastructure, bridges and culverts under buildings.
- Hull design or other modifications to vessels.
- Measures which are not proven to be technically successful or applicable at the scale or under the conditions of particular water bodies
- Removal of all barriers to migration

Reference	M5a
Element predicted not to achieve good by 2015	Fish
Reason for failure	Confirmed - physical modification barriers to fish migration
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive - Disproportionate burdens
Justification for alternative objective	
<p>If implemented before 2015, the required measure would impose a disproportionate burden. We are considering possible relevant alternative financing mechanisms.</p> <p>We are confident that the fish classification is at less than good status and that barriers to fish migration are the only or contributory factor in the observed impact. A technically feasible solution is available. The results of the national impact assessment have shown that there is a favourable cost/benefit ratio associated with remedies to deal with barriers to fish migration. This will be supported by the introduction of the fish passage regulations, expected in 2011. Further investigation of alternative financing mechanisms will take place in order to introduce these measures, or identification of the "polluter" if this is possible. We will follow the Common Implementation Strategy Guidance Document No. 20, where it states that when affordability arguments are used to extend the deadline, the possibility to use relevant alternative financing mechanisms should be fully considered, which could include distribution of costs along polluters and users, use of the public budget (at different levels), private investment, EU and international funds etc. Environment Agency, Defra and other EU partners are currently preparing an EU Life bid, for example, on developing expertise and sharing best practice on catchment restoration funds.</p> <p>Affordability is one area where there is limited guidance available at a European level and hence additional care must be taken in justifying exemptions to ensure that they follow the spirit of the Directive and its objectives. Additional care has been taken in explaining why these exemptions are being used and in making this transparent.</p> <p>Although the adoption of the WFD entails obligations for member state to make available the necessary means for implementation, this needs to be moderated by the option available to member state to phase the implementation (through extended deadlines) of measures to spread the costs of implementation (while taking clear and demonstrable action in the first cycle).</p> <p>To apply a time extension on grounds of affordability consideration should be given to the availability of alternative financing mechanisms, the consequences of non-action and steps taken to resolve affordability in the future.</p>	

Government is generally involved in financing fish passes because of the nature of the problem. There are no “polluters” in the normal sense of the word and the benefits are typically to the general public rather than identifiable individuals or organisation. Where fish passes can be financed by other means this is generally done. In particular to reduce costs care is taken to make sure that fish passes are installed where other changes to the water body (e.g. for flood defence) are taking place. This means that a large number of necessary fish passes are installed at low or no cost, but this is not sufficient to cover all cases where there is a positive benefit to cost ration.

The polluter pays principle is the central tenet of the Directive and where benefits are produced of similar importance is the beneficiary pays principle. Only when action is not financeable through these principles should resort be made to public budgets.

In the main the fish passes have no identifiable “polluter” and the beneficiaries are impossible to target because these are generally non use benefits (i.e. not individual or organisation like fisheries). If “polluters” or beneficiaries could be uniquely identified they would be chased for a contribution to the cost which may make them affordable depending upon the scale of the cost.

In terms of the consequences of the time extension for fish passes these are mainly the delayed benefits of achieving good ecological status in the relevant water bodies.

Defra is actively engaged in identifying alternative sources of financing for fish passes and in securing available funds through the process of allocating government funds. Defra sought an additional £10 million as part of business planning (25% to be spent on fish passes) and is currently establishing a business case for further expenditure as part of the Comprehensive Spending Review. Both the processes consider the costs and the benefits of the action in a similar way to that required by the Directive, to ensure that public budgets are spent on the most value for money interventions. As a consequence additional expenditure over and above that identified in the spending review process would not be considered value for money, in the sense that using the money to finance a greater number of fish passes would produce a net cost because the benefits of the passes are less than the benefits of alternative ways of spending the governments budget. This process of setting public budgets is kept under constant review as is the question of alternative sources of finance including taxes and charges and should changes arise in the future these will be reflected in later plans.

Investigation type

Investigate feasible measures

Example of investigation

Investigate cheaper measures and alternative financing mechanisms.

Possible future measures

The introduction of the new fish passage regulations will give additional powers to help address this pressure. Where the Environment Agency owns the barriers it will be our responsibility to address fish passage issues. For those owned by third parties, the responsibility will lie with them. Encourage local groups e.g. Rivers Trusts, angling associations, to install fish passes, which can often be more cost

effective.

Explore Axis 4 Leader options in funding action at local catchment level.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Removal of all barriers to fish migration. In most cases we will have to introduce fish passes rather than removing the obstruction.

E9 Sediments pressure

Scope of the sediment pressure

For the purpose of this Plan sediment is taken to mean:

- organic and inorganic solids which may be on, or near the bed of a water body, or suspended within the water column.
- the direct polluting effects of sediment (including direct physical damage to biota, shading effects and smothering habitat). It includes managing delivery of excessive quantities of sediment from land based activities (urban and rural) and managing the redistribution of sediment from within water body activities (e.g. weed cutting etc).

We have assumed that sediment pressure does not include:

- Lack of sediment in a habitat due to anthropogenic activities modifying sediment dynamics (e.g. due to dredging and bank/foreshore development). Such aspects are a result of hydromorphological alterations and should be assessed through abstraction and/or morphological pressures.
- Impacts due to contaminants associated with sediment (e.g. nutrients and chemicals). Such aspects are a result of polluting activities that should be assessed under the relevant pressure.

Sediment pressure is relevant to rivers, lakes, transitional (estuarine) and coastal (TraC) waters. It is assumed that it has limited significance to groundwater.

Sediment pressure can have an impact on a variety of objectives relevant to WFD including:

- Surface water 'status' objectives
- Habitat Directive protected areas
- Economically significant species protected areas (Freshwater Fish Directive)
- Drinking water protected areas (including colour problems) (Surface Water Abstraction Directive)

The scale of the problem

The relationship between the amount of sediment in a river and any environmental impact is not simple. In some river catchments there is relatively little sediment but because the river is particularly sensitive then the impact can be large. At the other end of the scale, some rivers can have a high sediment load but this may actually support a particular habitat or not be considered to have a significant impact.

All river basin districts identified sediment as a Significant Water Management Issue, with many citing it among the 'top five' issues within their river basin district (RBD). We are developing a weight of evidence approach to identify the scale and source of the problem. Risk assessment information forms part of this weight of evidence.

Sediment risk assessment information is given in Annex G. Note that the large water bodies that were split into smaller bodies at the end of 2008 have not yet had a new sediment risk assessment, and so have been reported as 'Not Assessed'. However, the assessment made on the original smaller water body has been taken into account as part of our wider weight of evidence to appraise and determine appropriate measures.

Another key piece of information for weight of evidence is sediment monitoring information. However, we do not routinely measure sediment quantity, type, or quality. Sediment is difficult to monitor routinely because levels of sediment are largely related to rainfall events that are unpredictable and sediment does not remain in the water column making normal

water quality sampling unreliable. The current evidence base is focussed on detailed studies at specific sites, with limited national collation.

Understanding precisely how ecology responds to different levels and types of sediment is complex, and often unclear. Given this diversity and uncertainty, it is extremely challenging to define appropriate targets and standards to support particular WFD objectives for different types of a water body.

There are currently no UKTAG water quality standards for sediment. Similarly there are no mandatory water quality standards for sediment in existing Directives. It is assumed that where sediment compromises delivery of WFD objectives (e.g. Good Ecological Status) then this will be picked up through ecological monitoring. However, WFD Classification and associated ecological monitoring are new tools. It is therefore unlikely we will have sufficient information or knowledge from them in the short term to develop new, widespread national measures for sediment pressure in the first round of river basin management planning. Our weight of evidence will incorporate this information when it becomes available but currently it is assumed that:

- planning of local measures to tackle sediment problems will be based on local knowledge and expert judgement of Environment Agency national, regional and area staff in close co-operation with other relevant co-deliverers (e.g. Natural England, Countryside Council for Wales)
- if there is no evidence that sediment is harming WFD objectives, we will assume sediment conditions are adequate for Good Ecological Status.

Source of the problem

The variation in sediment behaviour (derivation, transport, and deposition) coupled with limited monitoring can make it difficult to specifically apportion the sediment pressure to particular sources, sectors and activities. For example, it is difficult to determine the relative contributions of sediment to a rural watercourse from arable cultivation, the livestock sector and bank side erosion.

The complexity of apportioning the sediment pressure makes it difficult to precisely identify sources and sectors. It is also difficult to have confidence in the impact of specific measures and the timescale for improvements, particularly at a local level.

In the first round of river basin management planning we will be very reliant upon building a weight of evidence to justify and identify appropriate action at the river basin district scale, and in particular fishery, biology and investigative monitoring at the local scale.

Appraisal of measures and objectives

The approach to assessing available measures to tackle sediments and determining appropriate objectives is set out in the decision tree below.

National measures (M1, M2 and M3a)

Although we do not have enough information at a national level to justify new wide-scale national action on sediment, many existing national measures will help reduce the risk of problems from sediment. These measures will be particularly important to prevent further deterioration. They include:

- Legislation to minimise impacts from sediment and suspended solids in consented discharges.

- Pollution prevention legislation (such as anti-pollution Works Notices) to prevent illegal discharges or high risk activities that may give rise to sediment problems.
- Agricultural cross-compliance and associated measures (e.g. those stemming from Nitrates Directive, Sludge Directive, waste management and storage of materials such as slurry) to reduce the risks of sediment laden run-off from farming activities.
- Agri-environment Entry Level Scheme (ELS) in England and Tir Cynnal in Wales, as well as woodland management schemes in Rural Development Programmes.
- Pollution Reduction Plans for Priority Hazardous Substances (e.g. TBT) consider sediment as a source and sink of pollution and propose appropriate mitigation strategies.
- Existing pollution prevention guidance and policy to encourage:
 - better management of run-off from construction sites;
 - new developments to be better designed to avoid (or at least minimise) adverse impacts on sediment transport and deposition;
 - increased use of sustainable drainage systems (SUDS) to draining developed areas.

Many of these existing measures are primarily aimed at other pressures (e.g. phosphorus), but we must maximise their benefit for sediment management. Proposals for using these measures to tackle sediment are given in Annex C of this plan. Those measures that have not been included are summarised in Table 15 below.

It is assumed that the economic justification for using these national measures has been established through national processes such as public consultation on new and revised regulations and their associated impact assessments (e.g. recent Government consultations on revised powers to tackle diffuse pollution) and other appraisal (e.g. Defra/Welsh Assembly Government's preliminary Cost-Effectiveness Analysis for Water Framework Directive).

Regional measures (M3b and M4)

Despite the application of these national measures, there will be some water bodies where sediment remains a problem. Where there is sufficient evidence, we aim to ensure that measures are developed and implemented at a RBD, or more local, level to address these problems.

Local biology and fish class information has only very recently become available to help identify specific water bodies where sediment may be compromising WFD Objectives. Regional and Area Environment Agency staff have reviewed biological and fish class data and identified 'reasons for failure', including those water bodies believed to be impacted by sediment. They have also used expert judgement to estimate whether biological objectives are likely to be achieved given existing or proposed national and regional measures including:

1. Nationally funded but river basin district targeted (M3b) measures:
 - The England Catchment Sensitive Farming Delivery Initiative (ECSFDI) which RBD liaison panels have already contributed to through the recent extension and refresh programme.
 - Environment Agency Wales funded catchment initiatives.
 - Agri-environment Higher Level Scheme (HLS), Tir Cynnal and Tir Gofal.
 - Existing or proposed Grant in Aid funded pollution prevention campaigns (including use of anti-pollution works notices).
2. River basin district lead (M4) measures:
 - Partnerships with local authorities, water companies, local communities and developers to help control sediment from urban areas by putting in place Sustainable Urban Drainage Systems (SUDS).

- Partnerships with the farming community to help control sediment from agricultural diffuse pollution.
- Partnerships and Codes of Practice to help improve land drainage, dredging/de-silting and weed-cutting operations.
- Partnerships to minimise impacts from boat traffic wash.
- Bank/shore habitat restoration and stabilisation projects such as the work carried out by the various Rivers Trusts.

This process has lead to the development of the programme of measures outlined in Annex C of this river basin management plan.

It is likely that most new action to resolve sediment problems in the first round of river basin management will be carried out through existing or proposed voluntary initiatives and partnerships (M4 measures). The economic appraisal of these will be developed as part of the river basin district measures appraisal process.

Measures which were considered but have not been included in Annex C are summarised in Table 15 below.

Table 15. Sediment measures that have been considered but not included in scenarios A or B

Proposed option:	Type of measure:	Reason for not including it in scenario A or B
Modify agricultural cross-compliance so it is more effective at supporting WFD objectives in respect of sediment.	M2 – national	Technically Infeasible – practical constraints of a technical nature prevent implementation of the measure by an earlier date. Review and development of cross-compliance is linked to EU Common Agricultural Policy and undertaken at an EU level
Modify agri-environment schemes so they are more effective at supporting WFD objectives in respect of sediment.	M2 – national	Technically Infeasible – practical constraints of a technical nature prevent implementation of the measure by an earlier date. Review and development of agri-environment is linked to EU Common Agricultural Policy and undertaken at an EU level. There are also practical constraints to modifying individual farm agreements which have not yet completed their original lifespan. A review of some parts of agri-environment is due in 2010 and we intend identify a range of resource protection/sediment management measures that need to be included as options in future schemes
General Binding Rules (GBRs) to control sediment releases from particularly high risk activities (e.g. construction, or some forestry operations)	M3a - national	However, inclusion in this list of GBRs could change in the future depending on current discussions with Defra who have been considering GBRs as part of their work on non-Agricultural diffuse pollution.
Require all new developments to have Sustainable Urban Drainage Systems in catchments where sediment laden run-off is contributing to failure of good status.	M3b - nationally funded, locally targeted	However, inclusion in this list could change in the future depending on current discussions with Defra.

Proposed option:	Type of measure:	Reason for not including it in scenario A or B
Markedly increase Environment Agency resources allocated to agricultural and urban pollution prevention and enforcement activity.	M4 – RBD led	Likely to be disproportionately expensive - Implementation of the measure by an earlier deadline would impose disproportionate burdens We intend taking a phased approach, targeting Grant in Aid funded pollution prevention and enforcement work at the highest priority sites where we have most certainty about the activities giving rise to sediment problems.

Objectives and extended deadlines

Many of the national measures detailed above were originally intended for other pressures (e.g. nutrients). As such, there is significant uncertainty regarding how effective they will be in mitigating sediment pressures. It is highly probable that these measures alone will not be sufficient to ensure wide scale attainment of WFD objectives, where sediment is the principle cause of failure. However, we believe that if used robustly they may be sufficient to minimise further deterioration due to sediment, and are therefore worthwhile. There is also considerable uncertainty with regard to many sediment measures targeted by RBDs, particularly in relation to the efficacy of new diffuse pollution measures (e.g. Water Protection Zones) or the willingness of some stakeholders to participate in partnerships.

Furthermore there are often uncertainties on the causes of failure where sediment is a pressure. It is often difficult to demonstrate whether the primary cause of a biological failure is due to sediment or some other pressure (e.g. hydromorphology). Even when sediment is identified as the primary cause it is not always clear what the relative contributions of sediment are from different sources in a particular water body (e.g. agriculture sector and/or aquaculture sector).

Given these uncertainties it is highly likely that in many cases where sediment is implicated as a cause of failure, we will need to undertake further investigation to determine an appropriate course of action.

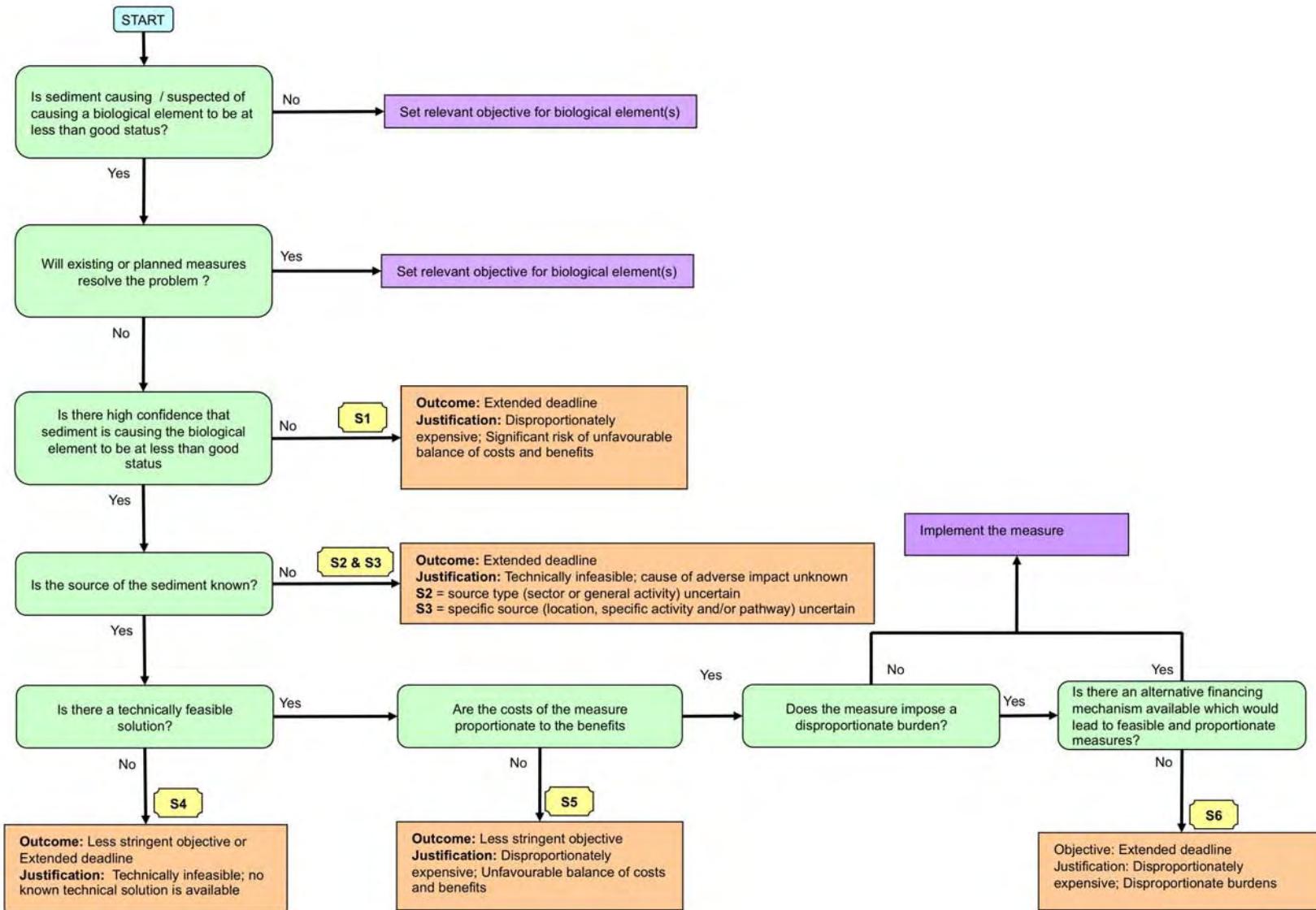
Actions required to improve the evidence base for future rounds

To improve our ability to deal with sediment appropriately in future, the following actions will be undertaken:

- Ensure the implementation of appropriate monitoring (routine and targeted) for suspended solids and bed sediments including sediment tracking studies.
- Collation and review of a national evidence base.
- Review of existing science and commissioning of new science in a strategic way to better understand:
 - the link between ecology and sediment,
 - the sources and fate of sediments in catchments,
 - appropriate standards/thresholds to help manage various types of sediment issue (including biological indicators),
 - the effectiveness of measures to tackle sediment problems.
- Development of guidance to support information gathering for weight of evidence approach, targeting monitoring and appraisal of measures.

Anticipated costs for this are likely to be a minimum of £20m over the first river basin management cycle (see Defra's preliminary Cost Effectiveness Analysis report for further detail).

Decision tree for sediment



Reference	S2a
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Suspected – sediment from unknown diffuse sources
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The source (sector or general activity) of the sediment impacting on biology is not yet confirmed</p> <p>The sediment causing the failure of biological elements to achieve good status is suspected to come from diffuse sources. Until the specific sources and pathways are known with reasonable confidence, the identification and application of measures (including who needs to implement them) to reduce the sediment inputs is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the source and pathways of sediment causing failure and to identify and implement appropriate measures.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to confirm the source of sediment and the pathways by which the sediments are entering water bodies (e.g. agricultural, urban or abandoned mines etc). The investigation may include site visits, monitoring, and desk study modelling.	
Possible future measures	
<p>Depending on outcome of investigation, potential measures include:</p> <ul style="list-style-type: none"> • More local partnership projects to support farmers to change practice, or stabilise bank-side habitat • Increased roll-out (in terms of duration and geographic extent) of Catchment Sensitive Farming type advisory initiatives in England and Wales • Increased Environment Agency-led pollution enforcement campaigns (including 	

use of anti-pollution works notices)

- Where appropriate designation of Water Protection Zones
- Widen the measures and activities included in agri-environment initiatives (e.g. rural sustainable drainage systems) as well as securing more effective targeting and enhanced funding
- Widen the measures and activities that are incorporated in to Common Agricultural Policy funded initiatives (e.g. increase soil resource protection measures in current approach to cross-compliance, or whatever may follow in future)
- Establish and or extend existing national partnerships that provide advice and support to land managers to improve practices (e.g. continued roll out of Think: Soils training)
- Targeted land use change (e.g. afforestation or reversion of arable land to low intensity pasture) in priority areas
- More local partnership projects with Forestry Commission and other forestry operators to implement Forestry Guidelines
- Develop current Forestry Guidelines into mandatory requirements or General Binding Rules for use in high risk situations
- Designation of Water Protection Zones that apply to sites specifically impacted by Forestry operations
- More local partnership projects with key partners e.g. Highways Agency, local authorities and Business Groups to change practice and reduce the risk of non-agricultural diffuse pollution
- Establish Urban Catchment Officers in England and Wales to give advice to businesses, local authorities and those responsible for managing roads to help prevent diffuse pollution (similar to England Catchment Sensitive Farming Delivery Initiative)
- Development of General Binding Rules for particular high risk activities and sectors (e.g. construction sector)
- Establish and or extend existing national partnerships that provide advice and support to improve practice
- Targeted retro-fitting of Sustainable Urban Drainage systems in priority areas
- Targeted land use change e.g. prohibition of development in priority areas
- Code of Practice on dredging and disposal of in-channel sediment
- Continue roll-out of national Coal Mine programme and Metal Mines Strategy in Wales
- Develop non-coal mine programme to target treatment solutions at priority sites
- Tighten discharge consents for some trade activities in high risk areas (i.e. will result in changes to operational practices and/or installation of treatment processes to remove sediment from waste water prior to discharge)

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales
- Wide scale prohibition of high risk forestry activities in large parts of England and Wales
- Wide scale land use change e.g. prohibition of development in large parts of England and Wales that are particularly sensitive to non-Agricultural diffuse water

pollution

- Wide scale, precautionary tightening of discharge consents for suspended solids for most point sources through England & Wales

Reference	S2b
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Suspected – sediment from diffuse source agricultural
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The source (sector or general activity) of the sediment impacting on biology is not yet confirmed</p> <p>Agriculture is the suspected source of the sediment. However, until this is confirmed with reasonable confidence, the identification and application of measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm that agricultural sources are causing the failure and to identify and implement appropriate measures.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to confirm the source of sediment and the pathways by which the sediments are entering water bodies (e.g. field run-off, field drains, road/track drains, bank-side erosion and livestock poaching etc.). The investigation may include site visits, monitoring, and desk study modelling.	
Possible future measures	
<p>If agriculture is confirmed as the source of the problem:</p> <ul style="list-style-type: none"> • More local partnership projects to support farmers to change practice, or stabilise bank-side habitat • Increased roll-out (in terms of duration and geographic extent) of Catchment Sensitive Farming type advisory initiatives in England and Wales • Increased Environment Agency-led pollution enforcement campaigns (including 	

- use of anti-pollution works notices)
- Where appropriate designation of Water Protection Zones
 - Widen the measures and activities included in agri-environment initiatives (e.g. rural sustainable drainage systems) as well as securing more effective targeting and enhanced funding
 - Widen the measures and activities that are incorporated in to Common Agricultural Policy funded initiatives (e.g. increase soil resource protection measures in current approach to cross-compliance, or whatever may follow in future)
 - Establish and or extend existing national partnerships that provide advice and support to land managers to improve practice
 - Targeted land use change (e.g. afforestation or reversion of arable land to low intensity pasture) in priority areas

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale reversion of arable land to low intensity pasture over large parts of England and key areas in Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	S2c
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Suspected – sediment from diffuse source forestry
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The source (sector or general activity) of the sediment impacting on biology is not yet confirmed</p> <p>Forestry is the suspected source of the sediment. However, until this is confirmed with reasonable confidence, the identification and application of measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help investigate and identify the sources and pathways of sediment that are contributing to biological failure and inform the identification of appropriate measures to reduce sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm that forestry is the source causing the failure and to identify and implement appropriate measures.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to confirm the source of sediment and the pathways by which the sediments are entering water bodies (e.g. forestry tracks, clear felling etc). The investigation may include site visits, monitoring, and desk study modelling.	
Possible future measures	
<p>If forestry is confirmed as the source of the problem:</p> <ul style="list-style-type: none"> • More local partnership projects with Forestry Commission and other forestry operators to implement Forestry Guidelines • Develop current Forestry Guidelines into mandatory requirements or General 	

Binding Rules for use in high risk situations

- Where appropriate, designation of Water Protection Zones that apply to sites specifically impacted by Forestry operations

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale prohibition of high risk forestry activities in large parts of England and Wales

Reference	S2d
Element predicted not to achieve good by 2015	Biological element
Reason for failure	<p>Suspected – sediment from diffuse source road run-off</p> <p>Suspected - sediment from diffuse source mixed urban run-off</p> <p>Suspected - sediment from diffuse source housing</p> <p>Suspected - sediment from diffuse source trading/industrial estates</p> <p>Suspected - sediment from diffuse source contaminated land</p> <p>Suspected - sediment from diffuse source contaminated sediments</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The source (sector or general activity) of the sediment impacting on biology is not yet confirmed</p> <p>Urban sources (including roads) are suspected source of the sediment. However, until this is confirmed with reasonable confidence, the identification and application of measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures to reduce sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm that urban sources of sediment are causing the failure and to identify and implement appropriate measures.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to confirm the source of sediment and the pathways by which the sediments are entering water bodies (e.g. housing estates, industrial/trading estates, contaminated land, waste management sites, misconnected foul sewers or road run-off etc). The investigation may include site visits, monitoring, and desk study	

modelling.

Possible future measures

If urban sources are confirmed as being the source of the problem:-

- More local partnership projects with key partners e.g. Highways Agency, local authorities and Business Groups to change practice and reduce the risk of non-agricultural diffuse pollution
- Establish Urban Catchment Officers in England and Wales to give advice to businesses, local authorities and those responsible for managing roads to help prevent diffuse pollution (similar to England Catchment Sensitive Farming Delivery Initiative)
- Increased Environment Agency pollution enforcement campaigns (including use of anti-pollution works notices)
- Where appropriate, designation of Water Protection Zones
- Development of General Binding Rules for particular high risk activities and sectors (e.g. construction sector)
- Establish and or extend existing national partnerships that provide advice and support to improve practice
- Extend the geographic scale and pace of roll-out of work to correct misconnections of foul sewers to surface water drains
- Targeted retro-fitting of Sustainable Urban Drainage systems in priority areas
- Targeted land use change e.g. prohibition of development in priority areas
- Code of Practice on dredging and disposal of in-channel sediment

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale land use change e.g. prohibition of development in large parts of England and Wales that are particularly sensitive to urban diffuse water pollution

Reference	S2e
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Suspected - sediment from disused mines - point and/or diffuse
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The source (sector or general activity) of the sediment impacting on biology is not yet confirmed</p> <p>Disused mines are a suspected source of the sediment. However, until this is confirmed with reasonable confidence, the identification and application of measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures to reduce sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm that disused mines are the source of the sediment causing failure and to identify and implement appropriate measures.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to confirm the source of sediment and the pathways by which the sediments are entering water bodies (e.g. old flooded adits, run-off from waste spoil heaps etc). The investigation may include site visits, monitoring, and desk study modelling.	
Possible future measures	
<p>If disused mines are confirmed as the source of the problem:</p> <ul style="list-style-type: none"> • Continue roll-out of national Coal Mine programme and Metal Mines Strategy in 	

Wales

- Develop non-coal mine programme to target treatment solutions at priority sites.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale rehabilitation at all disused coal and non-coal mines sites across the whole of England and Wales

Reference	S2f
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Suspected - sediment from point source (water industry, domestic and trade premises)
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The source (sector or general activity) of the sediment impacting on biology is not yet confirmed</p> <p>Point source discharges are the suspected source of the sediment. However, until this is confirmed with reasonable confidence, the identification and application of measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures to reduce sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm that point source discharges are the source of the sediment causing failure and to identify and implement appropriate measures.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to confirm the source of sediment and the pathways by which the sediments are entering water bodies (e.g. sewage works, water treatment works, sewer overflows, fish farms etc). The investigation may include site visits, monitoring, and desk study modelling.	
Possible future measures	
<p>If point source discharges are confirmed as the source of the problem:</p> <ul style="list-style-type: none"> • Tighten discharge consents for some trade activities in high risk areas (i.e. will 	

result in changes to operational practices and/or installation of treatment processes to remove sediment from waste water prior to discharge)

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

None

Reference	S3a
Element predicted not to achieve good by 2015	Biological element
Reason for failure	<p>Confirmed – sediment from agricultural diffuse Source</p> <p>Confirmed - sediment from diffuse source forestry</p> <p>Confirmed - sediment from road run-off</p> <p>Confirmed – sediment from mixed urban run-off</p> <p>Confirmed - sediment from housing diffuse source</p> <p>Confirmed – sediment from trading/industrial estates diffuse source</p> <p>Confirmed – sediment from contaminated land</p> <p>Confirmed - sediment from contaminated sediments</p> <p>Confirmed - sediment from disused mines point and/or diffuse</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The specific source (location, specific activity and/or pathway) of the sediment that is impacting on the biology is not known</p> <p>Until the specific source(s) of the sediment is known with reasonable confidence, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures</p> <p>Projects have also been initiated that will review the effectiveness of measures to control diffuse pollution, including sediment, that will improve the identification of appropriate cost effective solutions.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the source and pathways of sediment causing the failure and to identify and develop appropriate measures (e.g. source protection measures to stop diffuse pollution occurring in the first place or mitigation measures to stop sediment getting into water bodies).</p>	

Investigation type
Investigate source of failure
Example of investigation
Investigations to identify the relative importance of the specific activities and locations giving rise to unacceptable quantities of sediment in a river system. This may include site visits, monitoring, desk study modelling and stakeholder (e.g. farmer) liaison.
Possible future measures
<p>Depending on outcome of Investigation, potential measures include:</p> <ul style="list-style-type: none"> • More local partnership projects to support farmers to change practice, or stabilise bank-side habitat • Increased roll-out (in terms of duration and geographic extent) of Catchment Sensitive Farming type advisory initiatives in England and Wales • Increased Environment Agency-led pollution enforcement campaigns (including use of anti-pollution works notices) • Where appropriate designation of Water Protection Zones • Widen the measures and activities included in agri-environment initiatives (e.g. rural sustainable drainage systems) as well as securing more effective targeting and enhanced funding • Widen the measures and activities that are incorporated in to Common Agricultural Policy funded initiatives (e.g. increase soil resource protection measures in current approach to cross-compliance, or whatever may follow in future) • Establish and or extend existing national partnerships that provide advice and support to land managers to improve practices (e.g. continued roll out of Think: Soils training) • Targeted land use change (e.g. afforestation or reversion of arable land to low intensity pasture) in priority areas • More local partnership projects with Forestry Commission and other forestry operators to implement Forestry Guidelines • Develop current Forestry Guidelines into mandatory requirements or General Binding Rules for use in high risk situations • Designation of Water Protection Zones that apply to sites specifically impacted by Forestry operations • More local partnership projects with key partners e.g. Highways Agency, local authorities and Business Groups to change practice and reduce the risk of non-agricultural diffuse pollution • Establish Urban Catchment Officers in England and Wales to give advice to businesses, local authorities and those responsible for managing roads to help prevent diffuse pollution (similar to England Catchment Sensitive Farming Delivery Initiative) • Development of General Binding Rules for particular high risk activities and sectors (e.g. construction sector) • Establish and or extend existing national partnerships that provide advice and support to improve practice • Targeted retro-fitting of Sustainable Urban Drainage systems in priority areas • Targeted land use change e.g. prohibition of development in priority areas

- Code of Practice on dredging and disposal of in-channel sediment
- Continue roll-out of national Coal Mine programme and Metal Mines Strategy in Wales
- Develop non-coal mine programme to target treatment solutions at priority sites
- Tighten discharge consents for some trade activities in high risk areas (i.e. will result in changes to operational practices and/or installation of treatment processes to remove sediment from waste water prior to discharge)

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale reversion of arable land to low intensity pasture over large parts of England and Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales
- Wide scale prohibition of high risk forestry activities in large parts of England and Wales
- Wide scale land use change e.g. prohibition of development in large parts of England and Wales that are particularly sensitive to non-Agricultural diffuse water pollution
- Wide scale, precautionary tightening of discharge consents for suspended solids for most point sources through England & Wales

Reference	S3b
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Confirmed – sediment from agricultural diffuse source
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The specific agricultural source (location, specific activity and/or pathway) of the sediment that is impacting on the biology is not known</p> <p>Until the specific source(s) of the sediment is known with reasonable confidence, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures</p> <p>Projects have also been initiated that will review the effectiveness of measures to control diffuse pollution, including sediment, that will improve the identification of appropriate cost effective solutions to reduce sources of agricultural sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the agricultural source and pathways of sediment causing the failure and to identify and develop appropriate measures (e.g. source protection measures to stop diffuse pollution occurring in the first place or mitigation measures to stop sediment getting into water bodies).</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to identify the relative importance of the specific activities and locations giving rise to unacceptable quantities of sediment in a river system. This may include site visits, monitoring, desk study modelling and stakeholder (e.g. farmer) liaison.	

Possible future measures

When specific source identified:

- More local partnership projects to support farmers to change practice, or stabilise bank-side habitat
- Increased roll-out (in terms of duration and geographic extent) of Catchment Sensitive Farming type advisory initiatives in England and Wales
- Increased Environment Agency-led pollution enforcement campaigns (including use of anti-pollution works notices)
- Where appropriate designation of Water Protection Zones
- Widen the measures and activities included in agri-environment initiatives (e.g. rural sustainable drainage systems) as well as securing more effective targeting and enhanced funding
- Widen the measures and activities that are incorporated in to Common Agricultural Policy funded initiatives (e.g. increase soil resource protection measures in current approach to cross-compliance, or whatever may follow in future)
- Establish and or extend existing national partnerships that provide advice and support to land managers to improve practice
- Targeted land use change (e.g. afforestation or reversion of arable land to low intensity pasture) in priority areas

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale reversion of arable land to low intensity pasture over large parts of England and key areas in Wales
- Wide scale reversion of agricultural land to woodland over large parts of England and Wales
- Wide scale reduction in livestock densities (cattle, sheep and pigs) over large parts of England and Wales

Reference	S3c
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Confirmed - sediment from diffuse source forestry
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The specific forestry source (location, specific activity and/or pathway) of the sediment that is impacting on the biology is not known</p> <p>Until the specific source(s) of the sediment is known with reasonable confidence, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures</p> <p>Projects have been initiated that will review the effectiveness of measures and guidance to control diffuse pollution (e.g. review of the Forest and Water guidelines), including sediment, that will improve the identification of appropriate cost effective solutions to reduce sources of sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the agricultural source and pathways of sediment causing the failure and to identify and develop appropriate measures (e.g. source protection measures to stop diffuse pollution occurring in the first place or mitigation measures to stop sediment getting into water bodies).</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to identify the relative importance of the specific activities (e.g. Clear felling) and locations giving rise to unacceptable quantities of sediment in a river system. This may include site visits, monitoring, desk study, modelling and stakeholder liaison.	

Possible future measures

- More local partnership projects with Forestry Commission and other forestry operators to implement Forestry Guidelines
- Develop current Forestry Guidelines into mandatory requirements or General Binding Rules for use in high risk situations
- Where appropriate, designation of Water Protection Zones that apply to sites specifically impacted by Forestry operations

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale prohibition of high risk forestry activities in large parts of England and Wales

Reference	S3d
Element predicted not to achieve good by 2015	Biological element
Reason for failure	<p>Confirmed - sediment from road run-off</p> <p>Confirmed – sediment from mixed urban run-off</p> <p>Confirmed - sediment from housing diffuse source</p> <p>Confirmed – sediment from trading/industrial estates diffuse source</p> <p>Confirmed – sediment from contaminated land</p> <p>Confirmed - sediment from contaminated sediments</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The specific source (location, specific activity and/or pathway) of the sediment that is impacting on the biology is not known</p> <p>Until the specific Urban sources (including roads) of the sediment is known with reasonable confidence, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures</p> <p>Projects have also been initiated that will review the effectiveness of measures to control diffuse pollution, including sediment, that will improve the identification of appropriate cost effective solutions to reduce sources of sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the urban source and pathways of sediment causing the failure and to identify and develop appropriate measures (e.g. source protection measures to stop diffuse pollution occurring in the first place or mitigation measures to stop sediment getting in to water bodies e.g. SUDS)</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to identify the relative importance of the specific activities and locations giving rise to unacceptable quantities of sediment in a river system. This may include	

site visits, monitoring, desk study modelling and stakeholder liaison (e.g. SME sector groups, local authorities and Highways Agency, the public).

Possible future measures

- More local partnership projects with key partners e.g. Highways Agency, local authorities and Business Groups to change practice and reduce the risk of non-agricultural diffuse pollution
- Establish Urban Catchment Officers in England and Wales to give advice to businesses, local authorities and those responsible for managing roads to help prevent diffuse pollution (similar to England Catchment Sensitive Farming Delivery Initiative)
- Increased Environment Agency pollution enforcement campaigns (including use of anti-pollution works notices)
- Where appropriate, designation of Water Protection Zones
- Development of General Binding Rules for particular high risk activities and sectors (e.g. construction sector)
- Establish and or extend existing national partnerships that provide advice and support to improve practice
- Extend the geographic scale and pace of roll-out of work to correct misconnections of foul sewers to surface water drains
- Targeted retro-fitting of Sustainable Urban Drainage systems in priority areas
- Targeted land use change e.g. prohibition of development in priority areas
- Code of Practice on dredging and disposal of in-channel sediment

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale land use change e.g. prohibition of development in large parts of England and Wales that are particularly sensitive to non-Agricultural diffuse water pollution

Reference	S3e
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Confirmed - sediment from disused mines point and/or diffuse
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The specific source (location, specific activity and/or pathway) of the sediment that is impacting on the biology is not known</p> <p>Until the specific point or diffuse source(s) of the sediment from disused mines is known with reasonable confidence, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures</p> <p>Projects have also been initiated that will review the effectiveness of measures to control diffuse pollution, including sediment, that will improve the identification of appropriate cost effective solutions to reduce sources of sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the source and pathways of sediment causing the failure and to identify and develop appropriate measures (e.g. reducing the risk of run-off from waste spoil heaps or tackling flooded adits).</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to identify the relative importance of the specific activities and locations giving rise to unacceptable quantities of sediment in a river system. This may include site visits, monitoring, desk study modelling and stakeholder liaison (e.g. land owners and Coal Authority).	

Possible future measures

When Specific source is identified:

- Continue roll-out of national Coal Mine programme and Metal Mines Strategy in Wales
- Develop non-coal mine programme to target treatment solutions at priority sites.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

- Wide scale rehabilitation at all disused coal and non-coal mines sites across the whole of England and Wales

Reference	S3f
Element predicted not to achieve good by 2015	Biological element
Reason for failure	Confirmed - sediment from point source (water industry, private and trade)
Alternative objective	Extended deadline
Reason for alternative objective	Technically Infeasible - cause of adverse impact unknown
Justification for alternative objective	
<p>The specific point source (location, specific activity and/or pathway) of the sediment that is impacting on the biology is not known</p> <p>Until the specific point source of the sediment is known with reasonable confidence, the identification and application of additional measures (including who needs to implement them) tailored to local circumstances is not possible. It is therefore not technically feasible to achieve good status by 2015.</p> <p>Projects have been initiated that will develop methodologies for reviewing and gathering evidence to help identify the sources and pathways of sediment that is contributing to biological failure and inform the identification of appropriate measures</p> <p>Projects have also been initiated that will review the effectiveness of measures to control diffuse pollution, including sediment, that will improve the identification of appropriate cost effective solutions to reduce sources of sediment.</p> <p>An extended deadline for achieving good ecological status is therefore required. This will allow time to undertake investigations to confirm the source and pathways of sediment causing the failure and to identify and develop appropriate measures (e.g. put in place additional treatment, and/or changes in operational practices to reduce sediment in discharge).</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
Investigations to identify the relative importance of the specific activities and locations giving rise to unacceptable quantities of sediment in a river system. This may include site visits, monitoring, desk study modelling and stakeholder liaison (e.g. fish farms).	

Possible future measures
When point source is identified:
<ul style="list-style-type: none"> • Tighten discharge consents for some trade activities in high risk areas (i.e. will result in changes to operational practices and/or installation of treatment processes to remove sediment from waste water prior to discharge)
Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive
None

E10 Priority Substances, Priority Hazardous Substances and Specific Pollutants

Water Framework Directive requirements and standards

Priority Substances and Priority Hazardous Substances

The Water Framework Directive provides for the identification of priority substances, for which the objectives are a progressive reduction of discharges, emissions and losses and, for a subset of priority hazardous substances, a cessation or phasing out of discharges, emissions and losses within 20 years. It also requires that environmental quality standards (EQS) are established at EU level, which must be met for ‘good chemical status’ to be achieved.

A list of 33 priority substances, including 13 priority hazardous substances, was agreed by co-decision in 2001 (Decision 2455/2001/EC). EQS for these substances were published in December 2008 in Directive 2008/105/EC on Environmental Quality Standards in the Field of Water Policy (the “EQS Directive”). This effectively replaces the Dangerous Substances Directive (76/464/EEC). The EQS Directive also includes the requirement that concentrations of certain priority substances do not increase in sediment and/or biota, in addition to the requirement for Member States to establish an inventory of emissions, discharges and losses of priority substances and priority hazardous substances in each river basin district.

The EQS Directive reiterates that the objectives and provisions of WFD Article 4 apply, therefore the objective to achieve ‘good chemical status’ and for a progressive reduction of priority substances and cessation of priority hazardous substances are subject to disproportionate cost and technical infeasibility considerations.

Specific Pollutants

Member States must also identify “specific pollutants” - substances of national concern which are discharged in significant quantities – and develop appropriate EQS using a common methodology. Standards for specific pollutants must be met for good ecological status to be achieved

In the first instance, the UK WFD Technical Advisory Group (UKTAG) prioritised 19 potential specific pollutants. EQS were developed for 10 substances and these were reviewed by stakeholders in 2007. For the remaining 9 substances, UKTAG has recommended that existing standards should be used in the first planning cycle, because in the absence of high quality field and toxicity data, a large safety factor would have to be incorporated into the EQS. This approach tightens the EQS, potentially resulting in an over-precautionary standard that is inconsistent with environmental conditions and which confers no additional environmental benefit. The intention is that UKTAG will continue to collect suitable data with which to review standards in time for the second river basin management planning cycle. To this end, UKTAG has established links with other Member States (including Germany, France, the Netherlands, Belgium and the Republic of Ireland) with a view to sharing best practice and where possible developing common solutions.

Current compliance

We have assessed compliance with standards for priority substances and specific pollutants in order to identify those water bodies at risk of not achieving WFD objectives and consequently, where measures are required. Based on monitoring data from 2006-08, about 9% of water bodies in England and Wales will fail to achieve standards for priority

substances, priority hazardous substances and specific pollutants. Over half of these water bodies fail with high (at least 95%) confidence.

Pollution Reduction Plans and development of measures

Chemicals are released into the environment from a wide range of sources including urban and agricultural land use, industry, domestic release to sewers, mines, ports and harbours. The relative importance of these sources varies depending on the chemical, hence the feasibility and effectiveness of various actions to reduce environmental concentrations will vary between substances. For this reason, programmes of measures must be developed for each substance.

Our approach has been to develop national pollution reduction plans (PRPs) for all priority and priority hazardous substances and 6 specific pollutants. The full list is included in Annex F. PRPs review current data on production, uses, sources, environmental monitoring and release, and include an evaluation of available regulatory restrictions and potential control measures. This assesses each available and potential measure for technical feasibility and cost effectiveness, using a range of supporting information, e.g. the preliminary cost effectiveness analysis (pCEA).

Details of the available and potential measures for each substance were collated for each failing water body. Local Environment Agency staff used this information to select those measures that could be usefully applied at the water body scale within their RBD. They also identified any local (M4) measures that could help deliver WFD obligations. These include investigations, targeted pollution prevention advice and campaigns and voluntary agreements based on best practice. All relevant measures have been included in Annex C of this river basin management plan²⁸.

The PRPs were sent to industry sectors, trade associations, conservation organisations, regulators and liaison panels for their comments, during early 2009. This targeted consultation was supported by several sector-specific workshops. The PRPs were then updated to take account of comments received via the consultation and workshops, but are intended to be "living documents" and will be updated, for example to reflect changes in compliance, uses/sources and measures as more information becomes available, and as progress is made through the first river basin management planning cycle.

The rational used to identify measures for the first river basin management planning cycle is summarised below. More detailed information on measures, including those measures that apply at the national scale and which will be used for generally bearing down on emissions of priority hazardous substances, is provided in the PRPs.

Measures tend to fall into three categories:

i) Control at source

There are a number of initiatives, particularly at the European level, to restrict chemicals at source. These include the REACH (Registration, Evaluation and Authorisation of Chemicals) Regulations and substance-specific marketing and use restrictions. These initiatives will reduce emissions of chemicals to water and for some substances, for example isoproturon,

²⁸ NB: Water body compliance is based on median data from all sampling points within that water body. This may mean that a water body reported as "compliant" may have some localised areas of non-compliance. Where the source of non-compliance is known, additional M4 measures will be identified to address the problem, where it is cost effective and technically feasible to do so.

pentachlorophenol and trichlorobenzenes, we believe the reduction will sufficient to achieve WFD objectives.

The Environment Agency is an enforcing body for REACH and as such, undertakes risk-based campaigns to address assess compliance with chemical restrictions and coordinates associated enforcement action. Where possible, we will include priority substances and priority hazardous substances in our enforcement campaigns.

ii) Actions to address point sources of pollution

Sewage treatment works

While standards of sewage treatment have greatly improved in recent years, sewage treatment works (STW) are often a source of chemicals including metals, pesticides, PAHs and TBT. These can arise from discharges of trade effluent to sewer, domestic use and road runoff.

For some substances, the effectiveness of planned source control measures and additional end-of-pipe treatment options is unknown. In these cases, investment in improved sewage treatment (in addition to that required to comply with other EC Directives) might be ineffective and disproportionately costly. The updated WFD Impact Assessment estimated the annual cost to the water industry of end-of-pipe removal of chemicals at around £329m if implemented in the first planning cycle, or £131m if implemented over three cycles.

Therefore we have proposed that under PR09, the water industry will carry out a programme of investigation to identify those STW that are at risk of causing non-compliance with WFD objectives for chemicals. Where a STW is identified as causing a problem, companies will assess the effectiveness and costs of options for removing the risk, including end-of-pipe treatment, control at source and catchment-based solutions, for example tightening trade discharges to sewer. Investigations will be completed by 2012 to allow removal options to be appraised in time for the second round of river basin management planning.

Industrial discharges

Industrial sites, including those regulated under the Environmental Permitting Regulations (EPR, formally the Pollution Prevention and Control Regulations) may be a source of chemicals. There is some uncertainty in relation to the impact of specific sites or activities on the achievement of WFD objectives, particularly in relation to downstream EQS failures or emissions of priority hazardous substances. Therefore in the first planning cycle, we want to work with a range of sectors to address these information gaps. This may involve:

- Investigations to confirm the loading from sites listed on the Pollution Inventory and determine the contribution of that loading to downstream EQS failures
- Investigations to confirm whether priority hazardous substances are being discharged at specific sites
- An assessment of the available measures which could help achieve WFD objectives, for example, use of alternative chemicals, better pollution prevention measures or improved end-of-pipe treatment - and the cost of these measures.

Investigations may be prioritised at certain sites, depending on releases reported on the Pollution Inventory, downstream EQS failures or known uses of particular substances. Investigations should be completed by 2012 and where risks to the achievement of WFD objectives are confirmed, an appraisal of the available measures should also be carried out. Potential measures would be subject to a disproportionate cost assessment on a site by site basis. This will ensure that cost-effective, sustainable, long-term solutions can be identified and implemented within the second cycle of river basin management planning.

We will also provide advice to small and medium sized businesses on obligations in relation to priority substances, priority hazardous substances and specific pollutants through the NetRegs website (www.netregs.gov.uk).

Discharges from abandoned mines

Many of the largest discharges of metals to surface and ground waters arise from mining e.g. minewaters and discharges from mine spoil heaps. At least 164 river catchments in England and Wales are known to be impacted by abandoned mines and are failing to achieve good status.

Abandoned coal mines are a significant source of metals including iron. The Coal Authority is continuing to implement a phased remediation plan up to 2027 for the priority sites which are contributing to the failure of 54 water bodies to meet good status.

The majority of EQS failures for other metals, particularly lead and cadmium, are in metal mining areas, particularly in the South West, Western Wales, Dee, Northumbrian and North West RBDs. There are also some problems in the Humber, Solway-Tweed and Severn RBDs. 110 water bodies are failing to achieve good status because of non-coal (primarily metal) mines. The Defra/Welsh Assembly Government/Environment Agency non-coal mines prioritisation project included a comprehensive analysis of impact and identified 221 water bodies impacted by non-coal mines with a further 236 probably impacted.

Remediation of all non-coal mines by 2015 would rely on established technologies such as those employed at Wheal Jane in Cornwall. These technologies, whilst proven, consist of chemical dosing which is costly, energy intensive and unsustainable in the long-term. It would be disproportionately expensive to employ this treatment technology on a large scale. However recent trials of innovative technologies have indicated that passive treatment may be viable and cost effective. We are hoping to carry out studies to pilot these technologies in the first planning cycle.

To progress a suitable strategy we need to carry out detailed catchment investigations to confirm the relative importance of sources and to optimise treatment solutions. Phasing of subsequent remediation measures would allow costs to be spread and for treatment technologies to be developed at a significant saving. The non-coal mines project has estimated that a programme to deal with the water-related environmental problems in all of the impacted water bodies would cost £370 million over an initial ten year period, with additional subsequent operating costs.

It would also be beneficial if responsibility for managing non-coal minewaters could be given to a government funded body (analogous to the Coal Authority's role for coal mine waters). This change should take place before 2012 to allow measures to be implemented in the second planning cycle.

iii) Actions to address diffuse pollution

Diffuse pollution arises from a range of sectors. It is often difficult to quantify as it can vary spatially and over time, therefore the significance of various sources – and hence the effectiveness of any associated restrictions – can be uncertain. For this reason, the measures included in this plan tend to focus on pollution prevention through local education campaigns, voluntary initiatives and the adoption of best practice methodologies and improved source apportionment through investigations. Measures are driven by cross-compliance with Nitrates and Sludge Directives, the Silage, Slurry and Agricultural Fuel Oil Regulations, the Groundwater Directive, anti-pollution works notices and policies on development planning, as well as restrictions on the use of certain substances.

Most of the existing and proposed national measures to control diffuse water pollution focus on preventing deterioration in the status of water bodies. For example, there are few instances of non-compliance with standards for pesticides, but some are increasing in concentration in drinking water protected areas and this trend must be reversed to meet obligations under WFD Article 7 (specific measures to meet the requirements of Article 7 are listed in Annexes C and D). Our PRPs have identified a range of measures that could be deployed voluntarily or through regulatory mechanisms. For example while the pesticide cypermethrin has been temporarily suspended for use in sheep dip, we will continue to promote further use restrictions in the agricultural, forestry and wood preservation sectors through the use of voluntary mechanisms. These could include catchment sensitive farming, rectifying misconnections of foul sewer to surface water drains, and national pesticides initiatives, for example the Voluntary Initiative, the Amenity Forum and the National Pesticides Strategy. We will be aiming to achieve compliance with the EQS by 2015, and will complement voluntary and partnership working with targeting pollution enforcement activity, e.g. anti-pollution works notices. This will ensure actions taken by our co-deliverers are not undermined by the inappropriate activities of others.

For pesticides generally, we will promote the use of voluntary mechanisms during the first cycle unless there is a clear case for immediate introduction of measures via regulatory mechanisms. Early in the first planning cycle, we will be exploring the scope for use of water protection zones (a regulatory mechanism) for a limited number of sites where implementation of measures via voluntary approaches has already proved to be unsuccessful. For other catchments if voluntary take up is not successful in the first cycle we will be seeking more extensive regulatory mechanisms in subsequent cycles.

The situation is somewhat different for the marine antifoulant TBT. Just over 60 water bodies fail the EQS for TBT, despite its use being heavily restricted already. Although further measures to restrict tin-based substances as plastic additives are being considered at European level, (and we have included measures to increase enforcement of existing restrictions) it may be that the major remaining sources arise from historical contamination of sediments and land, the re-suspension by boat movements and dredging as well as inputs from the sewerage system.

Measures for TBT therefore include investigations by the navigation sector into the impact of dredging and dredging disposal activities where these may cause or contribute to EQS failures or deterioration in a water body. We have also included measures to require a national guidance framework for dredging and dredgings disposal to be developed by December 2009 and to be applied by December 2012. The development of the framework will be overseen by Defra and Welsh Assembly Government in conjunction with the Port and Harbour Authorities, the Marine and Fisheries Agency (and future Marine Management Organisation) and the Environment Agency. Where ports and harbours are confirmed as a significant source of TBT to a water body, for example as a result of dredging activities that re-suspend contaminated sediments into the water column, the framework will drive local measures for individual ports and harbours to be applied at a local level by December 2012 where not disproportionately expensive or technically infeasible. This work will be informed by the Defra "Contaminated Marine Sediment" Project and the Cefas Project which is assessing the environmental impact of navigational dredging in estuaries and coastal waters.

Measures will also be applied to other contributing sectors, as appropriate, to deal with their contributions. We cannot predict the extent the national guidance framework will achieve compliance with the EQS, so generally we have predicted less than good status by 2015.

Approach in the first planning cycle

There are a number of initiatives, particularly at EU level, to restrict chemicals at source. These should reduce emissions to water, and where we believe the reduction is sufficient to achieve WFD objectives e.g. where there are few or no EQS failures, we have not proposed additional measures for the first river basin management planning cycle. We will carry out appropriate monitoring to ensure that WFD obligations for such substances continue to be achieved.

Where we have less certainty that such restrictions will achieve WFD objectives, for example where other sources of a substance remain, we have proposed investigations to evaluate the significance of those sources and options to address their impact where a risk to WFD objectives is confirmed. We have included additional measures where we are able to quantify their impact with confidence and we will continue to carry out targeted pollution prevention measures and enforcement of existing marketing and use restrictions.

Development of predicted outcomes

We have identified predicted outcomes for the first planning cycle for each water body, for each relevant substance. These predicted outcomes are included in Annex B of this plan and take into account the effectiveness of the measures described above.

Where the available measures will maintain or achieve compliance with the EQS by 2015, we have assigned a predicted outcome of good chemical status for priority substances and at least good ecological status for specific pollutants. Where the available measures will not achieve compliance by 2015, we have set alternative objectives for those substances. The rationale for this decision is presented in the chemicals decision tree below. There are 5 main justifications for setting alternative objectives:

- the water body is currently non-compliant with the EQS with low confidence of failure;
- the water body is currently non-compliant with the EQS with high confidence of failure, but the source of the substance is not known, or not known in sufficient detail to be able to identify appropriate measures;
- the water body is currently non-compliant with the EQS, with high confidence of failure, the source of the substance is known but there is no technically feasible solution;
- the water body is currently non-compliant with the EQS, with high confidence of failure, the source of the substance is known, but while there are technically feasible measures, the costs of the measures are not proportionate to the benefits;
- the water body is currently non-compliant with the EQS, with high confidence of failure, the source of the substance is known, there is a technically feasible solution and the cost of a measure is in proportion to the benefit, but it imposes a disproportionate burden and an alternative financing mechanism is not available.

More information on alternative objectives is included in the decision code tables at the end of this section, together with details of the investigations that will be carried out to confirm failures and identify sources, potential measures for the second planning cycle and measures which are considered to be technically infeasible or disproportionately costly.

Use of Biotic Ligand Models

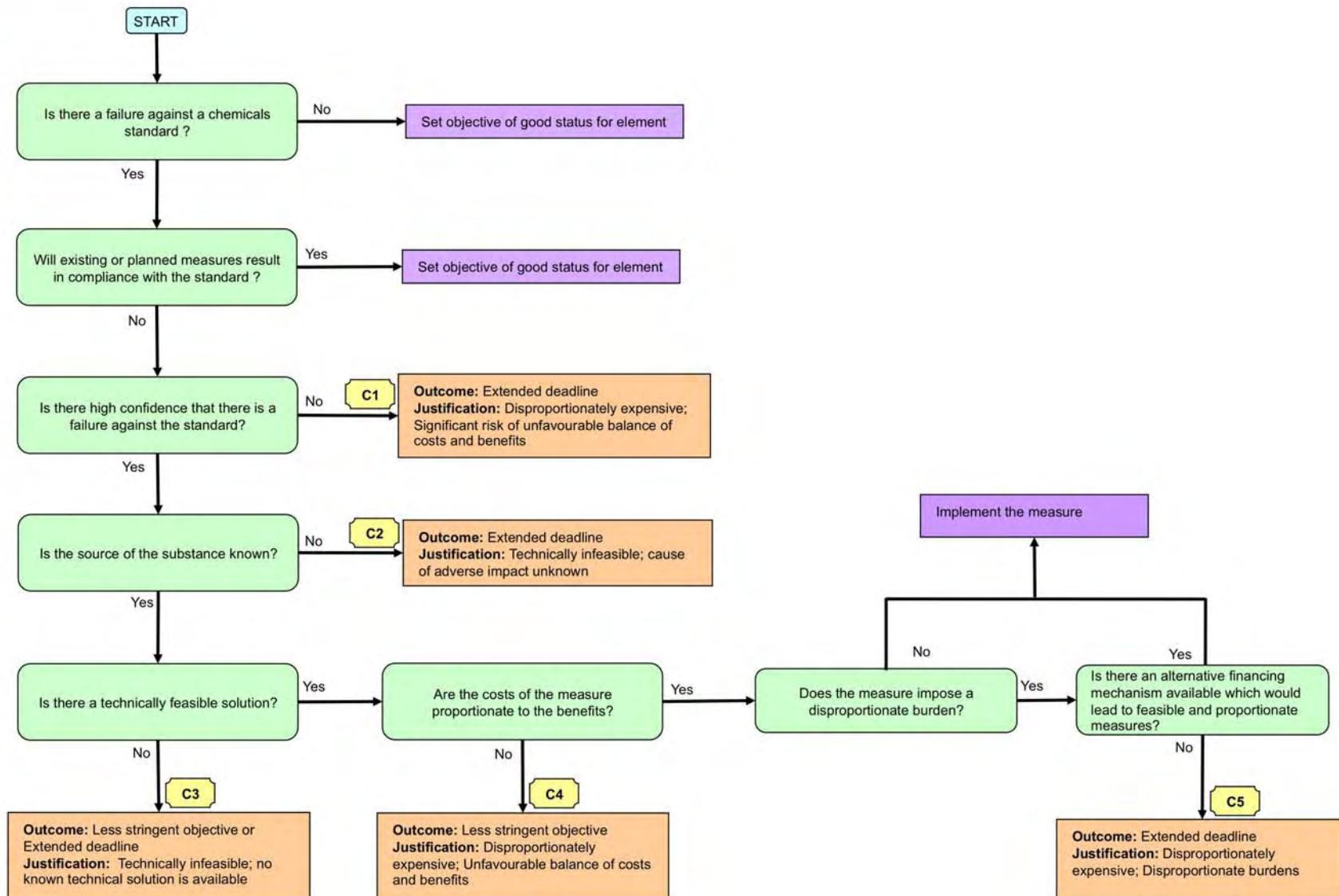
The WFD allows for the consideration of bioavailability when assessing monitored metal concentrations against EQS. We have developed biotic ligand models (BLMs) for copper and zinc, which are able to estimate the fraction of dissolved metal concentrations in freshwater that is biologically relevant, i.e. able to exert toxic effects, based on physico-chemical parameters. We have assessed our monitoring data for copper and zinc using the BLMs and as a result have 3 classes of compliance for these substances:

- Compliant with the EQS based on face value monitoring data, in which case we have assigned a predicted outcome of “good” by 2015;
- Compliant with the EQS based on bioavailable fraction, in which case we have assigned a predicted outcome of “good” by 2015 on the basis that prevailing physiochemical conditions protect against risk to biology.
- Non-compliant with EQS based on bioavailable fraction (and hence, face-value data), in which case we have extended the deadline for achieving “good” to 2027. In the interim period, investigations into sources will be undertaken in order to identify appropriate measures for implementation in subsequent planning cycles.

Future river basin management planning cycles

Work carried out in during the first river basin management planning cycle should deliver some improvement in chemical status. It should also identify cost effective, proportionate and sustainable measures for implementation in the second planning cycle, or provide robust evidence to support less stringent objectives on the grounds of technical feasibility or disproportionate cost.

Decision tree for
PHS, PS and SP



Reference	C1a
Element predicted not to achieve good by 2015	Priority substances, priority hazardous substances and specific pollutants
Reason for failure	Unknown - uncertain there is a failure / impact
Alternative objective	Extended Deadline
Reason for alternative objective	Disproportionately expensive: significant risk of unfavourable balance of costs and benefits
Justification for alternative objective	
<p>The water body is currently non-compliant with the EQS, but with low confidence of failure</p> <p>For over 20 years we have routinely monitored surface waters for chemical parameters listed in a range of national and European legislation (including for example, those chemicals specified in the Dangerous Substances and Freshwater Fish Directives). The Environmental Quality Standards Directive (2008/105/EC) introduces new or more stringent standards for many substances. In some cases where a new standard has been introduced, we have not previously monitored surface waters for these substances – our monitoring programme is targeted where risk is considered to be highest. Similarly where a more stringent standard has been introduced our analysis may have been at a higher limit of detection than would now be required to assess compliance with the increasingly stringent standards. While we have adapted our monitoring programme to take account of the new standards, there is sometimes insufficient monitoring data to assess compliance with high confidence. This will be addressed as additional monitoring data becomes available.</p> <p>For water bodies which are currently non-compliant with low confidence of failure, our priority in the first cycle will be to carry out further investigation to confirm the situation and identify sources and additional potential measures. To identify measures until the failure is confirmed would mean that there is a significant risk of wasted investment. This is considered disproportionately costly given the high possibility that such measures would not confer any additional environmental benefit.</p>	
Investigation type	
Investigate to confirm failure and/or impact	
Example of investigation	
Additional monitoring or modelling (e.g. using SIMCAT models) to confirm failure against the standard with high confidence. Where an EQS failure is confirmed with high confidence, the significance of various sources can then be assessed in order to identify and apportion causes of failure. This will allow appropriate measures to be targeted for implementation in this or subsequent river basin management planning cycles.	

Possible future measures

Possible future measures will depend on the substance in question, confirmation of failure against the standard and identification of sources that contribute to the failure. Measures which could be appropriate for individual substances are set out in national pollution reduction plans (PRPs) for all the priority and priority hazardous substances and 6 specific pollutants. Measures may include control at source (e.g. through additional marketing and use restrictions); additional regulatory controls on point sources, including sewage treatment works, industrial emissions and action to address discharges from abandoned mines; actions to address diffuse sources, e.g. pollution prevention (through local education campaigns, voluntary initiatives and the adoption of best practice methodologies), extension of schemes such as England Catchment Sensitive Farming Delivery Initiative and the Voluntary Initiative for pesticides, and additional controls on dredging to reduce releases of TBT from contaminated sediments.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Measures that are likely to be technically infeasible or disproportionately expensive will depend on the substance in question and the source of that substance. The PRPs include an evaluation of the technical feasibility and costs associated with available and potential measures, which is based a range of supporting information, e.g. the preliminary cost effectiveness analysis (pCEA).

This illustrates that some measures will be more useful in the first river basin management planning cycle than others. For example, it is feasible and relatively cost effective to investigate the concentration of lead in leachate from landfill sites and remediate where necessary (estimated at £5 million per tonne lead removed); it is neither feasible nor cost effective to replace all domestic lead pipes to prevent leaching into the sewerage system (£54 – 136 million per tonne lead removed). It should also be noted that some substances, e.g. cadmium are naturally occurring and complete elimination from all surface waters will not be possible. Furthermore, in some exceptional circumstances where water bodies are severely impacted by a legacy of metal mining, it may be technically infeasible or disproportionately expensive to restore metal concentrations to a level that approaches the standard due to the nature of the metal sources.

Reference	C2a
Element predicted not to achieve good by 2015	Priority substances, priority hazardous substances and specific pollutants
Reason for failure	Unknown - reasons for failure unknown
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
The source of the substance causing the failure is unknown	
<p>Chemicals are released into the environment from a wide range of sources including urban and agricultural land use, industry, domestic release to sewers, mines, ports and harbours. For water bodies where the sources of the pollution is not known, or not known in sufficient detail to be able to identify and appraise measures (including identification of the site or activity who is responsible for causing the pollution), it is technically infeasible to identify and implement additional measures, and achieve the objective by 2015.</p>	
<p>For over 20 years we have routinely (usually annually) assessed compliance with water quality standards (such as those for the Dangerous Substances and Freshwater Fish Directives) and tried to identify the activities releasing the substances and causing the failure of the standards. We use a number of different approaches to do this including routine and investigative monitoring, modelling, and site inspections. Despite this, the sources of some of these old failures remains unknown.</p>	
<p>In 2008 and 2009 we assessed compliance with the new standards for priority substances, priority hazardous substances and specific pollutants. Where these substances did not have standards under the old directives, or where the standards for the water framework directive are tighter than before, we have identified many new failures.</p>	
<p>We have produced and consulted on (in conjunction with the draft river basin management plans) national pollution reduction plans for all the priority and priority hazardous substances and 6 specific pollutants. These identify potential point, diffuse and historical sources of these substances but their significance varies locally and in the time available, we have not been able to identify specific sources and their relative contributions for each of the new failures. An extended deadline for achieving good ecological and/or chemical status is therefore required.</p>	
Investigation type	
Investigate cause of failure	

Example of investigation

Potential point, diffuse and historical sources are set out in national pollution reduction plans (PRPs) for all the priority and priority hazardous substances and 6 specific pollutants. The significance of these and any locally relevant sources will be assessed through additional monitoring or modelling (e.g. using SIMCAT models) to identify and apportion causes of failure. This will allow appropriate measures to be targeted for implementation in this or subsequent river basin management planning cycles.

Possible future measures

Possible future measures will depend on the substance in question and the sources that contribute to the failure. Measures which could be appropriate for individual substances are set out in the PRPs. Measures may include control at source (e.g. through additional marketing and use restrictions); additional regulatory controls on point sources, including sewage treatment works, industrial emissions and action to address discharges from abandoned mines; actions to address diffuse sources, e.g. pollution prevention (through local education campaigns, voluntary initiatives and the adoption of best practice methodologies), extension of schemes such as England Catchment Sensitive Farming Delivery Initiative and the Voluntary Initiative for pesticides, and additional controls on dredging to reduce releases of TBT from contaminated sediments.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

"Measures that are likely to be technically infeasible or disproportionately expensive will depend on the substance in question and the source of that substance. The PRPs include an evaluation of the technical feasibility and costs associated with available and potential measures, which is based a range of supporting information, e.g. the preliminary cost effectiveness analysis (pCEA).

This illustrates that some measures will be more useful in the first river basin management planning cycle than others. For example, it is feasible and relatively cost effective to investigate the concentration of lead in leachate from landfill sites and remediate where necessary (estimated at £5 million per tonne lead removed); it is neither feasible nor cost effective to replace all domestic lead pipes to prevent leaching into the sewerage system (£54 – 136 million per tonne lead removed). It should also be noted that some substances, e.g. cadmium are naturally occurring and complete elimination from all surface waters will not be possible. Furthermore, in some exceptional circumstances where water bodies are severely impacted by a legacy of metal mining, it may be technically infeasible or disproportionately expensive to restore metal concentrations to a level that approaches the standard due to the nature of the metal sources.

Reference	C3a
Element predicted not to achieve good by 2015	Priority substances, priority hazardous substances and specific pollutants
Reason for failure	<p>Confirmed - point source - trade/industry EPR (non-water industry)</p> <p>Confirmed - natural mineralisation</p> <p>Confirmed - disused mines point and/or diffuse source</p> <p>Confirmed - diffuse source - contaminated land (incl. landfill)</p> <p>Confirmed - point/diffuse source - disused mines</p>
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: no known technical solution
Justification for alternative objective	
<p>The water body is non-compliant with the EQS, but there is no technically feasible solution</p> <p>This applies where a water body is non-compliant with the EQS, with high confidence of failure, the source of the substance is known, but there is currently no known technical solution available to mitigate the source of pollution.</p> <p>For example, in one case of non-compliance with the EQS for iron, the reason for failure has been identified as natural mineralisation on the basis that there is a naturally high concentration of iron in the groundwater source discharging to the surface water body. There are no technically feasible means of removing the iron. It may be that it will never be possible to achieve the EQS in this water body, in which case when we review this plan in 2015 we will set a less stringent objective.</p> <p>Alternative objectives have also been set on this basis where landfill sites or trade discharges have been identified as the cause of EQS failures, but where appropriate treatment solutions must be developed. In these cases, our priority in the first cycle is to work with the relevant sectors to identify and develop cost-effective, sustainable, long-term solutions which can be implemented within the second cycle of river basin management planning. We have initiated this process through the consultation on our pollution reduction plans (PRPs).</p> <p>In most cases, alternative objectives have been set on the basis of this justification where discharges from abandoned mines have been confirmed as the cause of EQS failures for metals. At least 164 river catchments in England and Wales are known to be impacted by abandoned mines and are failing to achieve good status.</p>	

Although remediation of such discharges has been possible, for example at Wheal Jane in Cornwall, the treatment system consists of chemical dosing which is costly, energy intensive and unsustainable in the long-term. Furthermore, although this technology is effective for treating most point source discharges of minewaters, disused mines cause a range of environmental impacts. Site-specific solutions must be developed for both diffuse and point sources, and it takes several years to design and obtain permissions before they can be implemented. Sustainable treatment methods for non-coal minewaters are less well established than for coal minewaters.

Recent trials of innovative technologies have indicated that passive treatment may be viable and cost effective. However, it is not known whether this type of technology will be capable of delivering compliance with EQSs in all cases. Therefore our approach in the first planning cycle is to undertake additional investigations and research, in order to identify and pilot these technologies. This means that standards for metals in water bodies affected by mine water discharges may not be achieved by 2015. However this work will allow us to develop sustainable and long-term solutions which can be implemented within subsequent cycles of river basin management planning. Solutions will be developed to address a range of mine water impacts, leading to maximum environmental benefit when implemented. Furthermore the Impact Assessment of the EQS Directive (Defra, 2009) indicates that this phased approach will significantly reduce the costs of meeting standards for metals in these water bodies, from an estimated £585 million to an estimated £374 million (present value).

Investigation type

Investigate feasible measures

Example of investigation

Initiatives such as the Welsh Metal Mines Strategy are piloting novel treatment technologies for discharges from abandoned mines. Where other sites or activities have been identified as a source of metals or other substances, our priority in the first cycle is to work with the relevant sectors to identify and develop cost-effective, sustainable, long-term solutions which can be implemented within the second cycle of river basin management planning. We have initiated this process through the consultation on our pollution reduction plans (PRPs).

Possible future measures

The outputs from the investigations outlined above will help identify technically feasible measures for implementation in subsequent river basin management planning cycles. Measures which could be appropriate for individual substances are set out in the PRPs but could include control at source, additional controls on point sources (particularly discharges from abandoned mines), and actions to address diffuse sources.

Possible future measures will be implemented where the risk from a given sector, site or activity is confirmed. For many water bodies, this will involve action on sewage discharges and other point sources and management of dredging practices. For this reason, the water industry will be carrying out a programme of investigation which will include an appraisal of the relative merits of a range of control measures and it may be for example, that control at source (i.e. marketing and use restrictions) will be

more appropriate for some substances. Similarly the ports and harbours authorities are developing a national guidance framework on dredging and the disposal of dredgings, which will help identify technically feasible measures for implementation in subsequent river basin management planning cycles. It should be noted that new solutions identified or developed as a result of any programme of investigation will be subject to considerations of disproportionate cost.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Measures that are likely to be technically infeasible or disproportionately expensive will depend on the substance in question and the source of that substance. The PRPs include an evaluation of the technical feasibility and costs associated with available and potential measures, which is based a range of supporting information, e.g. the preliminary cost effectiveness analysis (pCEA, Defra 2007).

This illustrates that some measures will be more useful in the first river basin management planning cycle than others. For example, it is feasible and relatively cost effective to investigate the concentration of lead in leachate from landfill sites and remediate where necessary (estimated at £5 million per tonne lead removed); it is neither feasible nor cost effective to replace all domestic lead pipes to prevent leaching into the sewerage system (£54 – 136 million per tonne lead removed).

It should be noted that some substances, e.g. cadmium are naturally occurring and complete elimination from all surface waters will not be possible. Where this is confirmed, we may decide to set less stringent objectives. We have received qualitative evidence from industry that some priority substances are present in the raw materials used in industrial processes, for example mercury is often present in caustic soda. It may not be possible to use alternative materials in some manufacturing processes, therefore any future measures would have to focus on end of pipe treatment – if technically feasible and not disproportionately costly. Similarly, cadmium is sometimes present in high concentrations in coal, but security of energy sources is of national importance therefore it may not be technically feasible to reject coal from cadmium-rich ore.

In some exceptional circumstances, water bodies may be so severely impacted (e.g. for some rivers polluted through a legacy of metal mining) that it may be technically infeasible or disproportionately expensive to restore metal concentrations to a level that approaches the standard due to the nature of the metal sources.

Reference	C4a
Element predicted not to achieve good by 2015	Priority substances, priority hazardous substances and specific pollutants
Reason for failure	<p>Confirmed - diffuse source - mixed urban run-off</p> <p>Confirmed - point source - water industry sewage works</p> <p>Suspected - point source - water industry sewage works</p> <p>Suspected - diffuse source - contaminated sediments</p>
Alternative objective	Extended deadline
Reason for alternative objective	Disproportionately expensive: unfavourable balance of costs and benefits
Justification for alternative objective	
The water body is non-compliant with the EQS, but the costs of the measures are not proportionate to the benefits	
<p>In a very limited number of cases where a water body fails to achieve the EQS for TBT, technically feasible measures are available but an alternative objective has been set because the costs of the measures are currently considered to be disproportionate to the benefits.</p> <p>Although most uses of TBT are banned in the EU, non-compliance with the EQS remains due to historic contamination in sediments. TBT may be present in imported textiles and treated timber and is present as an impurity in organotin compounds e.g. those present in PVC. There are numerous potential sources of TBT to the environment, many of which subsequently emerge at sewage treatment works.</p> <p>The measures that would address these sources in the first planning cycle include a ban on the marketing and use of TBT-treated timber, requirements for special storage arrangements for TBT treated wood, a restriction on the use of dibutyltin stabilisers in PVC or a change to building regulation to ban the use of articles containing TBT above trace levels in new buildings where the TBT may be released to water. Without an accurate assessment of the significance of these sources and the environmental benefit that would arise from addressing them, it would be disproportionately costly to proceed with these measures.</p> <p>An alternative option would require improved end-of-pipe treatment at sewage treatment works. The water industry has continued to improve effluent treatment in order to meet the requirements of the Dangerous Substances Directive and many discharges have consented limits for TBT and other substances. However, the new EQS for TBT is 100 times more stringent than the previous EQS and it is likely that in</p>	

some cases, effluent treatment will have to be upgraded further. In the absence of evidence on the removal efficacy of various treatment technologies, tertiary treatment with sand filters and granular activated carbon is considered the most effective treatment. However the preliminary cost effectiveness analysis (pCEA, Defra, 2007) considered that the immediate requirement of sand filters and GAC at all STW would be disproportionately costly on the basis of very large costs and unknown or limited benefits. Furthermore, it would be premature to require improved treatment given:

- the impact that other regulatory drivers will have on the sources of chemicals to the sewerage network from domestic, industrial and diffuse sources in the forthcoming years
- uncertainties over which sewage treatment works may need improvement given the controls currently in place or to be introduced and, hence, the technologies (secondary treatment, tertiary treatment or some other action) that may be required, and
- the large number of sewage treatment works that have to be assessed in relation to the above.

The pCEA recommended that the impact of current and planned measures should be allowed to take effect before additional measures are considered. Therefore under PR09, the water industry will carry out a programme of investigation to identify those STW that are at risk of causing non-compliance with WFD objectives for chemicals. They will also investigate the efficacy of various treatment technologies and carry our selected catchment investigations. This will allow a full range of options to be appraised where a risk is confirmed.

As a general point, if it is considered necessary and feasible to upgrade effluent treatment at a specific STW, the appropriate scheme may be proposed through the AMP process. The cost would be considered as part of this process and cost-effective schemes would proceed. There have been no instances where a local or site-specific case could be made for proceeding with schemes to achieve the requirements of the EQS Directive through PR09, due to the uncertainties outlined above.

In terms of addressing the risk from contaminated sediments: the Impact Assessment for the EQS Directive (Defra, 2009) estimated that to achieve the EQS for TBT by 2015, measures relating to capital and maintenance dredging would result in annual costs of £185 million (based on current practices). By phasing implementation through the setting of alternative objectives, further work could be carried out to assess the cost-benefit of alternative solutions. This would result in annual costs of £35 million.

Investigation type

Cost / benefit assessment where the case for progressing a measure has yet to be confirmed

Example of investigation

Under PR09, the water industry will carry out a programme of investigation to identify those STW that are at risk of causing non-compliance with WFD objectives for chemicals. They will also investigate the efficacy of various treatment technologies and carry our selected catchment investigations. This will allow a full range of options

to be appraised where a risk is confirmed. We are hoping to carry out similar programmes of investigation with other sectors. Cost / benefit assessments will be based on site-specific considerations.

Possible future measures

Possible future measures will depend on the outputs of any cost / benefit assessments carried out. Measures which could be appropriate for individual substances are set out in the PRPs but could include control at source, additional controls on point sources and actions to address diffuse sources. For TBT, this may mean a ban on the marketing and use of TBT-treated timber, requirements for special storage arrangements for timber treated wood, a restriction on the use of dibutyltin stabilisers in PVC (this option is currently being explored at the EU level), a change to building regulation to ban the use of articles containing TBT above trace levels or additional effluent treatment at STW. It may be that measures which are currently considered disproportionately costly in relation to environmental benefit may become more viable options if technology developments or market forces result in a more favourable balance of costs and benefits.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Measures that are likely to be technically infeasible or disproportionately expensive will depend on the substance in question and the source of that substance. The PRPs include an evaluation of the technical feasibility and costs associated with available and potential measures, which is based a range of supporting information, e.g. the preliminary cost effectiveness analysis (pCEA).

This illustrates that some measures will be more useful in the first river basin management planning cycle than others. For example, it is feasible and relatively cost effective to investigate the concentration of lead in leachate from landfill sites and remediate where necessary (estimated at £5 million per tonne lead removed); it is neither feasible nor cost effective to replace all domestic lead pipes to prevent leaching into the sewerage system (£54 – 136 million per tonne lead removed). It should also be noted that some substances, e.g. cadmium are naturally occurring and complete elimination from all surface waters will not be possible. Furthermore, in some exceptional circumstances where water bodies are severely impacted by a legacy of metal mining, metal concentrations are so high that it is unlikely that any treatment will restore concentrations to a level that approaches the standard.

E11 Surface water drinking water protection planning

Water bodies from which drinking water is abstracted have been designated as Drinking Water Protected Areas (DrWPAs). The objectives for such areas are recorded in Annex D.

Pressures affecting surface water DrWPAs

The main pressures affecting surface water DrWPAs are pesticides, nutrients and organic matter from agriculture, although risks also exist from mining, transport, industry and the urban amenity sector. These pollutants most commonly enter watercourses through 'diffuse' pathways, such as runoff from fields or hard surfaces after application or rainfall; or in the case of organic matter, through degradation of drainage channels in peat.

Compliance status

There are currently 145 DrWPAs at risk in England and Wales. For full details see Annex D.

Development of measures

For **point source discharges** we use all existing permitting and other relevant regimes that are applicable. The main examples are Water Resources Act consents and Environmental Permitting Regulations permits.

For **non-deliberate, or diffuse inputs** of pollutants the controls are both regulatory and advisory and are delivered by the Environment Agency or through partnerships. The main measures are anti-pollution works notices, Nitrate Vulnerable Zone action plans, codes of good practice, local agreements and partnerships, the pesticides Voluntary Initiative, England Catchment Sensitive Farming Delivery Initiative and ad-hoc delivery of pollution prevention advice.

Consideration of DrWPAs will be made when planning and delivering these activities.

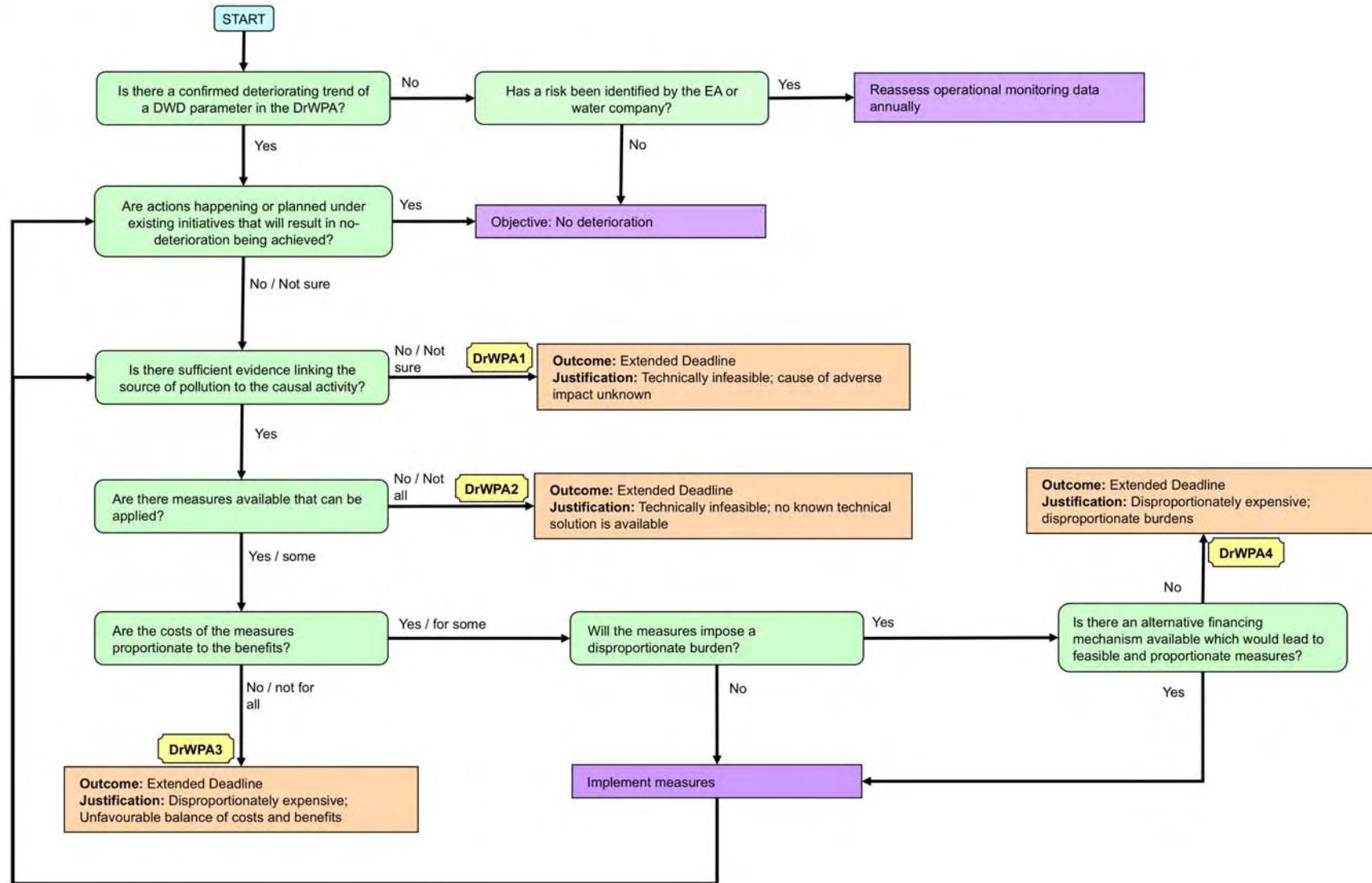
Where deterioration of DrWPAs can be confirmed with high confidence and existing measures are judged to be insufficient, Safeguard Zones may be established to target measures and gather information on the sources of pollution. Detailed Catchment Action Plans will be drawn up in Safeguard Zones to establish the necessary course of action.

The Environment Agency will seek to ensure the necessary environmental monitoring is undertaken to inform the designation of such areas and the programmes of measures needed.

Justification of extended deadlines

In some cases, although deterioration of water quality in a DrWPA can be confirmed, no measure can yet be applied because of the lack of understanding about the source or pathway of the pollutant. Extended deadlines for implementing measures have therefore been applied to 15 DrWPAs on the basis that measures are currently technically infeasible as the cause of the adverse impact is unknown. This decision process is outlined in the surface water DrWPA decision tree below and more detailed justification and supporting information is provided in the accompanying table.

Decision tree for surface water
Drinking Water Protected Areas
(DrWPAs)



Reference	DrWPA1a
Element predicted not to achieve good by 2015	Drinking Water Protected Areas
Reason for failure	Suspected - diffuse source agricultural
Alternative objective	Extended deadline
Reason for alternative objective	Technically infeasible: cause of adverse impact unknown
Justification for alternative objective	
<p>The specific source (location, specific activity and/or pathway) of the pollution is not known</p> <p>Metaldehyde, Colour and Ammonia are predicted to cause failure of Article 7 objectives with high confidence. Although safeguard zones have been proposed for Metaldehyde and Colour issues elsewhere, in these instances it is not possible without further investigations. The types of measures used for addressing these parameters are likely to be predominantly advice-based and will therefore require some level of targeting in order to be effective. While effective targeting of measures may not require individual contributors to be identified, it does require a degree of understanding of land use patterns within the catchment of the abstraction, and the interrelationships between the various source(s) and their transport media.</p> <p>Once investigations have yielded the necessary information, the Environment Agency will delineate Safeguard Zones and develop Catchment Action Plans within the first cycle.</p>	
Investigation type	
Investigate source of failure	
Example of investigation	
<p>Where the source of the issue cannot be sufficiently precisely identified as described above, there will be a number of ways in which to provide the necessary information. The most likely way forward will be to undertake both a desk-based exercise, using GIS mapping techniques and/or source apportionment modelling, in tandem with a bespoke investigative environmental monitoring programme.</p>	
Possible future measures	
<p>Farm visits, local seminars and workshops, text messaging and leaflet distribution are all communication media that can be utilised to disseminate best practice material and information on the relevant regulatory requirements. There are a variety of mechanisms available for such activity. Where such voluntary measures are ineffective, works notices may be served if appropriate, or Water Protection Zone (WPZ) orders may be sought to introduce additional statutory measures such as, for example, localised substance restrictions or mandatory limits on stocking densities or</p>	

fertiliser application.

Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive

Not relevant

E12 Identification and appraisal of M4 measures

In developing the local measures for the North West River Basin District it has been essential to work closely with Environment Agency staff and stakeholders.

We developed the first list of local measures for the draft river basin management plan by running a series of catchment-based one day workshops. We invited a range of stakeholders and Environment Agency staff to these workshops that aimed to provide the attendees with:

- an understanding of the Water Framework Directive in a local context and what it can realistically deliver in the first cycle
- an understanding of where we think the local environmental problems for the water environment are
- an understanding of what ‘national’ measures will provide in terms of environmental benefits, and an understanding of ‘the gap’
- an opportunity to highlight the opportunities for local measures, and to prioritise and target them
- stakeholder views on targeted local measures to address ‘the gap’
- an agreed list of volunteers for delivery
- any broad funding requirements

These workshops were targeted at key local co-deliverers of M4 measures and those we already engage with, either on Water Framework Directive or through existing groups. The local measures collected in these workshops were assessed by Environment Agency staff. We also identified those measures that would benefit the water environment at a river basin district scale.

These local measures were included in the draft river basin management plan consultation document. Following the consultation of the draft river basin management plan, we have been able to include additional local measures identified by respondents. Unfortunately, we haven’t been able to include all the suggestions as some measures were not well enough defined or sufficiently funded. However, we will work in partnership with the North West Liaison Panel and other organisations to prioritise and review these measures.



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex F: Mechanisms for action

Annex F: Mechanisms for action

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F.1 Introduction

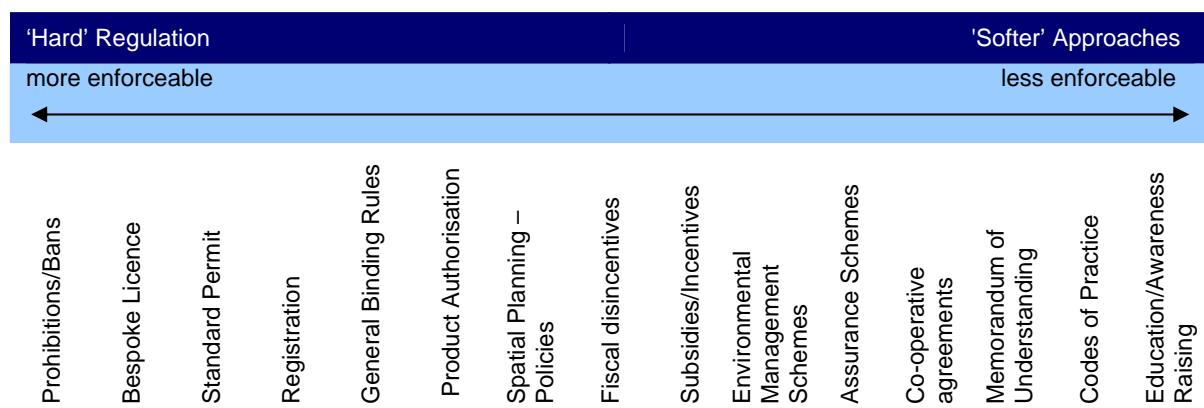
To achieve the objectives on the ground actions (also known as measures) need to be set out along with the mechanism that can be used to carry out that action.

A 'mechanism' means the policy, legal and financial tools that are used to bring about particular actions. Mechanisms have often been put in place to implement European directives, which have been established to deal with problems that exist in common with other countries in the European Union. Others have been set up to manage the way that particular problems occur in England and Wales.

For this plan 'measures' mean the on the ground actions that apply mechanisms, at a particular place or to deal with a particular issue. So, for example, a legislative mechanism enables a particular permit that controls emissions to be put in place, and this is what protects or improves the environment.

A range of mechanisms can be used, from hard regulation to softer approaches, which together can be very successful in achieving the outcomes needed for protecting and improving the water environment. Figure F.1 illustrates the types of approaches:

Figure F.1: Types of approaches for mechanisms



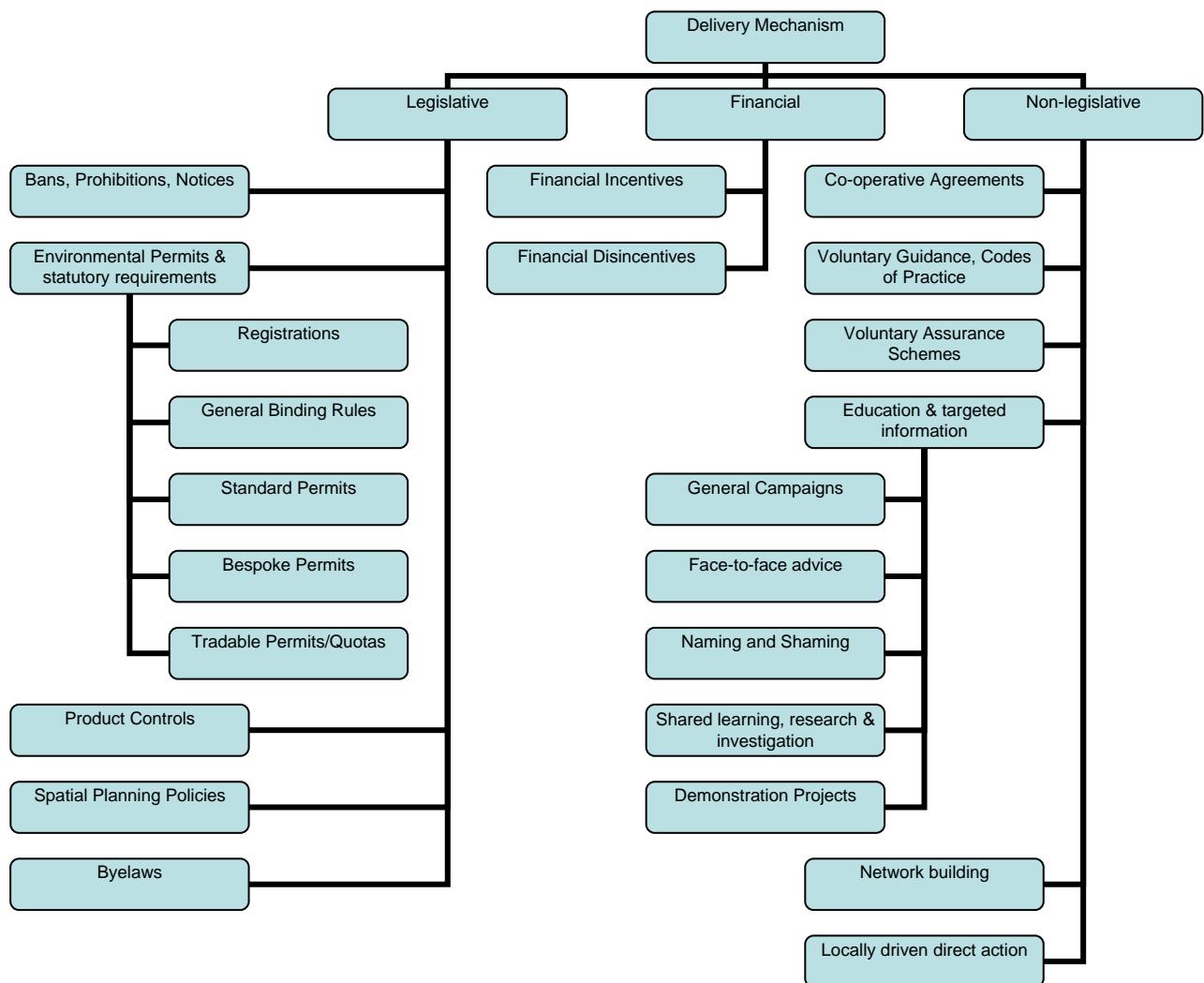
These mechanisms are already used to apply many of the so-called 'basic' measures to protect waters and the dependent ecology. These measures have helped achieve greatly improved standards, and represent a considerable amount of activity and investment. They need to continue in order to prevent deterioration.

Arrangements are also in place to make further use of these mechanisms, which will happen irrespective of the Water Framework Directive, and to establish further, 'supplementary' measures where these are needed to help achieve the Water Framework Directive's objectives.

- This annex provides a general description of mechanisms that are available. It notes how these mechanisms can be used to put new actions in place where more needs to be done to achieve the Water Framework Directive's objectives. It also considers where new mechanisms might be available in the future to support actions in place.

Figure F.2 shows how different mechanisms may be related to each other.

Figure F.2: A summary of types of mechanisms



Annex C summarises the particular actions that will be put in place in the North West River Basin District to help meet the Directive's objectives.

Annex E describes how the available mechanisms have been reviewed to identify the most suitable actions to deal with the pressures in the River Basin District and meet the objectives.

Other plans and programmes

As well as distinct mechanisms, this annex notes the various plans, programmes and strategies of the Environment Agency and other organisations that can be used to promote actions. Annex J (Other plans and processes) discusses in further detail how river basin planning and management can be better integrated with these at a strategic, policy and operational level so that multiple-benefits and sustainable outcomes can be achieved. It also sets out information to other public bodies as co-deliverers on what the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 require them to do.

In particular it looks at:

- Building, town and country planning and regeneration

- Rural planning and agriculture
- Forestry management
- Flood and coastal erosion risk management
- Marine issues

F.2 Implementing European Union legislation for protecting water

This section describes how European directives have been implemented in England and Wales.

i) Bathing Water Directive

The Bathing Water Directive (76/160/EEC) sets out microbiological and chemical standards to protect public health at designated bathing waters (coastal and inland). Since its implementation European Union member states have monitored bathing waters throughout the bathing season in order to assess and report water quality against the mandatory and guideline standards in the Bathing Water Directive.

A revised Bathing Water Directive (2006/7/EC) is now in force but some member states, including the UK, will continue reporting under the current Directive until 2015. The revised Bathing Water Directive (2006/7/EC) includes tighter microbiological standards and a requirement to provide information about bathing waters on signs at beaches and online. The revised Directive classifies waters into four categories- excellent, good, sufficient and poor. Apart from limited exceptions, bathing waters must be classified as at least 'sufficient' standard by 2015.

How this Directive is implemented

Both directives are implemented through the Bathing Water Regulations 2008. The current Directive is implemented by the Environment Agency through the designation of bathing waters under the Bathing Waters (Classification) Regulations, Notice and Direction 1991. The revised Directive is implemented through the Bathing Water Regulations 2008. The Environment Agency is the competent authority under the Regulations.

These regulations are supported by other mechanisms that control pollution from particular points or from more widespread, or diffuse, sources (see F.6 and F.7 below).

There have been significant improvements in bathing water quality by improving water company discharges from sewage works and the sewerage infrastructure. These improvements have been funded through the periodic review of water companies' spending, which includes environmental investments.

Annex D shows for the location of designated bathing waters in the North West River Basin District, their compliance with the repealed Directive's objectives and their predicted compliance under the revised Directive. The revised Directive was transposed into domestic law in 2008 and the requirements are being phased in during the period to 2015.

You can find further information on the Environment Agency's website at:
<http://www.environment-agency.gov.uk/business/regulation/107017.aspx>.

ii) Biocidal Products Directive

The Directive 98/8/EC on biocidal products concerns substances that are used to destroy or prevent the action of harmful organisms by chemical or biological means, and has three main objectives:

- To harmonise the European market for biocidal products, their active substances and product authorisation.
- To provide a high level of protection for people, animals and the environment from the use of biocidal products, through risk assessment. This requires the submission and evaluation of data on chemistry of the substances concerned, their toxicity to humans, and their toxicity and fate in the environment.
- To ensure products are sufficiently effective against the target species.

How this Directive is implemented

The Health and Safety Executive is the competent authority for the Directive, which is implemented through the Biocidal Products Regulations 2001 (as amended). The regulations are enforced by both the Health and Safety Executive and local authority inspectors and trading standards officers.

There are 23 different biocidal product types covering disinfectants, preservatives, pest control and speciality biocides such as antifouling products and embalming and taxidermist fluids.

You can find further information on the Health and Safety Executive's website -
<http://www.hse.gov.uk/biocides/bpd/index.htm>

iii) Birds Directive

The Council Directive on the conservation of wild birds (79/409/EEC) aims to control the hunting and killing of wild birds, and to protect their eggs and nests. European Union member states must also preserve, maintain or re-establish habitats (Special Protection Areas) to maintain the population of all species.

How this Directive is implemented

The Directive is implemented through the Wildlife and Countryside Act 1981 and the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). These are supported by a range of mechanisms, including:

- Direct action by Natural England, or by serving management notices or implementing management agreements under the Wildlife and Countryside Act 1981 to preserve, maintain and re-establish habitats and related environmental conditions for wild birds.
- This may be directed by Coastal Habitat Management Plans (CHaMPs) in some coastal sites.
- Conservation Regulations 1994 (Natural Habitats & Conservation) through designation of Special Protection Areas. There are seven SPAs in the North West River Basin District (see annex D).

You can find further information on the Joint Nature Conservation Committee's website at:
<http://www.jncc.gov.uk/page-1373>

iv) Dangerous Substances Directive

The Directive 2006/11/EC (replacing repealed Directive 76/464/EEC) on pollution caused by certain substances discharged into the water environment aims to reduce pollution of surface waters by these dangerous substances, which have been selected mainly on the basis of how toxic or persistent they are, including how much they may accumulate in organisms.

The Directive requires the control of discharges that are liable to contain substances defined in List I or List II of the Dangerous Substances Directive and any other substances determined as hazardous by the Environment Agency.

- List I covers those substances that are particularly toxic, persistent and accumulate in the environment. Actions must be introduced to eliminate pollution by these substances.
- List II covers substances whose effects are less severe. Actions must be introduced to reduce pollution by these substances.

The Directive has a number of daughter directives which set emission limit values and quality objectives, including:

- Directive 82/176/EEC concerning mercury discharged by the chloralkali electrolysis industry;
- Directive 84/156/EEC concerning mercury discharged by other industrial sectors;
- Directive 83/513/EEC concerning cadmium discharges;
- Directive 84/491/EEC concerning hexachlorocyclohexane discharges;
- Directive 86/280/EEC concerning DDT, carbon tetrachloride and pentachlorophenol;
- Directive 88/347/EEC concerning aldrin, dieldrin, endrin, isodrin, hexachlorobenzene, hexachlorobutadiene and chloroform;
- Directive 90/415/EEC concerning 1,2-dichloroethane, trichloroethane, perchloroethane and trichlorobenzene.

Article 6 (List I substances) of the Dangerous Substances Directive was repealed on entry into force of the Water Framework Directive. The remainder of the Directive will be fully repealed in 2013, after which controls under the Water Framework Directive will be used to provide at least the same level of protection.

How this Directive is implemented

The Environmental Quality Standards for List I substances are statutory standards under:

- The Surface Waters (Dangerous Substances) (Classification) Regulations 1989 (SI 1989/2286) and the Surface Waters (Dangerous Substances) Direction 1990;
- The Surface Waters (Dangerous Substances) (Classification) Regulations 1998 (SI 1992/337) and the Surface Waters (Dangerous Substances) Direction 1993.

National Environmental Quality Standards for Candidate List I and List II substances are set under:

- The Surface Waters (Dangerous Substances) (Classification) Regulation 1997 (SI 1997/2560);
- The Surface Waters (Dangerous Substances) (Classification) Regulations (SI 1998/389).

Non-statutory Environmental Quality Standards are set in the Department of the Environment Circular 7/89 "The Implementation of European Community Directives on Pollution caused by Certain Dangerous Substances discharged to the Aquatic Environment".

You can find further information on the Environment Agency's website at:
<http://www.environment-agency.gov.uk/business/regulation/31937.aspx>

v) Drinking Water Directive

The Drinking Water Directive (80/778/EEC), as amended by Directive (98/83/EC), aims to protect the health of consumers and make sure that the water is wholesome and clean. It sets standards for the quality of water intended for drinking or for use in food and drink manufacture to protect human health. A total of 48 microbiological and chemical water quality standards must be complied with and these are monitored mainly at the tap inside private and public premises. EU Member Countries can include additional and higher standards in their national regulations that implement the Directive, but must not set lower standards. This Directive also helps to protect the environment, as sources of drinking water must be free enough from contamination to allow inexpensive water treatment.

How this Directive is implemented

The Directive is implemented by the Drinking Water Inspectorate and water undertakers through the Water Supply (Water Quality) Regulations 2000, as amended and provisions of the Water Industry Act 1991.

These regulations are supported by other mechanisms that control pollution from point and diffuse sources (see F.6 and F.7 below).

There are 199 public supply abstractions in the North West River Basin District.

You can find further information, including data on how drinking water complies with the standards, on the Drinking Water Inspectorate's website at <http://www.dwi.gov.uk/>

vi) The Eel Regulation

The European Commission published Council Regulation 1100/2007 in September 2007, which aims to establish measures for the recovery of the stock of European eel. The Regulation requires Member States to develop and implement Eel Management Plans (EMPs) with the objective of reducing anthropogenic mortalities so as to permit with high probability the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement that would have existed if no anthropogenic influences had impacted the stock.

How this Regulation is implemented

The Environment Agency, on behalf of Defra and the Welsh Assembly Government, have produced 11 Eel Management plans for the ten River Basin Districts in England and Wales plus the cross-border Solway Tweed River Basin District, shared with Scotland. The Environment Agency will implement these Eel Management Plans following their approval by the European Commission during 2009. Each sets out short-term and long-term measures to manage and monitor eel populations within the 11 RBDs. Actions include better regulation of the fishery, removal of barriers to migration, increasing available habitat and reducing the impacts of entrainment. Progress against these measures must be reported to the European Commission triennially from June 2012.

You can find further information on the Defra website at:

<http://www.defra.gov.uk/foodfarm/fisheries/freshwater/fishman.htm>

vii) Environmental Impact Assessment Directive

Under the Environmental Impact Assessment Directive (85/337/EEC), as amended by Council Directive 97/11/EC and by Article 3 of Directive 2003/35/EC (to improve the rights for public participation), before consent is given for certain development projects, such as large-scale industrial or infrastructure projects, an assessment of the effects the development may have on the environment must be made, so that the competent authority that grants consent is aware of these possible consequences.

The developer makes the assessment and presents this in an environmental statement, which is consulted on widely. The environmental statement must identify, describe and assess impacts on people, plants and animals, soil, water, air, climate and the landscape, the built environment and cultural heritage, including how these factors link together. Consenting authorities can then assess whether a proposed development will have significant impacts on water bodies, and whether it may prevent environmental objectives being achieved.

How this Directive is implemented

The Directive is implemented through a number of statutory instruments, covering the consenting procedures for various categories of development, including activities such as forestry and quarrying. Projects that require planning permission are governed by the Town and Country Planning Regulations 1999 (Environmental Impact Assessment) (England and Wales) Regulations, as amended.

Associated mechanisms include:

- Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999;
- Harbour Works Environmental Impact Assessment Regulations 1999;
- Marine Works (Environmental Impact Assessment) Regulations 2007
- Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) Regulations 2007;
- Water Resources (England and Wales) Environmental Impact Assessment Regulations 2003 as amended;

- Uncultivated Land and Semi-natural Areas Environmental Impact Assessment Regulations 2001 (England).

The Environment Agency is consulted on environmental impact assessments for developments that may affect the water environment.

You can find further information on the communities and local government website at:
<http://www.communities.gov.uk/planningandbuilding/planning/sustainabilityenvironmental/environmentalimpactassessment>

viii) Environmental Liability Directive

The Environmental Liability Directive (2004/35/EC) seeks to achieve the prevention and remedying of environmental damage to habitats and species protected under EC law and to species or habitat on a site of special scientific interest for which the site has been notified, damage to water resources and land contamination which presents a threat to human health. It reinforces the polluter pays principle and makes operators financially liable for threats of or actual damage.

How this Directive is implemented

The Directive is implemented through the following regulations:

- The Environmental Damage (Prevention and Remediation) (England) Regulations 2009
- The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009

For which the competent authorities are:

- The Environment Agency, which deals with damage caused by activities that it regulates and all water damage;
- Local authorities, which deal with all land damage and the prevention of damage caused by activities regulated by them;
- Natural England, or Countryside Council for Wales, which deals mainly with damage relating to biodiversity on land;
- The Marine and Fisheries Agency in England, or Welsh Ministers in Wales, which deals with damage relating to biodiversity in marine waters if the damage is not caused by an activity regulated by the Environment Agency.

The regulations apply only to the most serious types of damage:

- damage that would lower the status of a Water Framework Directive water body;
- damage that adversely affects the site integrity of a SSSI or significantly affects the conservation status of a protected species or habitat;
- damage to land that causes a significant risk of adverse effects on human health.

Operators of economic activities are liable to prevent and remediate the damage their activities cause. For water and biodiversity damage the Regulations require much more extensive remediation than under existing legislation

You can find further information on Defra's website at
<http://www.defra.gov.uk/environment/policy/liability/index.htm>

ix) Floods Directive

The European Directive on the Assessment and Management of Flood Risks (2007/60/EC of 23 October 2007, the Floods Directive) is a common framework for Member States to assess the risk of flooding, map its potential impact and plan measures to reduce potential and significant flood risk, with a focus on human health, cultural heritage, the environment and economic activity.

How this Directive is implemented

The Floods Directive came into force on 26 November 2007. The UK and other European Union member states must establish their own legislation to implement the Directive within two years of this date. Defra and the Welsh Assembly Government began their consultation on this (<http://www.official-documents.gov.uk/document/cm75/7582/7582.pdf>) in April 2009, when its draft Flood and Water Bill was published, but may transpose the Directive under section 2(2) of the European Communities Act.

You can find further information on Defra's website at
<http://www.defra.gov.uk/environment/flooding/policy/fwmb/index.htm>

x) Freshwater Fish Directive

The Directive on the quality of fresh waters that need protecting or improving to support fish life (2006/44/EC replacing Directive 78/659/EEC which was repealed) aims to protect and improve running or still waters capable of supporting "indigenous species offering a natural diversity". It protects those fresh water bodies identified by European Union member states as waters suitable for sustaining fish.

It sets physical and chemical water quality objectives for salmonid (salmon and trout) waters and cyprinid (for example, roach, bream, tench and rudd) waters. The Directive will be repealed in 2013 after which controls under the Water Framework Directive will be used to provide at least the same level of protection as the Freshwater Fish Directive.

How this Directive is implemented

This Directive is implemented under the Surface Waters (Fishlife) (Classification) Regulations 1997 as amended and the Surface Waters (Fishlife) Direction 1997 with the Environment Agency as competent authority.

Annex D sets out the freshwater fish waters designated as protected areas in the North West River Basin District and their compliance with the Directive.

You can find further information on Defra's website at:
<http://www.defra.gov.uk/foodfarm/fisheries/index.htm>

and also on the Environment Agency's website at: <http://www.environment-agency.gov.uk/business/regulation/31955.aspx>.

xi) Groundwater Directives

The Directive on protecting groundwater against certain dangerous substances (80/68/EEC) prohibits discharges of particular substances and limits discharges of certain other substances into groundwater.

The Water Framework Directive and a new Directive (2006/118/EC) (on the protection of groundwater against pollution and deterioration, also known as the Groundwater Daughter Directive) was agreed in 2006, and this works alongside the old Groundwater Directive and provides supporting detail to the Water Framework Directive. It will be enacted in England and Wales during 2009. The old Directive will be repealed in December 2013.

The original Groundwater Directive (enacted in Great Britain through the Groundwater Regulations 1998) places controls on two lists of substances. (These Groundwater Directive lists are different from those in the Dangerous Substances Directive). Substances on List 1 are the most toxic and dangerous, whilst substances on List 2 are less dangerous but could still be harmful to groundwater in large amounts.

The 2006 Groundwater Directive replaces Lists 1 and 2 with hazardous substances and non-hazardous pollutants respectively, although the non-hazardous list is much broader than the old List 2 and covers all types of pollutants. The restrictions on these substances are substantially the same for both sets of legislation and are intended to prevent groundwater pollution. The Directives control both deliberate disposals of hazardous/non-hazardous substances, and other activities that might lead to accidental losses.

How these Directives are implemented

Directive 80/68/EEC is implemented by various pieces of legislation, including:

- The Environmental Permitting (England and Wales) Regulations 2007;
- The Water Resources Act 1991 (section 88 Discharge Consents);
- The Groundwater Regulations 1998 as amended.

The implementation of the new Groundwater Directive will initially be via the introduction of 2009 Groundwater Regulations which will repeal the 1998 Groundwater Regulations. Government will then incorporate the requirements in revised Environmental Permitting Regulations in 2010. There will be some minor policy changes but the existing enforcement arrangements will be maintained. Enforcement of groundwater authorisations under the existing regulations is also a part of cross-compliance under the Common Agricultural Policy.

Our Groundwater Protection: Policy and Practice document sets out our general approach on how we plan to deal with activities that pose a risk to groundwater and is available at <http://publications.environment-agency.gov.uk/pdf/GHO1006BLMW-e-e.pdf>

You can find further information on the old Groundwater Directive (80/68/EEC) at <http://www.environment-agency.gov.uk/business/regulation/31881.aspx>

You can find further information on the new Groundwater Directive (2006/118/EC) at <http://www.defra.gov.uk/environment/quality/water/wfd/daughter-dirs.htm>

xii) Habitats Directive

The “European Community Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora”, aims to contribute towards ensuring biodiversity through the conservation of natural habitats and wild plants and animals. Measures must be introduced to maintain or restore to ‘favourable conservation status’ the natural habitats and populations of wild plants and animals identified as important within the European Union (as specified in annexes to the Directive).

Representative areas with these habitats and species must be designated as Special Areas of Conservation. Special Areas of Conservation and Special Protection Areas designated under the Birds Directive (see section iii above) form a network of protected areas known as ‘Natura 2000’.

The Habitats Directive introduces for the first time for protected areas, the precautionary principle; that is that projects can only be permitted having ascertained no adverse effect on the integrity of the site. Projects may still be permitted if there are no alternatives, and there are imperative reasons of overriding public interest. In such cases compensation measures will be necessary to ensure the overall integrity of network of sites.

As a consequence of amendments to the Birds Directive these measures are also applied to Special Protection Areas.

How this Directive is implemented

The Directive is implemented by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), known as 'the Habitats Regulations', which are administered by Natural England and the Countryside Council for Wales. Special Areas of Conservation and Special Protection Areas are also notified as Sites of Special Scientific Interest.

Regulation 3(3) and 3(4) of the Habitats Regulations require every competent authority to have regard to the requirements of the Habitats Directive while carrying out their functions. The Habitats Regulations (Regulation 48) require that any plan or project, for example a development application or an environmental permit, that is not directly connected with or necessary to the management of a Natura 2000 site, but which could have a likely significant effect on it has to have an appropriate assessment of its implications on the conservation objectives of the site. In most cases, plans or projects that could have a negative effect on the integrity of a site can not proceed.

Regulation 50 of the Habitats Regulations require all Competent Authorities to review the impact of certain types of existing permits and modify or revoke them where necessary to remove effect or risk of effects on Natura 2000 sites.

Annex D shows the location of Natura 2000 sites and compliance with the Directive's objectives for the North West River Basin District.

You can find further information on the Joint Nature Conservation Committee's website at:
<http://www.jncc.gov.uk/page-1374>

xiii) Integrated Pollution Prevention and Control Directive

The Integrated Pollution Prevention and Control Directive (2008/1/EC replacing the repealed Directive 96/61/EC) is designed to prevent, reduce and eliminate pollution at source by using

natural resources efficiently. It is intended to help industries operate in a more environmentally sustainable way.

The activities covered include those arising from energy, metals, mineral, chemical, waste management industries, as well as others such as paper/board production, slaughterhouses, food and drink production, intensive pig and poultry farms. To comply with the regulations, operators need a permit and must use best available techniques to prevent emissions to air, land and water or, where that is not practicable, they must reduce them to an acceptable level. They must also minimise waste and recycle it where they can, conserve energy, prevent accidents and limit their environmental consequences, and return the site to a satisfactory state after operations cease.

How this Directive is implemented

The Directive is implemented by the Environmental Permitting (England and Wales) Regulations 2007. Competent authorities for these regulations are:

- the Environment Agency, which has responsibility for A(1) installations, the most polluting of the three industrial categories;
- local authorities, which have responsibility for A(2) installations (Local Authority Integrated Pollution Prevention and Control) and for Part B installations (Local Authority Pollution Prevention and Control).

(Prior to 6 April 2008 the Directive was implemented by the Pollution Prevention and Control (England and Wales) Regulations 2000).

This legislation helps deliver the Water Framework Directive objectives in a number of ways, including, for example, objectives for priority hazardous substances (cease or phase out discharges, emissions and losses) and by minimising other releases from major installations.

The regulations are supported by Europe-wide guidance notes on best available techniques.

There were 469 permits for Part A(1) installations in the North West River Basin District.

You can find further information on the Environment Agency's website at:
<http://www.environment-agency.gov.uk/homeandleisure/37801.aspx>

xiv) Major Accidents Directive

The Major Accidents Directive (96/82/EC), also known as the Seveso II Directive, aims to prevent accidents, and limit their consequences if they do occur, at sites using or storing certain dangerous substances above specified thresholds.

It deals with exceptional risks (fires, explosions and massive emissions of dangerous substances when an activity gets out of control) and the steps to be taken to prevent major accidents. Operators of establishments where high quantities of dangerous substances are used or stored must produce a safety report and an on-site emergency plan. In addition, the relevant local authority must produce an off-site emergency plan, and the public must be told of safety measures and what to do in the event of an accident.

How this Directive is implemented

The Directive is implemented by the Health and Safety Executive and the Environment Agency through the Control of Major Accident Hazards Regulations 1999.

You can find further information on the Health and Safety Executive's website at:
<http://www.hse.gov.uk/comah/>

xv) Marine Strategy Framework Directive

The Marine Strategy Framework Directive came into force on 15th July 2008. This Directive establishes an integrated policy for the protection of the marine environment in a similar manner to the Water Framework Directive. Where both directives apply in coastal waters, the Marine Strategy Framework Directive covers those aspects of the environmental status of the marine environment not covered by the Water Framework Directive. The Marine Strategy Framework Directive does not apply to transitional waters (e.g. estuaries). The Directive requires Member States to take necessary measures to maintain or achieve good environmental status in marine waters by 2020.

How this Directive is implemented

The Directive must be transposed by 2010. The Environment Agency is working with Defra, Welsh Assembly Government and others to ensure that implementation of both directives will be complementary where they overlap. Marine strategies have to be developed in order to protect and preserve the marine environment, prevent its deterioration, restore marine ecosystems and prevent and reduce inputs in the marine environment.

Date	Action
2012	<ul style="list-style-type: none">initial assessments of current environmental status and the environmental impact of human activitiesDetermination of good environmental status for waters concernedEstablishment of targets and indicators
2014	Establish monitoring programmes for ongoing assessment and updating of targets
2015	Develop programmes of actions to achieve/maintain good environmental status
2016	Implement programme of actions
2020	Take the necessary measures to achieve or maintain good environmental status in the marine environment

xvi) Nitrates Directive

The Nitrates Directive (91/676/EEC) aims to protect water quality against nitrate pollution from agriculture. It encourages better management of animal manure, manufactured fertilisers and other nitrogen-containing materials spread onto land. In England and Wales discrete areas of land have been designated as Nitrate Vulnerable Zones, where the waters that the land drains to contain, or are likely to contain 50 mg/l of nitrate, or the waters are eutrophic or likely to become so. Some other European Union member states have declared the whole territory as being vulnerable to nitrate pollution.

An action programme must be put in place in Nitrate Vulnerable Zones that farmers have to observe to reduce nitrate pollution. Rules cover the storage of manure and periods when spreading manure and manufactured fertiliser to land is not allowed and limits on rates of

nitrate application. A review of both the designations and action programme must be carried out at least every four years, the outcomes of which are used by Ministers to make appropriate amendments. As well as action programmes in Nitrate Vulnerable Zones Member States must have voluntary codes of good agricultural practice in place to promote general good practice to control nitrate on all farms.

How this Directive is implemented

This Directive is implemented under the Nitrate Pollution Prevention Regulations 2008.

The Environment Agency is the competent authority responsible for enforcing the Action Programmes.

Associated mechanisms include:

- Prohibition and notices under the Water Resources Act 1991 s85 and/or Water Resources Act 1991 s86 to prevent nitrate pollution from discharges;
- Water Protection Zones when existing mechanisms will not achieve the required objectives;
- Statutory Code of Good Agricultural Practice.

Just under 30% of land is currently designated as Nitrate Vulnerable Zone in the North West River Basin District. The next review is expected to be implemented in 2013.

You can find further information in annex D on protected areas and on the Environment Agency's website at: <http://www.environment-agency.gov.uk/business/regulation/31901.aspx>

xvii) Plant Protection Products Directive

The Plant Protection Products Directive (91/414/EEC), also known as 'The Authorisations Directive', aims to prevent adverse impacts from plant protection products by controlling the marketing and use of new products. Plant protection products include herbicides (weed killers), insecticides, fungicides, molluscicides (slug/snail killer) and other pesticide products used to protect plants.

New active substances for use in plant protection must be approved before they can be sold or used. To gain approval, the producers must submit a dossier identifying the active substance (and a plant protection product which contains it); its physical and chemical properties; its effects on target pests; and any possible effects on workers, consumers, the environment and non-target plants and animals. The dossiers are evaluated at European level and a decision is made on whether the new substance can be approved for use and which conditions will apply across all European Union member states.

How this Directive is implemented

The Directive is implemented under the Plant Protection Products Regulations 2005 and administered by the Chemicals Regulation Directorate, which is part of the Health and Safety Executive.

The Directive will be replaced by a new Regulation concerning the placing of plant protection products on the market, which is expected to come into force in 2011.

You can find more detailed information on the Chemicals Regulation Directorate website at:
<http://www.pesticides.gov.uk/approvals.asp?id=2310>

xviii) Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

REACH entered into force on 1st June 2007 under EC regulation 1907/2006 to streamline and improve the legislative framework on supply and use of chemicals in the European Union. REACH has several aims:

- To provide a high level of protection of human health and the environment from the use of chemicals.
- To make the people who place chemicals on the market (manufacturers and importers) responsible for understanding and managing the risks associated with their use.
- To allow the free movement of substances on the EU market.
- To enhance innovation in and the competitiveness of the EU chemicals industry.
- To promote the use of alternative methods for the assessment of the hazardous properties of substances e.g. quantitative structure-activity relationships (QSAR) and read across.

A major part of REACH is the requirement for manufacturers or importers of substances to register them with a central European Chemicals Agency (ECHA). A registration package will be supported by a standard set of data on that substance. The amount of data required is proportionate to the amount of substance manufactured or supplied. If a substance is not registered then the data on them will not be available and as a result it will no longer be possible to manufacture or supply it legally.

REACH applies to substances manufactured or imported into the EU in quantities of 1 tonne per year or more. Generally, it applies to all individual chemical substances on their own, in preparations or in articles (if the substance is intended to be released during normal and reasonably foreseeable conditions of use from an article). Some substances are specifically excluded, for example radioactive substances, substances under customs supervision, the transport of substances, non isolated intermediates, waste and some naturally occurring low-hazard substances.

Some substances, covered by more specific legislation, have tailored provisions, including human and veterinary medicines, food and foodstuff additives and plant protection products and biocides. Others have tailored provisions within the REACH legislation, as long they are used in specified conditions, such as isolated intermediates and substances used for research and development. REACH also allows for the restriction of substances where it poses a particular threat that is deemed to require Community-wide action to mitigate the risk, or for substances of very high concern a company wishing to market or use such a substance must submit an application to the European Chemicals Agency for an authorisation.

How this Regulation is implemented

The Competent Authority for REACH is the Health and Safety Executive (HSE), supported by others, in particular the Environment Agency. Implementation of REACH is phased with registration deadlines up to June 2018, depending on the annual tonnages involved.

Information on the hazardous properties of chemicals and their risk to the environment will be available through the European Chemicals Agency run database IUCLID <http://iuclid.eu/>

Further information is available at: <http://www.hse.gov.uk/reach/>

xix) Sewage Sludge Directive

The Sewage Sludge Directive (86/278/EEC) aims to protect people, animals, plants and the environment against the possibility of harmful effects from the uncontrolled spreading of sewage sludge on agricultural land.

It encourages sewage sludge to be used correctly and prohibits it being applied to soils unless the concentration of heavy metals in the soil is below certain limits (which vary according to pH). Monitoring must be carried out to make sure that the soil does not exceed these limits after sludge has been spread. Sludge must be treated before it is used, for example to reduce pathogen levels, unless it is injected or worked into the soil. Animals cannot graze on land that has been spread with sludge, and crops cannot be harvested from the land, for three weeks after the sludge has been spread.

Preventing soils becoming polluted in this way also protects surface water and groundwater from receiving polluted run-off.

How this Directive is implemented

The Directive is implemented through the Sludge Use in Agriculture Regulations 1989 as amended, with the Environment Agency as competent authority.

The Regulations are supported by general binding rules and financial disincentives through cross-compliance under the European Union's Common Agricultural Policy and Single Farm Payments made in England and Wales. All the water companies follow the Safe Sludge Matrix, an agreement made in December 1998 between Water UK and the British Retail Consortium, which bans the use of untreated sludge on agricultural land. There is also a non-statutory code of practice.

The water and sewerage companies are responsible for managing the recycling and disposal routes of the sewage sludge produced by their sewage treatment works. They must comply with the requirements of the Sewage Sludge Directive, the Waste Framework Directive and the Urban Waste Water Treatment Directive.

The Environment Agency is the enforcement authority for the relevant legislation.

The Water Services Regulation Authority is responsible for ensuring that the companies are adequately funded to carry out their functions, which include sewage sludge disposal.

You can find further information on the NetRegs website at: <http://www.environment-agency.gov.uk/netregs/businesses/agriculture/61893.aspx>

xx) Shellfish Waters Directive

The Directive on the quality required of shellfish waters (2006/113/EC replacing Directive 79/923/EEC which is repealed) aims to protect or improve shellfish waters to support shellfish life and growth. It protects the water habitat of bivalve and gastropod molluscs, including oysters, mussels, cockles, scallops and clams. In this way, it contributes to the

high quality of shellfish products eaten by humans. It sets physical, chemical and microbiological water quality requirements that designated shellfish waters must either comply with ('mandatory' standards) or try to meet ('guideline' standards).

The Directive will be repealed in 2013, after which controls under the Water Framework Directive will be used to provide at least the same level of protection to shellfish waters.

How this Directive is implemented

This Directive is implemented through the:

- Surface Waters (Shellfish) (Classification) Regulations (SI 1997/1332);
- Surface Waters (Shellfish) (Direction) 1997.

The Environment Agency is the competent authority.

Annex D sets out the shellfish waters designated as protected areas in the North West River Basin District and their compliance with the Directive.

Shellfish Waters Pollution Reduction Plans were prepared in 2008. These are available for the 124 Shellfish Waters in England and Wales and are available from:
<http://www.environment-agency.gov.uk/business/regulation/31931.aspx>

You can also find further information on Defra's website at:

<http://www.defra.gov.uk/environment/quality/water/waterquality/shellfish/index.htm>

xxi) Strategic Environmental Assessment Directive

The Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment requires a formal environmental assessment of plans and programmes which are likely to have significant effects on the environment. Authorities which prepare and/or adopt such a plan or programme must prepare a report on its likely significant environmental effects, consult environmental authorities and the public, and take the report and the results of the consultation into account during the preparation process and before the plan or programme is adopted. They must also make information available on the plan or programme as adopted and how the environmental assessment has been taken into account. River Basin Management Plans fall within the scope of the Strategic Environmental Assessment Directive.

How this Directive is implemented

The Strategic Environmental Assessment Directive is implemented through the Environmental Assessment of Plans and Programmes Regulations 2004.

Guidance is provided in 'A Practical Guide to the Strategic Environmental Assessment Directive'.

Further information is available on the Communities and Local Government website -
<http://www.communities.gov.uk/planningandbuilding/planning/sustainabilityenvironmental/strategicenvironmentalassessment/>

xxii) Sustainable Use of Pesticides Directive (Proposal)

The purpose of this Directive, as proposed, is to establish a legislative framework which:

- contributes to the reduction of impacts of plant protection products on human health and the environment;
- aims to achieve a more sustainable use of plant protection products;
- promotes a significant overall reduction in risks and hazards of using plant protection products consistent with necessary crop protection.

The final wording of this Directive will be adopted by the Commission in 2009. There are 2 articles of particular relevance to Water Framework Directive measures:

- Article 11 - specific measures to protect the aquatic environment and drinking water
- Article 12 - Reduction of pesticide use or risks in specific areas, including protected areas under the Water Framework Directive.

See

http://www.pesticides.gov.uk/environment.asp?id=1980#authorisation_regression_and_sustainable_use_directive for further information.

How this Directive will be implemented

The Directive will be implemented into UK legislation by late 2011. The Chemicals Regulation Directorate of the Health and Safety Executive (formerly Pesticides Safety Directorate) is the competent authority for overseeing implementation of UK Regulations (including an anticipated public consultation in 2009).

The Directive is expected to establish a framework which will promote 'best practice' in the storage, use and disposal of pesticides, and their packaging. Key features will include: the establishment of national action plans; compulsory testing of spray machinery and certification of spray operators, distributors and advisors; a ban (subject to derogations) on aerial spraying; special measures to protect the aquatic environment, public spaces and special conservation areas; minimising the risk of pollution through handling, storage and disposal; and the promotion of Integrated Pest Management.

Further information is available at

http://www.pesticides.gov.uk_authorisation_regression_and_sustainable_use_directive

xxiii) Surface Water Abstraction Directives

These two directives were repealed in 2007, and the related regulations in England and Wales repealed subsequently.

- Directive 75/440/EEC concerning the quality of surface water abstracted for use as drinking water

This aimed to make sure that surface water abstracted for use as drinking water reached certain standards and was adequately treated before being put into public supply. It aimed to improve rivers or other surface waters used as sources of drinking water. Surface waters

were classified by the water's general suitability for abstraction and level of treatment required before the water is suitable for public supply:

- A1 - simple physical treatment and disinfection;
 - A2 - normal physical/chemical treatment and disinfection;
 - A3 - intensive physical/chemical treatment, extended treatment and disinfection.
-
- Directive 79/869/EEC concerning the frequency of sampling and analysis of surface water intended for abstraction for drinking

This laid down the minimum standards, established the analytical methods to be used in measuring the parameters in 75/440/EEC, with minimum limits of detection, accuracy and precision, and set out the required sampling frequency.

How these Directives were implemented

The directives were implemented through:

- The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (SI 1996/3001);
- The Surface Waters (Abstraction for Drinking Water) Direction 1996.

You can find further information on the Environment Agency's website at
<http://www.environment-agency.gov.uk/business/regulation/31949.aspx>

Controls implemented under the Water Framework Directive, including for example through use of Drinking Water Protected Areas (see F4 below), will ensure that at least the same level of protection is afforded to drinking water and its sources.

xxiv) The Urban Waste Water Treatment Directive

The Urban Waste Water Treatment Directive (91/271/EEC) regulates the collection and treatment of waste water from homes and industry. It protects the environment from the negative effects of urban waste water and discharges from certain industrial sectors, such as food and drink processing plants (some of which produce waste that has a similar polluting effect to untreated sewage). Most waste water must have at least secondary treatment (biological treatment). 'Sensitive' receiving waters are identified where sewage requires extra treatment before discharge into them. One type of sensitive area is 'eutrophic waters', where additional nutrients (mainly nitrate or phosphate) stimulate the growth of algae and other plants, damaging the natural environment. Another type of sensitive area is where water is intended for abstraction for use as drinking water but nitrate levels are high. In these areas, larger sewage discharges must be treated to reduce their load of nutrients (tertiary treatment).

How this Directive is implemented

The Directive is implemented through the Urban Waste Water Treatment Regulations 1994. These identify the sensitive areas for controls on discharges of nutrients (see annex D) and ban the disposal of sludge at sea. Powers to consent discharges, with conditions to protect the receiving waters, are available under the Water Resources Act 1991 (see F.6 below).

Sewerage undertakers have to develop a programme for improving discharges every five years. This programme, which is approved by Water Services Regulation Authority, the Environment Agency, Drinking Water Inspectorate and Defra, provides the mechanism for funding and implementing the changes necessary to implement the Urban Waste Water Treatment Directive.

Associated mechanisms and resulting actions include:

- Codes of practice developed in partnership with UK Water Industry Research and the water industry;
- Financial incentives for sewerage undertakers to comply with permit conditions established under the Water Services Regulatory Authority operator performance assessment scheme, which links overall service provision to the price that customers pay.

You can find further information on Defra's website at:

<http://www.defra.gov.uk/environment/quality/water/waterquality/sewage/uwwtd/index.htm>

xxv) Veterinary Medicinal Products

Veterinary and human medicinal products in the European Union (EU) are regulated by the European Medicines Agency under Regulation (EC) No. 726/2004

How the Regulation is implemented.

The competent authority is the Veterinary Medicines Directorate which is an executive agency of Defra (<http://www.vmd.gov.uk/>).

Assessments and authorisation decisions are made by the Committee for Medicinal Products for Veterinary Use (<http://www.emea.europa.eu/htms/general/contacts/CVMP/CVMP.html>).

CVMP prepares scientific guidelines, in consultation with the competent authorities of the EU Member States, to help applicants prepare marketing-authorisation applications for medicinal products for veterinary use.

Environmental impacts assessments are carried out in two phases. In phase I the potential for environmental exposure is assessed based on the intended use of the VMP. Where a potential environmental risk is identified a detailed procedure of environmental risk assessment is carried out under Phase II. This provides a common basis for testing of veterinary medicinal products between the European Union, Japan, USA, Canada, Australia and New Zealand.

xxvi) Waste Framework Directive

The Directive 2008/98/EC on waste deals with the protection of human health and the environment against harmful effects caused by the collection, transport, treatment, storage and tipping of waste. Regulation under this legislation includes a system of permits and plans which set out the essential factors to be taken into consideration in respect of the various waste disposal and recovery operations. The Directive will be repealed and replaced by a revised Waste Framework Directive (2008/98/EC) from December 2010.

How this Directive is implemented.

Waste operations that give rise to point and diffuse sources of pollution are controlled through the Environmental Permitting (England and Wales) Regulations 2007. The carriage of waste is regulated by the Control of Pollution (Amendment) Act 1989, Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991, the Hazardous Waste (England and Wales) Regulations 2005 and the Hazardous Waste (Wales) Regulations 2005, which include a system of registration and waste transfer notes.

Part II of the Environmental Protection Act 1990 includes a prohibition on the general deposit of waste or knowingly causing or permitting such waste to be deposited in or on any land except in accordance with an appropriate environmental permit. This is reinforced by the waste duty of care which includes a duty on those producing waste to ensure that it is only passed to an authorised person and to take appropriate reasonable measures to prevent the escape of waste from their control or that of another person.

You can find further information:

- On waste management generally at <http://www.environment-agency.gov.uk/business/sectors/32320.aspx>
- On agricultural wastes at <http://www.environment-agency.gov.uk/business/sectors/32777.aspx>

F.3 Efficient and sustainable use of water

Under the Water Framework Directive water must be used efficiently and in a way that can sustain future supplies. The mechanisms in this annex all help to meet these aims. Particular mechanisms that are available include:

Table F.1: Mechanisms for efficient and sustainable use of water

Mechanism	What this does
Water Resources Act 1991 Part II	Sets out controls for abstraction and drought management
Water Industry Act 1991 Part IIIA	General duties for protecting, managing the quality and sufficiency of supplies and promoting efficient use of water.
Water Act 2003 s 81-83	Duty for the SoS and Welsh Assembly to encourage water conservation, public authorities (including local authorities and statutory undertakes) to take into account, where relevant, the desirability of conserving water supplied or to be supplied to premises. This would include promoting water efficiency through exercise of their land use planning functions – production of development plans and control of development.
Planning and Compulsory Purchase Act 2004	Establishes principle of contributing to sustainable development for Spatial Planning System and the new framework of Regional Spatial Strategies and Local Development Frameworks for England. For Wales there is the Wales Spatial Plan and Local Development Plans.

Mechanism	What this does
Planning Policy Statement 1 and Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1	These expand on the sustainable development duty, prudent use of natural resources and higher standards of sustainability if justified.
Planning Policy Wales	
Environment Act 1995 s 6(2)	Provides a duty on the Environment Agency to conserve, redistribute or augment water resources and to secure their proper use
Pollution Prevention and Control Regulations 2000	Include provision to encourage water conservation, through installation of water-efficient appliances.

Spatial planning has a clear principle that it should contribute to sustainable development (as required by S39 of 2004 Act) and the need for prudent use of resources, including water, particularly through the design of development (see Planning Policy Statement 1). Planning Policy Wales states that local planning authorities should promote increased efficiency and demand management of water resources, particularly in those areas where additional water resources may not be available.

Planning Policy Statement 1 and the planning and climate change supplement requires Regional Spatial Strategies to take into account the availability of water resources to support development.

Local Development Frameworks have to take account of capacity of water resources infrastructure when selecting sites for development or considering whether to go beyond national standards for sustainability where, without such requirements (for example water efficiency) development would be unacceptable for that location.

Where there is a locally justified need to go beyond minimum standards, the Government's Code for Sustainable Homes introduces higher standards for water efficiency for new development. In these instances, use of these standards can be initiated through Development Plan policies and through conditions on planning permission, and also by negotiation with Government for sustainable development initiatives, for example Ecotowns and growth points.

United Utilities in association with RSPB have established the Sustainable Catchment Management Programme (SCaMP). SCaMP is a land management scheme taking place in two key areas of United Utilities land; Bowland and the Peak District which are sources of public water supply. The programme is funded through the periodic review process, to reduce diffuse pollution. These schemes can also help to reduce downstream flooding and enhance biodiversity.

F.4 Protection of waters used for abstracting water

The mechanisms in this annex which protect the quality or quantity of water also protect water bodies that have abstractions for drinking water. These mechanisms include statutory protected areas (see annex D) and their related requirements under the Water Framework Directive. The Environment Agency's Groundwater Protection Policy also provides a range of guidance on activities in advisory source protection zones around groundwater abstractions.

More formal mechanisms that are in place for protecting waters abstracted for drinking water are shown in Table F.2:

Table F.2: Mechanisms for protecting drinking water

Mechanism	What this does
Water Resources Act 1991 s93	Provides the legislation for establishing statutory Water Protection Zones (WPZs). Work is currently underway to amend the legislation so that WPZs may be more readily applied to address pollution of drinking water catchments.
Surface Waters (Abstraction for Drinking Water) (Classification) Regulations and Direction 1996	Sets objectives and minimum standards for water to be abstracted for drinking water.
Water Industry Act 1991 Part III dealing with water supply	General duties for protecting and managing the quality and sufficiency of supplies.
Water Supply (Water Quality) Regulations 2000 as amended	Establishes a risk-based approach to the assessment and monitoring of water intended for public supply, requiring water supply operators to consider issues in the environment.
Private Water Supplies Regulations 1991 (administered by local authorities)	Sets objectives and minimum standards for drinking water from private supplies. Defra have consulted on new regulations which would introduce powers for local authorities and a risk based assessment element for protection of larger private supplies.
Water Framework Directive 2000 – Article 7	Requires the identification of Drinking Water Protected Areas and sets objectives for these. Allows for the creation of Safeguard Zones within which necessary protection measures can be focused.

i) Drinking water protected areas

Drinking water protected areas are water bodies that are used now, or may be used in the future, for abstracting water for drinking, cooking, preparing food, or in food production businesses. A drinking water protected area is defined if the water body provides more than an average of 10m³ a day in total or serves more than 50 people.

Existing mechanisms for dealing with diffuse and point sources of pollution are used to protect water quality in these protected areas (see F.6 and F.7) but are not always sufficient to provide the protection needed, particularly from diffuse sources of pollution. The Environment Agency has carried out risk assessments of drinking water protected areas. Protected areas and more specifically the associated safeguard zones will provide a focus for reinforcing existing measures or implementing additional measures where these may be needed so that Water Framework Directive objectives can be met. (See annex D on Protected Areas for details).

The Environment Agency is adopting a tiered, risk-based, approach to drinking water protection, with:

- i) a general level of protection for all drinking water sources (existing measures maintained);
- ii) safeguard zones around sources at particular risk where existing measures can be strictly enforced and additional new voluntary measures can be focused; and

- iii) the use of Water Protection Zones for sources at particular risk where existing and voluntary measures have failed or are unlikely to prevent failure of WFD objectives. Here new statutory measures will be sought. A small number of Water Protection Zones will be promoted in England in the first river basin management cycle.

Drinking water protected areas and proposed safeguard zones are shown in annex D. Any Water Protection Zones that are proposed in the North West River Basin District will be subject to a separate public consultation process.

Implementation in the North West River Basin District

There are 126 surface water bodies designated for drinking water protection in the North West River Basin District.

All the groundwater bodies in the North West River Basin District are Drinking Water Protected Areas. There are 43 existing groundwater source protection zones in the North West River Basin District that form the first general level of protection noted above.

Annex D highlights the groundwater safeguard zones in this district (see figures D2 and D3). The additional measures in these zones will address the specific contaminants and activities of concern in these zones.

F.5 Abstraction and impoundment of water

Under the Water Resources Act 1991 s.24 no abstraction is permitted without a licence, except for certain exemptions (see below). Table F.3 summarises the mechanisms to control abstraction and impoundment of water (that is, storage of water for later use).

Table F.3: Mechanisms to control abstraction and impoundment

Mechanism	What this does
Water Resources Act 1991 <ul style="list-style-type: none"> • Abstraction and impoundment licensing system Chapter II of Part II (as amended by Water Act 2003) • Agreements under s20, 20A &158 • Drought orders and drought permits under Chapter III of Part II 	<ul style="list-style-type: none"> • Conditions applied to abstraction and impoundment licences to manage impacts on the environment. e.g. flows, resources, saline intrusion • Make operational arrangements with water companies and other abstractors to reduce the impact of abstractions, for example river support schemes. • Provides further controls on authorisations for abstraction and impoundments during droughts
Habitats Directive Review of Consents,	Can revoke or amend licences to reduce unacceptable impacts of abstraction.
Water Resources Management Plan Regulations 2007 and Water Resource Management Plan Directions 2007 and 2007	Water companies produce water resources plans to say how they propose to manage water supply and demand and related environmental issues.

Time limited licences were introduced in many cases in the 1990s and are compulsory for all new licences under the changes to the Water Resources Act 1991 brought about by the Water Act 2003. Before then, licences were granted with no time limit, and some licences in the past may have had unacceptable impacts on the environment. Although the Environment Agency has powers to amend or revoke these licences under the Water Resources Act 1991, we may have to pay compensation to the licence holder.

The Water Act 2003 extends the abstraction licensing system to include previously exempt uses and areas. For example the uses now include trickle irrigation, quarry dewatering, transfers of water. The areas previously exempt include mid-Wales and parts of Northumbria. These provisions have not yet been implemented. Some further exemptions are also being considered, such as transfers of water within water meadows.

Abstractions of fresh surface water or groundwater in England and Wales of 20 m³ per day or less has been exempted from requiring prior authorisation being deemed to have no significant effect on water status.

Other plans and programmes

Abstraction licences are being reviewed to determine whether they are having an unacceptable impact on the environment. This is being done as part of the review of consents required by the Habitats Regulations and included within the programme for Restoring Sustainable Abstraction. The mechanisms for funding compensation payments have been under discussion with Defra and the Welsh Assembly Government.

The Environment Agency has developed Catchment Abstraction Management Strategies to help ensure a consistent approach in managing water resources and balancing the needs of water users and the environment. They also help inform the public on water resources and licensing practice and involve them in managing water resources in their area. Under the Water Resources Management Plan Direction 2007 and Water Resources Management Plan Direction 2008 (England only), water companies have to prepare water resources plans to say how they propose to manage water supply and demand over the following 25 years. These have to show how they will protect the environment from unnecessary damage caused by taking too much water for people to use.

The National Environment Programme is the water companies' five-yearly environmental improvement programme. Successive water company improvement programmes since privatisation of the industry have resulted in substantial benefits to the water environment.

Other approaches

A variety of mechanisms can be used to protect water resources that are used for abstraction. The Environment Agency's Groundwater Protection: Policy & Practice provides guidance on activities involving abstraction of groundwater. Voluntary agreements, permits, economic incentives (water pricing) water-saving campaigns etc. can be used to manage demand. Direct action can be taken to maintain or improve flows, for example river restoration schemes.

Implementation in the North West River Basin District

In 2007 there were 106 licensed impoundments in the North West River Basin District. The largest impoundments are regulated under the Reservoir Act 1975 in relation to public safety alone. There are 156 reservoirs on the register for the North West River Basin District.

In 2007 there were 1473 licensed abstractions in the North West River Basin District, authorising abstraction of over 5 million MI of water a year, from surface waters, groundwater and tidal waters. Further information is provided in table F.4.

Table F.4: Summary of licensed abstractions in the North West River Basin District

Sector	Licensed volume (MI ¹ / year)	Number of licences
Water supply	723844	220
Agriculture	19685	667
Fish and aquaculture ²	38036	56
Electricity production ²	3326251	42
Industry	734525	554
Other	6920	11
Total	4849261	1550

¹1MI is equivalent to 1000 m³

² Electricity and fish/aquaculture normally return the water close to the point of abstraction.

Information on abstraction and impoundment licences, including licence applications, appeals, and transfers, is provided in public registers, which you can inspect in the Environment Agency office at Richard Fairclough House, Knutsford Road, Latchford, Warrington, Cheshire, WA4 1HT. Abstractions and impoundments which are exempt from licensing requirements are not included in these registers.

F.6 Point source discharges

This section provides a summary of mechanisms for controlling discharges from identifiable point sources by limiting or preventing pollutants entering the water through prior authorisations, general binding rules and emission controls.

Point source discharges are controlled as follows:

Table F.5: Mechanisms to control point source discharges

Mechanism	What this does
Water Resources Act 1991 <ul style="list-style-type: none"> • Prosecution under s85 • Discharge consents, s88 • Prohibition Notices under s86 • Enforcement Notices under s90B • Works Notices under s161A 	<ul style="list-style-type: none"> • It is an offence to pollute controlled waters by causing or knowingly permitting entry or discharge of polluting matter. • Requires conditional consents for point source discharges to water • A Notice can be served to prohibit the discharge of any effluent onto or into land • A notice to remedy contraventions of consents • Any activity polluting or likely to pollute controlled waters can be served a ‘works notice’ to stop the activity or require certain

Mechanism	What this does
<ul style="list-style-type: none"> • Water Protection Zones under s93 Environmental Permitting Regulations (England and Wales) 2007, which replace • Pollution Prevention and Control (England and Wales) Regulations 2000 • Waste Management Licensing Regulations 1994 	<ul style="list-style-type: none"> improvements Can be used to implement specific point source controls within a formally designated zone.
<p>Groundwater Regulations 1998 (prevent or limit discharges to groundwater)</p> <p>Note: new Groundwater Regulations are due to be in place in Autumn 2009 and will replace the 1998 Regulations.</p>	<ul style="list-style-type: none"> Require permit with conditions to control deliberate emissions and minimise accidental losses from major installations; conditions prevent, minimise or render emissions harmless using the best available technologies as directed in guidance notes. Requires licence with conditions to control waste management operations.
Silage Slurry & Agricultural Fuel Oil Regulations 1991	Require authorisation for disposals/discharges that might lead to inputs to groundwater of substances listed under the Groundwater Regulations (or from Autumn 2009, WFD pollutants). Such authorisations include Water Resources Act discharge consents and Environmental Permitting Regulations permits.
The Control of Pollution (Oil Storage) (England) Regulations 2001	Notices to prohibit any activity that might lead to an input of a listed substance/WFD pollutant to groundwater through Regulation 19 Notice.
Water Industry Act 1991 s166	Cover the design, siting, construction and maintenance of Silage, Slurry and Agricultural Fuel Oil stores.
Town and Country Planning Act 1990, Planning and Compulsory Purchase Act 2004, Planning guidance provided through Planning Policy Statements in England and Planning Policy Wales and Technical Advice Notes in Wales	Sets minimum design standards for new and existing above ground oil storage facilities.
Environmental Protection Act 1990, Part 2A	Requires permit for operational (construction or maintenance) discharges relating to water abstraction and treatment.
	Planning policy contributes to the protection and improvement of the environment. In particular, planning should seek to ensure that development does not produce irreversible harmful effects on the natural environment.
	Controls point source discharges from contaminated land sites (local authorities lead, with Environment Agency regulating 'special sites').

Plans and programmes

Spatial planning

The spatial planning system and particularly the development plan system as required by the 2004 Compulsory Purchase Act sets the framework for controlling development within England and Wales. The planning system makes a major contribution to protecting and improving the environment, the quality of life, and local and global ecosystems.

Urban development is planned up to 20 years ahead through Development Plans. Under the

Planning & Compulsory Purchase Act 2004 these consist of Regional Spatial Strategies and Local Development Frameworks in England and in Wales, the Wales Spatial Plan and Local Development Plans. Planning Policy Statement 11 (Regional Spatial Strategies) and Planning Policy Statement 12 (Local Development Frameworks) and Planning Policy Wales set out more detailed guidance on the preparation of development plans in England and Wales.

In England Planning Policy Statement 1 specifically states that planning authorities should ensure that infrastructure and services are provided to support new and existing economic development and housing. Planning Policy Statement 23 also identifies the availability and capacity of waste water infrastructure as considerations in producing development plans and controlling development.

In Wales, guidance notes that planning authorities should “play an appropriate role in securing the provision of infrastructure (including water supplies, sewerage and associated waste water treatment facilities....” It goes on to state that in preparing development plans, development should be planned and located to enable the sustainable provision of water services infrastructure and that in the control of development, the adequacy of water supply and the sewage infrastructure are material in considering planning applications and appeals.

This enables planning authorities and utility providers to anticipate future demand for wastewater treatment, the adequacy of existing infrastructure and headroom in existing consents. Where it is justified, Development Plan policies can link the rate of planned development to the available capacity of wastewater treatment infrastructure and require planning authorities to investigate further through, for example, Water Cycle Strategies

Water industry planning.

Urban development is planned up to 20 years ahead through Development Plans. This enables planning authorities and utility providers to anticipate future demand for wastewater treatment, the adequacy of existing infrastructure and headroom in existing consents. Where it is justified, Development Plan policies can link the rate of planned development to the available capacity of wastewater treatment infrastructure and require planning authorities to investigate further through, for example, Water Cycle Strategies.

Discharges from the water industry can be improved by modifying discharge consents. The investment required to improve treatment facilities is decided by the Water Services Regulation Authority through the price review process. The latest of these is the Periodic Review in 2009 (PR09). This price review covers the period from 2010 to 2015. The mandatory requirements for the Water Framework Directive and other directives have been included in this process.

The Periodic Review 2009 has also been used as a mechanism to investigate discharges from sewage treatment works and potential treatment solutions. A list of sewage treatment works has been prioritised for investigation and these have been included in the companies' draft business plans.

Other approaches

Defra have produced several groundwater protection codes:

- Use and Disposal of Sheep Dip Compounds (August 2001)
- Petrol stations and other fuel dispensing facilities involving underground storage tanks (November 2002)
- Solvent Use and Storage (2004)

These support the Groundwater Regulations 1998, and deal with design, construction, operation, management and decommissioning of the relevant facilities.

The Highways Agency has established a register of soakaways and priority outfalls across the strategic road network and ranked these in accordance with the risk they may pose to underlying groundwater. This will help direct pollution prevention work.

The Environment Agency's Pollution Prevention Guideline Refuelling Facilities, (<http://publications.environment-agency.gov.uk/pdf/PMHO0804BIDG-e-e.pdf>), provides the background information to protect the environment through the correct delivery, storage and dispensing of fuels. The Environment Agency has signed an operating agreement with TOTAL for its petrol filling stations that ensures the company's capital investment is in line with related environmental risk. Other companies are considering similar agreements.

Pollution Prevention Guidelines also exist for a range of activities that have the potential to pollute surface waters, including:

- Above ground oil storage tanks (PPG02);
- Use and design of oil separators in surface water drainage systems (PPG03);
- Treatment and disposal of sewage where no foul sewer is available (PPG04);
- Working at construction and demolition sites (PPG06);
- Garages and vehicle service centres (PPG 19).

The full list is available at:

<http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx>

The Environmental Permitting Regulations will be implemented in 2010. These Regulations apply in England and Wales and will expand the current permitting regime to include permits, standard rules and a registration scheme. This will mean that all existing and new small sewage discharges have to be registered, which will enable us to identify clusters that may be contributing to the pollution load, particularly in relation to ammonia, biological oxygen demand and nutrients.

Implementation in the North West River Basin District

In the North West River Basin District there were in 2008:

- 7734 consents under the Water Resources Act (including treated effluent and site drainage)
 - 1748 of these were from water company owned sewage treatment works, with a total volume of more than 5,500,000 cubic metres per day
 - 473 were for trade effluent (including site drainage), with a total volume of more than 4,000,000 cubic metres per day
 - 490 permits were issued under the Pollution Prevention and Control Regulations 2000 (now dealt with under the Environmental Permitting Regulations).
- 137 controlled landfills, of which 119 had non-inert wastes, with particular controls to manage the risk of pollution
- 1012 authorisations under the Groundwater Regulations

Information on the controls for point source discharges is provided in public registers. These are available from Environment Agency area offices at Richard Fairclough House, Knutsford

Road, Latchford, Warrington, Cheshire, WA4 1HT and on our website (http://www2.environment-agency.gov.uk/epr/?lang=_e) and include lists of all discharges for which a permit or authorisation has been granted, the conditions in these permits, and the results of monitoring action taken in respect of samples.

F.7 Diffuse source pollution

Diffuse pollution results from scattered or dispersed sources that together have a significant effect, but individually have limited environmental impact. Examples of diffuse pollution include:

- The cumulative effect of many individual and ill-defined events, such as poor management practice in storage and handling of sewage or farmyard manure. Although individually they can be small and hard to detect, at a catchment scale they can have a significant impact on groundwater and surface water quality.
- The dispersal of pollutants over an area, for example nitrate from the atmosphere, or leaching of fertilisers and pesticides from soils, including sediment loss.

Water Protection Zones

Water Protection Zones can already be designated under the Water Resources Act and additional statutory provisions can be used to prevent water pollution. To date this has been used only once in England & Wales to deal with point source pollution. There are well developed proposals to amend how Water Protection Zones can be used so that they can more readily deal with diffuse pollution and hydromorphological pressures. Both Defra and Welsh Assembly Government will be issuing statutory guidance to the Environment Agency on the use of Water Protection Zones

Before designating a Water Protection Zone, the Environment Agency would have to make an appropriate case to the Secretary of State. The Environment Agency would also carry out a 12 week public consultation, which will include assessments of the costs and benefits of any proposed measures to be used within a zone.

Water Protection Zones may then be used as a mechanism where evidence shows that existing statutory or voluntary measures have been or are unlikely to be sufficient to meet Water Framework Directive objectives. It will then be possible to enforce prohibition or management of polluting activities within those zones. Their size and nature will be dependent on the location and the nature of the problem.

The Environment Agency intends that Water Protection Zones should be put in place in a phased, prioritised programme. Work is being carried out to improve certainty about the Water Protection Zone mechanism and the locations for designating them. To this end the Environment Agency is trialling their use in a limited number of candidate areas in England to prove their concept as a useful and efficient mechanism to meet the objectives of the Water Framework Directive. Following this the intention is to use Water Protection Zones in a limited number of cases focussing on where Protected Areas are failing, or likely to fail Water Framework Directive requirements.

i) Agricultural pollution

There is a range of mechanisms that can be used to manage diffuse pollution from agricultural sources, and key legislative controls are shown on table F.5 below.

Other mechanisms include voluntary initiatives, such as work with river trusts, and other partnerships (for example Sustainable Catchment Management Programme (SCaMP) with Royal Society for the Protection of Birds, United Utilities and the agricultural industry. The Professional Nutrient Management Initiative), and pollution prevention campaigns such as England Catchment Sensitive Farming Delivery Initiative.

Part 4 of the Groundwater Protection Policy sets out the Environment Agency's policy on and approach to activities in advisory Source Protection Zones around groundwater abstractions, and also sets out good practice to protect the wider groundwater resource.

Catchment Sensitive Farming

The England Catchment Sensitive Farming Delivery Initiative is part of Defra's Catchment Sensitive Farming Programme, which aims to reduce diffuse water pollution from agriculture. The initiative was introduced in April 2006 in forty priority catchments in England and was further extended in 2008 to new target areas, including extensions of existing priority catchments and 10 new priority areas.

It includes encouraging farmers to follow good practice when using fertilisers, manures and pesticides; promoting good soil structure to maximise infiltration of rainfall and minimise run-off and erosion; protecting watercourses from faecal contamination (for example with fencing and livestock crossings), and from sedimentation and pesticides (for example with buffer strips); reducing stocking density or grazing intensity; reverting to grassland etc.

A small capital grants scheme runs alongside advice delivery in the priority catchments to assist farmers in making investments to reduce agricultural diffuse pollution.

Table F.6: Mechanisms for managing agricultural diffuse pollution

Mechanism	What this does
Water Resources Act 1991 <ul style="list-style-type: none"> • Causing or knowingly permitting pollution, s85 • Anti-pollution Works Notices,-s161A • Water Protection Zones s93 	<ul style="list-style-type: none"> • Allows prosecution for various offences where surface waters and/or groundwater is polluted • Requires a person to carry out works and operations to prevent or deal with the consequences of any poisonous, noxious or polluting matter or any solid waste entering controlled waters. • Restricts or prohibits activities in order to protect the water environment from entry of poisonous, noxious or polluting matter.
Environmental Permitting Regulations 2007 (England and Wales) which replace <ul style="list-style-type: none"> • Pollution Prevention and Control (England and Wales) Regulations 2000 • Waste Management (England and Wales) Regulations 2006 	<ul style="list-style-type: none"> • Permits for pig and poultry farms of certain size, with conditions to protect the environment • Makes sure that agricultural waste is recovered or disposed of without putting people's health at risk and without using processes or methods that could harm the environment.

Mechanism	What this does
Nitrate Pollution Prevention Regulations 2008	Require a code of good agricultural practice to be made for all farmers. In addition, on farms within Nitrate Vulnerable Zones farmers to follow an action programme that reduces nitrate entering the water,
Groundwater Regulations 1998 and associated statutory Codes of Practice Note: new Groundwater Regulations are due to be in place in Autumn 2009 and will replace the 1998 Regulations.	<ul style="list-style-type: none"> • Require authorisation for disposals/discharges that might lead to inputs to groundwater of substances listed under the Groundwater Regulations (or from Autumn 2009, WFD pollutants). Such authorisations include Water Resources Act discharge consents and Environmental Permitting Regulations permits. • Notices to prohibit any activity that might lead to an input of a listed substance/WFD pollutant to groundwater. • Codes of Practice to encourage better management/prevention of releases of pollutants to groundwater.
EU driven authorisation / approval mechanisms for the marketing and use of plant protection products, biocides and veterinary medicines. (These are enforced via equivalent UK Regulations covering plant protection products, veterinary medicines and biocides)	Require human health and environmental risk assessment of products and requirement for authorisation or approval by UK competent authorities before the products can be marketed or used.
Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) 'SSAFO' Regulations	Encourages agricultural storage facilities to be managed better by setting minimum standards as general binding rules for constructing or changing them.
Environmental Protection Act 1990, Part 2A	Provides a system for identifying and improving land where contamination is causing unacceptable risks to people's health, crops and livestock or the environment.
Environmental Damage (Prevention and Remediation) Regulations 2009	Will require operators to carry out measures to prevent imminent or actual damage to the environment.
Wildlife and Countryside Act 1981 (as amended)	Allows consent to be refused for activities that may damage Sites of Specific Scientific Interest and action against third party damage to Sites of Specific Scientific Interest
Salmon and Freshwater Fisheries Act 1975	Takes action against polluters who harm or injure fish, spawning grounds or fish food.

Mechanism	What this does
The Sludge (Use in Agriculture) Regulations 1989	Makes sure that recycling sludge to agricultural land is carried out in a way that protects people's and animals' health and the environment.
Cross compliance	Requires farmers who receive the Single Payment to comply with environmental protection measures (e.g. Groundwater Regulations, Nitrate Vulnerable Zones, Sludge Regulations) and to achieve good agricultural and environmental condition

Plans and programmes

The Rural Development Programme for England (RDPE) is the mechanism Defra has for supporting rural development in accordance with European regulations and runs over the 6 year period from 2007 to 2013. It is administered by a number of organisations, including the Regional Development Agencies, Natural England and the Forestry Commission and supports farming and rural businesses and heritage. The Environment Agency worked closely with Natural England in identifying the priorities for resource protection within Environmental Stewardship. There are a number of different strands which include land based skills, capital grants, advisory services and agri-environment schemes. All of these strands can also be used for promoting protection of the water environment. Agri-environment schemes that help deal with diffuse pollution from run-off and soil erosion can also be funded.

Other approaches

Other approaches for tackling agricultural pollution include:

- The Code of Good Agricultural Practice, which provides practical guidance to help farmers and growers avoid causing pollution
- The industry group (CLA, AIC, FWAG, LEAF, NFU) has launched a "Tried & Tested" nutrient management plan to help farmers and growers plan their fertiliser and manure use, meet increasing regulatory demands and protect the environment.
- Voluntary Initiative (VI) measures aimed at minimising the environmental impacts from agricultural and horticultural use of pesticides (including annual sprayer testing and spray operator training, implementation of Crop Protection Management Plans and best practice advice on individual 'problem' pesticides). The voluntary industry group has also formed a national strategic partnership with Natural England to deliver a whole range of advice through the Catchment Sensitive Farming initiative
- Other voluntary schemes such as:
 - British Agrochemical Standards Inspection Scheme - a certification scheme for staff handling pesticides and fertilisers;
 - Stop Every Drop pollution reduction plan for sheep dip
 - oFarm assurance schemes, including the Red Tractor, run by an alliance of farmers, food processors, retailers and distributors who work together to maintain and raise production standard, including environmental standards; The LEAF (Linking Environment and Farming) Marque has a strong emphasis on environment in its assurance scheme
- Guidance such as the 'Think Soils Manual'; Sludge (use in agriculture) code of practice and Fertiliser recommendations for agricultural and horticultural crops (RB209).

- Groundwater protection code: Use and disposal of sheep dip compounds.

Implementation in North West River Basin District

In the Northwest RBD, the Wyre and Bassenthwaite Lake form the England Catchment Sensitive Farming Delivery Initiative (ECSFDI) priority catchments. Under the Catchment Sensitive Farming (CSF) project, farmers have made a significant contribution towards reducing sediment and nutrients entering watercourses through the production and implementation of soil and nutrient management plans. Working in partnership, farmers identified their potential to reduce inorganic fertiliser inputs, target manures more effectively. This reduces; excess nutrient application to land and the potential to transfer sediment or nutrients to watercourses.

Through this initiative, awareness has also been raised about the nutrient value of cow slurry. ECSFDI have held sessions with farmers to tray test fertiliser spreaders, correcting any inaccuracies in spread pattern to encourage accurate application and even utilisation of inorganic fertilisers. Farmers will also receive ongoing advice through the ECSFDI project working in the priority catchments established in 2008-09 alongside local partners .

Rural Development Programme for England will deliver nutrient and wider resource management advice and will fund grants to farmers up to 2013. These funds form part of the Common Agricultural Policy budget and are administered by the Regional Development Agency.

ii) Diffuse non-agricultural pollution

Run off from transport, on-street activities such as car washing, industrial estates, forestry and leisure industries, wrong connections into the surface water sewer network and discharges from contaminated land and disused mines all contribute to diffuse pollution from non-agricultural sources.

Formal mechanisms for managing diffuse pollution from non-agricultural sources are set out in table F.7 below. Spatial planning procedures and policies, supported by the planning consultation process are also valuable mechanisms for achieving controls on diffuse pollution. In addition, Defra and Welsh Assembly Government have published a consultation on measures and mechanisms to meet the requirements of the Water Framework Directive on non agricultural diffuse pollution.¹ Defra and Welsh Assembly Government are pursuing elements of the proposals including the removal of phosphate from laundry detergents and sustainable drainage systems and are looking at the case for further measures.

The Environment Agency's Groundwater Protection: Policy & Practice provides guidance on activities in advisory source protection zones around groundwater abstractions and promotes good practice to protect groundwater generally.

¹ Consultation on non agricultural diffuse pollution in England and Wales, Defra, Welsh Assembly Government, February 2007

Table F.7: Mechanisms for managing non-agricultural diffuse pollution

Mechanism	What this does
Water Resources Act 1991, <ul style="list-style-type: none"> • Anti pollution works notices s161A • Abandonment of mines s91A & B as amended by the Mines (Notice and Abandonment) Regulations 1998 • Causing or knowingly permitting pollution, s85 • Water Protection Zones s93 	<ul style="list-style-type: none"> • Notices can be served on polluters or prospective polluters to prevent water pollution • Requires mine owners to notify the Environment Agency if they plan to abandon a mine and to produce a closure plan. • Allows prosecution for various offences where surface waters and/or groundwater is polluted • Restricts or prohibits activities in order to protect the water environment from poisonous, noxious or polluting matter
Water Industry Act 1991,s101A	Provision of first time sewerage as a solution where there may be pollution from multiple septic tanks or cesspools, providing certain conditions are met
Control of Pollution (Oil Storage) (England) Regulations 2001	Sets minimum design standards for new and existing above ground oil storage facilities
Groundwater Regulations 1998 and associated statutory Codes of Practice Note: new Groundwater Regulations are due to be in place in Autumn 2009 and will replace the 1998 Regulations.	<ul style="list-style-type: none"> • Require authorisation for disposals/discharges that might lead to inputs to groundwater of substances listed under the Groundwater Regulations (or from Autumn 2009, WFD pollutants). Such authorisations include Water Resources Act discharge consents and Environmental Permitting Regulations permits. • Notices to prohibit any activity that might lead to an input of a listed substance/WFD pollutant to groundwater. • Codes of Practice to encourage better management/prevention of releases of pollutants to groundwater.
EU driven authorisation / approval mechanisms for the marketing and use of plant protection products, biocides and veterinary medicines. (These are enforced via equivalent UK Regulations covering plant protection products, veterinary medicines and biocides)	Require human health and environmental risk assessment of products and requirement for 'authorisation' or 'approval' by UK competent authorities before the products can be marketed or used.
Environmental Permitting (England and Wales) Regulations 2007, which replace: <ul style="list-style-type: none"> • Pollution Prevention and Control (England and Wales) 	<ul style="list-style-type: none"> • Allows conditions to be set in the authorisation of a process that can include pollution prevention and other actions to prevent diffuse pollution, including air emissions that can lead to acidification.

Mechanism	What this does
Regulations 2000 • Waste Management Licensing Regulations 1994	<ul style="list-style-type: none"> Requirements for secure storage, safe transport and controlled disposal reduce the potential for waste materials of all kinds to enter the water environment.
Coal Industry Act 1994 as amended by Water Act 2003 and supported by Ministerial Statements and a Memorandum of Understanding with the Environment Agency	Provides powers to the Coal Authority to clean up and prevent water pollution from coal mines in England and Wales together with a prioritised programme of improvements required to minewaters in order to meet WFD objectives.
Trade effluent controls under the Water Resources Act 1991 and the Water Industry Act 1991	Applies to discharges and drainage arrangements from certain industrial sites.
Detergents Regulations 2005	Covers use of detergents by industry, institutions and consumers, as well as specifying the biodegradability of active ingredients of detergents (surfactants).
Environmental Protection Act 1990, Part 2A (remediation of contaminated land) and the Contaminated Land Regulations 2006	Provides for Notices to require remediation of contaminated land to improve the quality of groundwater and surface water.

Table F.8: Local authority controls for managing non-agricultural diffuse pollution

Mechanism	What this does
Public Health Acts 1936 and 1961 and the Building Act 1984	Gives local authorities powers relating to wrong sewer connections.
Building Regulations 2000 - Part H	Deals with sewers and encourages the Sustainable Urban Drainage Systems approach to surface water drainage.
Building Regulations 2000 - Part J	Deals with oil storage, and complements the scope of the Oil Storage Regulations (England) 2001.
Town and Country Planning Acts, supported by planning policy or guidance (Planning Policy Statements - PPSs)	In England, using the Sustainable Urban Drainage System approach to surface water drainage is promoted in PPS 23 - Planning and pollution control - and PPS 25 - Development and flood risk. Flood Risk Management policies in Development Plans identify the need for Sustainable Urban Drainage Systems to be used where local water management requires it. Conditions can be attached to development permission to require the use of Sustainable Urban Drainage Systems where it is appropriate. Planning agreements (s.106) may also be required. PPS 23 also requires clean up of land contamination.
Town and Country Planning Act 1990, s215	Gives local authorities powers to serve a notice on the owner or occupier of amenity land, or adjacent land, in

their area to improve the condition of the land.

Other approaches

Other approaches, such as voluntary mechanisms, include:

- The Highways Agency is developing the Highways Agency Drainage Database Management System for the strategic road network. This will be used to identify and help manage pollution risks. The Highways Agency has invested in a new fleet of salt gritters which optimise salt spreading rates and limit the risks to the water environment. They are also carrying out research into alternative de-icing agents.
- General public awareness raising, such as the Oil Care campaign, and Netregs website (Environment Agency) environmental information to small businesses.
- Influencing developers to construct Sustainable Drainage Systems in new developments, and retrofit in existing developments where practicable;
- Education and training, for example including environmental issues in Construction Industry Training Board sponsored National Vocational Qualifications.
- Joint regulator/operator agreements/memoranda of understanding, such as the Network Rail/water companies herbicide agreements, the Environment Agency/Fire Service emergency response agreements and the Environment Agency/Coal Authority Memorandum of Understanding.
- Voluntary codes of practice, such as the Timber Treatment Code of Practice, Forest and Water Guidelines, a Metal Finishers code, a photo-imaging code and the British Marine Federation/Royal Yachting Association Environmental Code of Practice and the Charter for Sustainable Cleaning (December 2004) which is driven by the detergents industry and includes key performance indicators in order to monitor progress; United Kingdom Water Industry Research Limited common framework for capital maintenance planning, and sustainable drainage systems code of practice; interim code of practice on sustainable drainage systems (published by Construction Industry Research & Information Association).
- Industry initiatives such as the Amenity Forum, which is concerned with promoting best practice in using pesticides in the amenity sector, and measures identified within the UK Strategy for the Sustainable Use of Plant Protection Products to deal with amenity and home and garden use of pesticides.
- Guidance, for example:
 - The Code for Sustainable Homes;
 - Industry sector guides, such Building a Cleaner Future and the Construction Industry Research & Information Association's control of water pollution from construction sites guide;
 - Regulator guidance, such as the Pollution Prevention Guidance notes from the Environment Agency;
- Supply chain controls - for example including environmental requirements in construction contracts.
- Best practice and design manuals - such as the Highways Agency's Design Manual for Roads and Bridges.

Defra, supported by Welsh Assembly Government, are funding a national prioritisation

programme for England and Wales for sites impacted by metal mines which is due to report in 2009.

Implementation in North West River Basin District

There is a priority list of 19 minewater discharge schemes in the Northwest RBD, which have been agreed with the Coal Authority who use it to define their work programme. 7 of these already have a remediation scheme in place. Mine sites such as Deerplay, Bridgewater and Old Meadows have operational schemes that collect and treat the mine discharge to a very high standard which is then discharged back to the watercourse. Schemes are also being developed that would identify, scope and remediate old metal mines that are impacting on water quality.

Major pollution incidents are often caused on highways. The Environment Agency has worked closely with the Highways Agency to identify ways to contain spillages from incidents, therefore limiting pollution to watercourses. We have put together green pollution prevention 'pods' which are being rolled out across the North West and emergency personnel have been trained in their deployment.

Progress has been made on Contaminated Surface Waters (CSW) through a targeted United Utilities programme. The process involves identification of CSWs, determination of the cause, awareness programmes, voluntary and aided schemes to control pollution.

F.8 Morphology - physical modifications

Hydromorphology is a term used in the Water Framework Directive to describe the processes operating within, and the physical form of, a water body, which could be a river, lake, estuary or coastal water. The term encompasses both hydrological and geomorphological characteristics that, in combination, help support a healthy ecology within these freshwater and marine environments. The Directive requires that these water bodies are managed in such a way as to protect or improve hydromorphological conditions so that the ecology is protected or enhanced. In doing so, the Directive recognises the key role that water resources and habitats play in supporting healthy aquatic ecosystems.

The sections below provide an overview of mechanisms to deliver physical improvements to the morphology of surface water bodies and to control morphological pressures with the aim of preventing deterioration of ecological status or potential:

- Inland navigation
- Spatial planning
- Land drainage and dredging of inland waters
- Flood and coastal erosion risk management
- Dredging, disposal and development in estuaries (transitional waters) and coastal waters
- Other controls, plans and programmes

i) Inland navigation

British Waterways has general environmental duties under section 22 of the British

Waterways Act 1995, which include conservation of flora and fauna.

The Association of Inland Navigation Authorities has prepared the report, 'Management strategies and mitigation measures for the inland navigation sector in relation to ecological potential for inland waterways'. This formed part of the UKTAG project to develop a methodology to classify good ecological potential (GEP) for artificial water bodies (AWBs) and heavily modified water bodies (HMWBs).

Appendix A to the report gives details of the pressures and impacts associated with inland navigation, including boat movement and dredging, and Appendix B has the measures which the inland navigation sector can use to mitigate these impacts (see http://www.aina.org.uk/work_programme/WFD-RH.html).

In addition to this work, the report, "Environmental impacts of boats: a review of possible mitigation strategies for inland waterways", produced by the Green Blue initiative, provides information on mitigating the impacts of recreational boating on inland waterways. The Green Blue was set up by the Royal Yachting Association (RYA) and the British Marine Federation (BMF) to inform and educate the recreational boating sector on how to improve their environmental performance.

ii) Spatial planning

There is a sustainable development duty under the spatial planning system and environmental protection and enhancement must be considered. The statutory processes of Sustainability Appraisal (incorporating Strategic Environmental Assessment), Habitats Regulation Assessment and individual Environmental Impact Assessment processes (or other relevant assessments) provide the means for screening for potential impacts of plans, programmes and individual proposals.

Any hydromorphological impacts identified have to be considered in line with Planning Policy Statement 9 which states that plans, policies and planning decisions should aim to maintain, and enhance, restore or add to biodiversity and geological conservation interests. Planning decisions should seek to prevent harm in the first instance and where this cannot be achieved, be satisfied that the development cannot reasonably be located on or provided for on any alternative sites that would result in less or no harm. In the absence of any such alternatives, adequate mitigation measures must be put in place with appropriate compensation measures sought for any unavoidable residual impacts. If this is not possible, then planning permission should be refused.

To achieve this, planning policies at regional and local scale, that help control both principles and detail of development, are needed that set out specific measures or criteria to be met to address any hydromorphological impacts and to encourage hydromorphological improvements.

This is particularly important where new development requires new or changed flood defences or improved coastal defences as these can often be designed to combine improving ecological quality with providing recreation facilities ('green infrastructure') for the local community. In England, growth funding may be available from Government or from development-related funding for these projects.

Influencing the final planning decision

The Environment Agency is a statutory consultee for regional spatial strategies, local development Frameworks (England) and Local Development Plans (Wales) and is also a statutory consultee under the Strategic Environmental Assessment Directive.

Under the provisions of The Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006, the Environment Agency is a statutory consultee for all planning applications where flood risk is an issue and for development on, in or within 20 metres of a main river or which include culverting or controlling its flow.

Statutory consultee status provides the means for the Environment Agency to influence the planning policy framework and the control of developments at the local level.

Overarching Planning Policy Statements such as PPS1 (Delivering sustainable development), 9 (Biodiversity and geological conservation), 25 (Development and flood risk) will be important for protecting and enhancing the hydromorphological conditions of waterbodies. They support sustainable development and require that development proposals look to enhance the environment as part of development.

Policies dealing with hydromorphology need to be included as part of the identified priorities for the environment in Regional Spatial Strategies. Waterbodies also need to be considered in regard to the proposed scale and distribution of new housing and infrastructure in the region. Regional Spatial Strategies set the overall scale of development in each region of England for a 15-20 year period. Plans must be assessed in terms of their potential environmental consequences, including any resulting from a hydromorphological change under the SEA Directive.

These are supported by Local Development Frameworks, which include the 'portfolio' of statutory local development documents setting out the spatial planning strategy for a local authority or unitary authority area. It is important to ensure that such plans and frameworks have clear policies in respect of hydromorphology since they establish the principle of what use is proposed for a piece of land before a planning application for the detailed development is received and how that application is considered.

The Environment Agency is a statutory consultee for all planning applications where flood risk is an issue. This is a key delivery mechanism for improving the hydromorphological condition of water bodies and regulates development which has the potential to cause deterioration of a water body. Conditions can be required to mitigate the flood risk impacts of proposed development and we already work with local planning authorities and developers to achieve these aims.

Where new development requires flood storage areas or improved coastal defences these often combine improving ecological quality with providing recreation facilities ('green infrastructure') for the local community. Growth funding may be available from Government or from development-related funding for these projects.

Table F.9: Mechanisms for managing spatial planning and hydromorphological pressures

Mechanism	What this does
Town & Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999	Requires an Environmental Impact Assessment for certain activities (listed in the Schedules of the Regulations) to determine the likelihood that a proposed project (development or other activity) will have significant environmental effects. Consenting authorities can modify or reject proposals that would significantly impact on hydromorphological conditions and can secure additional conservation gains as a condition of project approval.

Mechanism	What this does
Environmental Assessment of Plans and Programmes Regulations 2004	Ensures the environmental implications are taken into account before certain plans and programmes are adopted. The strategic environmental assessment process is integrated throughout the development of a plan or programme, notably during data gathering, feasibility of options, development of the preferred option, and monitoring its implementation. The Environment Agency is a statutory consultee to Environmental Assessments (Strategic Environmental Assessments and Environmental Impact Assessments) produced by other public bodies and developers.
The Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006	Establishes the Environment Agency as a statutory consultee for any planning application for development which involves the carrying out of works or operations in the bed of, or within 20 metres of the top of a bank of, a main river which has been notified to the local planning authority by the Environment Agency as a main river for the purposes of this provision; or the culverting or control of flow of any river or stream
Planning and Compulsory Purchase Act 2004 s39	Establishes the sustainable development duty of spatial planning and establishes the principles of and need to produce Regional Spatial Strategies and Local Development Frameworks

iii) Land drainage and dredging of inland waters

Land drainage

The Environment Agency can carry out various actions on main river to cleanse, repair or otherwise maintain existing watercourses. It can improve any existing watercourse or drainage by deepening, widening, straightening, raising or otherwise improving, or by removing or altering mill dams, weirs or other obstructions. It can make any new watercourse or drainage or do any other act required for the efficient drainage of any land. Local authorities and Internal Drainage Boards have similar powers to act on ordinary watercourses.

Land drainage works undertaken by the Environment Agency, local authorities or Internal Drainage Boards can only be undertaken to maintain or improve the efficient working of drainage systems. These powers cannot be used to undertake works for the sole purpose of improving the physical condition or conservation interest of rivers, although in some cases it can be possible to realise these benefits additionally.

The Natural Environment and Rural Communities Act 2006 gave the Environment Agency and other drainage authorities amended byelaw-making powers to ensure that the broader effects of drainage systems on the environment can be taken into account when considering land drainage consent applications under byelaws. The Environment Agency is intending to use these powers to replace regional land drainage byelaws with a single set of national byelaws. By taking greater account of the environmental impacts of land drainage activities these proposed new byelaws will help reduce impacts to hydromorphological conditions in main rivers.

The Natural Environment and Rural Communities Act 2006 provides similar byelaw-making powers to local authorities and Internal Drainage Boards. This power could be used by these authorities to redraft their byelaws to help reduce impacts to hydromorphological conditions in ordinary watercourses.

Dredging

The Environment Agency's land drainage byelaws can be used to some extent to control dredging activities, and in some areas the Environment Agency has the power to control dredging under specific local legislation.

Dredging undertaken by public bodies (including the Environment Agency) for the purposes of land drainage, flood risk management or navigation in ordinary watercourses are exempt from land drainage consenting. Control of potentially damaging activities is limited to the development of and adherence to good practice guides and memoranda of understanding.

Table F.10: Mechanisms for managing land drainage works

Mechanism	What this does
Water Resources Act 1991, s109	Provides Environment Agency with regulatory control (through land drainage consenting) of the construction, alteration or repair of structures in, over or under any main river. Power is also given to Environment Agency to alter or remove any works in contravention of section 109 and recover the costs of this. Conditions can be imposed only in relation to the time and manner in which work can be carried out. <u>Limited power to achieve WFD's hydromorphological objectives.</u>
• Water Resources Act 1991, s165 • Land Drainage Act 1991 s14(2)	Empowers Environment Agency to maintain or improve existing drainage works or to construct new works on main river. Power also extends to maintain, improve or construct drainage works for the purpose of defence against sea water or tidal water. Work can only be undertaken to improve flow conveyance and ensure the efficient working of the drainage system, though other conservation benefits may also be achieved. Equivalent powers are conferred upon Internal Drainage Boards and local authorities through section 14(2) of the Land Drainage Act 1991. Any work carried out by third parties that may impact on flow conveyance is subject to a land drainage consent from the relevant authority (Environment Agency, Internal Drainage Board or local authority) – see below
• Water Resources Act 1991 s107 • Land Drainage Act 1991, s21 and s25	Provides Environment Agency power to serve a notice in regard to main river to ensure that necessary works to improve flow conveyance are carried out, or to undertake the works and recover reasonable costs.
Land Drainage Act 1991, s23	Provides Internal Drainage Boards and local authorities powers to serve a notice in regard to ordinary watercourses to ensure that necessary works to improve flow conveyance are carried out, or to undertake the works and recover reasonable costs.
Water Resources Act 1991, Schedule 25 as amended by s 00 of the Natural Environment and	Provides Environment Agency and Internal Drainage Boards a regulatory control (through land drainage consenting) of the erection, raising or otherwise altering of mill dams, weirs or other like obstructions to flow. Written consent is also required for the erection or alteration of any culvert that is likely to affect the flow in ordinary watercourses.
	Provides power to the Environment Agency to make byelaws necessary for the efficient working of any drainage system and for regulating the effects of any drainage system on the environment

Mechanism	What this does
Rural Communities Act 2006	
Land Drainage Act 1991 as amended by s100 of the Natural Environment & Rural Communities Act 2006	Confers byelaw-making powers on Internal Drainage Boards and local authorities that are deemed necessary for the efficient working of the drainage system and for regulating the effects of any drainage system on the environment. Powers for Internal Drainage Boards only extend to ordinary watercourses.
Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999	Requires an Environmental Impact Assessment for certain activities (listed in the Schedules of the Regulations) to determine the likelihood that a proposed project (development or other activity) will have significant environmental effects. Consenting authorities can modify or reject proposals that would significantly impact on hydromorphological conditions and can secure additional conservation gains as a condition of project approval.

iv) Flood and coastal erosion risk management

The Environment Agency, local authorities and Internal Drainage Boards manage flood and coastal erosion risks within England and Wales.

The Environment Agency's flood risk management activities, and how they can benefit river basin management through the use of particular mechanisms, are guided by the following plans and strategies:

- *Making Space for Water* – the Government's strategy for sustainable flood risk management in England for the next 20 years and beyond.
- *Catchment Flood Management Plans* – are prepared by the Environment Agency and set long term policies for sustainable flood risk management within a catchment.
- *Shoreline Management Plans* – are prepared by coastal local authorities and the Environment Agency, and promote sustainable management policies for the coastline over a 100 year period.
- *Delivery Plans* - specific 'delivery' plans will be developed to determine the best measures to deliver the policy intents of Shoreline Management Plans and Catchment Flood Management Plans. These plans could include for example Water Level Management Plans, System Asset Management Plans, Local Flood Warning Plans, and Multi-Agency Response Plans for flooding.

Any flood and coastal erosion risk management strategies or schemes which are promoted in accordance with policies in Shoreline Management Plans and Catchment Flood Management Plans will have to be assessed against the requirement to prevent deterioration in ecological status or potential and will have to comply with Article 4.7 of the Water Framework Directive. Project Appraisal Guidance for flood and coastal erosion risk management schemes are being revised to take account of Government policy, the Water Framework Directive and other relevant legislation.

Flood risk management grant in aid can legally fund the provision of environmental benefits, such as river restoration work, where it is integral to a flood or erosion risk management scheme. This expenditure remains subject to Government spending rules and priorities, such as Project Appraisal Guidance and Outcome Measures.

v) Dredging, disposal and development in estuaries (transitional waters) and coastal waters

The existing legislative mechanisms for licensing works in estuaries and coastal waters provide varying levels of control. Currently, some works may require a number of licences while others are not regulated at all. The licensing system is being completely revised through the Marine and Coastal Access Act 2009.

The Environment Agency does have some remit in estuaries and coastal waters for regulation through land drainage consents and discharge consents. Most works in estuaries and coasts however are not licensed by the Environment Agency. While the Environment Agency is not a statutory consultee in the process it is standard practice for it to be consulted on applications made for licences issued by the Marine and Fisheries Agency. Many marine works are also subject to Environmental Impact Assessment and hydromorphological impacts will be assessed as part of this. Important environmental considerations for regulators are the potential hydrological effects, interference with other marine activities, the possibility of turbidity, noise, drift of fine materials smothering seabed flora and fauna, and the risk of impact to designated conservation areas. In this way new physical modifications can be assessed to see if they will cause deterioration of the hydrological and morphological conditions. This will also highlight opportunities to make improvements, where this is possible.

In England the Marine and Fisheries Agency has statutory control over marine works, which were previously the responsibility of Defra and CLG, including construction, coastal defences, dredging, marine aggregates extraction and the disposal of waste materials in the sea. Coast Protection Act (1949, Part II) licences will remain with the Marine and Fisheries Agency until they are also replaced by the marine licence being introduced by the Marine and Coastal Access Act 2009.

Table F.11 provides an overview of mechanisms for managing dredging in estuaries, coastal and marine waters.

Table F.11: Mechanisms for managing dredging in estuaries, coastal and marine waters

Mechanism	What this does
Food and Environment Protection Act 1985	Controls the deposit of dredged material and construction on the sea bed
Coast Protection Act 1949	Controls any capital dredge and any dredging for navigation where there are no harbour controls
Marine Works Environmental Impact Assessment Regulations 2007	Requires an Environmental Impact Assessment for certain activities (listed in the Schedules of the Regulations) to determine the likelihood that a proposed project (development or other activity) will have significant environmental effects. Consenting authorities can modify or reject proposals that would significantly impact on hydromorphological conditions and can secure additional conservation gains as a condition of project approval.
Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (England)	Marine Minerals regulations were introduced in 2007 to replace the Government View procedure and establish a scheme of regulation for marine minerals dredging.

Mechanism	What this does
and Northern Ireland) Regulations 2007	
Harbour Orders/local powers	Controls the dredging of materials within a set area associated with a port or marine

The Marine and Coastal Access Act 2009 makes provision for one marine licence combining the requirements of Food and Environment Protection Act (1985), Part 2 of the Coast Protection Act (1949) and the previous non-statutory procedure for marine minerals extraction. Importantly, the Act includes the provision for all types of dredging to be included in the marine licence, although Defra are consulting on whether maintenance dredging that has no or little impact on the environment might be exempted under the subsequent exemptions order. However, any exemption made would not compromise the objectives of the Water Framework Directive. Renewable energy schemes will need consent under section 36 of the Electricity Act 1989 and a marine licence, but will have both applications considered together under one set of procedures. The Marine Management Organisation will administer the new marine licence.

The separate requirement to seek an Environment Agency land drainage Consent under the Water Resources Act 1991 and its byelaws can also be disapplied by the Environment Agency where a marine licence is also needed for a particular activity, although we would be part of this licence process. This is an area where we can influence development and protect or try to enhance the ecology of a water body by looking at the impacts on hydromorphology.

Harbour authorities need to take account of the Water Framework Directive. The Environment Agency will continue to work with navigation authorities so that they can prepare and implement maintenance dredging plans that support river basin management. The Water Framework Directive should also be taken into account as part of their harbour orders or marine licences. The Marine and Coastal Access Act 2009 contains a power to delegate the harbour order making functions of the Secretary of State to the Marine Management Organisation to enable applications for new harbour orders and a marine licence to be considered together through one set of procedures by one body and to ensure all issues are addressed by one or the other authorisations.

Many estuaries have Natura 2000 sites and under the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended), works likely to have a significant environmental impact will be subject to an appropriate assessment. Alternatively, under the voluntary Maintenance Dredging Protocol participating port and harbour authorities will need to produce a baseline document which will review whether the proposals will impact on the protected site. Where the works are then aligned with the objectives of the Natura 2000 site it may also be possible to protect hydromorphological conditions.

The on-line guide (<http://www.estuary-guide.net/>) sets out how to assess and manage morphological change in estuaries, coastal habitat creation, restoration and recharge schemes.

vi) Other controls, plans and programmes

The management of activities that have potential to have an impact on hydromorphological conditions is of relevance across many different sectors and, within the Environment Agency, is a requirement for many different functions. As such the management of hydromorphological pressures requires an integrated catchment management approach. This section and Table F.12 below lists other relevant mechanisms for managing hydromorphological pressures.

Table F.12: Mechanisms for managing hydromorphological pressures

Mechanism	What this does
Salmon and Freshwater Fisheries Act 1975 Part II	Requires that new obstructions to the passage of salmon and migratory trout (or the raising or repair of existing obstructions) be fitted with appropriate fish passes. Includes powers to serve notice (under section 9) to require these works to be undertaken. Section 2(4) of this Act makes it an offence to wilfully disturb any river or lake bed, bank or shallow on which any spawn or spawning fish may be. Proposals to extend the powers in this Act to allow passage of all fish species are outlined in the January 2009 Defra consultation on modernisation of salmon and freshwater fisheries legislation; new Order to address the passage of fish.
Water Act 2003, s 3 and 4	Empowers the Environment Agency to licence existing unlicensed impoundments or remove or else modify existing unlicensed impoundments where necessary for the protection of the environment by serving notice under section 4.
Conservation (Natural Habitats, & c.) Regulations 1994 (as amended)	The legislative framework (along with the Wildlife & Countryside Act 1981) through which the Habitats Directive and Birds Directive are implemented. Regulations 3(3), 3(4), 48 and 50 provide a conservation duty for Natura 2000 sites that overrides all other statutory regimes. Powers are employed to assess new and existing consents and permissions for significant adverse impacts and to provide compensatory habitat if required. Habitats Directive objectives are reflected in Water Framework Directive Protected Areas objectives and so the requirements of Habitats Directive have to be met under Water Framework Directive. The Review of Consents process does not include land drainage consents
Wildlife & Countryside Act 1981, s 28G	Places a duty on public bodies (including Environment Agency) in exercising their functions to take reasonable steps to further the conservation and enhancement of the special features of Sites of Special Scientific Interest. Limited geographical application
Wildlife & Countryside Act 1981, s 28J	Gives Natural England and Countryside Council for Wales powers to put in place a management scheme to conserve or restore the flora, fauna, geological or geophysical features of Sites of Special Scientific Interest. May need Environment Agency (or other drainage authority) consent for the works. Limited geographical application
Wildlife & Countryside Act 1981 s 28K	Gives Natural England and Countryside Council for Wales powers to serve a management notice to ensure that conservation or restoration works are implemented. Also empowers Natural England to carry out the works itself and recover the costs from the owner or occupier. May need Environment Agency (or other drainage authority) consent for the works. Limited geographical application.

Diffuse pollution control measures have significant potential to control activities that cause deterioration of hydromorphological conditions, and offer great potential to restore water bodies to a more natural condition. These mechanisms are discussed in section F.7.

Several Environment Agency plans and strategies can also be used to guide the extent (and location) of application of the mechanisms outlined in this section, including:

- Fisheries Action Plans
- Salmon Action Plans
- Eel Management Plans
- National (England and Wales) Trout and Grayling Strategy
- Sea Trout and Salmon Fisheries Strategy
- Biodiversity Action Plans
- Species action Plans
- Habitat Action Plans
- Local Biodiversity Action Plans
- Water Resources Strategy

Many restoration and enhancement projects are undertaken in partnership with, or in some cases solely by, Natural England and other conservation bodies such as the Rivers Trusts. Many projects are undertaken through voluntary agreements at local level.

The Wetland Vision

The Wetland Vision has been developed in partnership between Natural England, the Environment Agency, English Heritage, Royal Society for the Protection of Birds and the Wildlife Trusts. It sets out the need for strategic action to restore the wetland environment, mainly for nature conservation and the preservation of the historic environment, but with significant benefits for society through flood mitigation, groundwater recharge and storage of carbon. Maps have been prepared that help visualise the action needed to ensure sustainable wetland biodiversity and provide other benefits. The Vision will be implemented through existing mechanisms and partnerships, such as agri-environment schemes, remedial work to Sites of Special Scientific Interest (SSSIs), the Environment Agency's Regional Habitat Creation Programme and nature reserve acquisition.

Catchment Restoration Fund

Defra is in discussion with the Environment Agency, Welsh Assembly Government and key environmental NGOs on the potential establishment of a Catchment Restoration Fund. Such a fund would be used to deliver morphological improvements across all water body types for the purpose of helping to achieve Water Framework Directive environmental objectives.

A Defra-led project began in early 2009 to investigate the potential sources of funding for a Catchment Restoration Fund and to explore options for its administration. This project has produced a report that provides a summary of regional, national and European sources of funding that currently are used by the Environment Agency and Water Framework Directive co-deliverers for hydromorphological improvements. A further draft report from this project assesses the potential benefits and limitations of a number of different administrative models for a potential Catchment Restoration Fund. This report makes recommendations for preferred options as discussed by this group of stakeholders.

Working towards delivery of new mechanisms

The Environment Agency has identified a number of gaps in, or limitations of, existing legislation that weaken the ability the ability of the Environment Agency and other public bodies to deliver the environmental objectives of the Water Framework Directive. These limitations principally relate to the ability of the Environment Agency and other public bodies.

The Environment Agency has been working with Defra and the Welsh Assembly Government to find ways to improve the ability to limit or prevent deterioration in water body status and secure improvements to water body status. Several proposals were included in Defra consultations on the draft Flood and Water Management Bill (April 2009) and Water Protection Zones (December 2008). A summary of these is provided in table F.13 below.

Table F.13: Possible new mechanisms for managing hydromorphological pressures

Mechanism	What this would do
Consenting Works Affecting Water Courses	The draft Flood and Water Management Bill contains a draft clause that would enable the Environment Agency, local authorities and Internal Drainage Boards to make consents subject to reasonable conditions. Such provision would ensure that flood and coastal erosion risk management authorities are able to impose conditions on consents to prevent, limit or mitigate damage to hydromorphological conditions in line with WFD requirements.
WFD Duty on Drainage Authorities	The draft Flood and Water Management Bill contains a draft clause that would place a duty on all flood and coastal erosion risk management authorities to act in accordance with WFD requirements. This is intended to ensure that the operational and regulatory flood and coastal erosion risk management activities of these authorities are undertaken so as to secure compliance with the requirements of the WFD.
Power to Improve Hydromorphological Conditions	The draft Flood and Water Management Bill consults on proposals for the provision of a permissive power for the Environment Agency to enter land and undertake works for the purpose of improving hydromorphological conditions as necessary to achieve WFD environmental objectives. Such a power would be employed in cases where the existing suite of delivery mechanisms had failed to deliver necessary improvements to hydromorphological conditions.
Water Protection Zones	The Defra/ Welsh Assembly Government consultation on Water Protection Zones (December 2008) proposed legislative change to section 93 of the Water Resources Act 1991. This would allow the Environment Agency to use WPZs to manage or prohibit a specific set of high risk activities causing direct or indirect damage to the hydromorphological condition of the bed, banks and riparian zone of surface water bodies.
Works Notices and Emergency Works	The Defra/ Welsh Assembly Government consultation on Water Protection Zones (December 2008) proposed legislative change to sections 161 and 161A of the Water Resources Act 1991. The proposed changes would allow the Environment Agency to issue a Works Notice, in cases where damage has been caused to the morphological condition of controlled waters, to require restoration of those waters to their state immediately before the damage occurred. The Environment Agency would also be empowered to act itself to restore controlled waters where damage has been caused or to investigate the cause of damage, with cost recovery.

Implementation in the North West River Basin District

An excellent planning example from Northwest is the restoration of Sinderland Brook near Altrincham in partnership with The National Trust, Redrow Homes and Taylor Woodrow. The 1.8 Km of the channelised Sinderland Brook was restored to its natural meandering floodplain; reducing flood risk and bringing in immense habitat value to the area. Additionally, a new housing development with water and energy efficient homes were built on the restored land adjacent to the brook. Seven hectares of community woodland, Sustainable Urban Drainage Systems (SUDS), eco-friendly homes and well-connected greenways and wildlife corridors; this planning enterprise is exemplary in every sense.

F.9 Fishing and fish stocking

The Environment Agency's responsibility for the management of fisheries covers England and Wales and extends out to 6 nm from the baselines. In carrying out its functions, the Environment Agency's principle aim is to protect and enhance the environment and take the appropriate steps towards achieving sustainable development. With regards to fisheries, the Agency is required to maintain, improve and develop migratory and freshwater fisheries. This includes:

- Ensure conservation and maintain diversity of fish and conserve the aquatic environment
- Enhance the contribution that salmon and freshwater fish make to the economy
- Enhance the social value of fishing

The Environment Agency is also required to maintain healthy fish populations, and ensure that inappropriate fish species are not introduced and that the diseases or parasites they may carry are adequately controlled.

In most recreational fisheries it has become popular to practise catch and release (almost 100% for coarse fish and more than 50% for salmon) or to re-stock to maintain the fish population. The main commercial fisheries that remove fish are those for inshore fisheries, salmon/sea trout and eel, and the 4000 consents to crop coarse fish that we regulate each year.

Formal mechanisms that help the Environment Agency to conserve protect fish populations are set out below.

Table F.14: Mechanisms for managing fisheries

Mechanism	What this does
National spring salmon byelaws	Prohibits the killing of salmon before 1 June each year
Fisheries byelaws	Controls on fishing activities, such as bans on use of live bait and restricting the fishing methods used.
Fish Health Directive	Requires fish farms, suppliers and fisheries to be registered or authorised so that the transfer of fish diseases is better controlled
Import of Live Fish Act (ILFA) 1980	Controls spread of non-native species. ILFA regulates the import, keeping and release of non native fish in England and Wales, by means of Orders relating to specific listed species.
Prohibition of Keeping or	Prohibits the keeping or release of listed non-native

Mechanism	What this does
Release of Live Fish (Specified Species) Order 1998 (as amended in 2003)	species except under licence.
Prohibition of Keeping of Live Fish(Crayfish) Order 1996	Prohibits, with one exception being signal crayfish (<i>Pacifastacus leniusculus</i>) in areas where it has become established, the keeping of any non-native crayfish except under licence.
Wildlife and Countryside Act 1981	Prohibits the releasing to the wild of scheduled invasive-non-native species or allowing them to escape into the wild.
Salmon & Freshwater Fisheries Act 1975, s30	Prohibits the release of fish into inland waters without consent.
Salmon and Freshwater Fisheries Act 1975	Provides various powers for the protection and management of fisheries, including the introductions of orders that limit the number of nets fishing in a public fishery.
Water Resources Act 1991	Sets out the responsibilities of the Environment Agency in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation.
Environment Act 1995	Sets up the Environment Agency and set new standards for environmental management
Other related legislation	These include the Salmon Act 1986 etc.

In addition to these a number of informal mechanisms are available.

The Environment Agency works with national and local organisations to improve awareness of issues and to promote good practice. Accreditation schemes that promote fish welfare and conservation help with this and include schemes that relate to products used by anglers.

Fisheries action plans are local plans developed in partnership between the Environment Agency and local angling and fisheries groups, with input from conservation and other interest groups. They are based on river catchments, but cover canal and still-water fisheries as well as rivers. They may cover a wide range of issues from fish habitat through to angling promotion and land management. Each Fisheries action plan is different and reflects the concerns and priorities of local angling and fisheries interests.

Salmon and eel action plans have been prepared that identify a range of pressures that need to be addressed to improve salmon and eel stocks. The Environment Agency's strategy for the management of salmon fisheries in England and Wales requires the production of an individual Salmon Action Plan (SAP) for each principal salmon river. As well as updating these plans at regular intervals, they will be progressively integrated to the 6-yearly Water Framework Directive Planning Cycle. Whilst the strategy recognises the need to maintain a national overview of salmon conservation, the key component requires individual stocks to be managed effectively. Government has instructed the Agency to set Conservation Limits (CLs) for individual rivers and to refine these limits and the way they are used to take account of improvements in methodologies and new data. This approach is endorsed by the North Atlantic Salmon Conservation Organisation which is an inter-governmental body concerned with salmon conservation at an international level.

The Anglers Monitoring Initiative is a national scheme led by the Riverfly Partnership. Anglers use a simple technique, with reference to riverflies, to monitor river water quality.

This complements the Environment Agency's invertebrate monitoring programme and helps ensure that water quality is checked more widely so that action can be taken at the earliest opportunity if problems are apparent. It is a good example of collaborative working between communities and the statutory bodies, which has widespread support. It deters casual polluters and helps identify waters for further investigation.

Future mechanisms that will be introduced to ensure more appropriate measures are in place is highlighted below:

In response to the collapse of the single European eel stock across Europe, the European Commission published Council Regulation No 1100/2007 introducing limits on eel fisheries. The Environment Agency has produced Eel Management Plans (EMPs), which set out the necessary measures and timescales to achieve 40% escapement of silver eel. Some of the measures needed includes: eel net limitations; close seasons; maximum size limits; regulation of eel traders; and traceability of imports and exports of eels.

The Marine and Coastal Access Act 2009 provides the Environment Agency with new powers and modernised tools for the effective management of fisheries and their enforcement, to enable the better protection of stocks and their habitats. Such powers include provisions to make emergency byelaws to respond effectively and promptly to unforeseen threats to fish stocks; modify the existing fishing licensing regime and introduce an authorisation regime for some fishing activities; and they give powers for Ministers to introduce a new regulatory scheme to manage the movement of live fish in order to protect local and national biodiversity.

The Environment Agency have day-to-day responsibility for the regulation and management of migratory and freshwater fisheries in England and Wales, including the Border River Esk in Scotland, but excludes the English River Tweed.

The newly formed Inshore Fishing and Conservation Authorities (IFCAs), previously Sea Fisheries Committees (SFCs), can introduce byelaws for the regulation of sea fisheries that have an impact on salmonids, in order to protect these species.

This arrangement exists currently and will continue under the Bill. This is because salmon and other migratory species are included in the wider definition of the 'marine environment' and so byelaws to regulate sea fisheries (e.g. requirements to set a bass net at a certain level so that salmon can swim over) can continue. IFCAs will work with the Environment Agency – as SFCs do now - so appropriate measures can be taken to regulate sea fish for the protection of salmon and other migratory species.

Implementation in North West River Basin District

The Environment Agency issued 756 consents in 2008 to stock fish to freshwaters in the North West River Basin District.

F.10 Invasive non-native (alien) species

Non-native (or alien) species are those species that are not native to this country, or to a particular water body. After being introduced accidentally or deliberately, they may become established and may have the ability to out-compete native species, taking over their new environments. They are commonly referred to as invasive non-native species (INNS) or invasive alien species (IAS).

Management of this problem will be led by the “Invasive Non-native Species Framework Strategy for Great Britain”, Defra, May 2008. (available at the GB Non-Native Species Secretariat website <http://www.nonnativespecies.org/>)

Key measures in the strategy include:

- Developing ways to educate people on the risks from invasive non-native species, and how to help avoid introducing these species.
- Developing a web-based shared Non-Native Species Information Portal that will show the distribution of non-native species and more detailed factsheets for 300 species
- Developing expertise for early identification of potential problem species that may already be here or on their way, and the best ways to handle them.
- Developing a clear framework for rapid responses when invasive species are detected for the first time in Britain.
- Encouraging a partnership approach to managing invasions.
- Supporting research on cost-effective methods to address established invasions.

An action plan has been developed by the GB Programme Board to implement this strategy which sets out actions to tackle the problems of non-native species across England and Wales.

Some of the formal mechanisms already available include the following:

Table F.15: Mechanisms for managing invasive non-native species

Mechanism	What this does
Import of Live Fish Act (ILFA) 1980	Controls spread of non-native species. ILFA regulates the import, keeping and release of non native fish in England and Wales, by means of Orders relating to specific listed species.
Prohibition of Keeping or Release of Live Fish (Specified Species) Order 1998 (as amended in 2003)	Prohibits the keeping or release of listed non-native species except under licence.
Prohibition of Keeping of Live Fish(Crayfish) Order 1996	Prohibits, with one exception being signal crayfish (<i>Pacifastacus leniusculus</i>) in areas where it has become established, the keeping of any non-native crayfish except under licence.
Wildlife and Countryside Act 1981	Prohibits the sale of, and releasing to the wild of scheduled invasive-non-native species or allowing them to escape into the wild.
Salmon & Freshwater Fisheries Act 1975, s30	Prohibits the release of fish into inland waters without consent.
Fisheries byelaws	Controls on fishing activities, such as bans on use of live bait (or by using the licence schemes described above).

Guidance on good practice to avoid introducing invasive non-native species, or to detect and/or eradicate these is given in national codes of practice, such as “The knotweed code of practice” for managing Japanese knotweed on development sites (Environment Agency, 2006) and the Horticultural Code of Practice (Defra, 2005).

Partnerships between ports authorities and other interested groups have introduced guidance under the International Convention for the Control and Management of Ship’s Ballast Water and Sediment (to be ratified).

Direct action to detect and eradicate invasive non-native species may be taken locally, often in partnership with others (for example a local “Invasive non-native species forum”) and as part of Local Biodiversity Action Plans. Flood risk river management programmes often include actions to manage non-native plant species where they have an impact on flood risk. Areas of high biodiversity value, or of high risk from plant-induced flooding, may benefit from plans to prevent invasive non-native species from becoming established.

Implementation in North West River Basin District

In the Northwest River Basin District the Environment Agency runs annual Japanese Knotweed eradication programmes for watercourses along the West Lancashire and Fylde coasts. This allows access to the watercourses for regular maintenance, recreation and keeps the channel clear for flood waters.

Fisheries and Biodiversity teams ran a leaflet campaign across the River Basin District on signal crayfish. Information detailed the risk of introducing American signal crayfish to rivers. Leaflets were sent to over 20,000 licensed anglers explaining the impact caused by introducing non-native species to watercourses and the law that prevents this practice.

F.11 Direct discharge of pollutants into groundwater

The direct discharge of pollutants into groundwater is discouraged but can be allowed in some locations and in specific circumstances. Any direct discharge must still comply with the overall objectives of the Water Framework Directive and Groundwater Daughter Directive. That is, the discharge does not cause pollution, the input of hazardous pollutants is prevented, the status of the groundwater body is not reduced and there is no significant rising trend of pollutants that needs to be reversed. Direct discharges of List I substances are already prohibited by the Groundwater Directive, which is put into effect through the Groundwater Regulations 1998 and other legislation noted under F.2 xi above, subject to certain exemptions.

F.12 Priority substances

The Water Framework Directive provides for the identification of priority substances (PS) for which the objectives are a progressive reduction of discharges, emissions and losses and, for a subset of priority hazardous substances (PHS), a cessation or phasing-out of discharges, emissions and losses within 20 years. It also requires the determination at European Union level of environmental quality standards (EQS), which will be used as criteria for the assessment of ‘good chemical status’ for surface water bodies. The ‘priority list’ of dangerous substances was agreed by co-decision (Decision 2455/2001/EC) in 2001. Priority substances were selected on a risk-based prioritisation process which identified both priority substances and priority hazardous substances using monitored and modelled data demonstrating EU-wide significance, and taking into account their persistence, bioaccumulation and toxicity.

There are 33 priority substances (or groups of substances), of which 13 have been identified as priority hazardous substances. Environmental quality standards for these substances were published in December 2008 in the Priority Substance Daughter Directive (2008/105/EC). All the standards in that Directive must be met for a surface water body to be classified as being of 'good chemical status'

The Priority Substance Daughter Directive reiterates that the objectives and provisions of Water Framework Directive Article 4 apply. Therefore the objectives to achieve 'good chemical status' and for a progressive reduction of priority substances and cessation of priority hazardous substances are subject to disproportionate cost and technical infeasibility considerations.

A further objective of the proposal is for Member States to take measures aimed at ensuring, subject to Water Framework Directive Article 4, that concentrations of certain priority substances that tend to accumulate in sediment and/or biota do not significantly increase.

Member States are also to establish an inventory of emissions, discharges and losses of the pollutants listed in the Priority Substance Daughter Directive for each river basin district.

Until June 2009, measures for priority substances were set out in European Community Council Regulation No 793/93 of 23 March 1993 on the Evaluation and Control of the Risks of Existing Substances. This legislation required risks to human health and the environment (including the water environment) to be assessed. Where risks were confirmed, risk reduction strategies were implemented. This legislation has been the main factor driving restrictions on certain chemicals (such as nonylphenol) due to their impact on the water environment and will be replaced and expanded by the REACH (Registration, Evaluation, Authorisation and restriction of Chemicals) Regulations. REACH manages chemical substances produced or imported into the European Union in quantities over one tonne a year. This includes registration and assessment of risks to human health and the environment. Substances of high risk to human health or the environment will be subject to high levels of control. The REACH regulations came into force on 1 June 2009.

The competent authority for managing REACH in England and Wales is the Health and Safety Executive, working closely with the Environment Agency and other key partners.

Many of the mechanisms listed in F.6 (point source pollution) and F.7 (diffuse pollution) can be used to avoid or limit pollution from priority substances.

Other available mechanisms for managing priority substances are given in Table F.16.

Table F.16: Measures for managing priority substances

Mechanism	What this does
Controls on point or diffuse sources of pollution under: <ul style="list-style-type: none">• Water Resources Act 1991• Groundwater Regulations 1998	Place controls on discharges or disposals of priority hazardous substances; eliminates, reduces and renders emissions harmless.
And under the Environmental Permitting (England and Wales) Regulations 2007, which replace: <ul style="list-style-type: none">• Pollution Prevention and Control (England and Wales) Regulations 2000	(See also Section F.6 on Point Source Discharges and Section F.7 on Diffuse Source Pollution)

Mechanism	What this does
<ul style="list-style-type: none"> • Waste Management Regulations 1994 • Landfill Regulations 2002 • Waste Management Regulations (England and Wales) 2006 (Agricultural Waste Regulations) 	
Control of Pollution Act 1974 and Food and Environment Protection Act 1985	Bans use of tributyltin (TBT) on boats less than 25m long.
European Regulation 782/2003	Removal of tributyltin (TBT) from hulls by July 2003. No vessels in European Union waters by 2008 with TBT on their hulls.
Marketing and Use Restriction under Regulation European Community 850/2004	Bans use of particular substances in the European Union.
Marketing and Use Restrictions under the Control of Pesticides Regulations 1986	Bans or restricts use of priority hazardous substances used for pesticides.
World-wide treaty on Persistent Organic Pollutants	Bans marketing and use of these substances

The European Union mercury strategy and the work of the OSPAR Commission² have reduced the use of mercury in industry, including a ban on mercury thermometers.

The Environment Agency's Memorandum of Understanding with the Coal Authority deals with the prevention of new discharges and remediation of existing discharges from abandoned coal mines, exchange of information, research and to ensure (as far as possible) operators deal with potential pollution from closure of licensed coal mines

There are several national assurance schemes that help to minimise the environmental risks from sheep dip chemicals and prevent further environmental damage. These include Linking Environment and Farming, Local Environment Risk Assessment for Pesticides, voluntary agreements on use of pesticides and sheep dip, for example Pesticide Voluntary Initiative with Defra, WaterUK, and the Environment Agency.

Registration of users and certificates of competence under BASIS - minimises the environmental risks from sheep dip and other chemicals and prevents further environmental damage.

Pollution Reduction Programmes are also in place for the following substances:

Priority Substances: 1,2-Dichloroethane, Alachlor, Atrazine, Chlorfenvinphos, Diuron, Simazine and Trifluralin, Benzene, Chlorpyrifos, DEHP, Dichloromethane, Isoproturon, Lead, Naphthalene, Nickel, Octylphenol, Pentachlorophenol, Trichlorobenzenes and Trichloromethane.

Priority Hazardous Substances: Anthracene, Cadmium, Endosulfan, Hexachlorobenzene, Hexachlorobutadiene, Hexachlorocyclohexane, Mercury, Nonylphenol, PAHs, Pentabromodiphenyl ether, Pentachlorobenzene, Short chain chlorinated paraffins and tributyltin (TBT).

² The 1992 OSPAR (Oslo-Paris) Convention is the current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic

Specific Pollutants: 2,4-D, Cypermethrin, Diazinon, Dimethoate, Linuron and Mecoprop.

These provide information on probable sources, and possible measures together with their likely contribution to status and their cost-effectiveness.

These provide information on probable sources, and possible measures together with their likely contribution to status and their cost-effectiveness. They also set out how progress will be made towards stopping use of Priority Hazardous Substances and compliance with status objectives for other chemicals. Pollution Reduction Plans were released in September 2009.

The Environment Agency has published pollution prevention guidance, including guidelines on sheep dipping (PPG12).

Groundwater protection codes:

- Use and storage of solvents- prevents pollution from solvents.
- Groundwater protection code: Use and disposal of sheep dip compounds - minimises the environmental risks from sheep dip chemicals and prevents further environmental damage.

Implementation in the North West River Basin District

The National Farmer's Union launched a 'Stop every Drop' campaign, initiated to raise user awareness of the environmental risks associated with use of sheep dip products and to ensure farmers and contractors adopt best practice when dipping. The North West River Basin District targeted sheep dip pollution as a high-risk priority in 2007. Environment Agency local area teams conducted training sessions for sheep dip contractors and farmers.

F.13 Accidental pollution incidents

Mechanisms set out above in sections F.6 on point source discharges, F.7 on diffuse source pollution and F.11 on priority pollutants can also be used to help avoid or deal with the effects of accidental pollution. Educational programmes and raising public awareness are also valuable mechanisms.

The more specific measures to prevent or reduce the impact of accidental pollution incidents are set out in Table F.17.

Table F.17: Mechanisms to prevent or reduce accidents

Mechanism	What this does
Control of Major Accident Hazard	
Regulations 1999 in partnership with Health & Safety Executive	Minimises accidents from stored pollutants.
Environmental Permitting (England and Wales) Regulations 2007	Controls on process industries to minimize accidental emissions
Water Resources Act 1991	
• Liability for sewage discharges from sewerage system, s87	• Makes sure sewerage undertakers (owners/operators) prevent illegal inputs to sewage treatment works
• Works notices, s161A	• To prevent/reduce pollution.
• Storage of pollutants and use of Water	• Minimises/Prevents accidents from

Mechanism	What this does
Protection Zones, s93 • Flood warnings, s166	stored pollutants. • Carry out flood defence functions, including flood warnings, by use of committees
Groundwater Regulations 1998 (due to be replaced in Autumn 2009 by new Groundwater Regulations)	Notices to prohibit any activity that might lead to an input of a listed substance/WFD pollutant to groundwater.
Control of Pollution (Oil Storage) (England) Regulations 2001	Minimises/Prevents accidents from oil storage.
The Environmental Damage (Prevention and Remediation) (England) Regulations 2009 The Environmental Damage (Prevention and Remediation) (Wales) Regulations 2009	Prevention and remedying of environmental damage to habitats and species protected under EC law and to species or habitat on a site of special scientific interest. Environment Agency, local authorities, Natural England and Marine and Fisheries Agency

Planning for managing accidents can help prevent a spill becoming a pollution incident. Emergency Planning activities are carried out by a range of organisations, including central government and local authorities, and by industry and business.

An example is the Maritime and Coastguard Agency's National Contingency Plan which deals with pollution incidents in the marine environment. Owners and masters of ships and the operators of offshore installations have the responsibility for ensuring that they do not pollute the sea. Harbour authorities are responsible for ensuring that their ports avoid marine pollution and for responding to incidents within their limits. The Maritime and Coastguard Agency will also provide national support to ships, offshore installations, harbour authorities and coastal local authorities where this is necessary.

Implementation in the North West River Basin District

In the North West River Basin District in 2008 there were:

- 8 category 1 and 52 category 2 incidents ³ affecting the water environment

Further information is available on the Environment Agency's website at <http://www.environment-agency.gov.uk/research/library/data/34363.aspx>

F.14 Marine waters

Much of the pollution in marine waters comes from the land and freshwater. Many of the measures listed in previous sections help to avoid marine waters becoming increasingly polluted. Particularly relevant are:

- Section F.6 on point source discharges;
- Section F.7 on diffuse source pollution;

³ Category 1 incidents have a serious, and often persistent, effect on quality water, air or land, with uses that are dependent on these, such as ecosystems, public supply abstractions. Category 2 incidents are significant but less severe.

- Section F.8 on hydromorphology, especially controls relating to managing sediment in estuaries by activities such as maintenance dredging (including disturbance of trybutyl tin accumulation), flood risk management and development;
- Section F.10 on invasive non-native (alien) species related to shipping and ballast waters;
- Section F.12 on priority hazardous substances particularly polyaromatic hydrocarbons (PAH), and agricultural pesticides;
- Section F.13 on accidental pollution.

There are also specific mechanisms used to avoid increased pollution in seas. These include:

Table F.18: Mechanisms for managing pressures on marine waters

Mechanism	What this does
Urban Waste Water Treatment Regulations 1994	Bans disposal of sludge to sea
Sea Fisheries (Regulation) Act 1966	Sea Fisheries Committees can make byelaws for managing and conserving their district's fisheries
Environment Act 1995	The Environment Agency regulates fishing for salmon, migratory trout and eels to 6 nautical miles. The Marine and Coastal Access Act adds smelt and lamprey to this list
Water Resources Act 1991	It is an offence to pollute controlled waters by causing or knowingly permitting entry or discharge of polluting matter. The WRA 1991 requires conditional consents for point source discharges to water - see section F4. These controls extend out to 3 nautical miles from the baseline

- The Marine and Fisheries Agency regulate the marine consents and licensing work and marine aggregates extraction previously undertaken within Defra and CLG. This includes the Coast Protection Act (1949, Part II) licences and Food and Environment Protection Act (1985, Part 11) licences and marine aggregates extraction permissions.
- Sea Fisheries Committees can make byelaws for managing and conserving their districts' fisheries under the Sea Fisheries (Regulation) Act 1966 (out to 6nm). Byelaws can be used to control fishing activities to prevent bed sediments being disrupted, bed habitat being removed, flow/sediment dynamics being altered, contaminants being disturbed, and changes to water quality. These committees will be replaced by Inshore Fisheries and Conservation Authorities under the Marine and Coastal Access Act 2009. They will cover a similar area but take over all estuaries in England including those for which the Environment Agency is currently responsible.
- The Marine and Fisheries Agency has responsibility for enforcing sea fisheries regulations within English and Welsh waters (out to 200nm or the median line with neighbouring states) under the European Union's Common Fisheries Policy. It also enforces national fisheries measures, including those implemented under the Sea Fish (Conservation) Act 1967 and associated regulations.
- Controls on the operators of shell fisheries and fish farming are available through - Centre for Environment, Fisheries, and Aquaculture Science register, seabed licence from the Crown estate, several regulating Orders.

The Marine and Coastal Access Act 2009 provides for a better system of achieving sustainable development of the marine and coastal environment is expected in the next parliamentary session. This will introduce:

- A new strategic marine planning system;
- Streamlined marine licensing;
- Improved inshore fisheries management, including Sea Fisheries Committee reform;
- Nature conservation legislation – including the creation of marine conservation zones.
- Clauses on coastal access;
- New migratory and freshwater fisheries legislation.

There will also be a new marine management organisation which will play a key role and new measures for protecting or ensuring 'good status' so that the aims and objectives of the Water Framework Directive are met. Marine planning will enable development in the marine environment to be better balanced and the environment to be fully considered, and this will be taken into account in making decisions on future licensing applications. It is important that River Basin Management Plans inform the new marine planning system. The introduction of national marine protection areas 'Marine Conservation Zones' will help to protect nationally important biodiversity, which will help achieve Water Framework Directive objectives in protecting important parts of estuaries and coastline. In particular protection for areas which provide nursery grounds for juvenile fish would be proposed. This would not mean that all activities would need to be prohibited in these areas and some controls may only be necessary at certain times of the year. The new fisheries legislation and the new Inshore Fisheries and Conservation Authorities will provide better measures to protect and manage migratory and sea fisheries.

You can find further information, on the Marine and Fisheries Agency website at:
<http://www.mfa.gov.uk>



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex G: Pressures and risks

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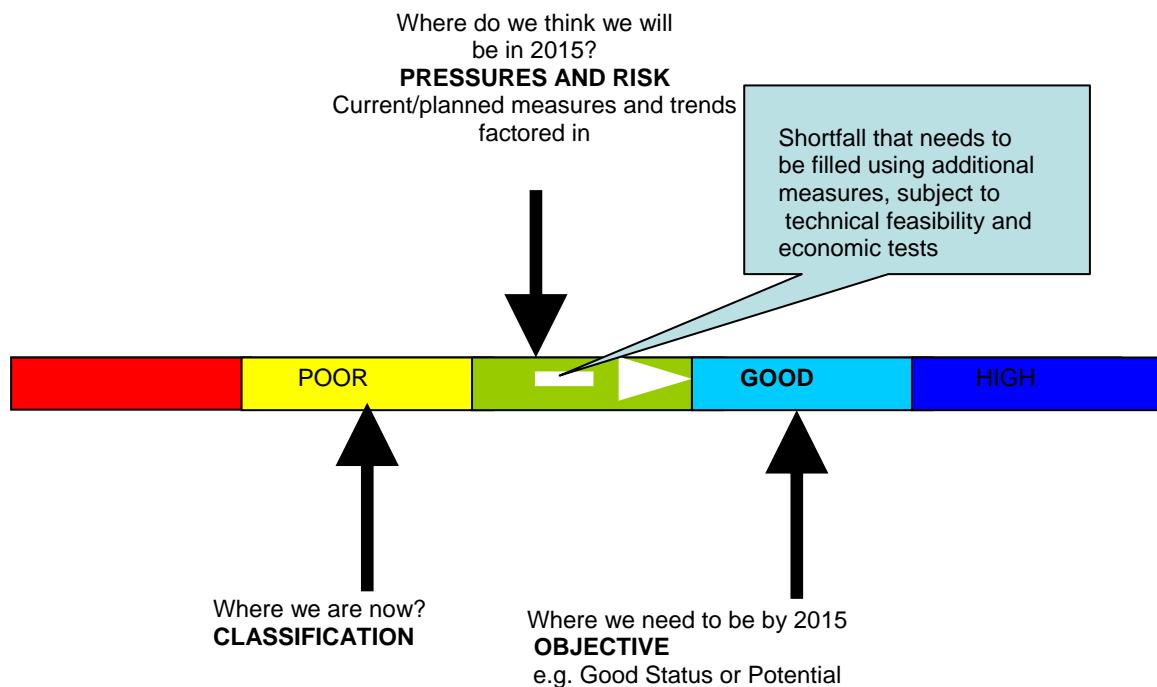
G.1 Introduction

This annex provides a summary of the significant pressures and the risks resulting from humans' activities on the status of surface water and groundwater. The Water Framework Directive requires the management of risk to the environment caused by anthropogenic pressures, not just their impacts. There is a fundamental difference in terms of the management approach required to meet these needs. Managing impact is 'reactive' whereas managing risk is 'proactive', requiring the ability to identify where an impact might occur (or is occurring) and prevent it from happening in the future. For example, the Environment Agency issues consents to discharge effluent to water or licences to abstract water that minimises the impact before it happens and is based on the risk to the water from the activity and the sensitivity of the water.

We need to assess the risks posed to the environment, in terms of failing to achieve the objectives of the Water Framework Directive (e.g. Good Status or Potential) either now or in 2015. Information on trends enables action to be taken to prevent water bodies being impacted in the future. This is critical given the timescales imposed by the Directive for achieving Good Status (see Figure G.1).

The measures proposed in Annex C will aim to **further reduce the current impact** of pressures, ensure **no deterioration** and **reduce the risks** posed to the environment so future impacts are less likely.

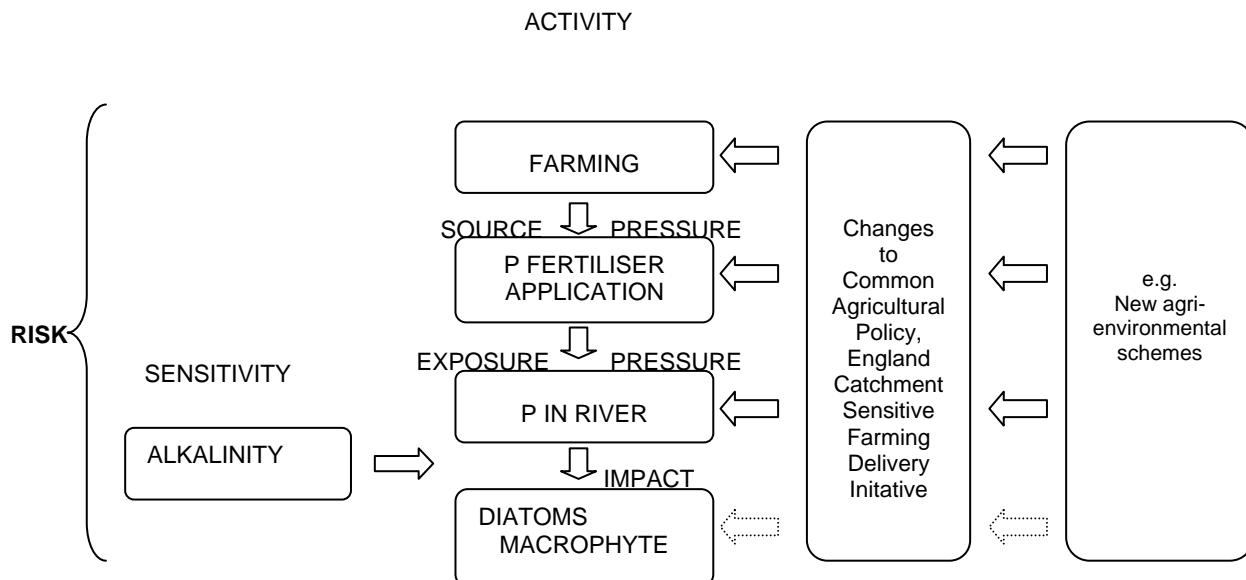
Figure G.1: Simple overview of how classification and risk are used to define objectives and measures



The consideration of pressures and risks (potential impacts) help build up an evidence base that can justify the objectives and the actions to deliver them (see Annex C – Programmes of Measures). Figure G.2 shows an example of the risk model used.

Further information on how the Environment Agency produced the risk assessments and the methods used can be found at <http://www.environment-agency.gov.uk/research/planning/33238.aspx>

Figure G.2: Example of conceptual risk model using example of the pressure from phosphate (P) fertilisers



G.2 Information on significant pressures

Previously, pressures have been looked at in the context of:

- Estimating point source pollution.
- Estimating diffuse source pollution, including land use.
- Estimating pressures on the quantitative status of water including abstractions.
- Analysis of other impacts of human activity on the status of water.

Risk assessments to assess the risk of not achieving the default objectives of the Water Framework Directive have been produced for different sources of pressures under these headings and can be found at <http://www.environment-agency.gov.uk/research/planning/33268.aspx>.

For protected areas, assessments of compliance are presented separately in Annex D.

In the River Basin Planning: Summary of Significant Water Management Issues report for the North West River Basin District, a series of environmental pressures were considered, these are listed in Figure G.3.

Figure G.3: Pressures affecting the water environment

WFD PRESSURES	Specific pressures considered
Point source pollution	<ul style="list-style-type: none"> • Organic pollution - including ammonia and biochemical oxygen demand • Chemicals - including priority hazardous substances, priority substances, specific pollutants • Other Pollutants - faecal indicator organisms • Acidification • Nutrients - nitrate, phosphorus • Mines and minewaters
Diffuse source pollution	<ul style="list-style-type: none"> • Chemicals - including priority hazardous substances, priority substances, specific pollutants (including pesticides) • Oils and Hydrocarbons • Sediments
Pressures on the quantitative status of water	<ul style="list-style-type: none"> • Abstraction and other artificial flow pressures • Physical modification - morphology
Other impacts on the status of water	<ul style="list-style-type: none"> • Physical modification - morphology • Invasive non-native species species • Biological pressures - including fish stocking, biota removal • Sediments • "Emerging" substances such as endocrine disrupters • Urban and transport pressures • Recreation (e.g. boating, fishing) • Saline Intrusion into groundwater bodies (resulting from abstraction pressures)

These are generalised categories and it is recognised that some pressures, such as ammonia, may be included in more than one category. It is also acknowledged that diffuse source pollution may also include unspecified point sources dispersed over a wide area.

The effects of climate change on the environment are another pressure that should be considered when understanding how to protect or improve the status of water bodies. Temperature changes in the environment may be linked to changes in species, habitat and water quantity and availability, for example. The source of local temperature changes may be traced to specific activities such as cooling water from power stations, as the by-product of power generation. We are still learning how we can monitor and predict the effects of temperature changes for the future. Annex H discusses the effects and impacts of climate change on the river basin scale in more detail.

For the North West River Basin District, a number of specific pressures were identified as significant water management issues:

- Diffuse pollution from rural areas
- Diffuse pollution from roads and urban areas
- Point source pollution caused by discharges from the industry

- Point source pollution from discharges from sewerage systems
- Physical modifications of rivers and the coastline
- Abstraction and other artificial flow pressures

Pressures that were found **not to** represent significant water management issues at a district level in this river basin district, but may still have a significant effect at local level are listed as follows and described further in Section G.3:

- Invasive non-native species
- Commercial Fisheries
- Recreation
- Endocrine disrupters

Figure G.4 below demonstrates how the pressures were grouped under the Significant Water Management Issues for the North West River Basin District.

Figure G.4 Grouping potential issues into significant issues headings

Potential Issue (Contributing Pressure)	Significant Issues					
	Diffuse pollution from rural areas	Diffuse pollution from roads and urban areas	Pollution caused by discharges from industry	Pollution caused by discharges from sewerage systems	Physical modification of rivers and coastlines	Abstraction and other artificial flow pressures
Phosphates	✓		✓	✓		
Biochemical oxygen demand	✓	✓	✓	✓		
Ammonia	✓	✓	✓	✓		
Nitrates	✓	✓	✓	✓		
Sediments	✓	✓			✓	
Pesticides	✓		✓			
Faecal indicator organisms	✓			✓		
Metals		✓	✓	✓		
Urban and transport		✓				
Priority substances and chlorinated solvents			✓	✓		
Mines and minewaters			✓			
Physical modification (rivers and lakes)					✓	

Potential Issue (Contributing Pressure)	Significant Issues					
	Diffuse pollution from rural areas	Diffuse pollution from roads and urban areas	Pollution caused by discharges from industry	Pollution caused by discharges from sewerage systems	Physical modification of rivers and coastlines	Abstraction and other artificial flow pressures
Physical modification (estuaries & coastal waters)					✓	
Abstraction and flow						✓
Invasive non-native species						
Acidification						
Radioactive substances						
Commercial fisheries						
Recreation						

The next sections describe the significance and extent of the pressures which have been identified as contributing to the significant water management issues in the North West River Basin District. We also discuss the other pressures which although not recognised as part of a significant water management issue may still be contributing to poor water quality.

Understanding the maps

The results of our risk assessments are displayed through maps showing which water bodies are at risk of failing the Water Framework Directive objectives in 2015. These assessments do not reflect the current quality or status of a water body, rather the risk that they may fail objectives as a result of pressures acting on them.

The maps show the risk of failing Water Framework Directive objectives with the following colour key:

- Water body at significant risk of failing objectives - dark purple
- Water body probably at significant risk of failing objectives - light purple
- Water body probably not at risk of failing objectives - pink
- Water body not at risk of failing objectives - pale pink
- Water body not assessed – white.

A water body may be “not assessed” if the risk assessment has not been applied to it. For example, where large water bodies have been split into smaller water bodies late in the river basin planning process, the risk assessment may not have been subsequently applied to the smaller water bodies. These risk assessments will be updated during the first cycle of river basin management planning.

The statistics for river water bodies include rivers, surface water transfers and canals. Lake water body statistics include lakes and Site of Special Scientific Interest (SSSI) ditches.

G.2.1 Phosphorus in rivers and standing waters

High phosphorus concentrations are the main cause of eutrophication in fresh waters. Eutrophication is the enrichment of waters by nutrients causing excess plant/algae growth and leading to undesirable effects on the ecology, quality and uses of the water. Activities that can be affected include water abstraction, water sports, angling, wildlife conservation and livestock watering. In standing fresh waters, blue-green algal blooms can occur; many such blooms are toxic and pose a hazard to humans involved in water sports and to animals that drink the water.

Defra has identified phosphate standards to support Good Ecological Status in fresh waters. They will be applied such that measures will be targeted to water bodies where there is evidence that nutrient levels are causing undesirable ecological impacts. Benefits should be seen from the planned introduction of phosphate reduction at sewage treatment works discharging to waters identified as Sensitive Areas under the Urban Waste Water Treatment Directive.

There are predicted reductions in livestock by 2015 with a general move from farming in the uplands to the lowland areas of England, which is expected to reduce the amount of phosphate entering waters. Other changes in agriculture predicted in the Business as Usual Projections of Agricultural Outputs¹ work will need to be reassessed in the light of unexpectedly large changes in commodity prices, which together with reductions in set aside, are likely to increase intensity of arable production. Reducing phosphorus pollution is one of the aims of the England Catchment Sensitive Farming Delivery Initiative, particularly where related to designated sites such as SAC and SSSI rivers.

The control measures within Nitrate Vulnerable Zones under the Nitrate Directive, although primarily designed to reduce nitrate pollution, are likely to bring indirect benefits, through improved nutrient management, in terms of reduced agricultural phosphorus pollution.

Phosphorus has been considered to be of far less significance to groundwater (see Figure G.5). Research is currently being carried out on the impact of phosphorus on surface waters and habitats that are sensitive to groundwater seepage and spring flows.

In the North West River Basin District, 26 lakes are at risk or probably at risk from diffuse source phosphorus and 11 are at risk or probably at risk from point source phosphorus. Of the 164 lake and SSSI ditch water bodies in the district, 164 are not yet assessed for risk from phosphorus.

The risk assessments also indicate that 2468 km (41% of total length) of rivers are at risk or probably at risk from combined source (point and diffuse) phosphorus pressures (see Figure G.6).

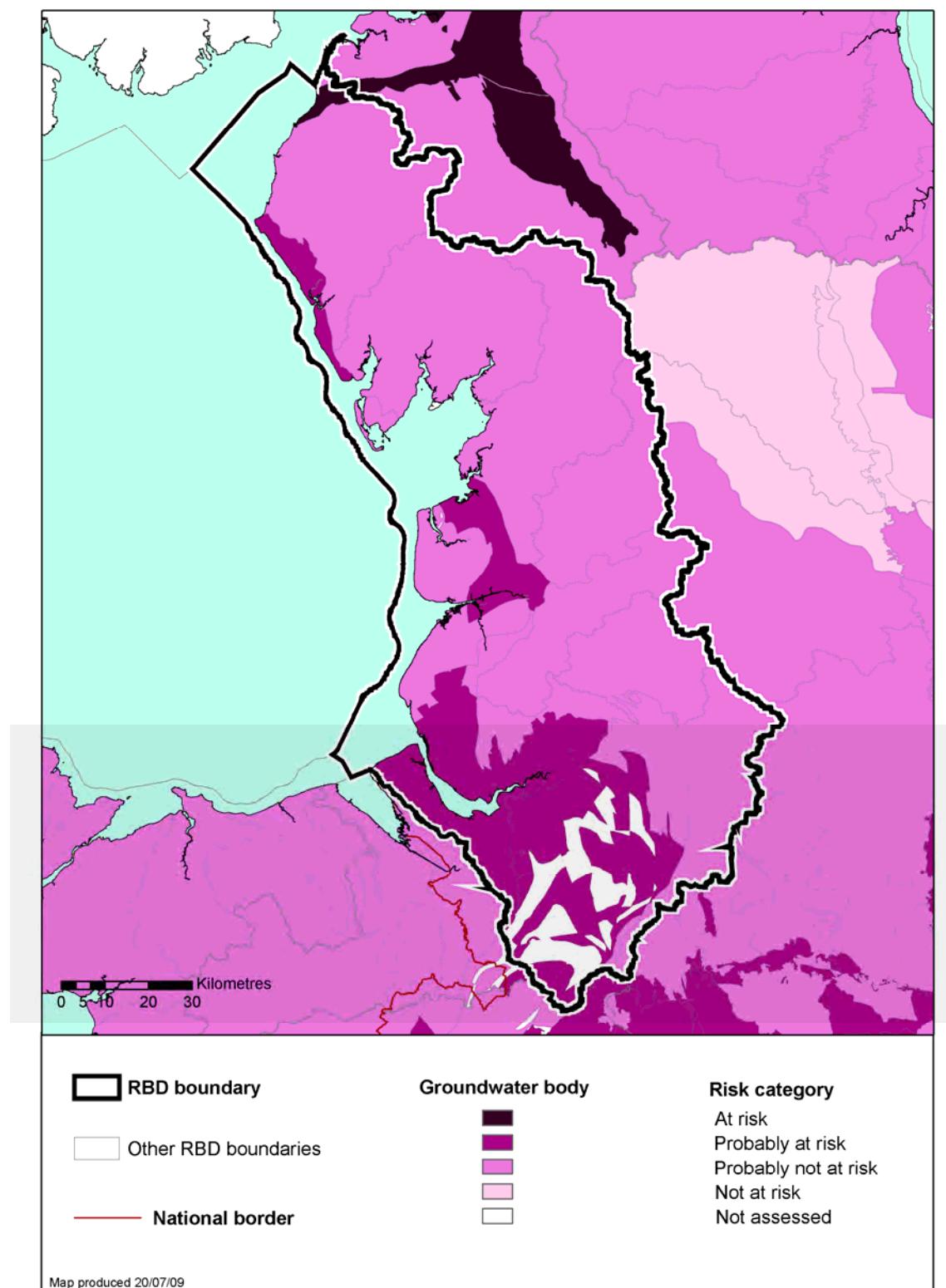
The SIMCAT models used for the latest rivers combined phosphorus assessment estimate that 78% of the phosphorus load in the North West River Basin District is derived from point sources and 22% is from diffuse sources.

¹ Environment Agency: *Business as Usual Projections of Agricultural Outputs*
Centre for Rural Economics Research, University of Cambridge, Environment Agency, July 2004.
<http://www.environment-agency.gov.uk/economics>

It is estimated that over 57% of the total length of river water bodies are at risk or probably at risk from diffuse phosphorus from agricultural pollution, see Figure G.7.

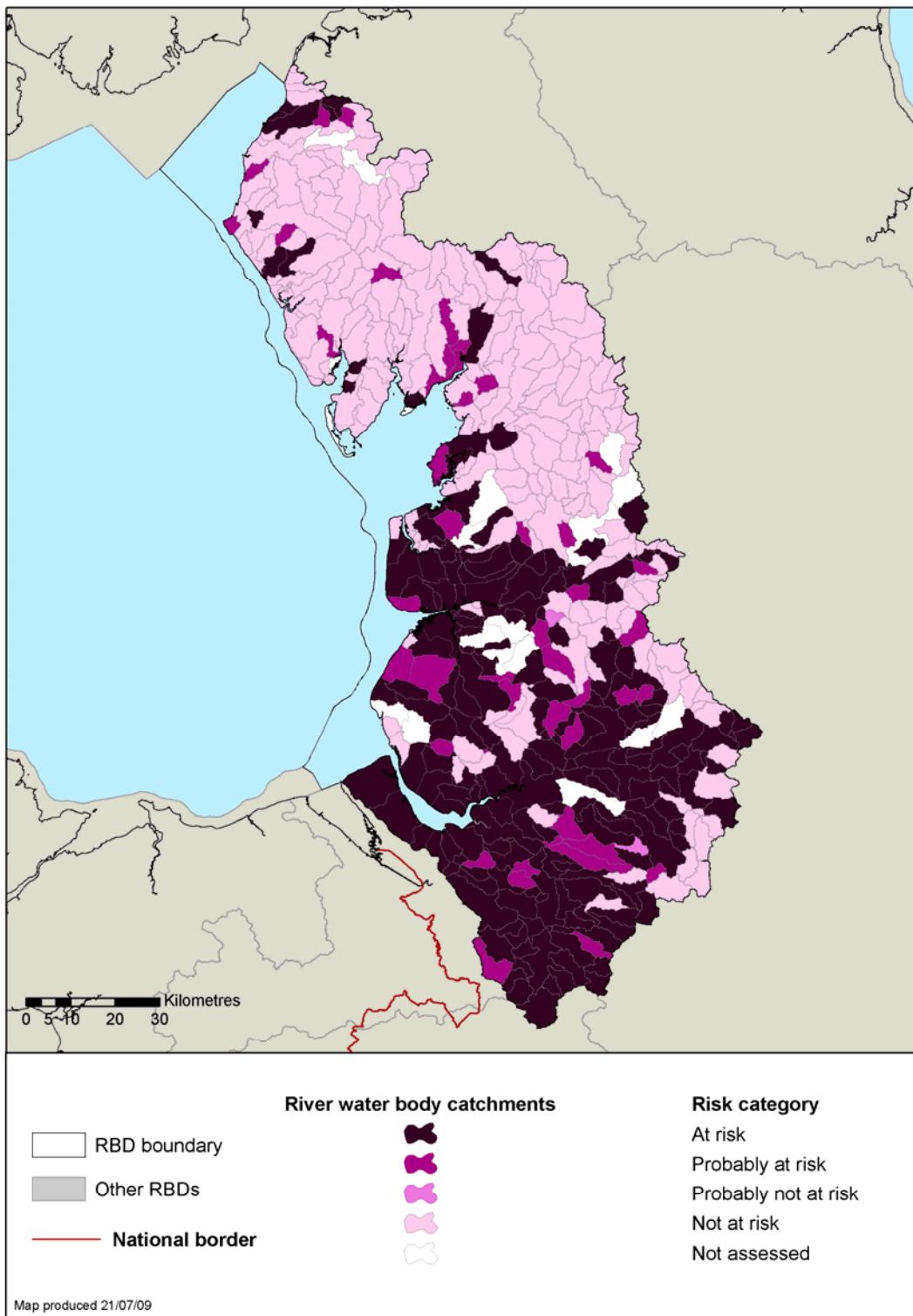
A range of tools have been used to assess the risk to rivers from phosphorus to provide a broad a picture as possible of the sources and impact of the pressure. However, in order to capture the broad range of potential sources the methodologies employed to develop the two risk assessments differ. As a result the outputs for Diffuse phosphorus from agriculture risk assessment and the Combined Phosphorus risk assessments aren't directly comparable, but when considered separately the individual assessments highlight the likely relative risk from each pressure. Please refer to the method statements for each assessment for further details.

Figure G.5 Groundwaters within the North West River Basin District at risk from diffuse source phosphate



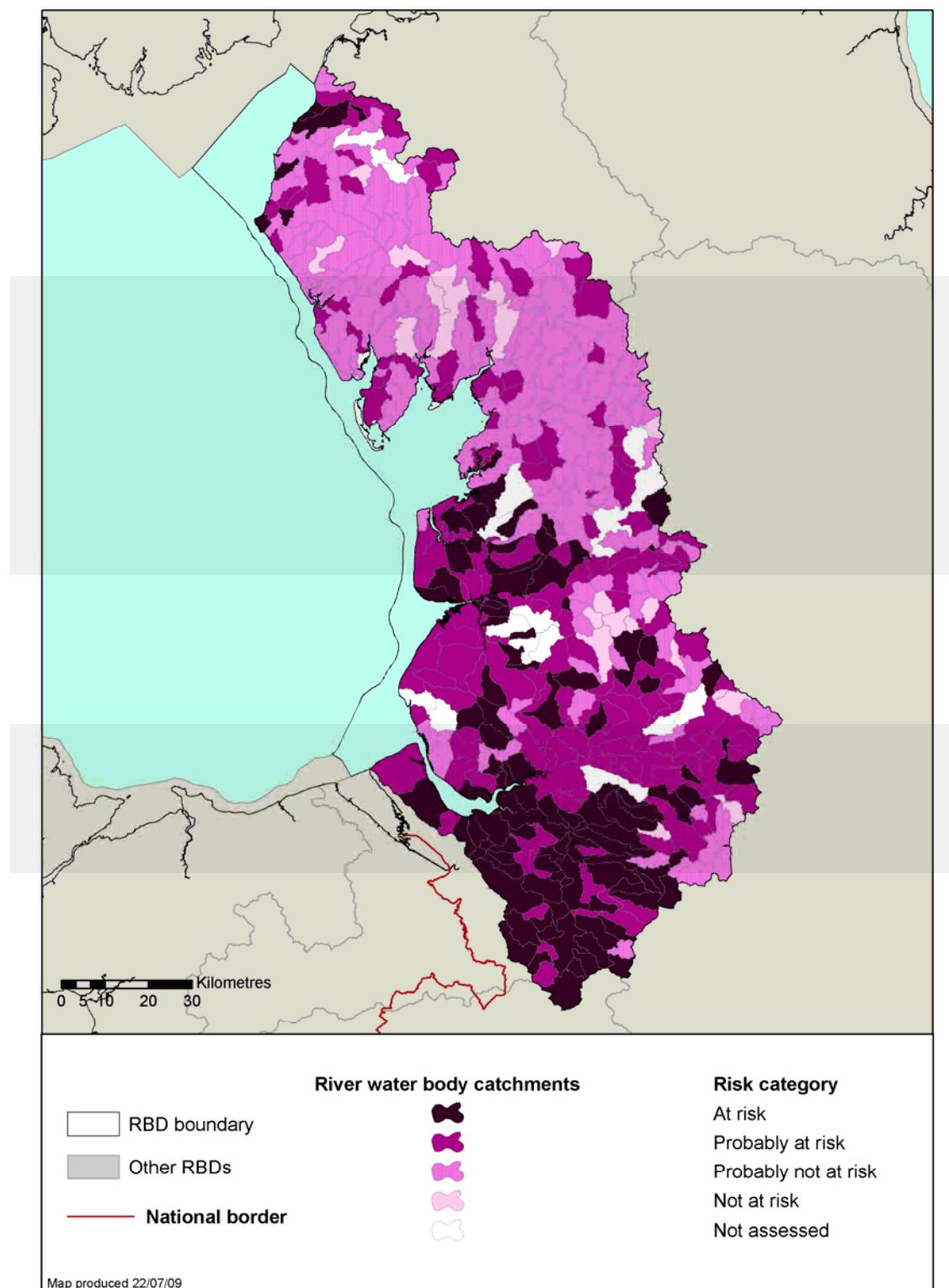
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Figure G.6 Rivers in the North West River Basin District at risk from combined (point and diffuse) source phosphorus



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Figure G.7 Rivers in the North West River Basin District at risk from diffuse source phosphorus from agricultural sources



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G.2.2 Organic pollution (ammonia and biochemical oxygen demand)

For the purposes of our assessments, organic pollution is comprised of ammonia and biochemical oxygen demand. The toxicity of ammonia to fish and other aquatic life is dependent on the pH and temperature of the water. Increasing pH increases the proportion of toxic 'free' ammonia. Biochemical oxygen demand is not an individual pollutant, but a measure of the amount of biodegradable organic matter present. A high concentration of biochemical oxygen demand exerts a high oxygen demand on water, leading to oxygen depletion with potentially severe impacts on the whole ecosystem.

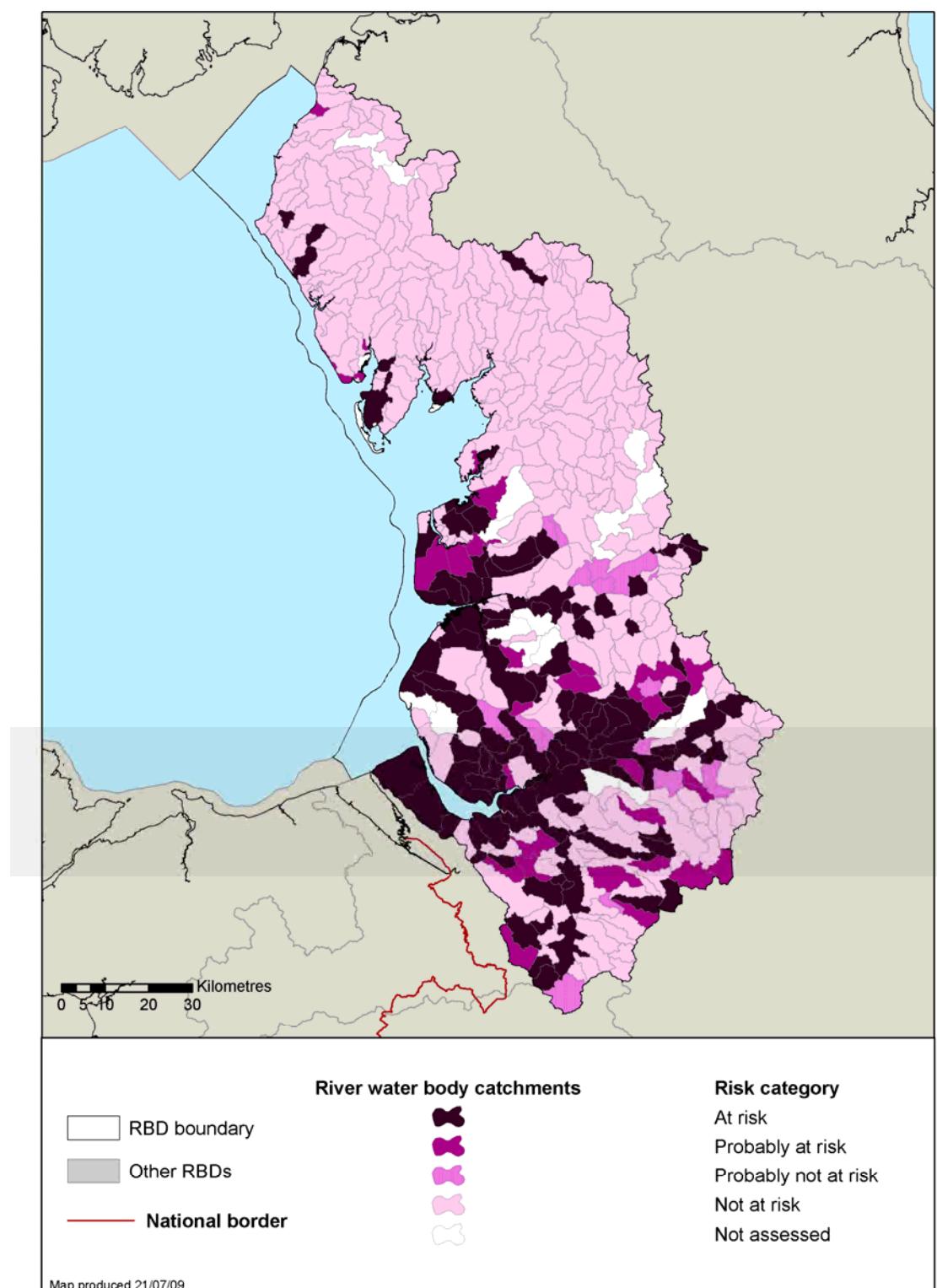
Much of the pressure from organic pollution is the result of discharges of treated sewage effluent. Tightening of discharge standards and cessation of discharges of raw sewage to coastal waters over the past 15 years has resulted in marked improvements in water quality. National classification schemes based on organic pollutants have reflected this as shown in figures for General Quality Assessment compliance from 1990 to 2007.

Our latest risk assessments show that:

- 1446 km (24% of total length) of river water bodies within the North West River Basin District are at risk or probably at risk of failing the ammonia standards (see Figure G.8);
- 779 km (13% of total length) of river water bodies within the North West River Basin District are at risk of failing the biochemical oxygen demand (BOD) standards² (see Figure G.9).

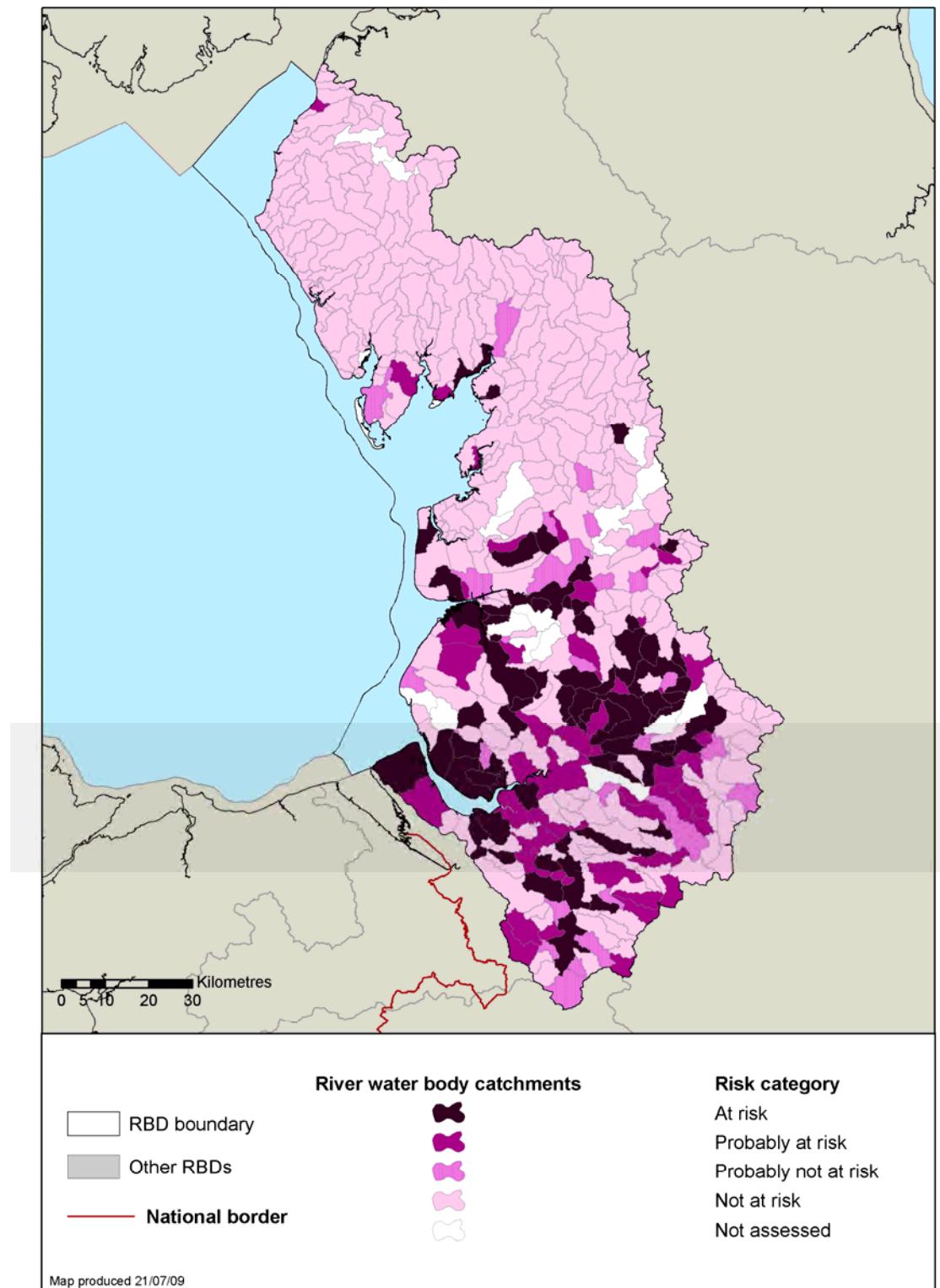
² BOD is not used for classification

Figure G.8 Rivers in the North West River Basin District at risk from combined (point and diffuse) source ammonia



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Figure G.9 Rivers in the North West River Basin District at risk from combined (point and diffuse) source biochemical oxygen demand (BOD)



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G.2.3 Nitrate in surface and groundwater

Nitrate pollution can impact on both surface water and groundwater and comes principally from agriculture (61%) and sewage treatment works discharges (32%) (figures for England and Wales, Defra 2004). In urban areas the main inputs are from contaminated land, leaking sewers and water mains. The magnitude and balance of diffuse and point sources vary across river basin districts, as will the extent of inputs to surface and groundwater.

High nitrate concentrations are thought to be the main cause of eutrophication in estuarine and coastal waters and may also contribute to eutrophication in certain types of freshwaters. Eutrophication is described as the enrichment of waters by nutrients, causing excess plant and algal growth and leading to undesirable effects on the ecology, quality and/or uses of the water. High nitrate concentrations can impact on terrestrial ecosystems, such as wetlands, for example, through excessive nettle growth. High nitrate concentrations in drinking water are a threat to human health and are controlled by meeting the standards in the Drinking Water Directive (50 mg/l nitrate for water at the point of supply).

Defra has identified nitrate standards to support Good Ecological Status in saline waters. They will be applied such that targeted measures will be taken where eutrophication is occurring. There are no equivalent ecological standards for nitrate in relation to the ecological status of surface freshwaters - the 50 mg/l drinking water standard continues to drive action.

The Environment Agency's risk assessments for the Water Framework Directive indicate that 26 (14% of total river length) of rivers are at risk of failing the 50mg/l threshold for nitrate in the North West River Basin District (see Figure G.11).

Nitrate levels in groundwater are of particular significance as around 17% of the drinking water within the river basin district comes from this source³, and there are controls on the amount of nitrate that is acceptable in drinking water. All groundwater bodies have been designated as Drinking Water Protected Areas.

Few groundwater sources for public supply received more than simple purification treatment 30 years ago. All of these sources are now treated in North West River Basin District. Rising nitrates in drinking water taken from groundwater have previously been dealt with by blending water from different sources to achieve the drinking water standard. With the widespread rise in nitrate concentrations, low nitrate waters for blending are becoming very limited and water supply companies are now installing treatment plants. If the current trend in increasing treatment continues, then 83% of sources in England and Wales will need treatment for nitrates by 2029.

The latest assessment shows that 17% groundwater bodies within North West River Basin District are at risk of failing their environmental objectives as a result of nitrate. Two of the five tests used to assess groundwater chemical status directly consider nitrate impact – the General Chemical Test and the Drinking Water Protected Area test. Nitrate impact is also considered when carrying out the Groundwater Dependent Terrestrial Ecosystem Test (wetlands). The current results of these tests are listed below:

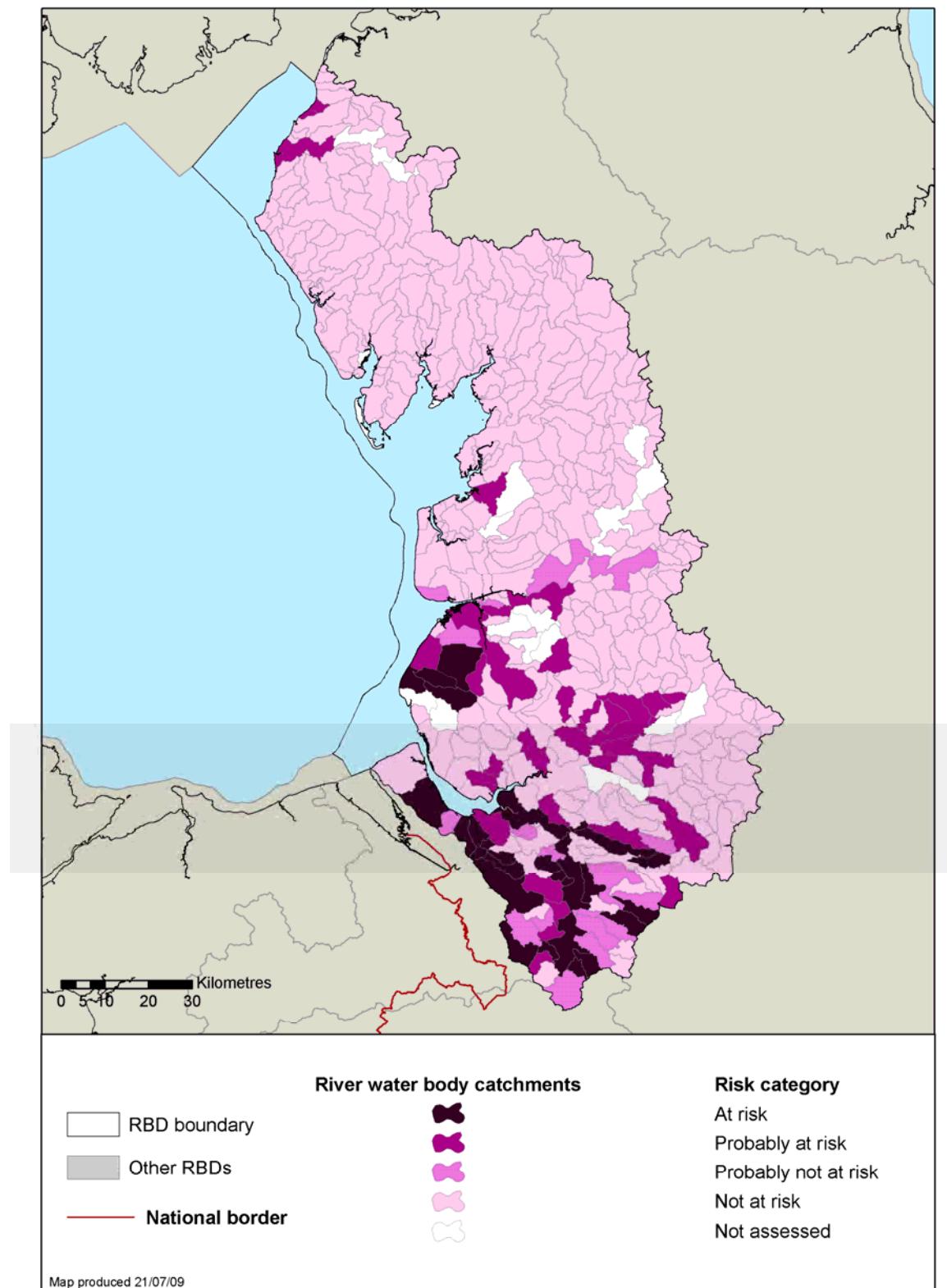
³ Environment Agency 2007, River Basin Planning, Summary of Significant Water Management Issues, North West River Basin District, Consultation Document 2007.

Figure G.10 **Groundwater tests**

Test	Number (and percentage) of groundwater bodies failing the test for nitrate in the North West River Basin District
General Chemical Test	18 groundwater bodies (100%)
Drinking Water Protected Area test	13 groundwater bodies (72%)
Groundwater Dependent Terrestrial Ecosystem test	6 groundwater bodies (33%)

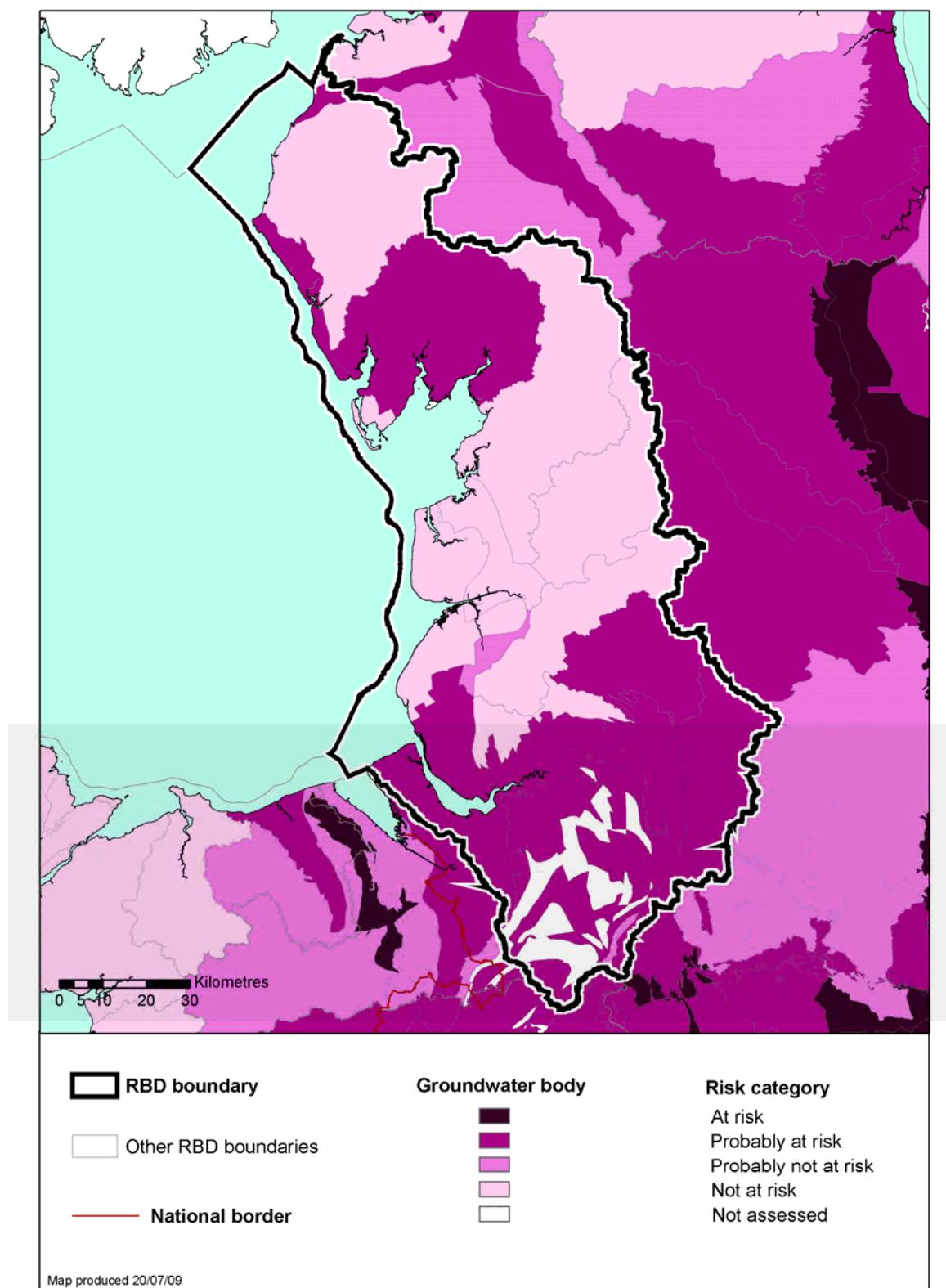
In addition we found that one groundwater bodies in the North West River Basin District (6 %) had a significant and sustained increase in nitrate concentration in groundwater (Figure G.12).

Figure G.11 Rivers within the North West River Basin District at risk from combined (point and diffuse) source total oxidised nitrogen



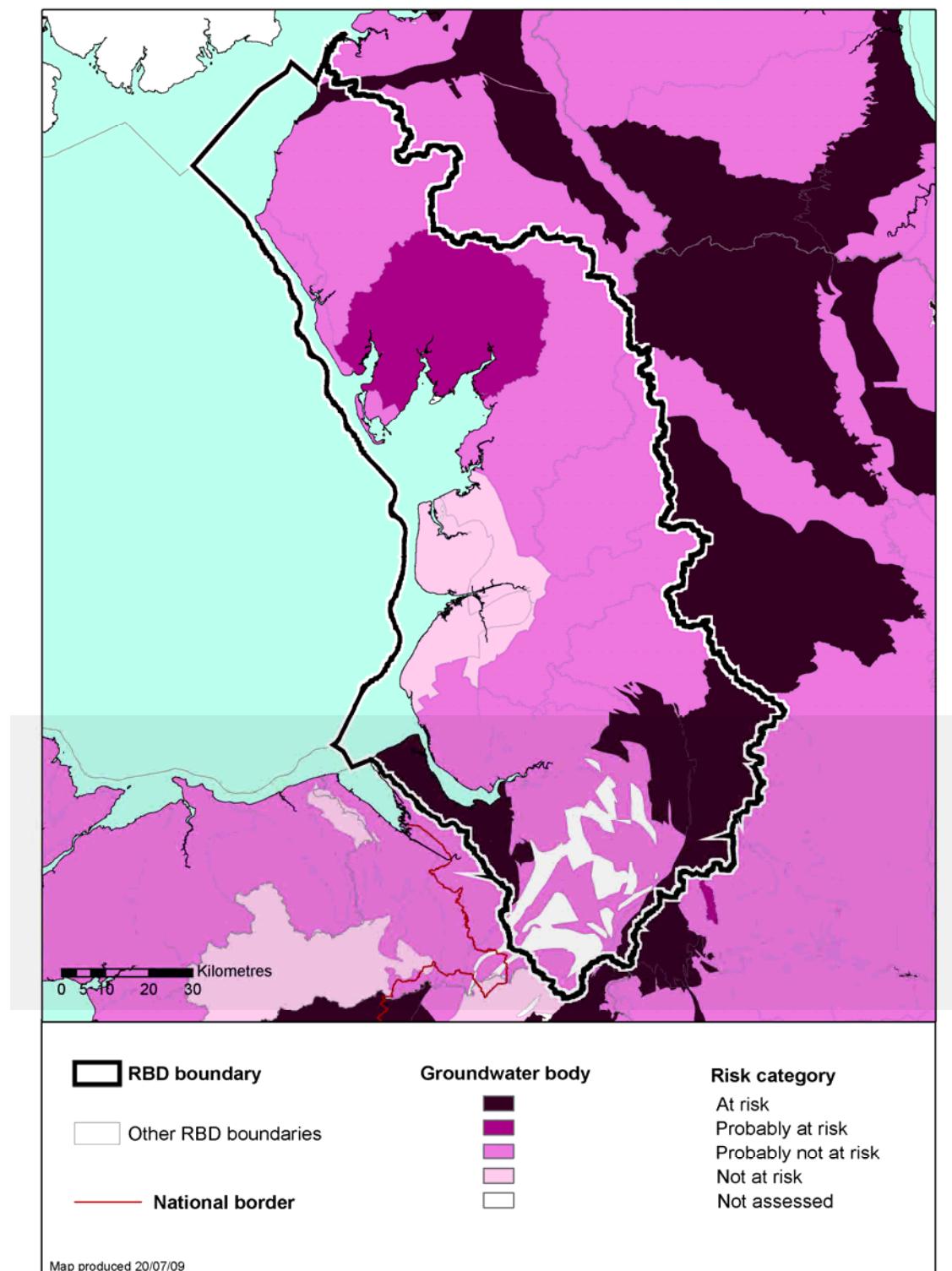
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Figure G.12 Groundwaters within the North West River Basin District at risk from diffuse source nitrates



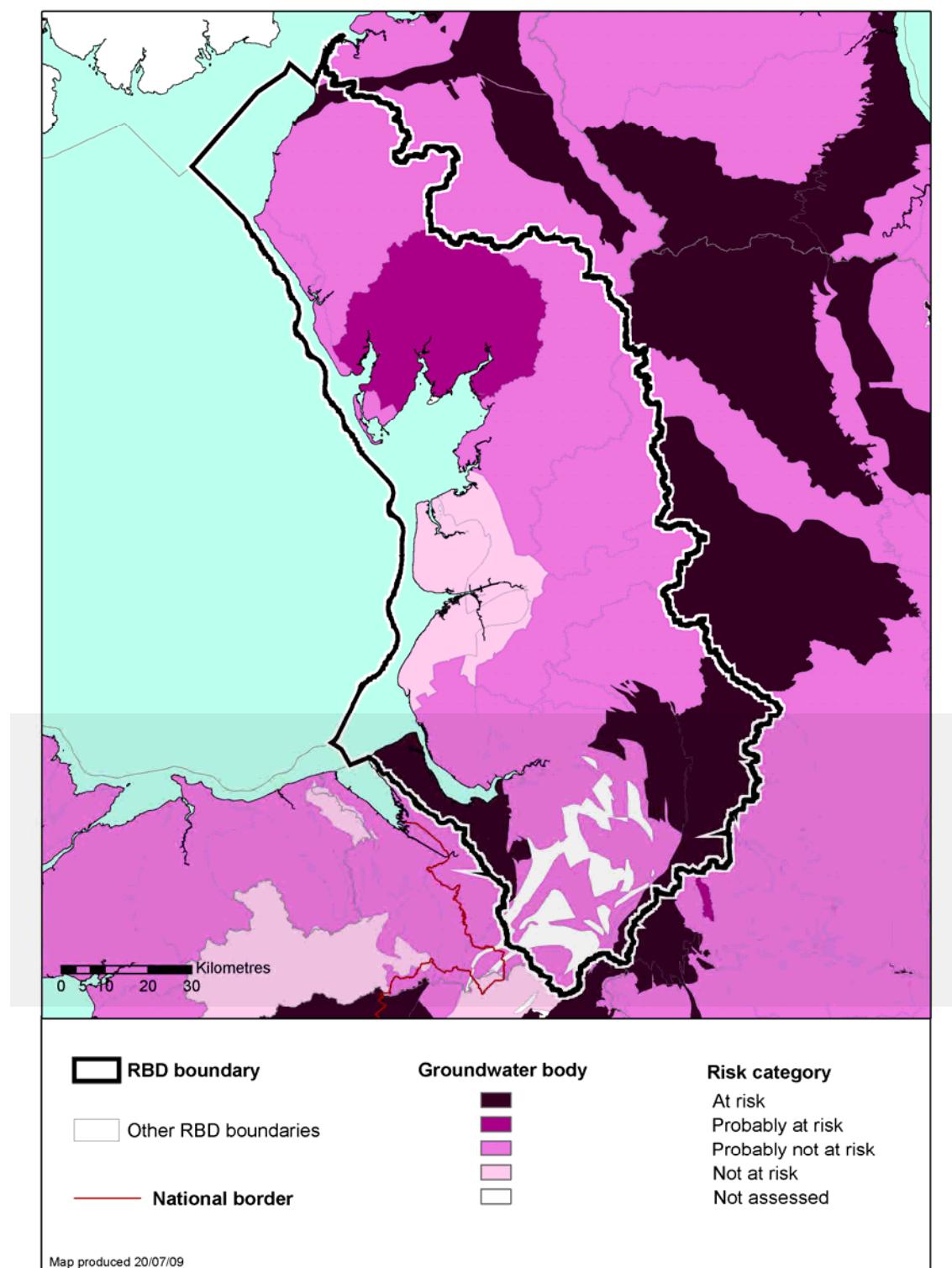
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Figure G.13 Groundwaters within the North West River Basin District at risk of failing drinking water protected area standards



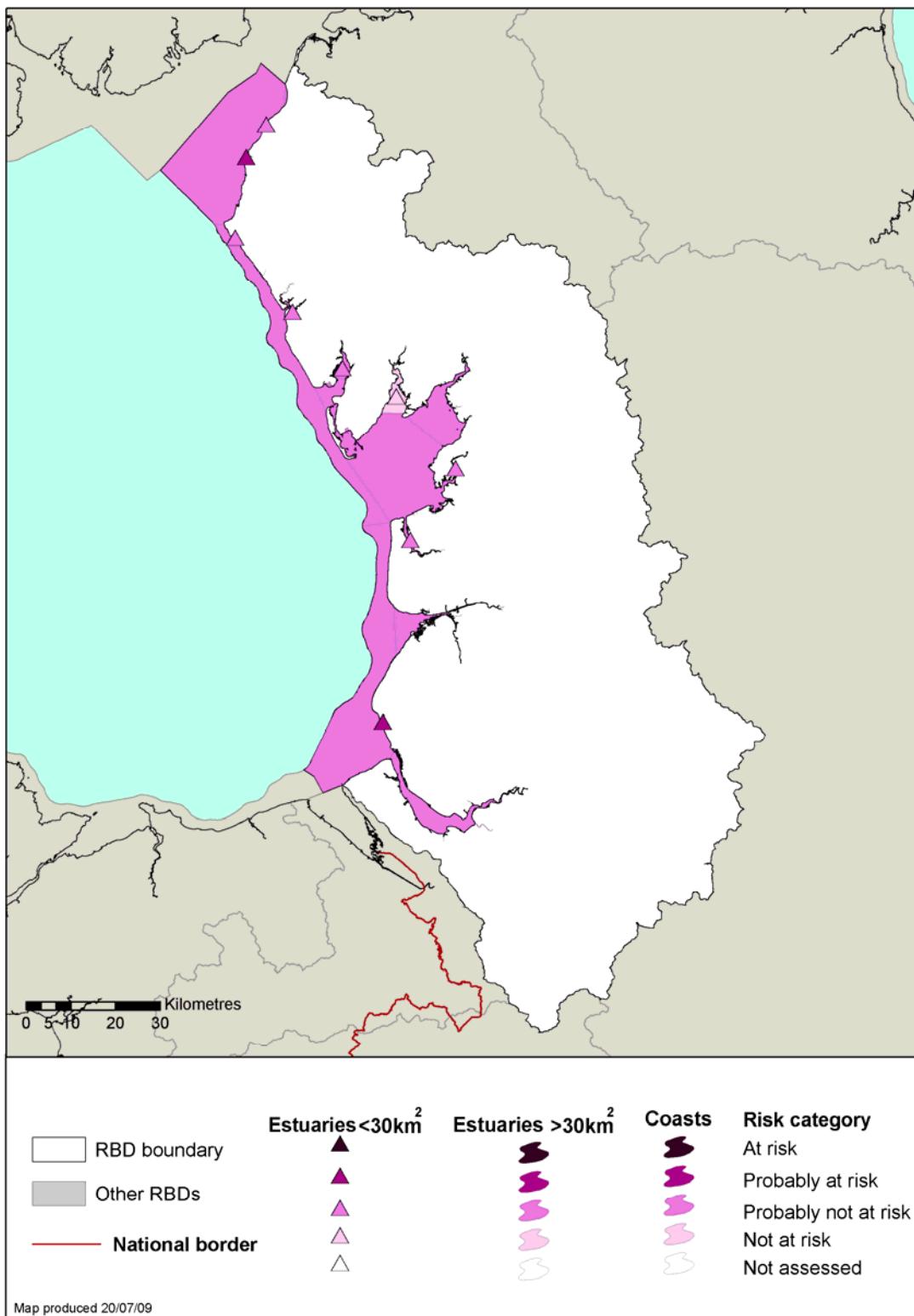
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Figure G.14 Groundwaters within the North West River Basin District with upward trend in nitrate concentration



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Figure G.15 Estuarine and coastal waters in the North West River Basin District at risk from diffuse source nutrient nitrogen



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G.2.4 Sediment

The term 'sediment' refers to anything that is not dissolved or in solution and which filtration or settlement can remove. The term includes solids that are floating on top of, or suspended within, the water.

Much of the sediment we are concerned with is caused by the erosion of soil. Whilst there is a natural level of erosion, it is the increased rates of erosion – caused by land based activities such as forestry, construction and, particularly, agricultural cultivation and grazing practices - that need to be addressed. It is worth noting that phosphorus is often associated with sediment as it is bound to soil (unlike nitrates, which are more soluble). Metals and many toxic organic compounds can accumulate in sediments. However, in some cases (for example, estuaries) sediment is an essential component of the ecosystem to maintain mudflats and salt marsh habitats.

High concentrations of suspended solids can:

- Bury fish eggs in the stream bed or coat their surface if they are on vegetation, causing suffocation.
- Cause physical damage to fish gills which can result in death, a reduction in growth or cause a reduction in resistance to disease.
- Cause undesirable changes to the populations of river bed plants and animals which are the food of fish.
- Suppress photosynthesis due to a reduction in light penetration and by coating.
- Be unsightly and an aesthetic nuisance.

Demonstrating evidence of ecological impact as a result of human influenced sediment load is, however, difficult.

The direct effects of sediment include: impairment of spawning gravels for fish; siltation of reservoirs and navigable waterways; obstruction of drains and river channels, and increasing flood risk. Sediment also increases turbidity, which reduces light penetration and oxygenation of water. This results in reduced productivity, direct damage to fish gills from suspended sediment and reduced organism survival, especially for fish.

Conversely insufficient sediment in rivers, estuaries, and coastal waters causes erosion of important or protected habitats such as wetlands, mudflats, salt marshes, and beaches. Erosion of riverbanks can occur, along with bank collapse and river profile degradation. There may be downstream erosion of the river bed, damaging infrastructure and resulting in morphological changes which can alter the ecology.

The indirect effects of sediment include those resulting from current and historic point and diffuse sources of pollution. Many pollutants (metals, nutrients and organic compounds such as polycyclic aromatic hydrocarbons) can be held on and released from sediments. This can result in reduced growth and breeding success of the river bed animals (such as invertebrates) which form the basis of the aquatic food chain.

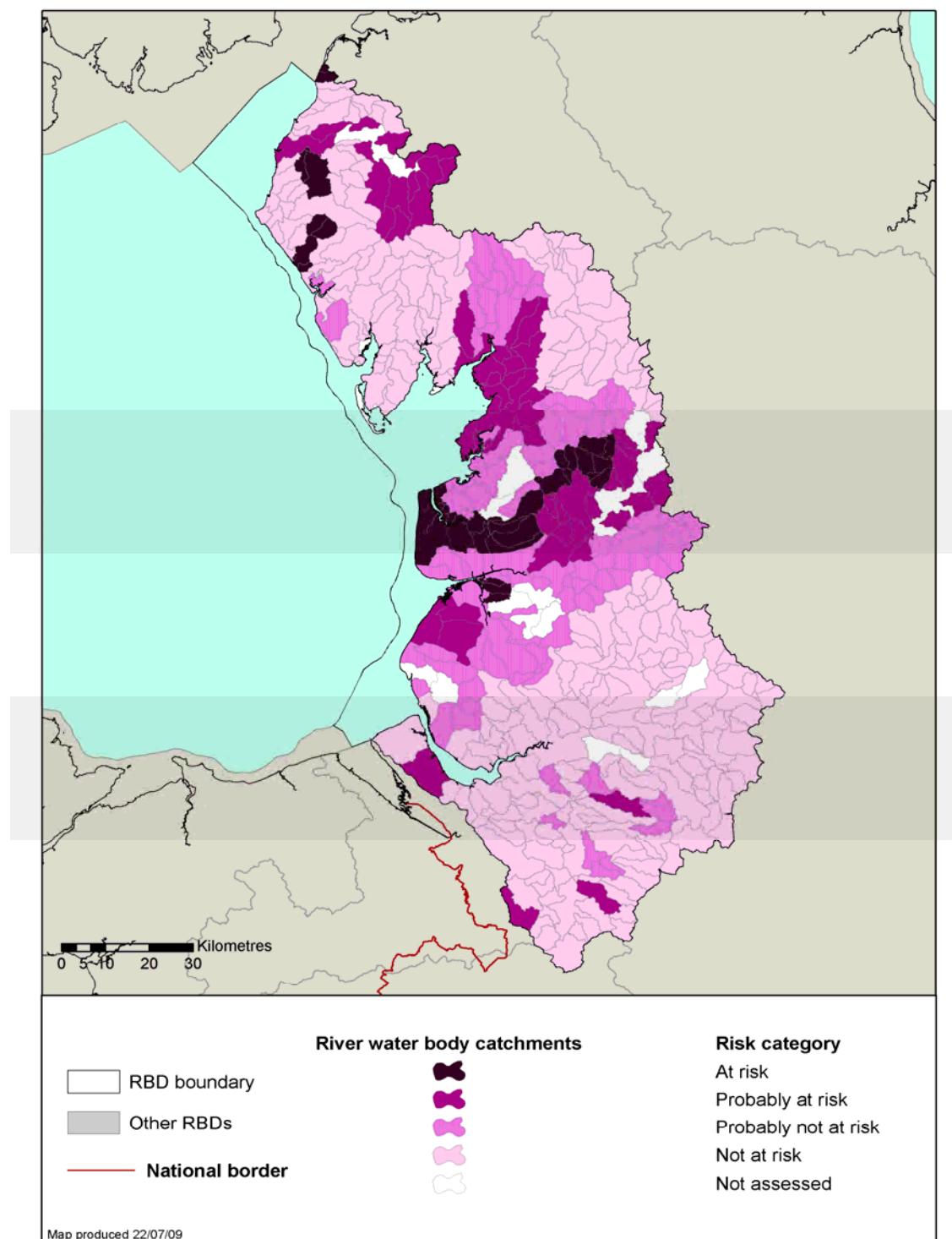
Indirect effects may be temporary in nature as contaminated sediments (for example, those contaminated with metals, nutrients, and organic compounds such as polycyclic aromatic hydrocarbons, polychlorinated biphenyl, and persistent organic pollutants such as pesticides) are re-suspended at times of high flows. This may happen more often in a changing climate.

This can impact on the wider environment, for example when contaminated sediment settles on floodplains following flooding.

The latest characterisation maps in the North West, show that 1111 km of water bodies (18 % of total length) are at risk or probably at risk from the direct effects of sediment (see Figure G.16). In addition, trout spawning beds in 57% of reaches surveyed across England have levels of fine sediment at which half the eggs and larvae would be expected to die. More than 40% of freshwater wetland Sites of Special Scientific Interest (SSSI) in England are in unfavourable condition, with sediment a contributory factor in most cases.

Note that the large water bodies that were split into smaller bodies at the end of 2008 have not yet had a new sediment risk assessment, and so have been reported as Not Assessed. However, the assessment made on the original smaller water body has been taken into account as part of a wider weight of evidence to appraise and determine appropriate measures. See Annex E for further information on the measures appraisal undertaken to manage sediment pressures.

Figure G.16 Rivers in the North West River Basin District at risk from diffuse source sediments



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G.2.5 Pesticides

'Pesticide' is a general term that includes all chemical and biological products used to kill or control pests. Pests are living organisms such as rodents, insects, fungi and plants that harm our food, our health or our environment. Pesticides are used in domestic, amenity, forestry, horticultural and agricultural scenarios. Because of their toxic nature they can cause harm to 'non-target' organisms and if they are not stored, used and disposed of properly they pose a risk to terrestrial and aquatic wildlife. As well as ecological impacts, pesticides can also contaminate surface water and groundwater bodies used as drinking water sources, thus increasing the need for treatment.

Sheep dip is a veterinary medicine used to treat parasites on sheep (e.g. scab, blowfly, ticks and lice). The two active ingredients used in sheep dip products are diazinon and cypermethrin (although the use of products containing cypermethrin is currently suspended). Both these substances are highly toxic to invertebrates and very small levels in rivers can cause severe ecological damage. Studies have shown that they can interfere with salmon reproduction by disrupting the ability of the male fish to respond to female hormones.^{4,5}

Tributyltin is a biocide. European regulatory controls now prevent its use in products for the EU market. Historically its main use was to prevent fouling on shipping; however it was also used in wood preservation, paper and pulp and textiles. Whilst its use has now been restricted it is highly persistent in the environment. It is also known to be a contaminant in PVC.

Figure G.17: Significant issues groups that include pesticides

Significant Issue Group	Principle source of pesticides
Diffuse pollution from rural areas	Sheep dip application, application of pesticides to crops
Diffuse pollution from urban areas and transport	Anti-foulants on boats, application of pesticides to hard surfaces for weed control. Weeds
Point sources pollution	Discharges of treated effluents from pesticide manufacturing plants (via STWs), spillage incidents.

The latest assessments for pesticides for the North West River Basin District show that;

- 1000 km of river are at risk or probably at risk from diffuse agricultural pesticides (see Figure G.18)
- 762 km of river are at risk or probably at risk from sheep dip (see Figure G.19).

We have estimated that three river water bodies in the North West River Basin District are at risk from point sources of pesticides (see Figure G.20).

We have estimated that one groundwater body in the North West River Basin District is probably at risk from pesticides (see Figure G.22).

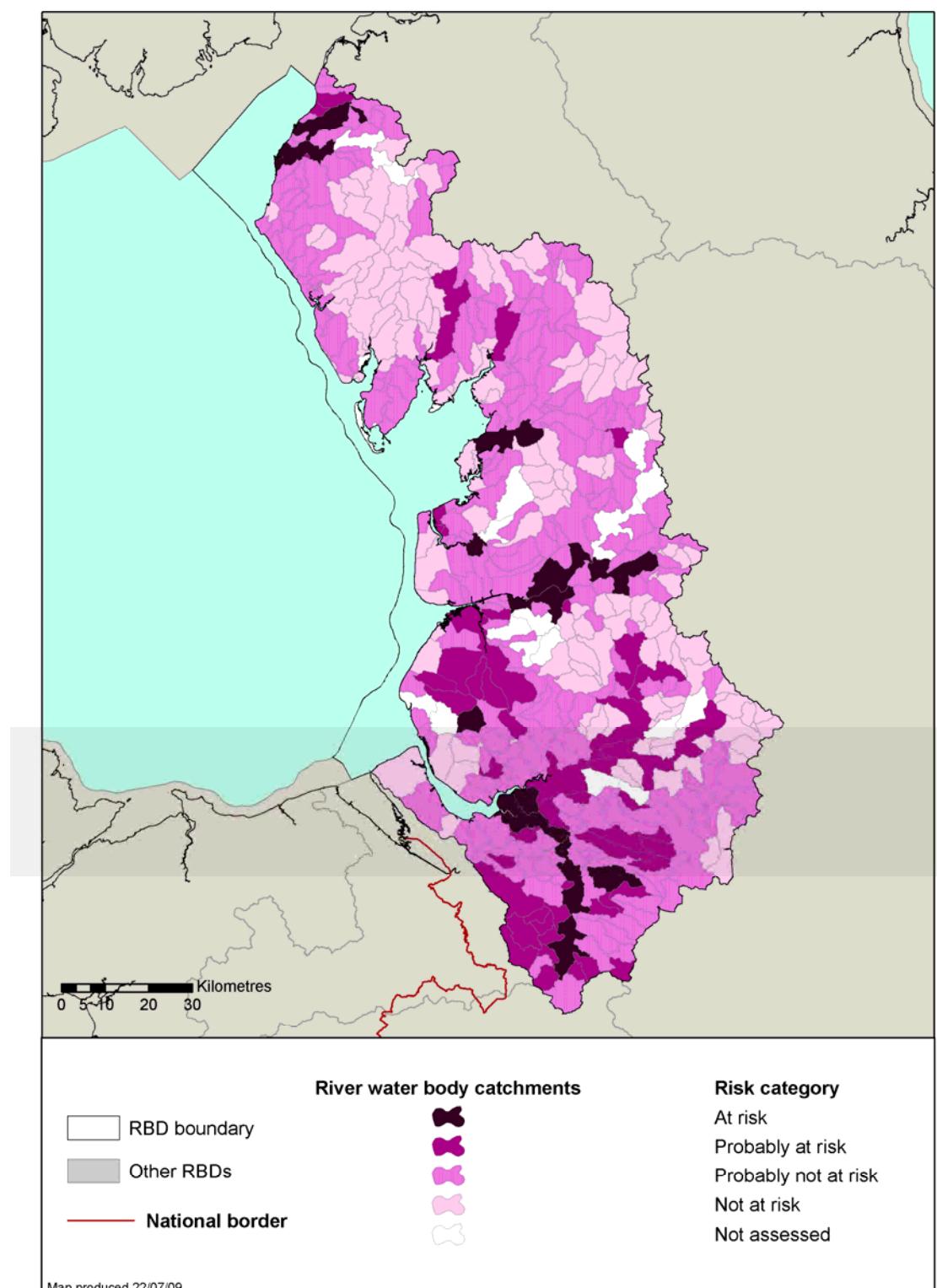
⁴ Moore, A. & Waring, C.P., 1995. Sub-lethal effects of the pesticide Diazinon on olfactory function in mature male Atlantic salmon (*Salmo salar* L.) parr. *Journal of Fish Biology* **48**, 758-775.

⁵ Moore, A. & Waring, C.P., 2001, The effects of a synthetic pyrethroid pesticide on some aspects of reproduction in Atlantic salmon. *Aquatic Toxicology* **52**, -12.

The Environment Agency report 'The Unseen Threat to Water Quality'⁶ reports the widespread failure of the EQS for tributyl tin and its effects on dog whelk populations. The report also states that pesticides were detected in nearly one-fifth of groundwater monitored. It reported that in certain areas these concentrations were declining.

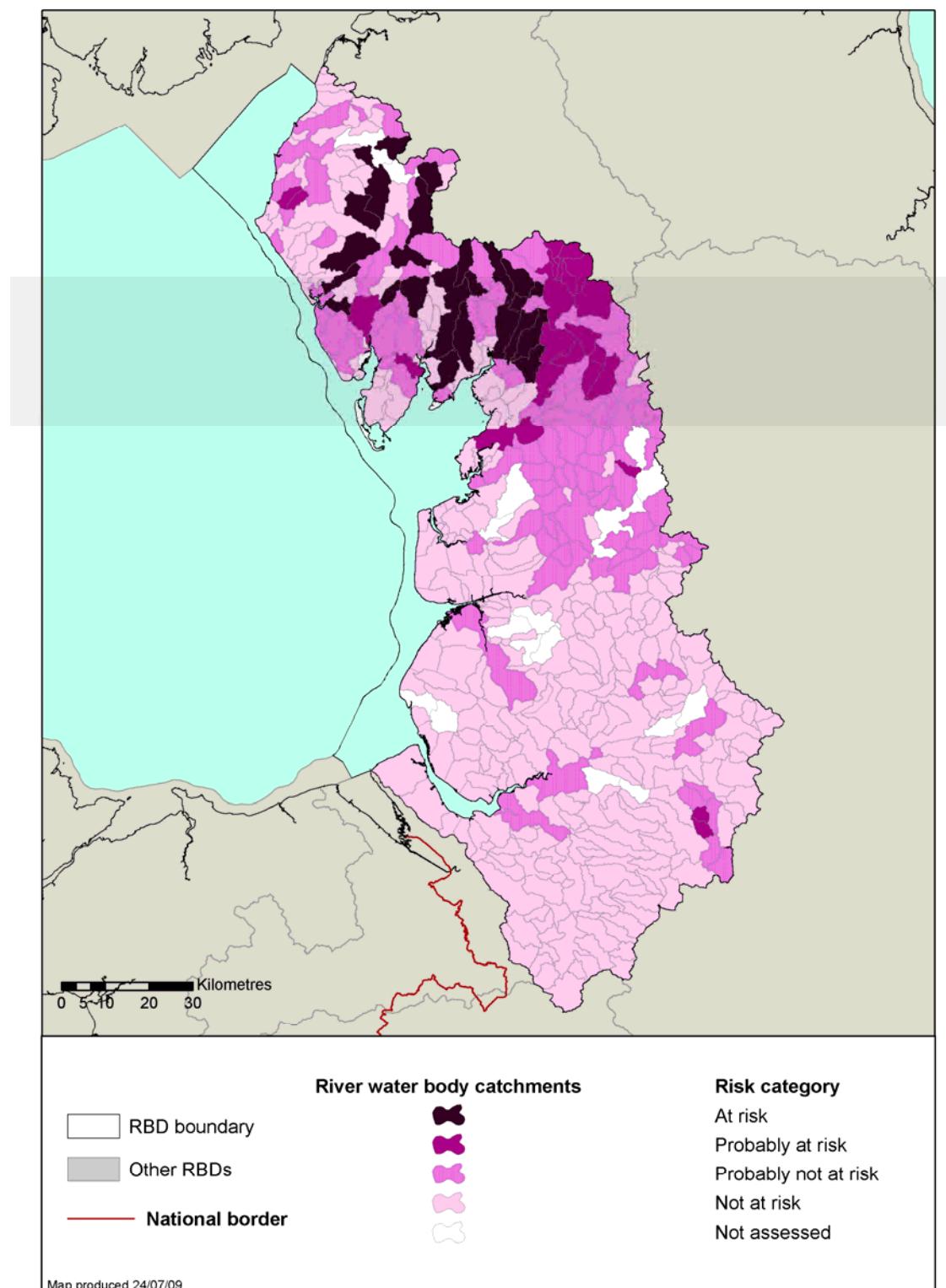
⁶ Environment Agency 2007, The Unseen threat to water quality, Diffuse Pollution in England and Wales, May 2007.

Figure G.18 Drinking water sources (rivers) at risk from agricultural pesticides within the North West River Basin District



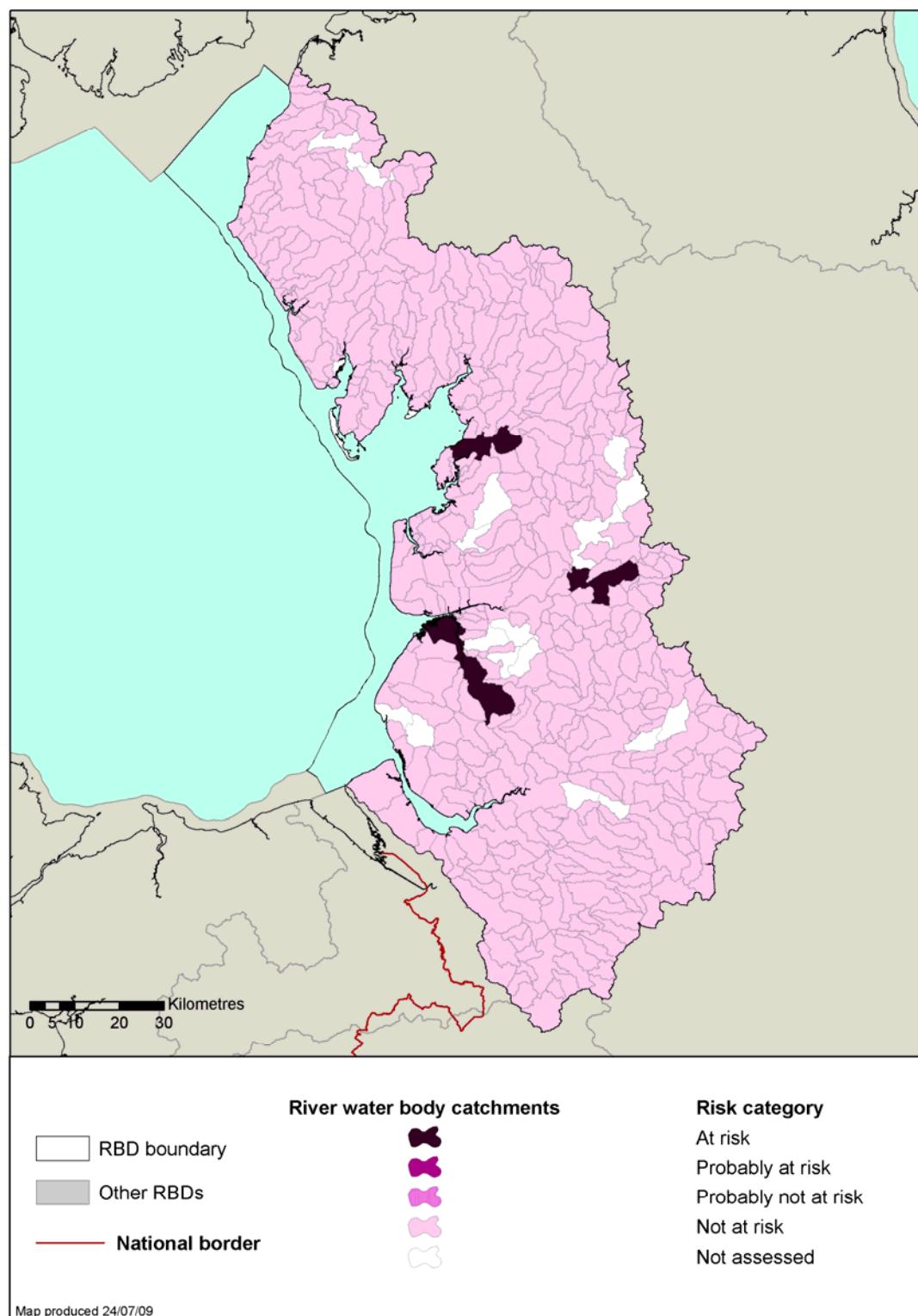
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Figure G.19 Rivers at risk from diffuse source sheep dip in the North West River basin District



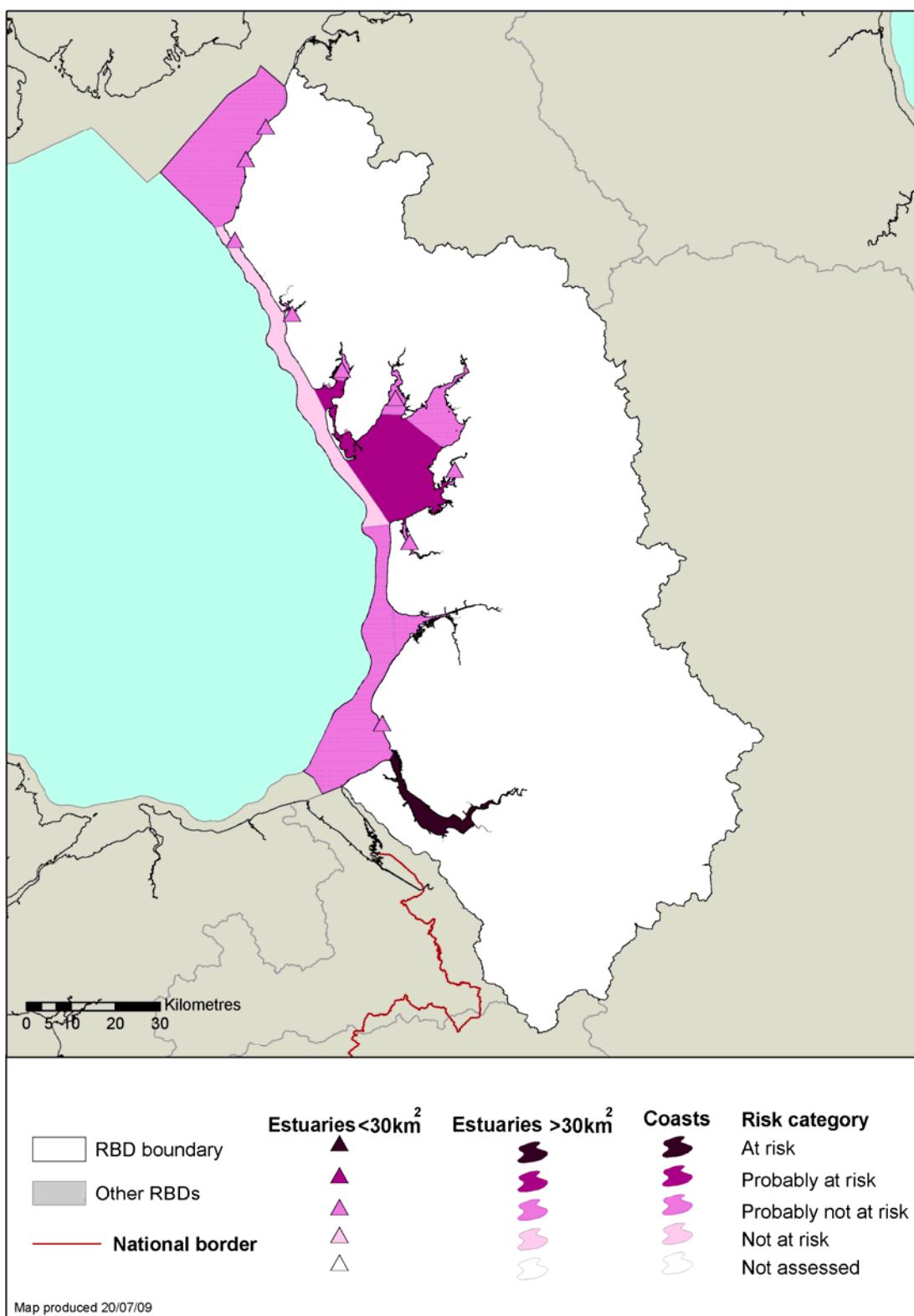
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Figure G.20 Rivers within the North West River Basin District at risk from point source pesticides



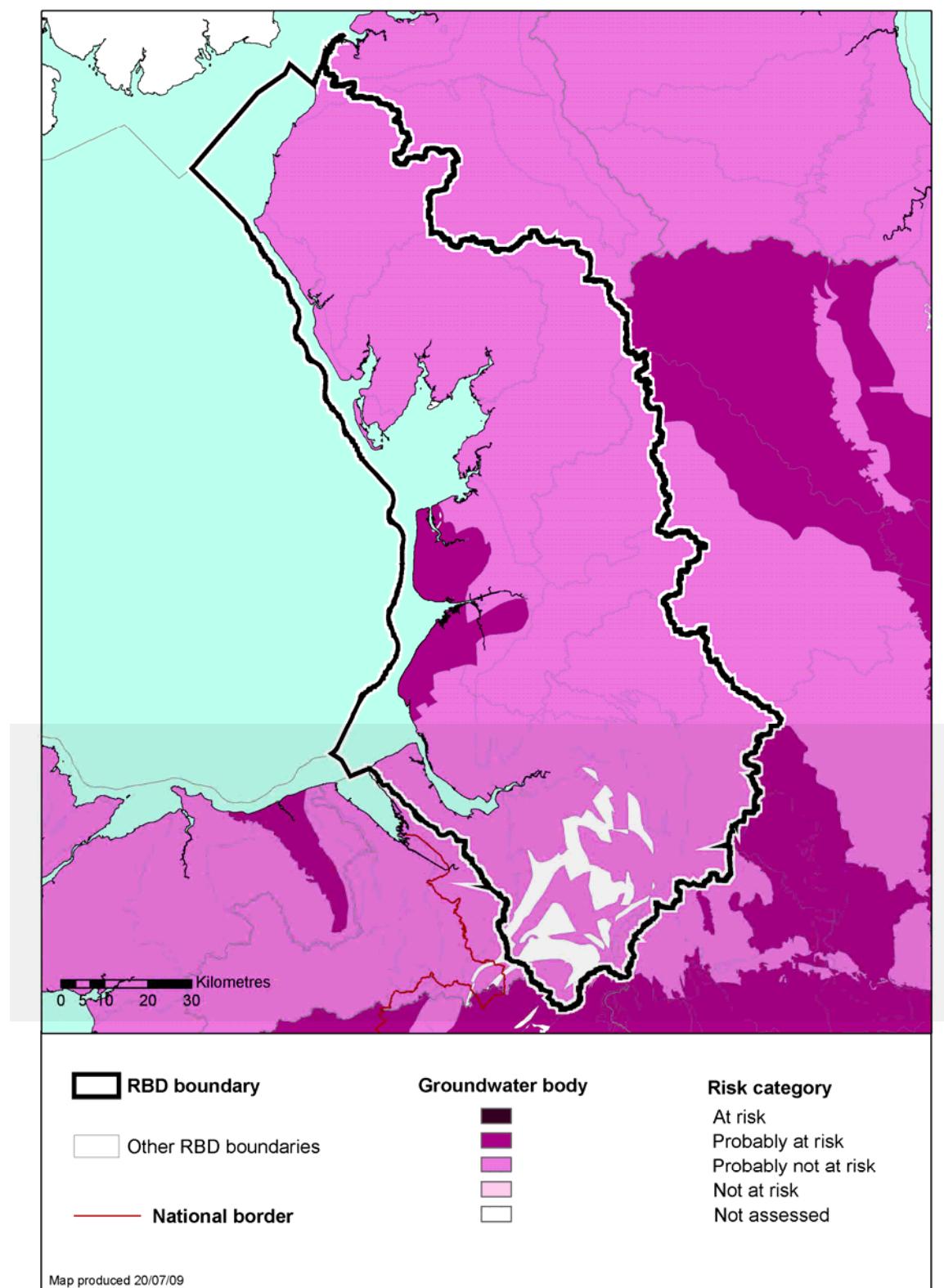
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Figure G.21 Estuarine and coastal waters in the North West River Basin District at risk from diffuse source pesticides (Tributyl tin (TBT))



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Figure G.22 Groundwaters within the North West River Basin District at risk from diffuse source pesticides



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G.2.6 Faecal indicator organisms

Micro-organisms occur in vast numbers in the natural aquatic environment. The greatest waterborne risk of infection to humans is through drinking water or shellfish contaminated by pathogenic (that is, infection causing) organisms, such as bacteria or viruses, from sewage or animal excrement. However, infection (such as gastroenteritis – inflammation of stomach and gut) can also occur through ingesting contaminated seawater or freshwater during bathing.

It is impractical to test water for every known pathogen in every sample, and it has therefore become standard practice to test water for ‘faecal indicator organisms’. Whilst generally harmless in themselves, their presence in water are an indicator of sewage or animal contamination and the potential for pathogenic organisms to be present.

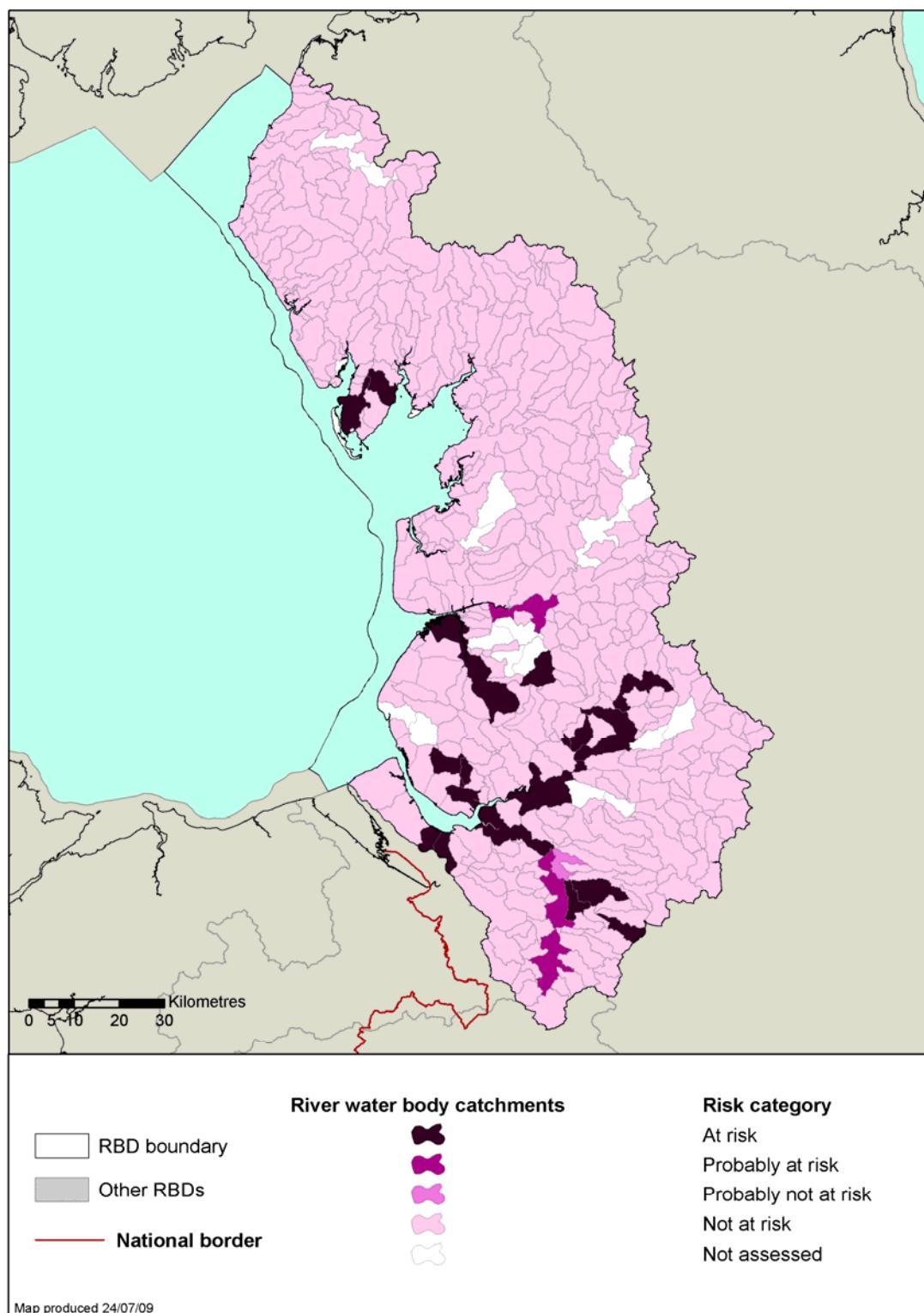
The European Bathing Waters Directive (1976) includes faecal indicator organisms such as faecal coliforms, total coliforms and faecal streptococci. The recently revised Bathing Waters Directive (2006), with objectives set in line with the Water Framework Directive for 2015, takes account of more recent public health research and uses the faecal coliform *Escherichia coli* and the faecal streptococci intestinal enterococci as its faecal indicator organisms.

The Environment Agency monitors faecal indicator organism in those waters identified under the EU Bathing Waters, and Shellfish Waters Directives, and the Government uses the results to report compliance or otherwise with the Directives’ faecal indicator organisms standards each year. See Annex D for details of the relevant Protected Areas (areas designated as recreational waters and areas designated for the protection of economically significant aquatic species) and their compliance.

G.2.7 Metals

Metals are naturally occurring in the environment and many are needed in small amounts by organisms to function properly. However, they can be toxic to aquatic organisms such as freshwater fish, invertebrates and marine organisms in larger quantities. Metal pollutants are covered under a number of other pressure categories including urban and transport (section G.2.8), mines and minewaters (section G.2.10) and chemicals, including priority hazardous, priority and specific polluting substances (section G.2.9).

Figure G.23 Rivers at risk from point source metals within the North West River Basin District



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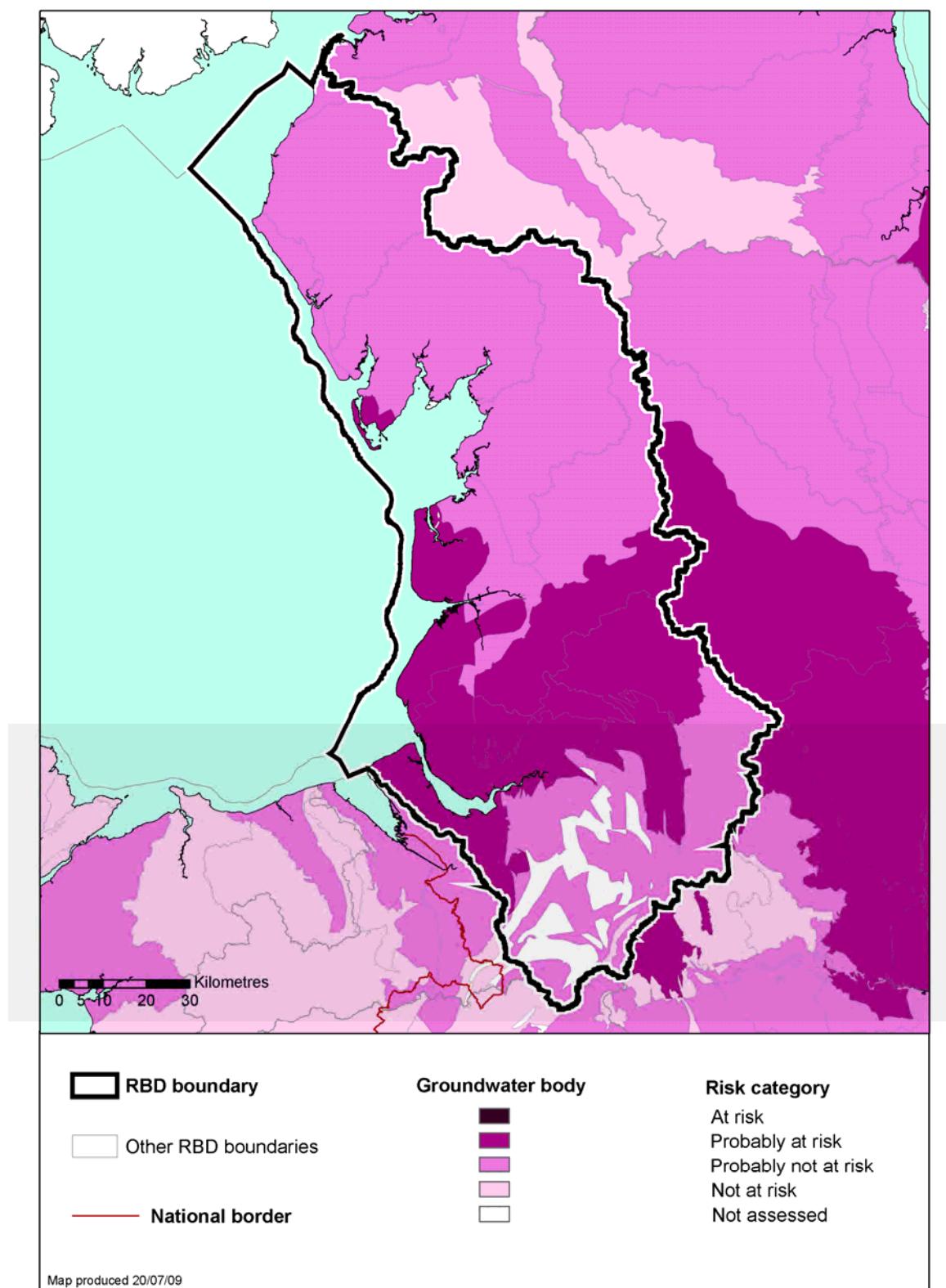
G.2.8 Urban and Transport Pressures

Various pollution issues relate to the urban environment and transport networks. These include:

- Urban drainage containing a variety of pollutants, such as:
 - phosphorus from misconnections (e.g. washing machines incorrectly plumbed into the surface water sewer instead of the foul)
 - organic waste (dog fouling) from parks and pavements
 - fertilisers used in gardens
 - sediment from construction sites
 - a range of pollutants which are present in run-off from roads including contaminated sediment, metals, organic substances
- Air emissions from vehicles which are then deposited to water or land (and in some cases can cause acidification).
- Pesticides used to control weeds on roads, pavements, railway tracks and other amenity areas such as parks and playing fields.
- Run-off from air strips that may contain de-icers and pesticides to control weeds.
- Dredging and maintenance of navigable waterways that can result in water quality issues from suspended solids and leaching of contaminants from the sediment.
- Leaching of pollutants from contaminated land.

Our latest information shows that 158 river water bodies are at risk or probably at risk from urban diffuse pollution. See also the section on phosphorus (G.2.1) and organic pollution (Section G.2.2) for the latest detailed information.

Figure G.24 Groundwaters within the North West River Basin District at risk from diffuse source urban and transport pressures



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G.2.9 Chemicals including priority hazardous substances, priority substances & specific pollutants (excluding pesticides)

The Environmental Quality Standards Directive designates the most polluting substances as priority substances and priority hazardous substances. The list includes pesticides (see also section G.2.5 and G.2.7) and other synthetic organic chemicals including chlorinated hydrocarbons and some naturally occurring substances such as metals. The severity of their effects depends on the availability to organisms, the nature of the particular substance and the susceptibility of the biological receptor.

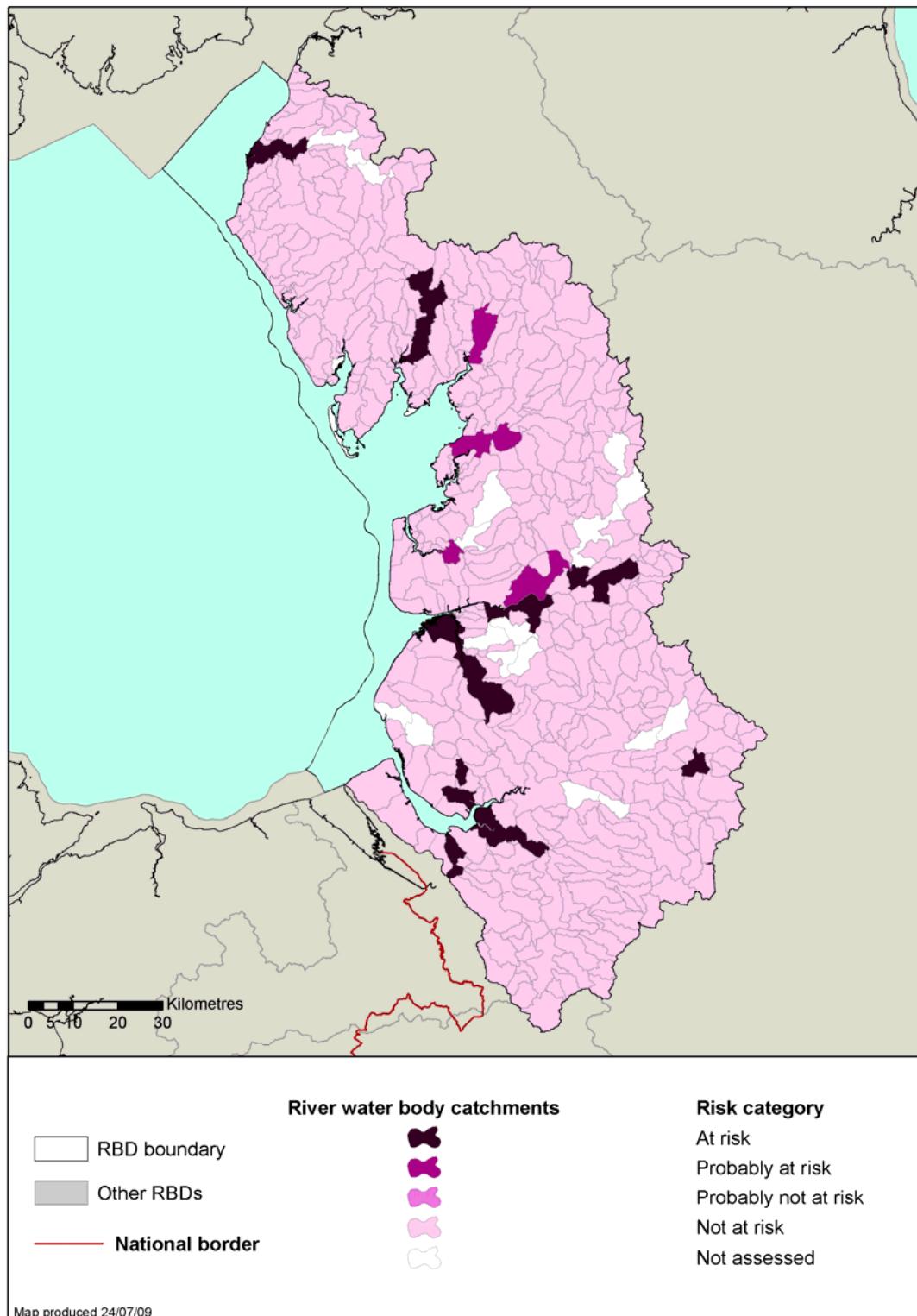
Severe contamination can result in lethal effects to the extent that the habitat becomes characterised by tolerant or opportunistic species. In less severe circumstances, sub-lethal impacts may affect the physiology, growth and development and reproduction of organisms in the water column and sediment. Furthermore, a number of these substances bio-accumulate and many persist in sediments. The most polluting have been termed priority hazardous substances and the aim is to eliminate discharges of these substances to the aquatic environment wherever possible.

Information gathered to monitor environmental quality and compliance with other Directives shows that chemicals cause problems for the water environment in the North West River Basin District. The pressure from tributyltin is a concern at specific sites and is covered in discussions in relation to pesticides in section G.2.5

Our initial view of risk assessments reported that 16 out of 477 river water bodies and four out of 12 estuarine water bodies are either at risk or probably at risk of failing Water Framework Directive objectives based on an assessment against Dangerous Substances Directive compliance. Note that the standards in the Dangerous Substances Directive will be replaced by the Environmental Quality Standards Directive (2008/105/EC). See Figure G.25 and Figure G.26.

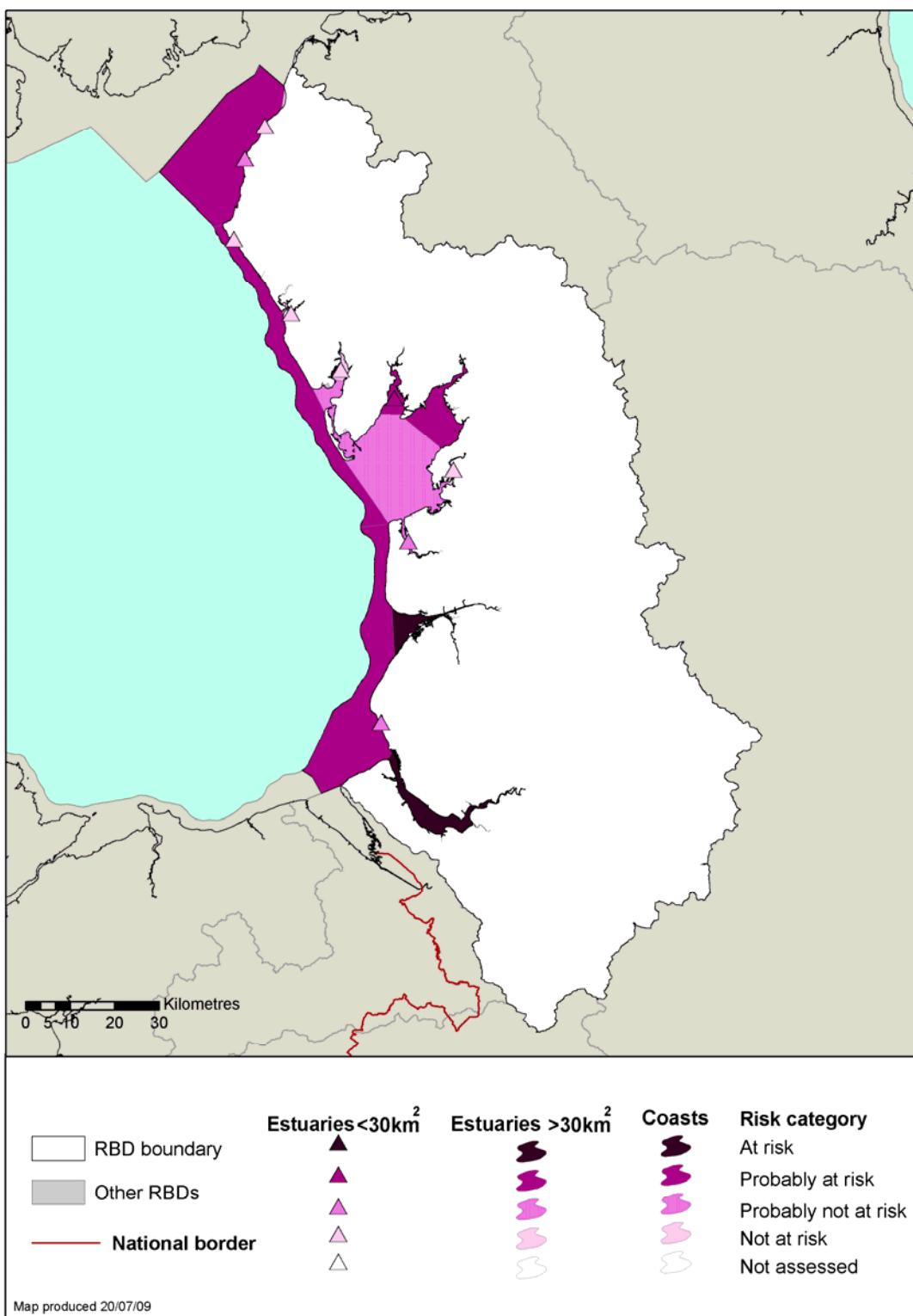
There are also three groundwater bodies at risk from hazardous substances (not including pesticides) and four water bodies at risk from chlorinated solvents. See Figure G.27 and Figure G.28.

Figure G.25 Rivers within the North West River Basin District at risk based on Dangerous Substances Directive compliance



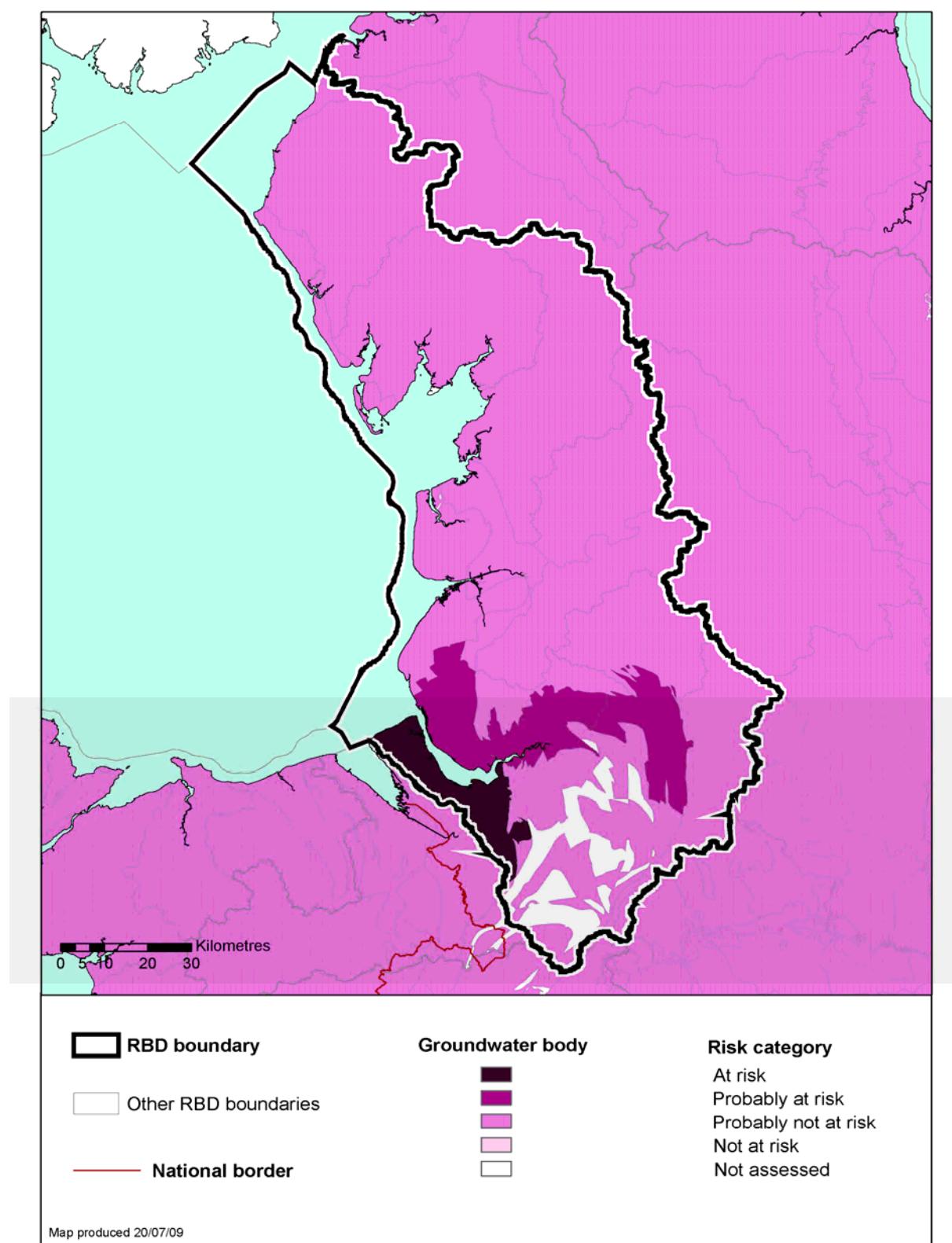
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Figure G.26 Estuarine and coastal waters within the North West River Basin District at risk based on Dangerous Substances Directive compliance



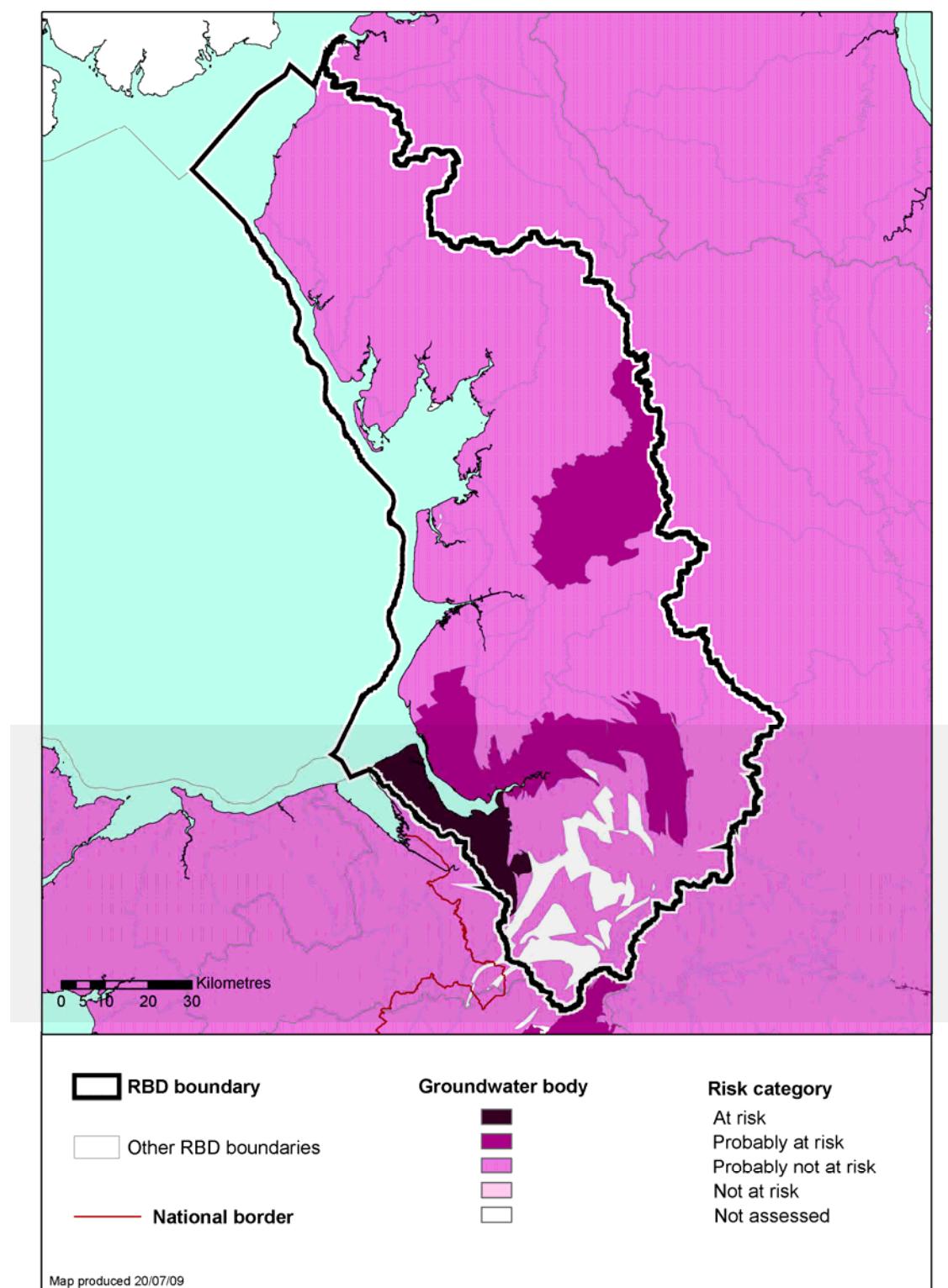
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Figure G.27 Groundwater within the North West River Basin District at risk from diffuse source hazardous substances



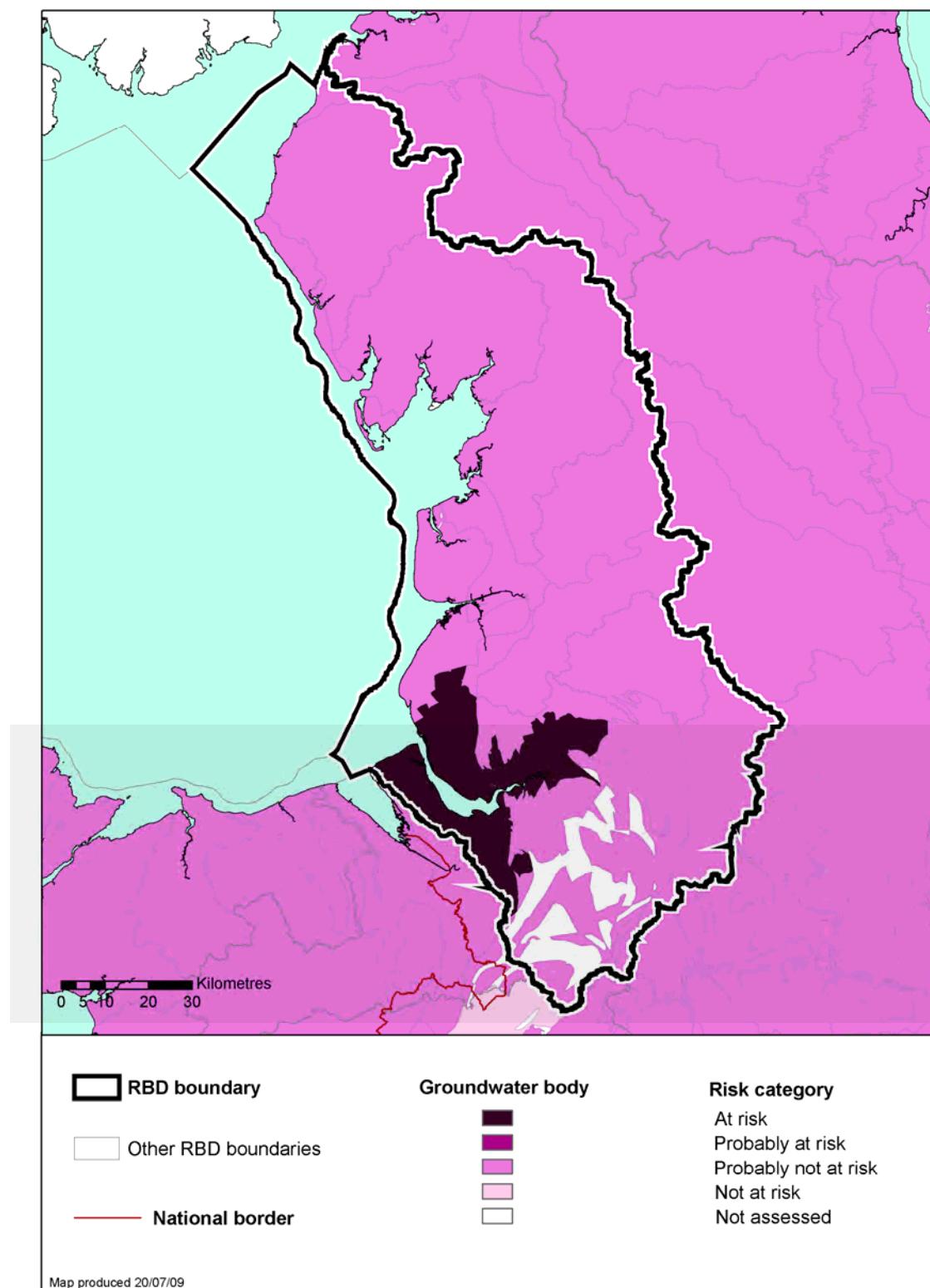
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Figure G.28 Groundwater within the North West River Basin District at risk from diffuse source chlorinated solvents



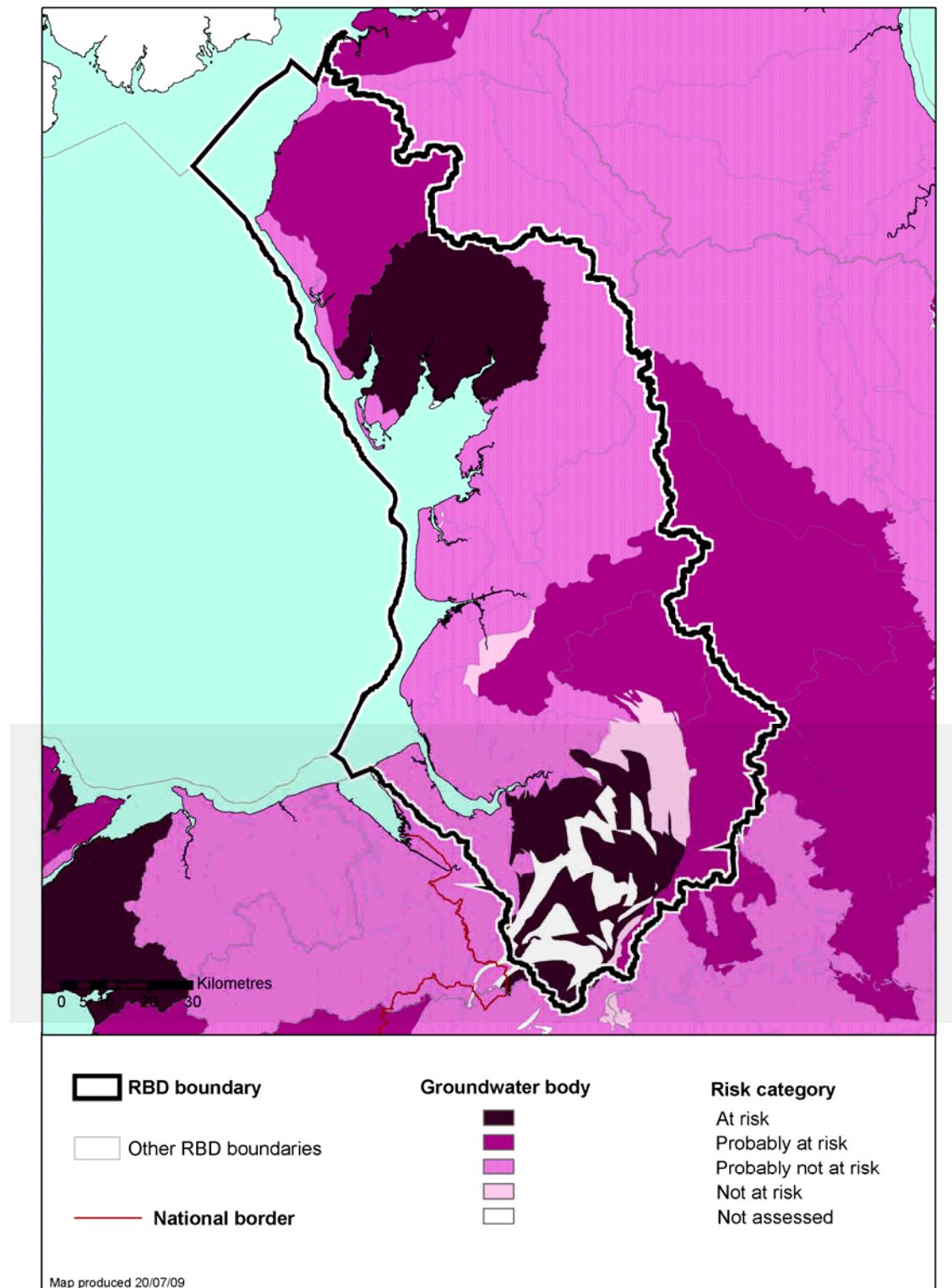
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Figure G.29 Groundwater within the North West River Basin District at risk from overall point source pollution



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Figure G.30 Groundwater within the North West River Basin District at risk from diffuse pressures on groundwater dependent terrestrial ecosystems



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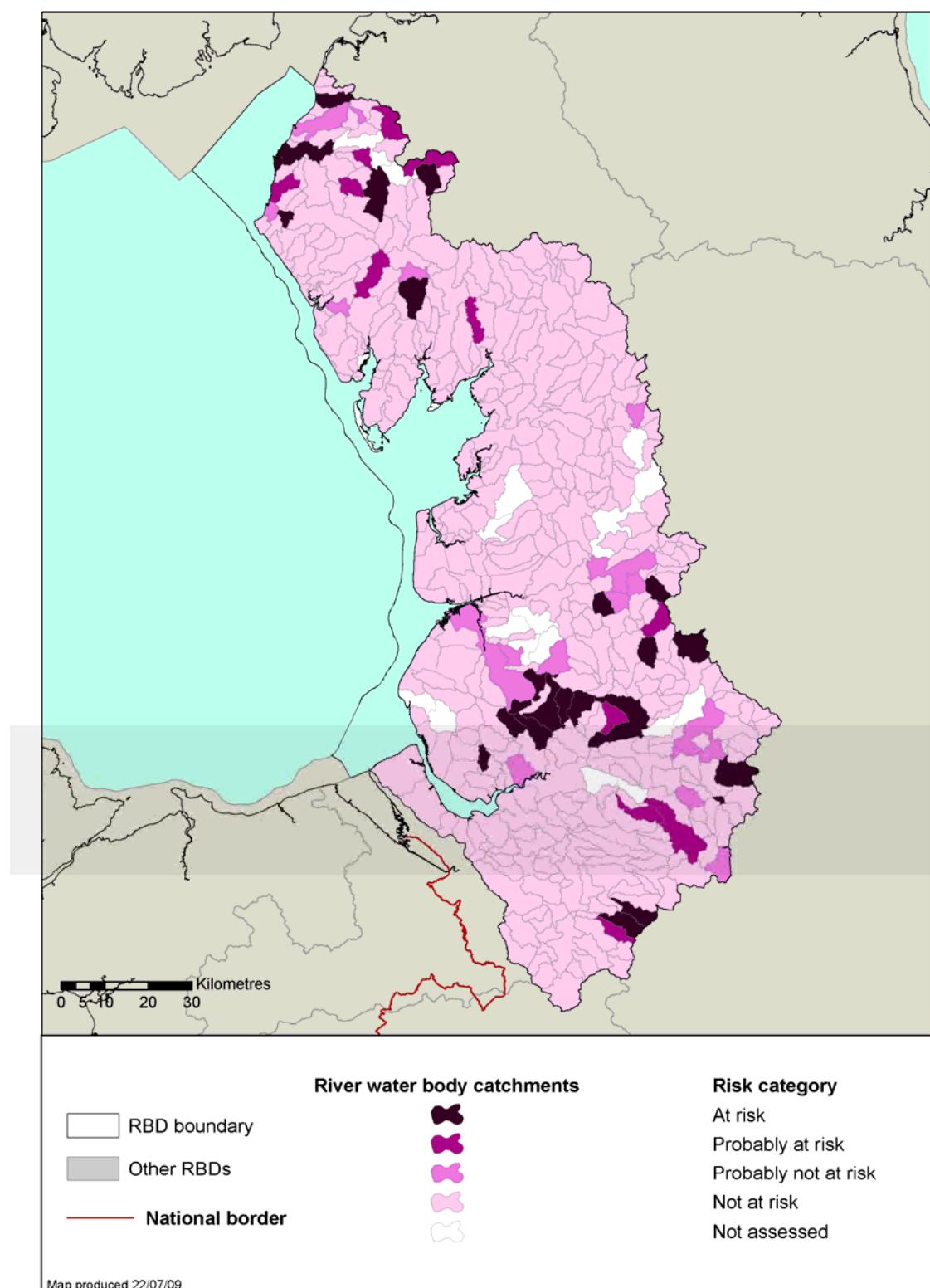
G.2.10 Mines and Minewaters

Minewaters are often acidic (low pH) and the main contaminants are metals, for example; copper, iron, manganese and zinc. Minewater may also contain priority substances such as cadmium and lead. These contaminants are released when oxygen in the air or water reacts with minerals in the rock found near coal seams and mineral veins. The metals are then dissolved in the groundwater which discharges back into surface water bodies, or by diffuse run-off in the case of spoil heaps. Such minewater related pollution may have significant ecological impacts.

In the North West River Basin District there are 37 water bodies at risk from mines and minewaters (see Figures G.31, G.32 and G.33).

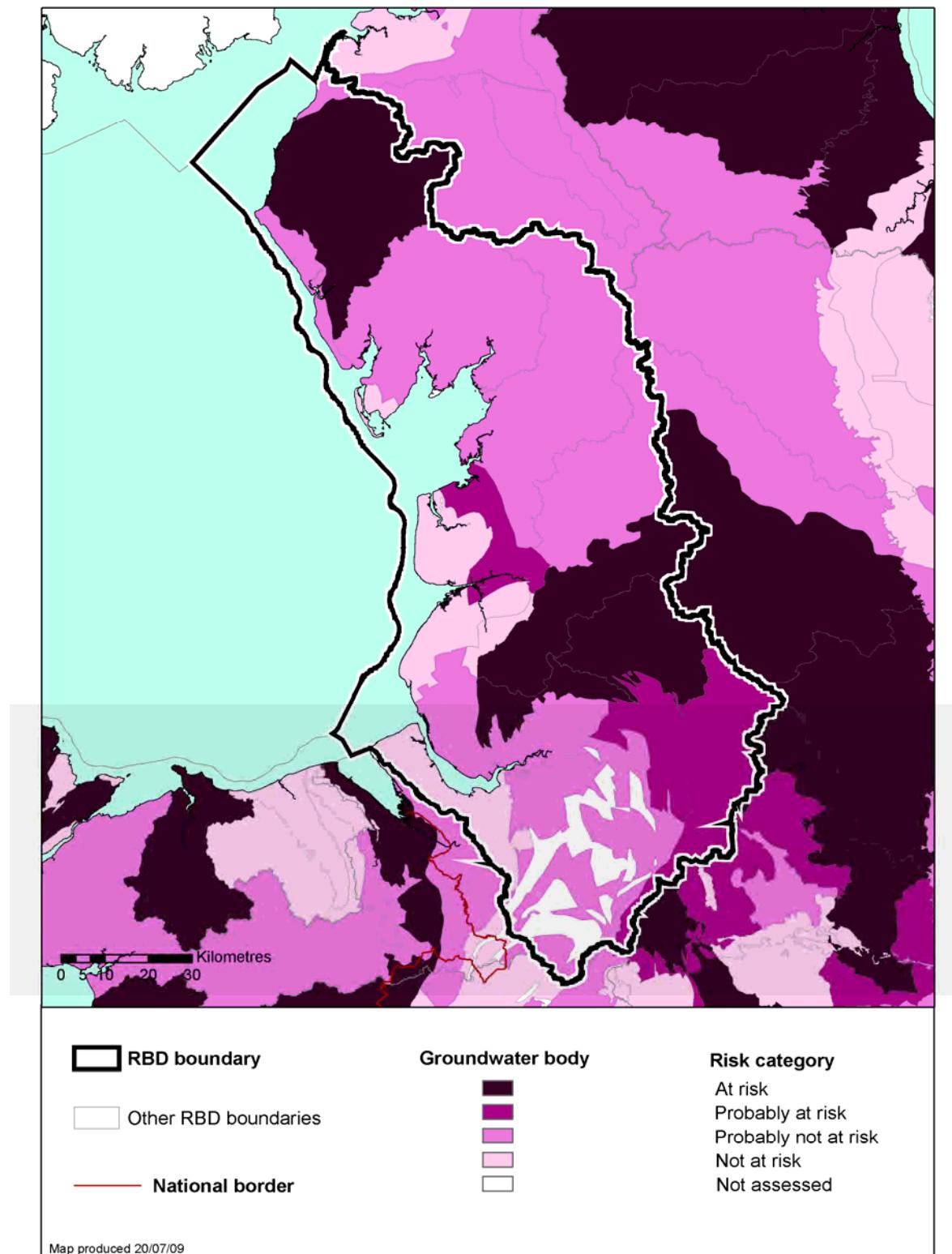
Please note that there is some overlap between the pressure category “Mines and minewaters” and some metals that are covered in section G.2.7. Also note that metals in minewater discharges have been designated as priority substances, priority hazardous substances and specific pollutants. The objectives for these types are described in Annex E.

Figure G.31 Rivers within the North West River Basin District at risk from mines and minewaters



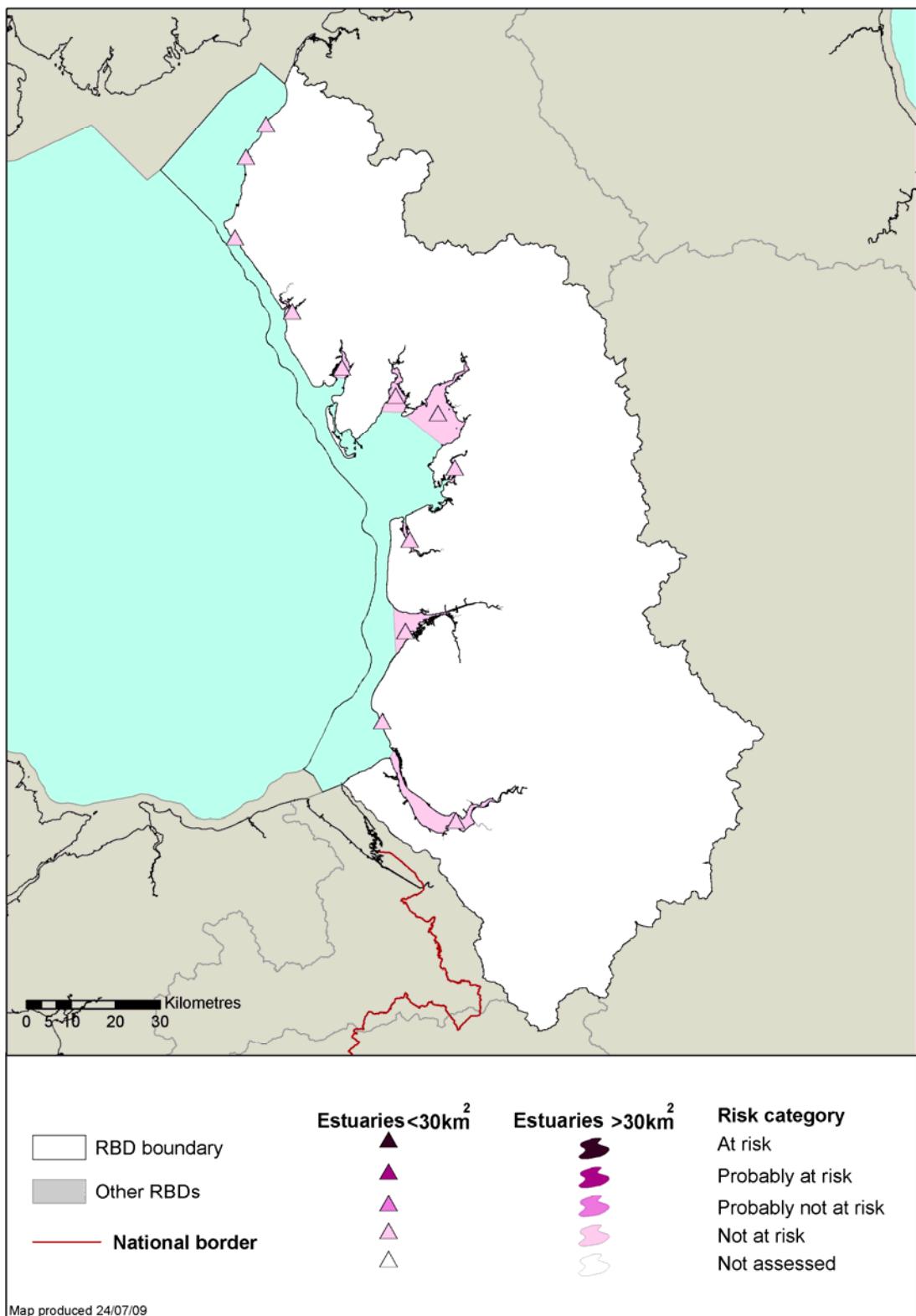
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Figure G.32 Groundwaters within the North West River Basin District at risk of pollution from mine and minewater



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Figure G.33 Estuarine and coastal waters within the North West River Basin District at risk from mines and minewaters



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G.2.11 Physical modification (morphology)

The ecology of estuarine and coastal waters in the river basin district can be affected by a number of physical habitat pressures. These include land claim, shoreline reinforcement and dredging activities. The existence of weirs or tidal sluices can limit the migration of fish such as salmon, restrict sediment movement, promote siltation, and prevent natural mixing between fresh and saline waters with consequent impacts on transitional ecological communities. Coastal defences may inhibit the inland migration and maintenance of intertidal habitats squeezed by sea level rise as a result of climate change.

Many lowland rivers in England and Wales have also been subject to physical alteration⁷. These modifications include channel straightening, bunding, bank re-profiling and dredging for flood prevention, drainage or navigation purposes. In addition new channels have been created to supply mills with water or to divert water for irrigation. Weirs, sluices and other impoundment in the river network may restrict the migration of migratory and freshwater fish such as eels, salmon and lampreys, impede sediment movement, promote siltation, and disrupt the interconnections between accessible habitat, particularly during periods of low flow. Such pressures may result in ecological habitat damage or loss.

Many lakes and reservoirs have been subject to significant physical alteration, and the artificial manipulation of water storage and levels behind them. Some are wholly artificial, being constructed in a site where no water body existed before.

Further evidence is needed on how hydromorphological pressures influence ecology. There is extensive research being undertaken to look at this issue and also how different mitigation measures can improve the ecology of physical modifications⁸.

Figure G.34 Activities that include physical modifications to estuaries and coasts, rivers and lakes

Significant Issue	Physical modification issues
Physical modifications	<ul style="list-style-type: none">• Control structures• Dredging• Land claim• Aggregate extraction• Flood risk management• Impoundments

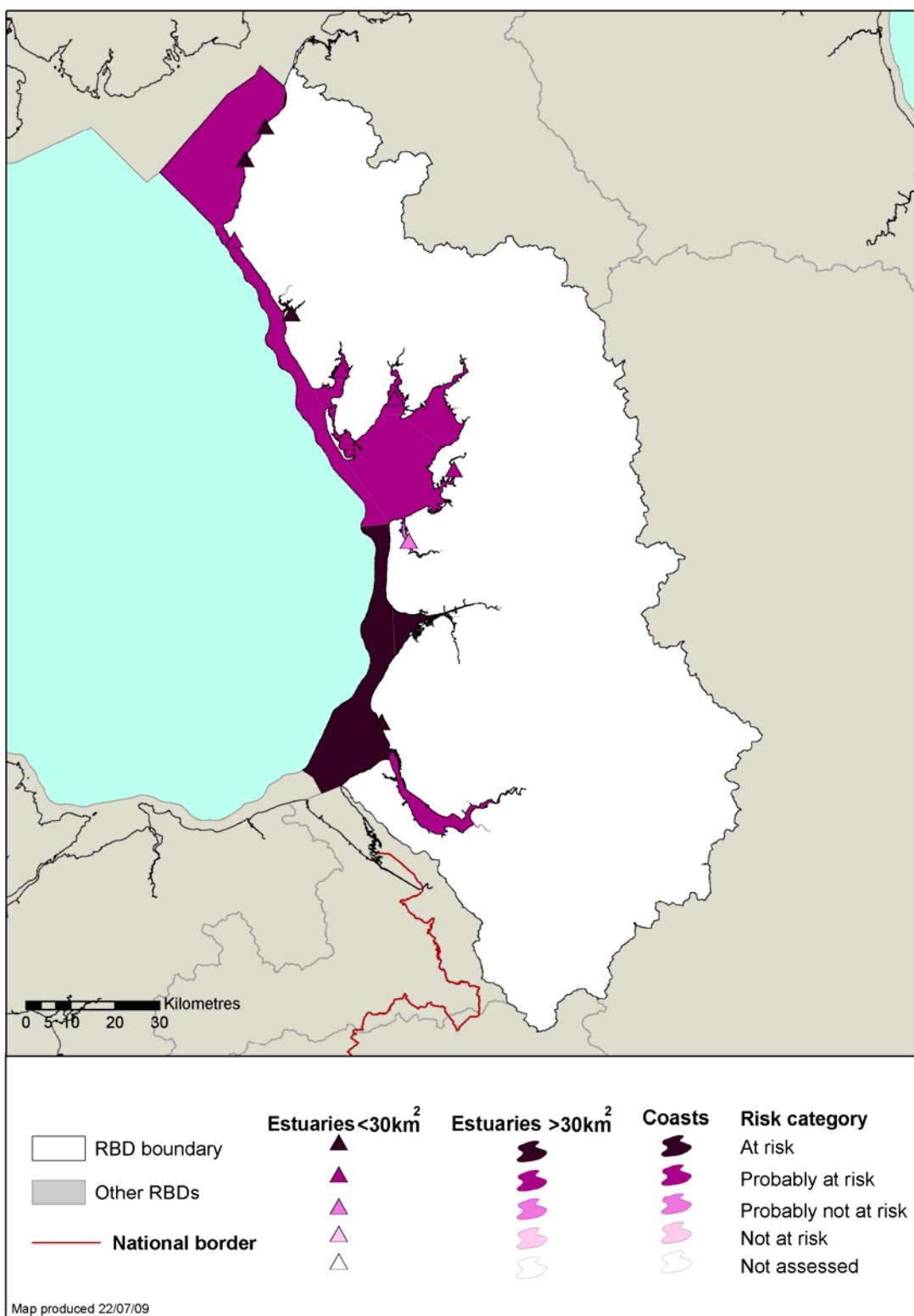
Our latest tests showed that for morphological pressure:⁹

⁷ Environment Agency 2007, River Basin Planning, Summary of Significant Water Management Issues, Supporting document, North West River Basin District, Consultation Document 2007.

⁸ Environment Agency 2007, Management strategies and mitigation of measures for Heavily Modified Water Bodies & Artificial Water Bodies in relation to ecological potential , Summary of Projects: March 2007, Internal document.

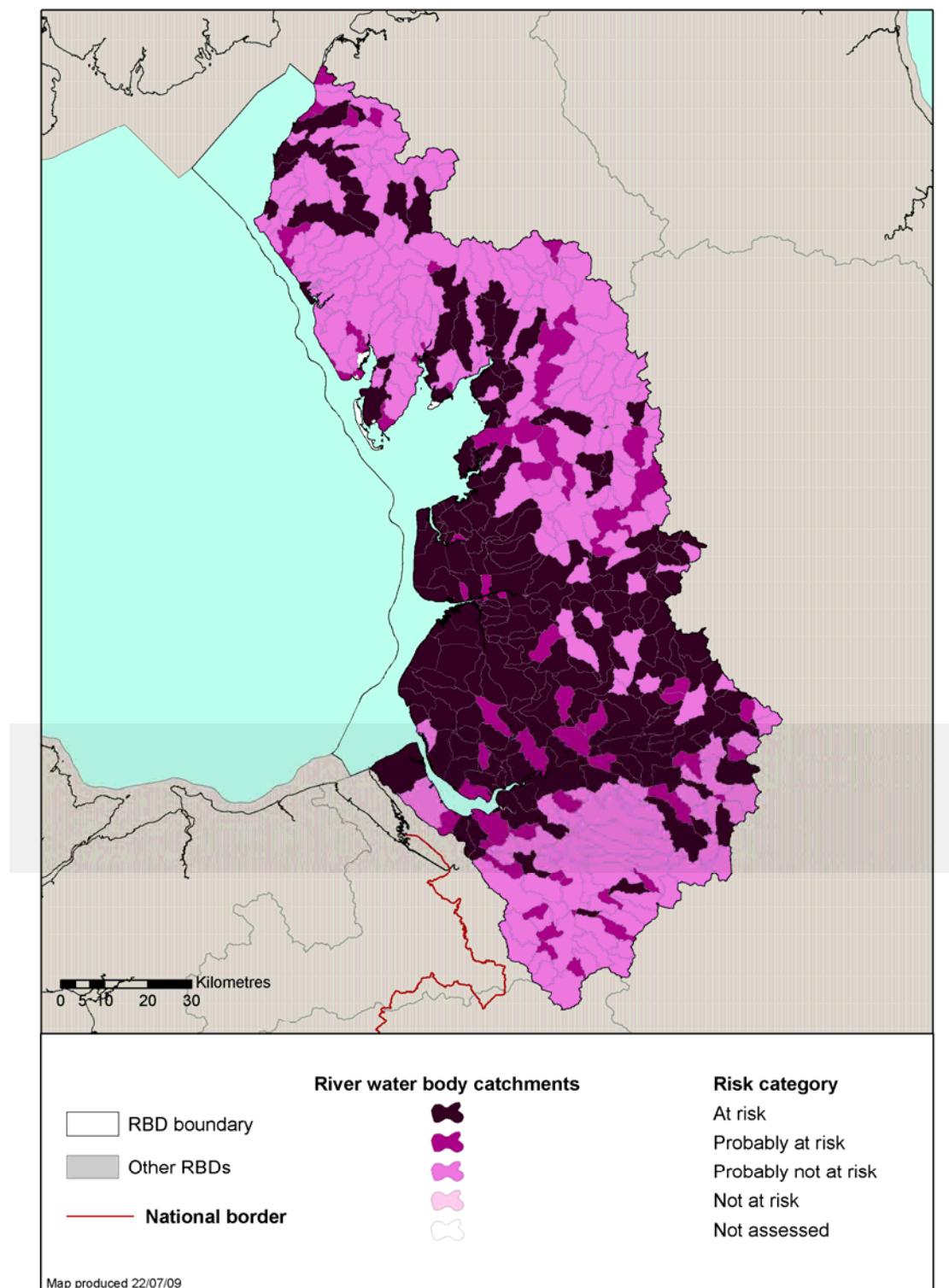
- All coastal waterbodies and 11 (92%) of all estuarine water bodies in the North West River Basin District are at risk or are probably at risk of failing Water Framework Directive objectives in 2015. The main pressures in the North West are due to dredging, flood defence structures and shell fisheries (see Figure G.35);
- 2662 km (44% of total length) of rivers are at risk or probably at risk of failing Water Framework Directive objectives in 2015 due to morphological pressure; (see Figure G.36);
- 133 (81%) of lake water bodies are at risk or probably at risk from morphological pressures (see Figure G.37).

Figure G.35 Estuarine and coastal waters within the North West River Basin District at risk from physical or morphological alteration



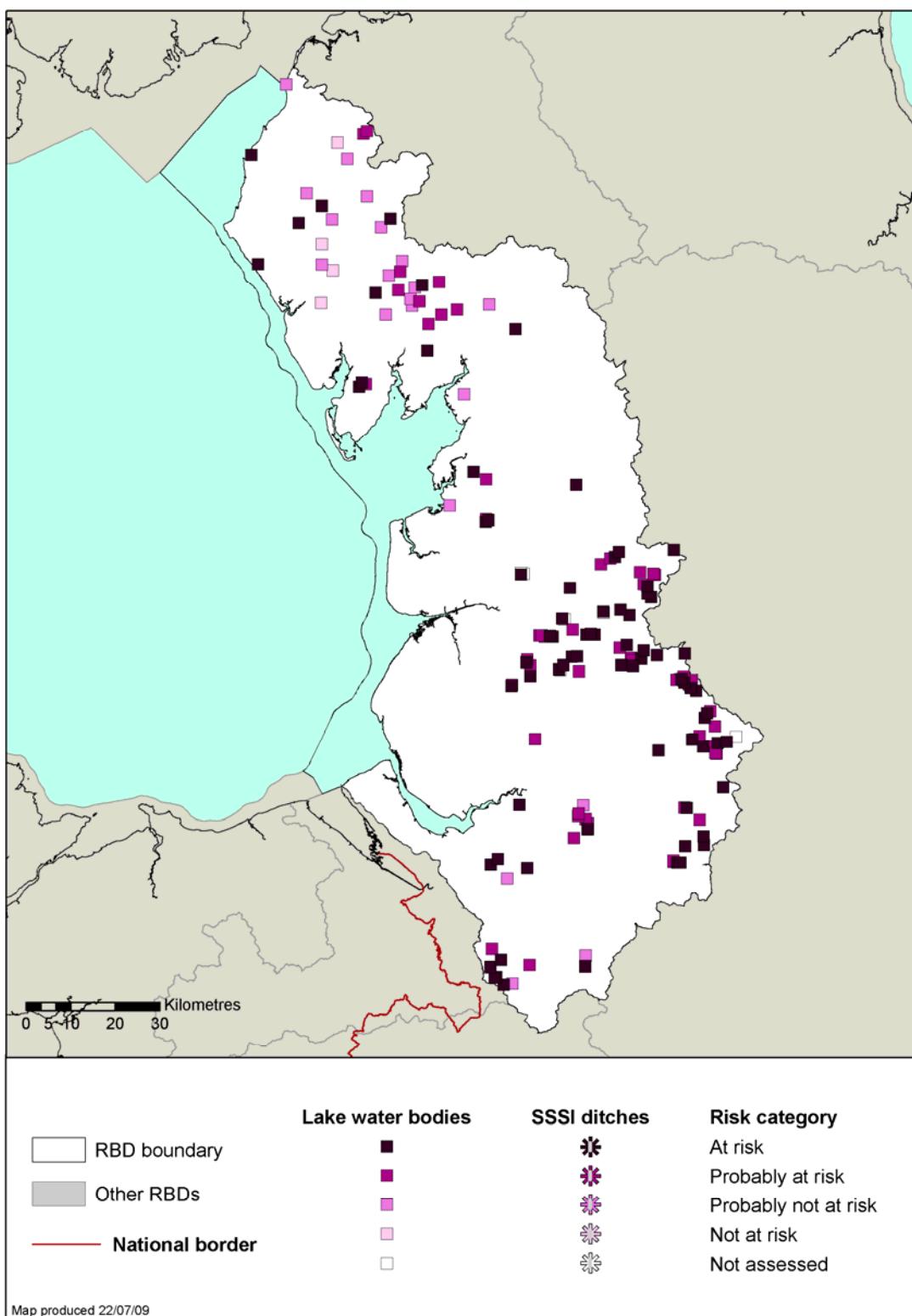
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Figure G.36 Rivers within the North West River Basin District at risk from physical or morphological alteration



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Figure G.37 Lakes within the North West River Basin District at risk from physical or morphological alteration



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G.2.12 Abstraction and other artificial flow pressures

Periods of naturally low flows are caused by low rainfall (e.g. during droughts) and are part of the mechanism that supports bio-diversity. Low flows can be prolonged or made worse by high levels of abstraction for public water supply, industry, agriculture or domestic use. Unsustainable abstraction from groundwater can lower groundwater levels and affect dependent river flows or wetlands, or can induce the intrusion of poorer quality water from the sea or from deeper aquifers.

Other artificial influences on flow include the discharge of treated sewage, transfer of water between catchments and the storage and release of water from reservoirs. These influences may offset some of the impacts of abstraction, or result in flows being significantly higher or lower than they would naturally be.

Flow in surface water bodies is a supporting element to biological classification for all classes other than High status, for which it is an obligatory consideration. Outflow from groundwater bodies contributes to the surface water flows required to support the biological classification.

Unsustainable rates of abstraction reduce surface water flows and may result in lower flow velocities, reduced depths and reduced flow continuity that may limit ecological status. In addition, groundwater pumping may locally reduce spring flows and water levels important to retaining the ecological diversity and resilience of groundwater fed wetlands.

The North West is currently under 'low' water stress with the general perception that the region is water rich. However, change in climate and planned housing development as outlined in the Regional Spatial Strategy and Regional Economic Strategy are likely to increase demand considerably. With rising temperatures, more irrigation intensive agriculture is being practised in the North West, increasing the demand even further. Restoring Sustainable Abstraction initiatives in the region are likely to restrict some public water supply sources. All these issues are likely to put considerable pressure on our water resources.

Ecological impacts can also arise from water being diverted for other uses. For example, fish farms can take a substantial amount of water out of rivers and return it further downstream. The ecology in the 'deprived reach' between the inlet and outlet can be significantly affected. Flow impacts can also arise from river channels being over widened or poorly managed.

Restricted or low flows can lead to higher residence time along some river stretches. These, combined with higher concentrations of nutrients such as phosphate and nitrate, may lead to algal blooms. More frequent periods of low rainfall are expected under current climate change scenarios, which may increase the environmental impact of flow problems.

There are 1550 abstraction licences within the North West River Basin District authorising abstraction of 4,849,261 million litres of water a year (based on the maximum licensed volume). These abstractions cover water taken from rivers or the ground, both from freshwater and tidal reaches.

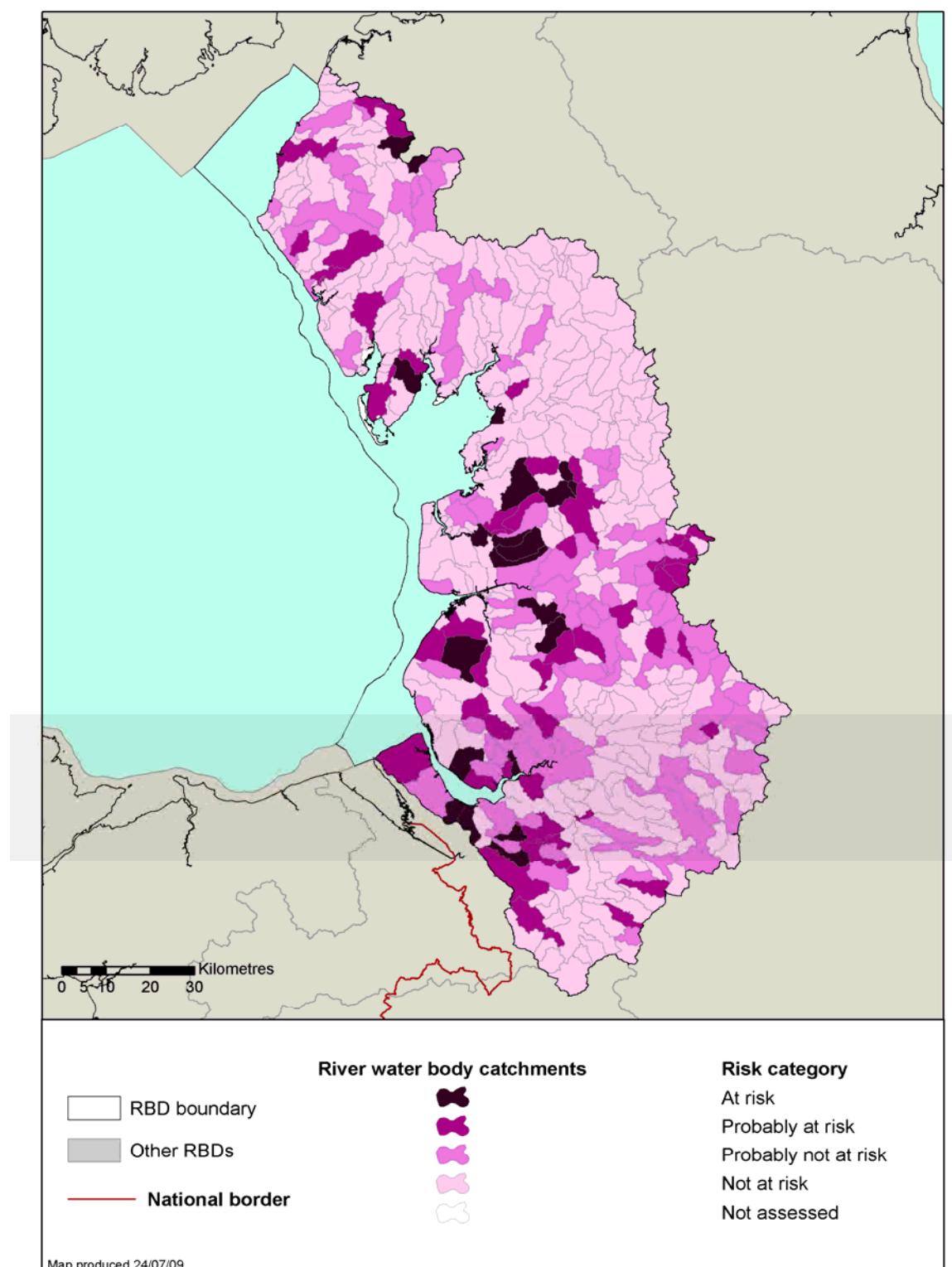
Figure G.38: Summary of abstractions in the North West River Basin District

Sector	Licensed volume (Ml/ year)	Number of Licences
Water Supply	723,844	220
Agriculture	19,685	667
Fish and Aquaculture	38,036	56
Electricity Production	3,326,251	42
Industry	734,525	554
Other	6920	11
Total	4,849,261	1550
(Maximum licensed volume)		

Our latest assessments of the pressure show that:

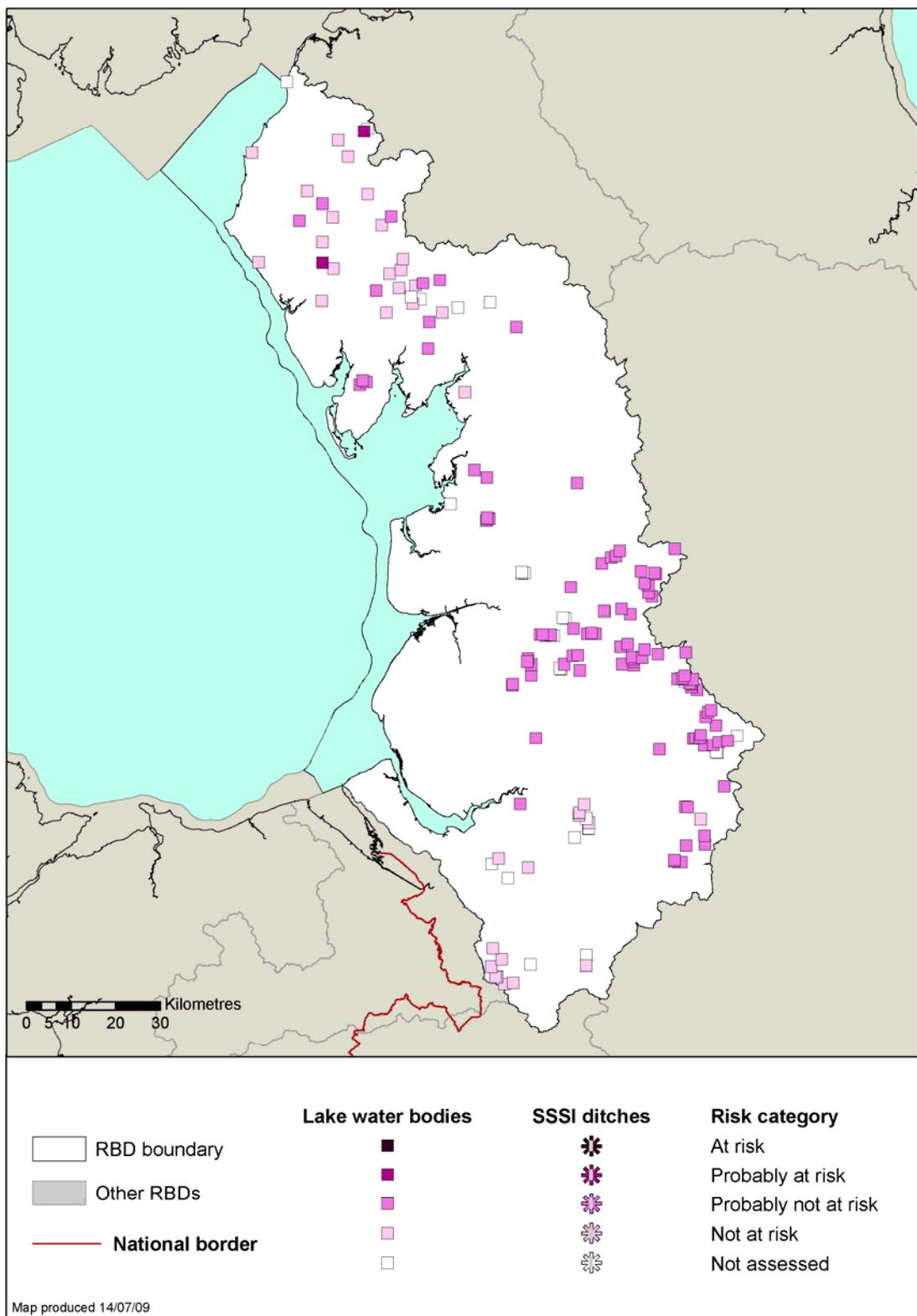
- 889 km (15%) of river length is at risk or probably at risk from abstraction and flow regulation (see Figure G.39)
- Two lakes are probably at risk from abstraction and flow regulation pressures (see Figure G.40).
- Figures G.41–G.44 show the abstraction pressures on groundwater
- Figures G.45 and G.46 show the abstraction pressures on estuaries in the river basin district.

Figure G.39 Rivers within the North West River Basin District at risk from abstraction and other artificial flow pressures



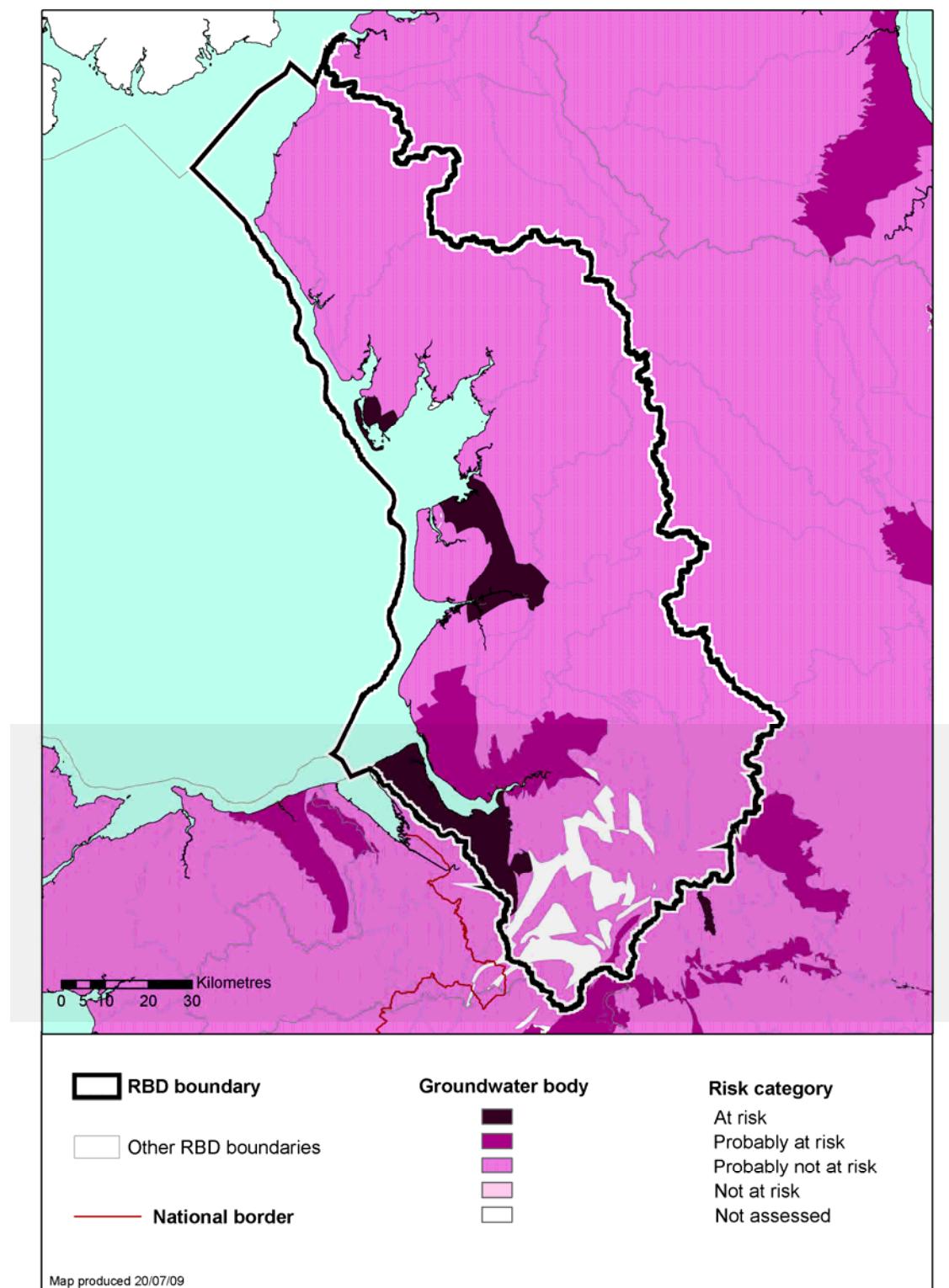
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Figure G.40 Lakes within the North West River Basin District at risk from abstraction and other artificial flow pressures



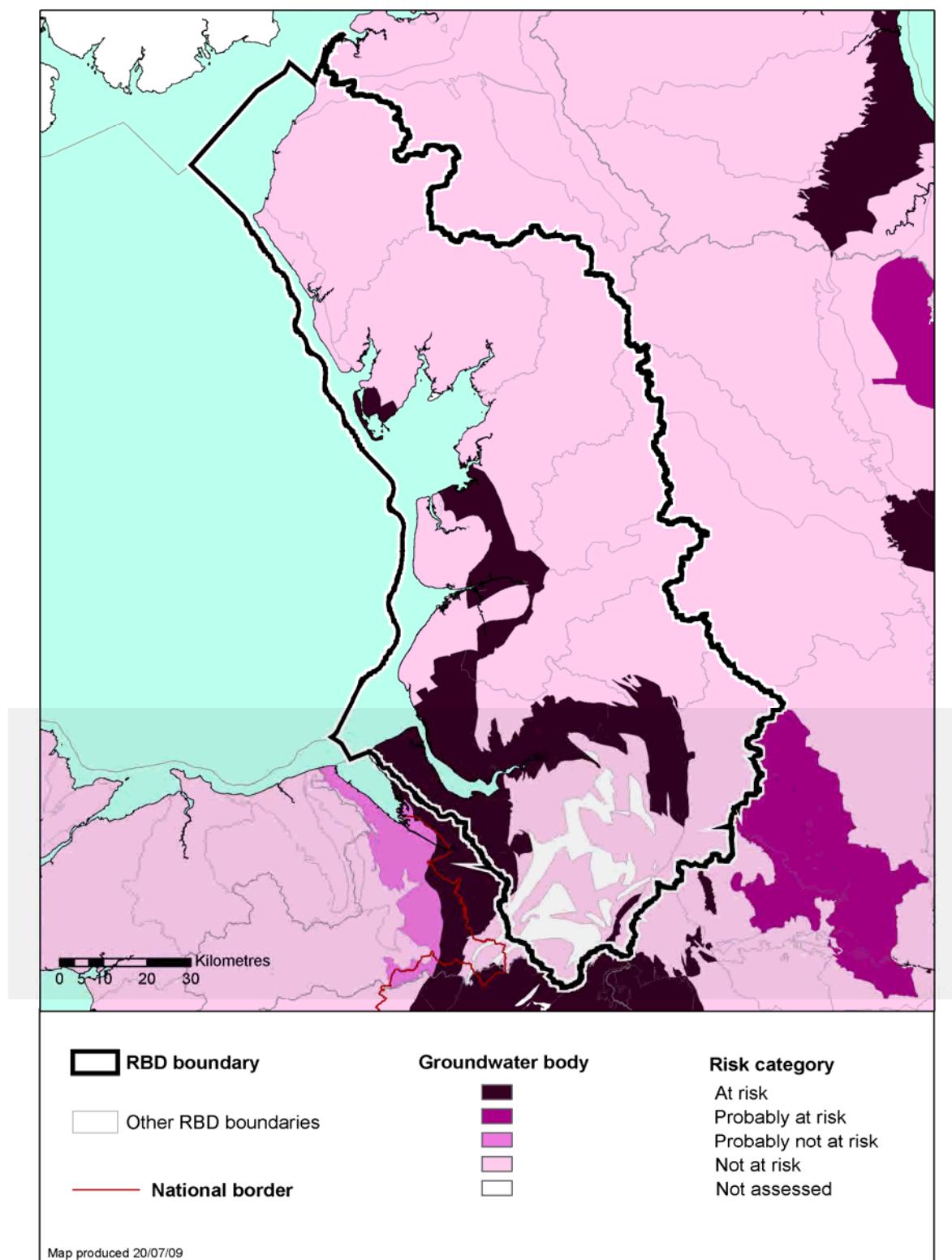
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Figure G.41 Groundwaters within the North West River Basin District at risk from abstraction and flow regulation impacting on water balance



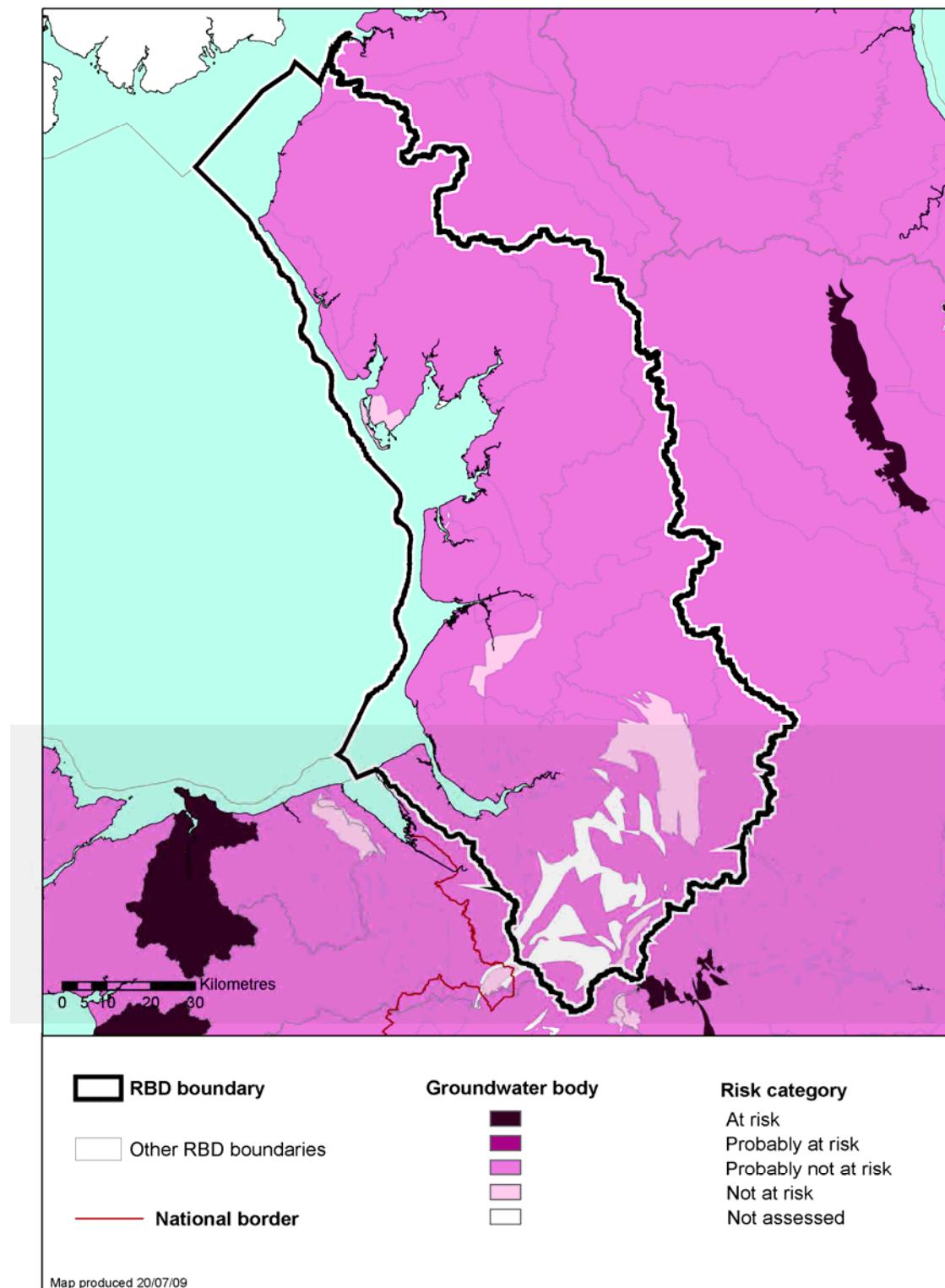
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Figure G.42 Groundwaters within the North West River Basin District at risk from abstraction and flow regulation impacting surface water flow



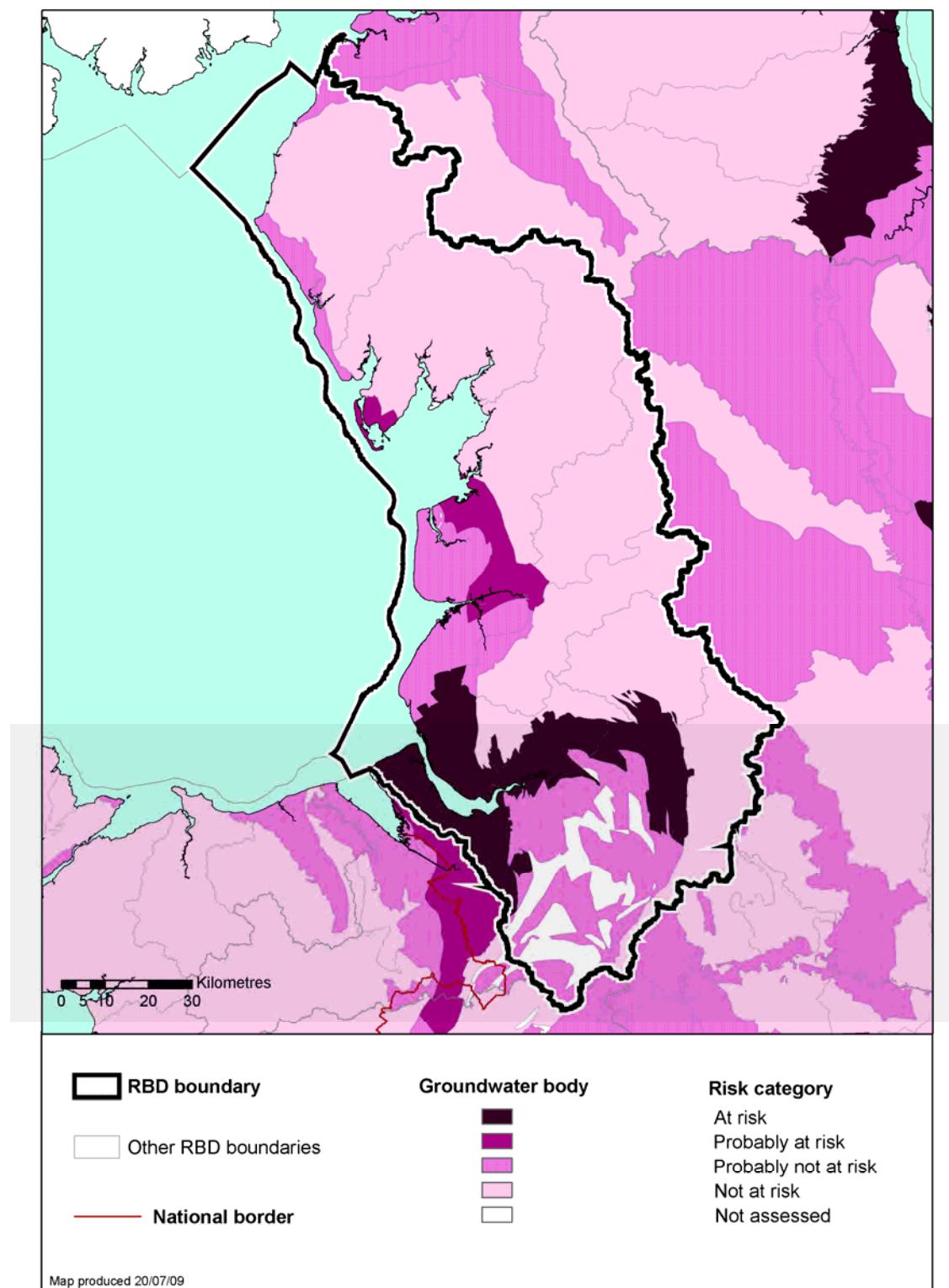
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Figure G.43 Groundwaters within the North West River Basin District at risk from abstraction and flow regulation impacting groundwater dependent terrestrial ecosystems



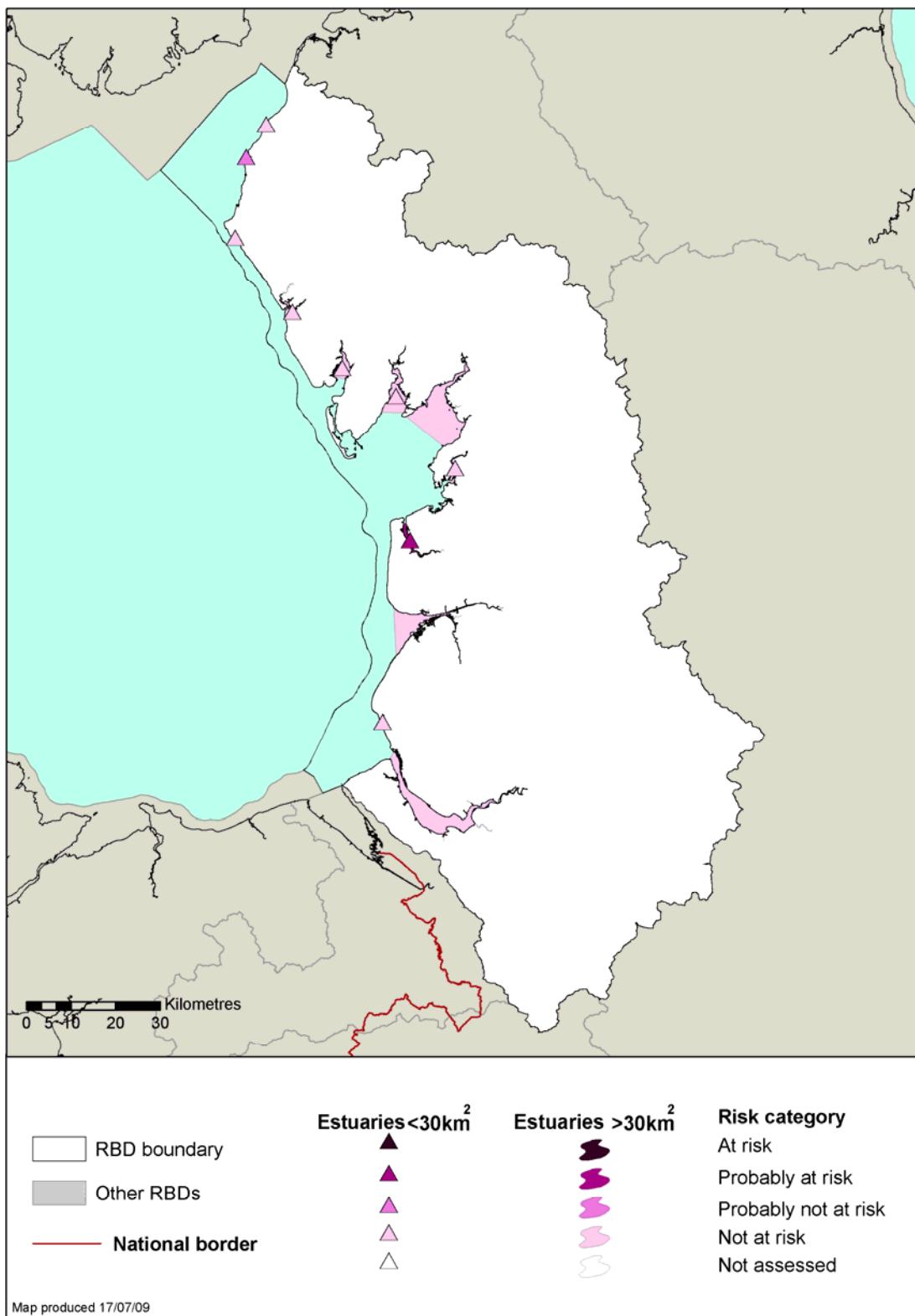
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Figure G.44 Groundwaters within the North West River Basin District at risk from saline intrusion due to abstraction and flow regulation pressures



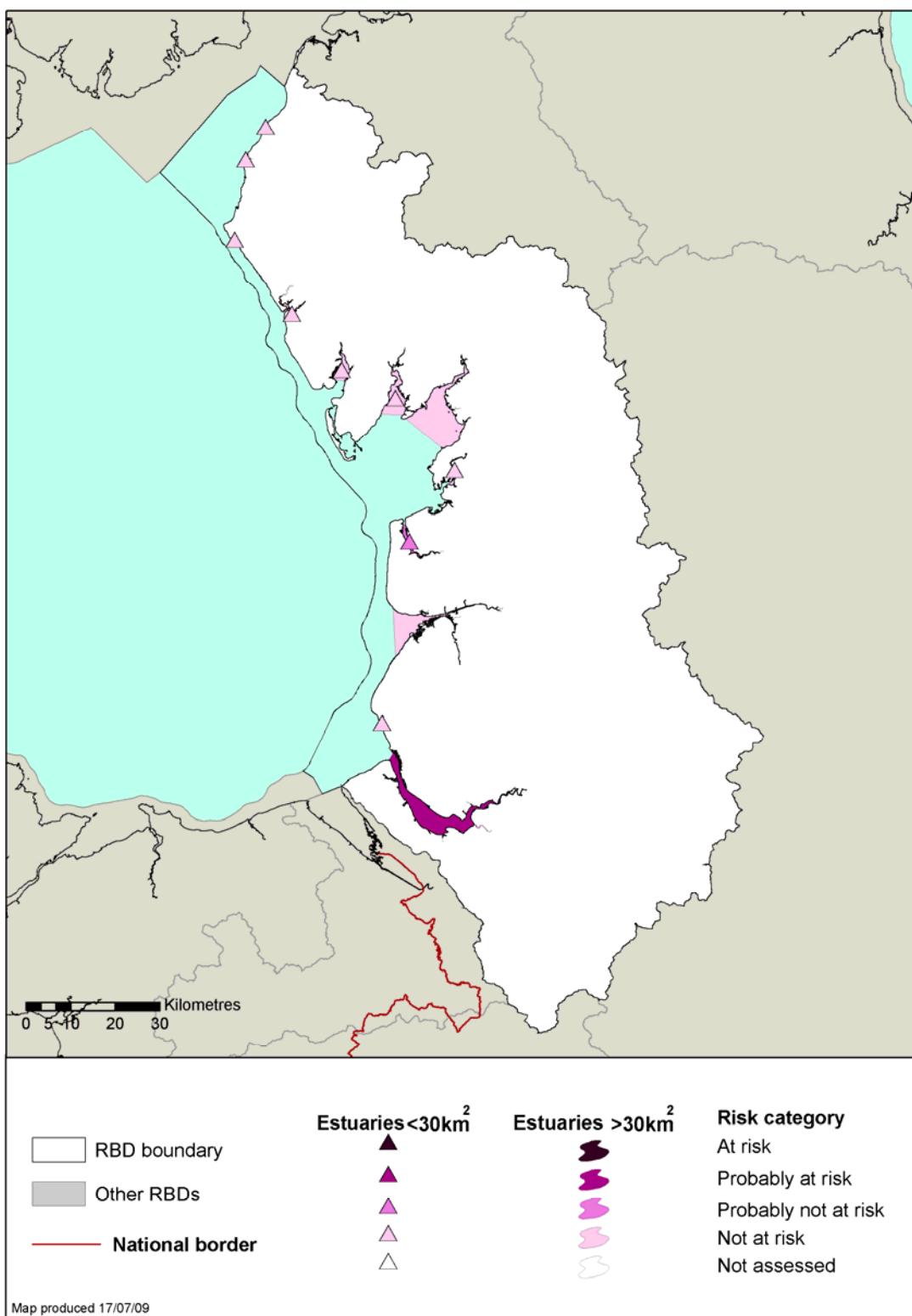
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Figure G.45 Estuarine waters in the North West River Basin District at risk from water abstraction and artificial flow pressures



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Figure G.46 Estuarine and coastal waters in the North West River Basin District at risk from industrial abstraction



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G.3 Other water management issues

Other water management issues were identified as affecting the water environment at a local level in the River Basin Planning: Summary of Significant Water Management Issues report for the North West River Basin District. These are described below.

- Invasive non-native species
- Acidification
- Recreation
- Endocrine disrupters

G.3.1 Invasive non-native species

Invasive non-native species are plants and animals that have deliberately or accidentally been introduced outside their natural range, and by spreading quickly threaten native wildlife and can cause economic damage.

Some species pose serious threats to our natural biodiversity and have economic impacts for example, for flood risk management, water transfer schemes, disposal of soil as waste and fisheries management. Their presence and unabated spread can represent an important pressure on the ecological status of many water bodies. Once established they are difficult or impossible to control. Examples include the plant Japanese knotweed, the mammal American mink, the fish Topmouth gudgeon and the crustacean American signal crayfish.

A number of species introduced to the UK continue to cause local and regional problems. Within the North West River Basin District we run annual Japanese Knotweed eradication programmes to treat watercourses across west Lancashire and the Fylde coast. We have run a river basin district campaign on signal crayfish informing licensed anglers of the impact of introducing invasive non-native species and the law that is in place to prevent this practice.

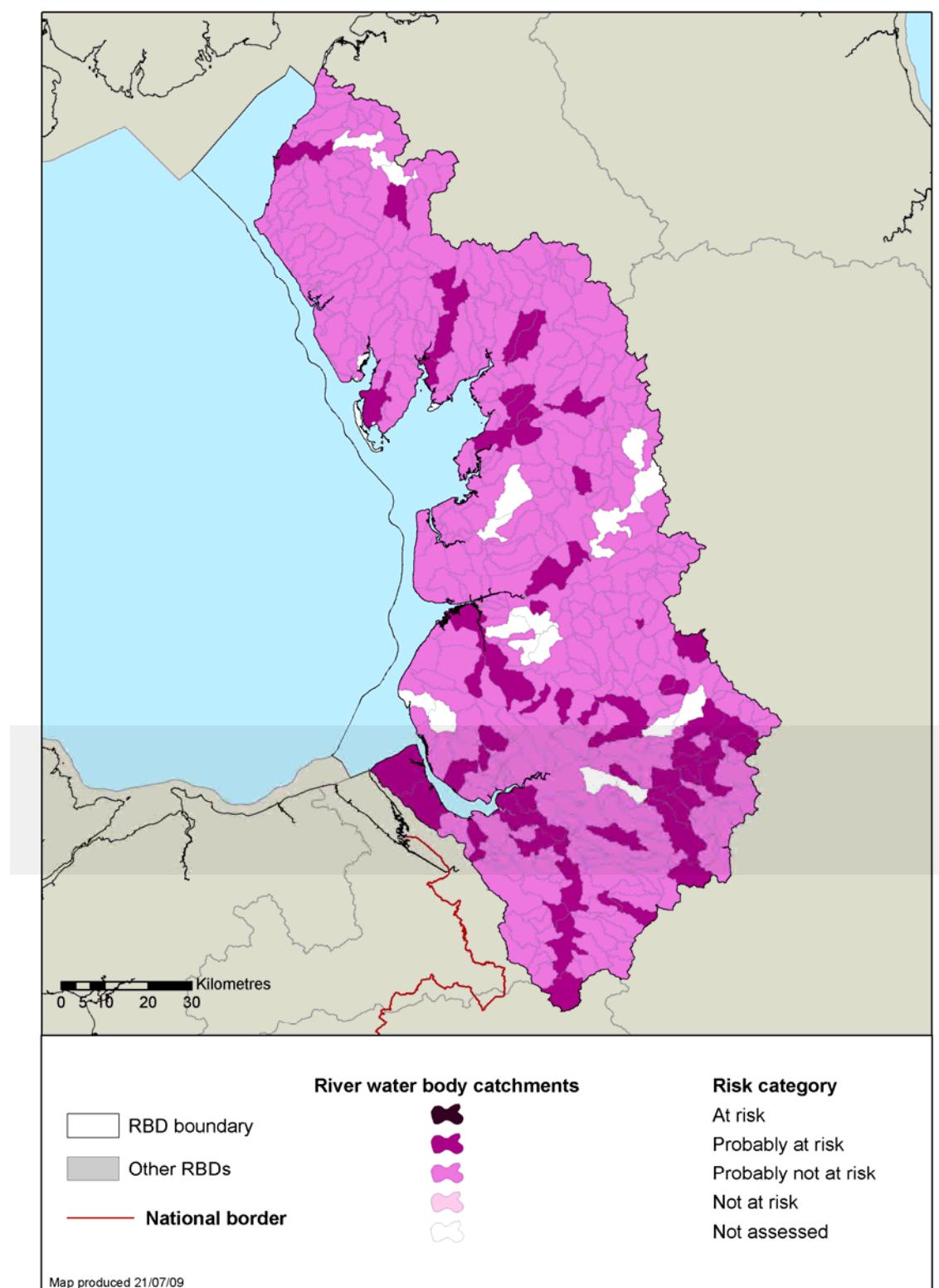
Water bodies that have a significant presence of invasive non-native species will not meet 'high ecological status' under the Water Framework Directive. Their presence, however, will not always prevent achievement of good ecological status.

Our risk assessments show that of 477 river water bodies in the North West River Basin District, 53 (10%) are probably at risk of failing WFD objectives in 2015 due to direct effects of invasive non-native species on the achievement of good ecological status. Out of 156 lake water bodies four (2%) are probably at risk. None of our coastal water bodies are thought to be at risk of failing to meet good ecological status due to presence of invasive non-native species. Two out of 12 estuarine waters are also probably at risk. See Figures G.47, G.48 and G.49 for maps displaying the risk to rivers, lakes and estuaries of failing to meet good ecological status.

Additional evidence

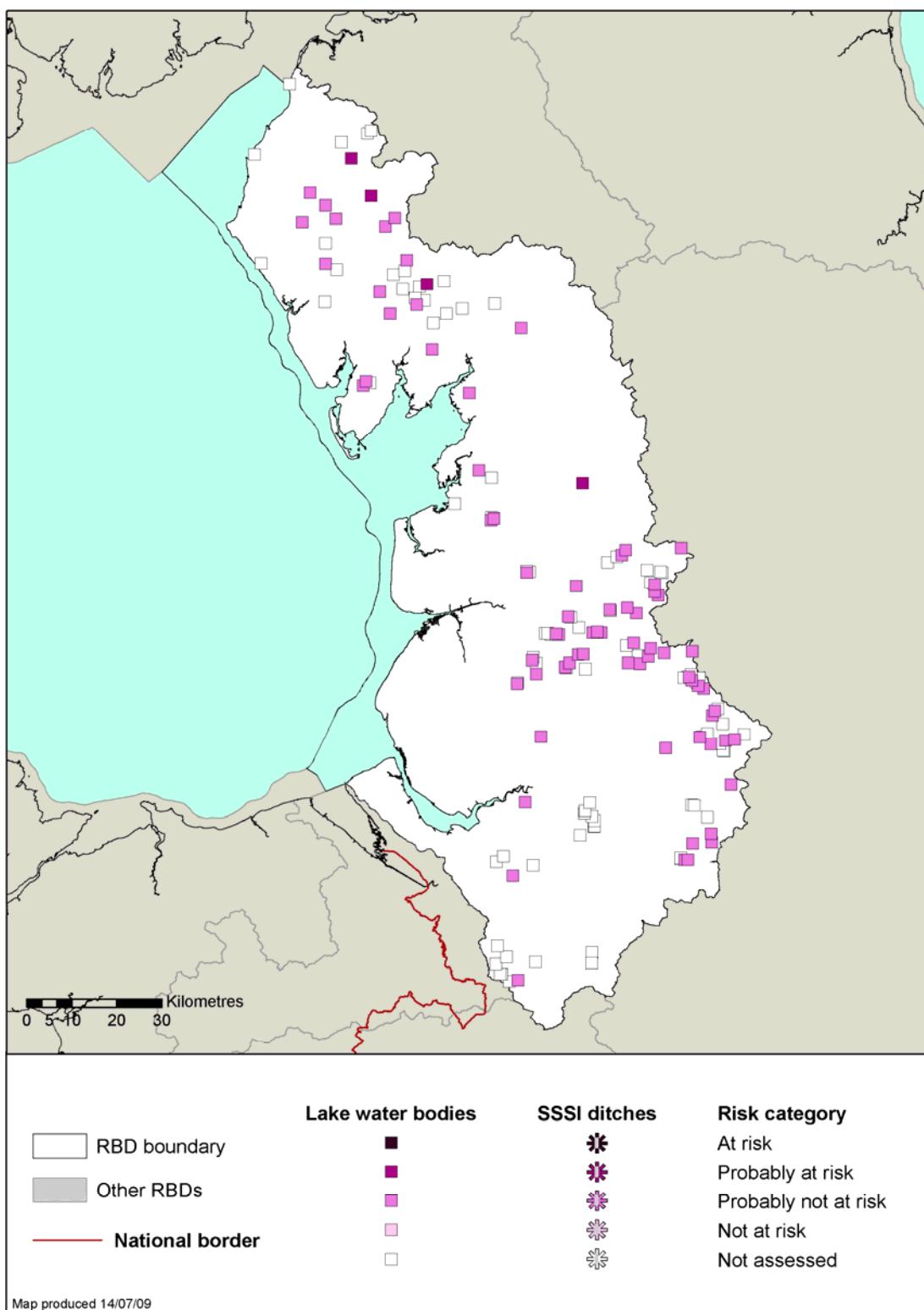
The National Strategic Assessment flagged invasive non-native species as being a potentially significant issue requiring further research and more investigation. A robust evidence base could then be developed to support the assessment of objective impacts or targeting further measures at specific sectors. A risk-based approach is being adopted for the control of invasive non-native species. The Environment Agency is an active partner in the "Invasive non-native species framework strategy for Great Britain" (2008) which takes a risk-based approach to make the best use of available resources. The delivery of this strategy will rely on the work of local partnerships.

Figure G.47 Rivers in the North West River Basin District at risk from invasive non-native species



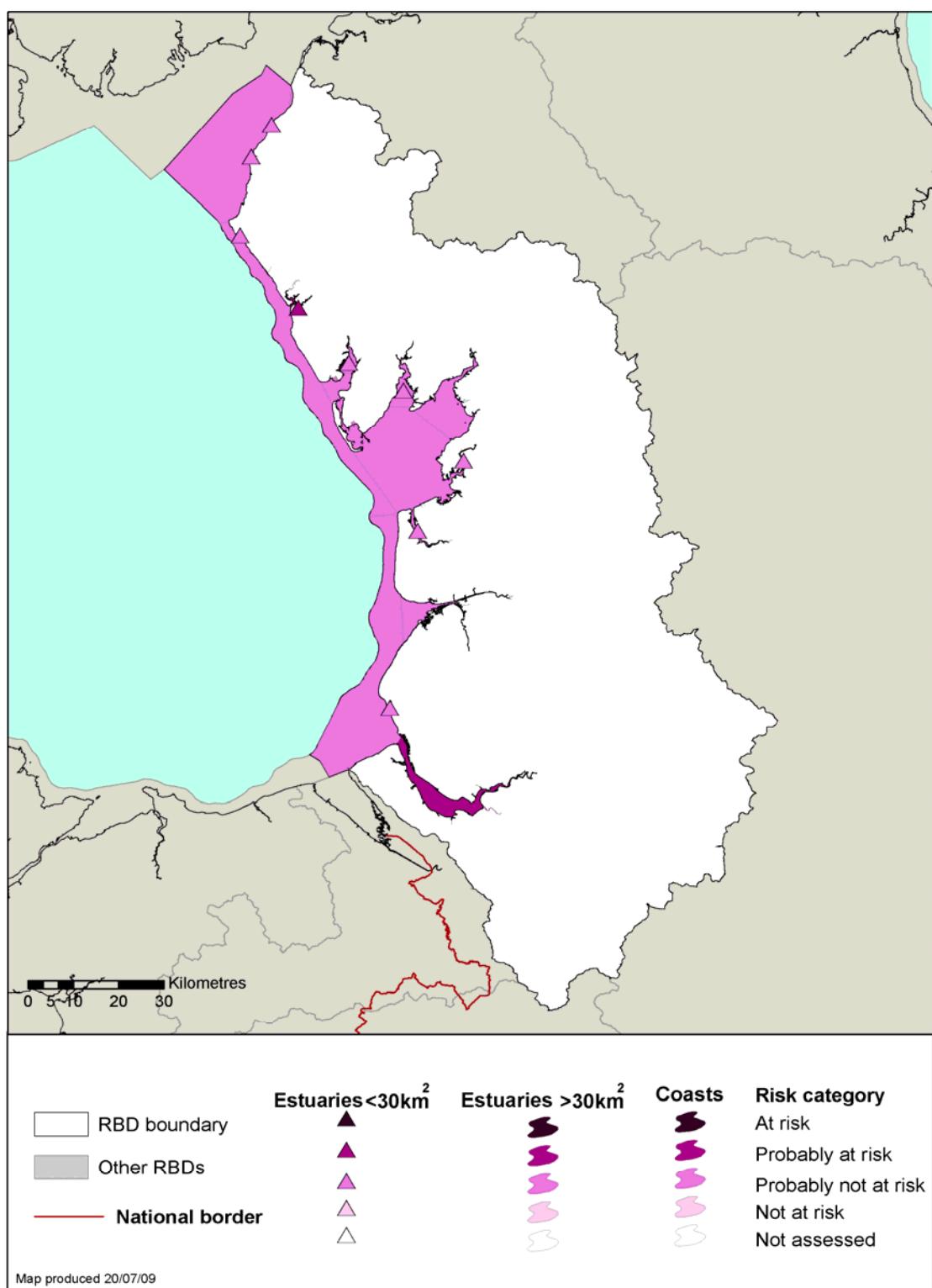
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Figure G.48 Lakes within the North West River Basin District at risk from invasive non-native species



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Figure G.49 Estuarine and coastal waters within the North West River Basin District at risk from invasive non-native species

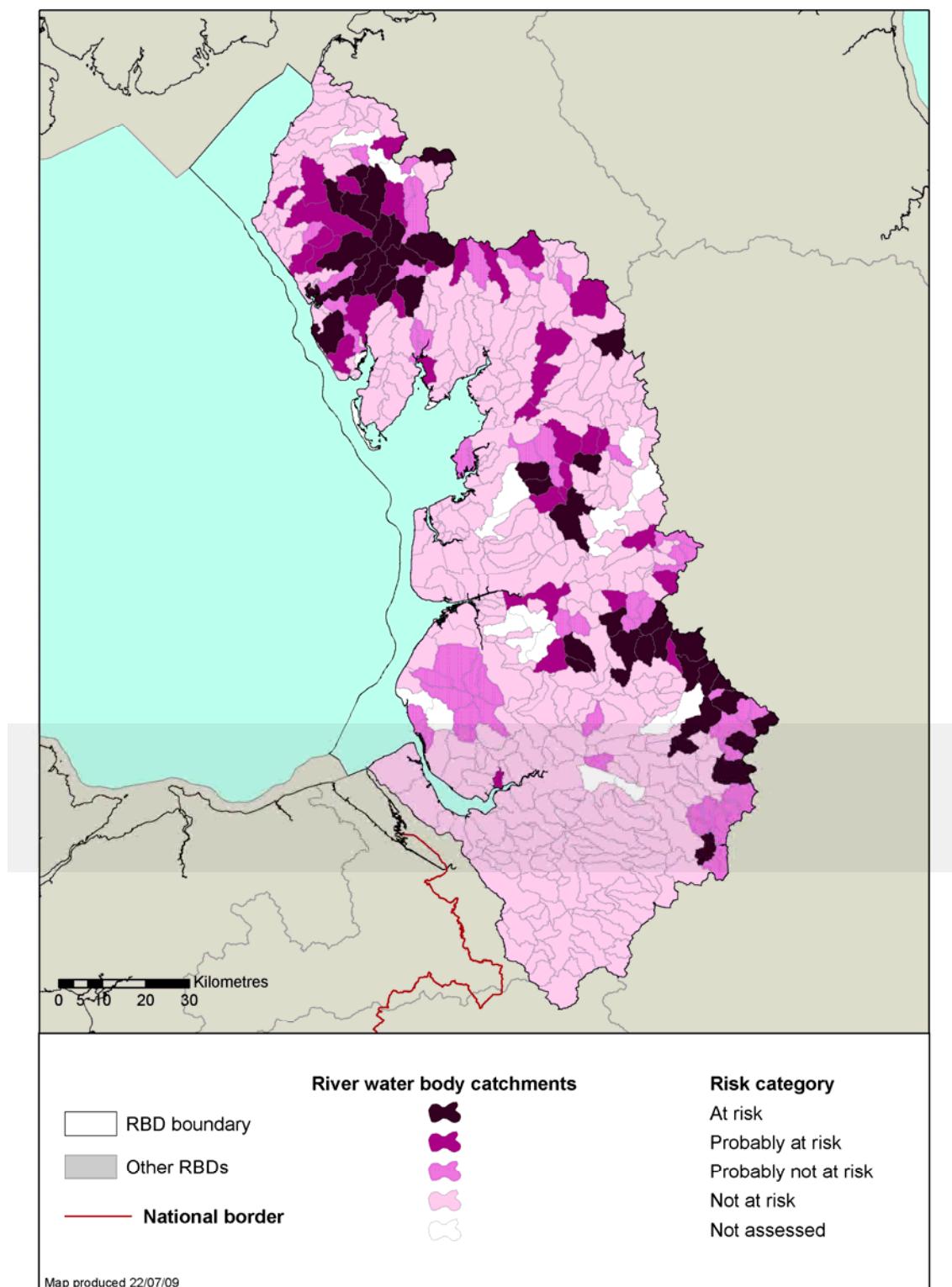


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G.3.2 Acidification

Acidification is the process whereby nitrogen oxides, sulphur dioxide and ammonia released into the atmosphere are converted into acidic substances. Acidification can cause toxic metals to leach out of soils and enter surface water or groundwater. Various land-use practices such as farming and forestry can contribute to acidification of watercourses, causing loss of sensitive plants and animals. At present, there is no evidence of impact from acidification on the district's water bodies. Our latest view of river basin characterisation showed that of 477 river water bodies in the North West River Basin District, 72 (13 %) are at risk or probably at risk of failing Water Framework Directive objectives in 2015 due to acidification (see Figure G.50).

Figure G.50 Rivers within the North West River Basin District at risk from acidification



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G.3.3 Commercial fisheries (estuaries and coastal waters)

Commercial fishing or shell-fishing can represent an important pressure on the ecological status of estuarine or coastal water bodies, including the condition of EC designated Shellfish Waters (Protected Areas incorporated within the Water Framework Directive). This may involve the direct capture and removal of fish or shellfish, or the wider habitat damage that can result from some types of fishing which drag the seabed or estuary substrate. Initial characterisation (risk assessment under Article 5 of the Water Framework Directive) risk assessment focused on the potential for physical habitat damage associated with fishing activities but also noted the need for a more holistic consideration of the direct impacts of fish or shellfish removal. Commercial fishing or fish farming may also have a detrimental ecological impact in fresh waters - either through the large scale netting of migratory fish such as eels or salmon, or through the influence of fish stocking or farming on natural populations. Fish farming may also have associated abstraction or pollution pressures.

G.3.4 Recreation (e.g. boating and fishing)

Recreational activities on or associated with water may have a direct impact on its quality or on the ecological assemblages within it. Boating activity, if intensive in shallow river or lake waters, may be associated with raised levels of suspended solids, bank erosion and fuel related pollution. Recreational angling may also lead to impacts on fish communities unless sensitively and sustainably managed.

G.3.5 Endocrine Disrupters

Hormones control essential processes in animals and plants, such as growth, metabolism, reproduction and the functioning of various organs. Some chemicals can disrupt the normal working of the hormonal system (or endocrine system), and these are referred to as 'endocrine disrupting substances'. These substances may mimic the action of natural hormones, block their action, interfere in feedback mechanisms or have other effects.

There is considerable evidence of impacts on fish development, growth and reproduction, demonstrated particularly where male fish have become feminised. The Defra EDCAT project is currently investigating effects on fish populations and this will be completed in 2010. The severity of the effects of endocrine disrupting substances depends on a range of variables which are not yet fully understood, but include exposure to these substances (possibly at particular stages in the life cycle and the duration of that exposure), the nature of the particular substance and the susceptibility of the biological receptor.



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex H: Adapting to climate
change

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H.1 Introduction

The water environment is particularly vulnerable to the effects of climate change. We are already experiencing trends in climatic factors that are having impacts on the water environment.

The Intergovernmental Panel on Climate Change (IPCC) Climate Change and Water Technical Paper¹ concluded that “observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences on human societies and ecosystems”.

Projections of future climate from the UK Climate Impacts Programme ('UK Climate projections: UKCP09^{2,3}) identify that we can all expect climate changes to intensify with the following key changes:

- All areas of the UK get warmer, and the warming is greater in summer than in winter;
- There is little change in the amount of precipitation (rain, hail, snow etc) that falls annually, but it is likely that more of it will fall in the winter, with drier summers, for much of the UK. There is likely to be an increasing incidence of very intense heavy rainfall (see section H3);
- Sea levels rise, with this rise being greater in the south of the UK than the north.

Climate change will inevitably affect the conditions and pressures that the Water Framework Directive seeks to manage in the water environment. Climate change impacts may not be strongly felt during the first river basin management cycle up to 2015 and may not be easily distinguishable from normal climatic variations. However, decisions and investments made during this period may have a lifetime that extends for many decades. In particular new infrastructure or modifications to existing infrastructure will last more than one cycle. Over this extended period, towards the end of cycle two (to 2021) and through cycle three (to 2027), it is predicted that the UK's climate is likely to change significantly. Therefore, if we all fail to take account of climate change now, this could result in poor investment decisions in terms of actions and limit the extent to which we can meet Water Framework Directive objectives and/or the efficiency with which we will achieve them. Further, climate change could affect the predicted effectiveness of current or new actions in meeting Water Framework Directive objectives (unless we all take this into account). This presents real risks for implementation and success.

The European Commission has identified water management as the priority area for action in taking into account the impact of climate change. In April 2009 an EU White Paper was produced, 'Adapting to climate change: Towards a European framework for action'. This describes the kind of action that can be best delivered at EU level to deal with the impacts of climate change. The White Paper sets out a framework to reduce the EU's vulnerability to the impacts of climate change. It specifically highlights the need to take climate change into account when developing the River Basin Management Plans and the role that the river basin management process can play in delivering sustainable water management in a changing climate.

¹ Bates, B.C., Kundzewicz, Z.W. Wu, S. and Palutikof, J.P. (Eds.) 2008: Climate Change and Water. Technical Paper VI of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp. Available at: <http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf>

² <http://ukclimateprojections.defra.gov.uk/>

³ Note that UKCP09 was launched on the 18th June 2009. In developing the draft river basin management plan we used the previous UK climate change projections (UKCIP02) that were available at that time. For this plan we have now considered the outputs of UKCP09 in carrying out an initial revision of our approach to climate change and particularly the likely performance of measures.

With respect to climate change impacts on the water environment, the European Commission has made it clear that member states should take climate change into account when implementing the Water Framework Directive. A policy paper on the need for, and approach, to climate change adaptation through implementation of the Water Framework Directive has been endorsed by the EU Water Directors.⁴ A Common Implementation Strategy activity on Climate Change and Water, started in 2007, is currently focusing on making the best use of existing EU water legislation and identifying adaptation measures at different scales to progress adaptation for water, and is currently producing guidance on integration of climate change into Water Framework Directive implementation. This guidance should be published by the end of 2009. The EU white paper identifies the development of guidance and supporting tools to 'climate-proof' River Basin Management Plans as a specific action. The UK (through Defra with the support of the Environment Agency) is supporting the development of this guidance including leading on the drafting of a chapter on the 'analysis' stages of Water Framework Directive implementation.

As a minimum, the European Commission expects our response to climate change to include, in the first cycle, screening of the likely effects of climate change on the pressures identified under the characterisation (Article 5) step of the river basin management process. The European Commission also recommends that member states carry out a climate impact sensitivity analysis or 'climate check' on the programme of actions to help in 'selecting actions that are effective, sustainable and cost efficient under changing conditions'. The European Commission also states that, 'In the second planning cycle, climate change impacts should be taken fully into account. The European Commission recommendation is primarily in relation to climate change adaptation (rather than mitigation) which is the main thrust of this annex. This annex seeks to summarise how the Environment Agency has approached these assessments of the impacts of climate change in producing this first River Basin Management Plan.

H.2 Summary of approach in dealing with climate change

The Environment Agency priorities for dealing with climate change in the first cycle of implementing the Water Framework Directive in England and Wales will be to:

- consider the change in risk, due to climate change, of not achieving the Water Framework Directive default objectives (for example no-deterioration, good status) as a consequence of the identified Water Framework Directive pressures (for example abstraction);
- consider the impacts of climate change when identifying and appraising actions and propose appropriate adaptation of actions where necessary.
- look for opportunities in the monitoring programme to improve our understanding of climate change trends;
- consider the likely contribution of actions to future climate change through their impact on emissions of greenhouse gases, and propose appropriate mitigation where necessary.

In the first cycle the Environment Agency will not attempt to incorporate climate change into typologies, reference condition descriptions or default objective (including standards) and final water body objective setting. This is because we require some stability in our planning assumptions for subsequent work and because further work is required to understand what impact climate change will have on underlying conditions before we can do this. Further, on the basis of current scientific results, it is not expected that, within the timeframe of initial Water Framework Directive implementation (i.e. up to 2027) and within the metrics used for pressure assessment, a climate change signal will be observable above natural variability or adequately distinguishable from other human pressures at a level to cause major changes in

⁴ Common implementation strategy for the Water Framework Directive, policy paper on climate change and water, June 2008

typology or major changes at reference sites. We are following the recommendations of the European Commission for the first cycle and are expecting a view from the commission as to common and consistent action to address issues identified above for future cycles. We will not reopen the agreed monitoring plan for similar reasons. However these aspects of the planning cycle will be addressed by future planning cycles.

We will do further research and scoping work in the first cycle of river basin management to determine if and how climate change should be factored into these considerations. There is already relevant ongoing or proposed research which will help inform our decision on these issues in the future. Examples include:

- A proposed assessment of the impact of climate change on river flows and groundwater levels across England and Wales, to improve the Environment Agency's capacity for taking this into account in management and regulatory decisions.
- Proposed development of guidance for water companies to prepare plans for future water supply that include effective adaptation to and mitigation of climate change.
- Project on 'Potential impacts of climate change on river water quality' (Environment Agency Science report: SC070043/SR).
- Project on 'climate change impacts and water temperature' (Environment Agency science report: SC060017/SR).
- Project on 'Preparing for climate change impacts on freshwater ecosystems (PRINCE)' (Environment Agency science report: SC030300).

Further work is also required to determine if and how controlling non-climate change pressures and maintaining ecosystems in good functional condition increases the resilience of ecosystems to the impacts of climate change. Robust evidence for this could influence adaptation strategies, appraisal outcomes and therefore alternative objective setting.

This annex addresses a number of the priorities identified in the bullets above:

- The impacts of climate change in England and Wales and the river basin district.
- The potential impacts of climate change on the identified Water Framework Directive pressures.
- How resilient the programme of actions are to the impacts of climate change.

Essentially this annex looks at climate change impacts on the pressures, actions and achievement of Water Framework Directive objectives in the River Basin Management Plan. It does not report in detail the impact of the programmes of actions on greenhouse gas emissions and future climate change. These aspects are considered in the strategic environmental assessment reports which accompany the draft and this River Basin Management Plan and annex E which describes how the cost of carbon was included in the economic appraisal process. As such this annex, annex E and the Strategic Environmental Assessment are complementary. The assessments in this annex are essentially qualitative. More quantitative information may have been used in appraising existing measures or through other processes (e.g. PR09) and should be used in updating risk assessments prior to measures implementation.

H.3 Summary of climate change impacts

This section summarises climate change effects in England and Wales to date and scenarios for future climate change effects as reported in UKCP09⁵. You can find more detailed analyses and descriptions on historic trends and future projections, together with guidance on how to plan for climate change via either the UKCP09 or the UK Climate Impacts Programme⁶ websites.

Climate change effects to date

The ‘climate of the UK and recent trends’ report from UKCP09 identifies the following climate change effects to date for the UK⁷:

- Warming of the global climate system is unequivocal, with global average temperatures having risen by nearly 0.8 °C since the late 19th century, and rising at about 0.2 °C a decade over the past 25 years.
- It is very likely⁸ that man-made greenhouse gas emissions caused most of the observed temperature rise since the mid 20th century.
- Global sea-level rise has accelerated between mid-19th century and mid-20th century, and is now about 3mm per year. It is likely that human activities have contributed between a quarter and a half of the rise in the last half of the 20th century.
- Central England temperature has risen by about a 1.0 °C since the 1970s, with 2006 being the warmest on record. It is likely that there has been a significant influence from human activity on the recent warming.
- Annual mean precipitation (rain, hail, snow etc) over England and Wales has not changed significantly since records began in 1766. Seasonal rainfall is highly variable, but appears to have decreased in summer and increased in winter, although with little change in the latter over the last 50 years.
- All regions of the UK have experienced an increase over the past 45 years in the contribution to winter rainfall from heavy precipitation (rain, hail, snow etc) events; in summer all regions (except North-East England and Northern Scotland) show decreases.
- Severe windstorms around the UK have become more frequent in the past few decades, though not above that seen in the 1920s.
- Sea-surface temperatures around the UK coast have risen over the past three decades by about 0.7 °C.
- Sea level around the UK rose by about 1mm a year in the 20th century, corrected for land movement. The rate for the 1990s and 2000s has been higher than this.

Scenarios for future climate change

Much of the change in climate over the next 30 to 40 years has already been determined by historic emissions and because of the inertia in the climate system. We are all likely, therefore, to have to adapt to some degree of climate change even if future emissions are reduced. The climate of the second half of the twenty-first century, and beyond, will be increasingly influenced, however, by the volume of greenhouse gases that human society emits over the coming decades.

⁵ <http://ukclimateprojections.defra.gov.uk>

⁶ <http://www.UKCIPI.org.uk/>

⁷ Jenkins G.J., Perry M.C. and Prior M.J.O., 2009. The Climate of the United Kingdom and Recent Trends, Revised Edition, Jan 2009, Met Office Hadley Centre

⁸ The IPCC definitions of likelihood are used throughout this annex, i.e.: very likely means: more than 90 per cent probability of occurrence; likely means: more than 66 per cent probability; unlikely means: less than 33 per cent probability; very unlikely means: less than 10 per cent probability.

Consideration of future climate change is based on scenarios of future global emissions of greenhouse gases. The scenarios reported by UK Climate Impact Programme 2009 describe three alternative emissions scenarios for the UK. These are 'low emissions', 'medium emissions' and 'high emissions'. Due to space constraints we have largely presented results in this document for the medium emissions scenario. However in the Environment Agency assessment of climate impacts on pressures and the performance of measures we have looked across all three emission scenarios.

As well as uncertainty surrounding future greenhouse gas emissions there are also other significant uncertainties (for example in the choice of climate model to use) that mean that it is not possible to give one correct value for future climate. UKCP09 addresses this through, for the first time, presenting climate change projections in probabilistic form. This has been made possible through advancements in the understanding and modelling of the climate system, advances in computing power, and the integration of the results of climate models from centres other than the Meteorological Office Hadley Centre. Within UKCP09 and in this annex, where probabilities are described, the Intergovernmental Panel on Climate Change definitions are used – for example very unlikely means that there is less than 10 per cent probability of occurrence of an event. Further, UKCP09 presents projections for three different emission scenarios: 'low', 'medium' and 'high'.

The following statistics, maps (Figure H1-H3) and cumulative distribution functions (Figure H4) are provided in order to give an indication of the scale, direction of change and uncertainty associated with annual average temperature, winter precipitation and summer precipitation in the 2050s. The 2050s are presented to allow consideration of the potential changes in climate over the lifespan of those measures that might be less flexible to changing conditions (i.e. fixed infrastructure such as housing, flood defences, reservoirs, wastewater treatment works and so on). UKCP09 projections are provided at seven 30-year time periods covering the period from 2010 to the end of this century – thus the '2050s' represents the average across the time period from 2040-2069. The changes are relative to a 1961-1990 baseline. Further information including other significant variables (e.g. humidity, rainfall intensity, maximum and minimum temperatures), additional timescales and alternative probability levels are available from the UKCP09 website <http://ukclimateprojections.defra.gov.uk>.

The UKCP09 projections suggest that for the North West River Basin District⁹ in the 2050's:

- Under medium emissions, the central estimate of increase in **winter mean temperature** is 2°C; it is very unlikely to be less than 1°C and is very unlikely to be more than 3°C.
- Under medium emissions, the central estimate of increase in **summer mean temperature** is 2.6°C; it is very unlikely to be less than 1.2°C and is very unlikely to be more than 4.1°C.
- Under medium emissions, the central estimate of increase in **summer mean daily maximum temperature** is 3.3°C; it is very unlikely to be less than 1°C and is very unlikely to be more than 5.8°C.
- Under medium emissions, the central estimate of increase in **summer mean daily minimum temperature** is 2.5°C; it is very unlikely to be less than 1°C and is very unlikely to be more than 4.4°C.
- Under medium emissions, the central estimate of change in **annual mean precipitation** is 0 per cent; it is very unlikely to be less than -5 per cent and is very unlikely to be more than 6 per cent.
- Under medium emissions, the central estimate of change in **winter mean precipitation** is 13 per cent; it is very unlikely to be less than 3 per cent and is very unlikely to be more than 26 per cent.

⁹ Based on the UKCP09 'North West England' administrative area

- Under medium emissions, the central estimate of change in **summer mean precipitation** is -17 per cent; it is very unlikely to be less than -34 per cent and is very unlikely to be more than 1 per cent.

Figure H1 - Change in annual mean temperature (°C) in the 2050s under the Medium emissions scenario for the North West River Basin District for the a.) 10 per cent; b.) 50 per cent and c.) 90 per cent probability levels. Results from UKCP09.

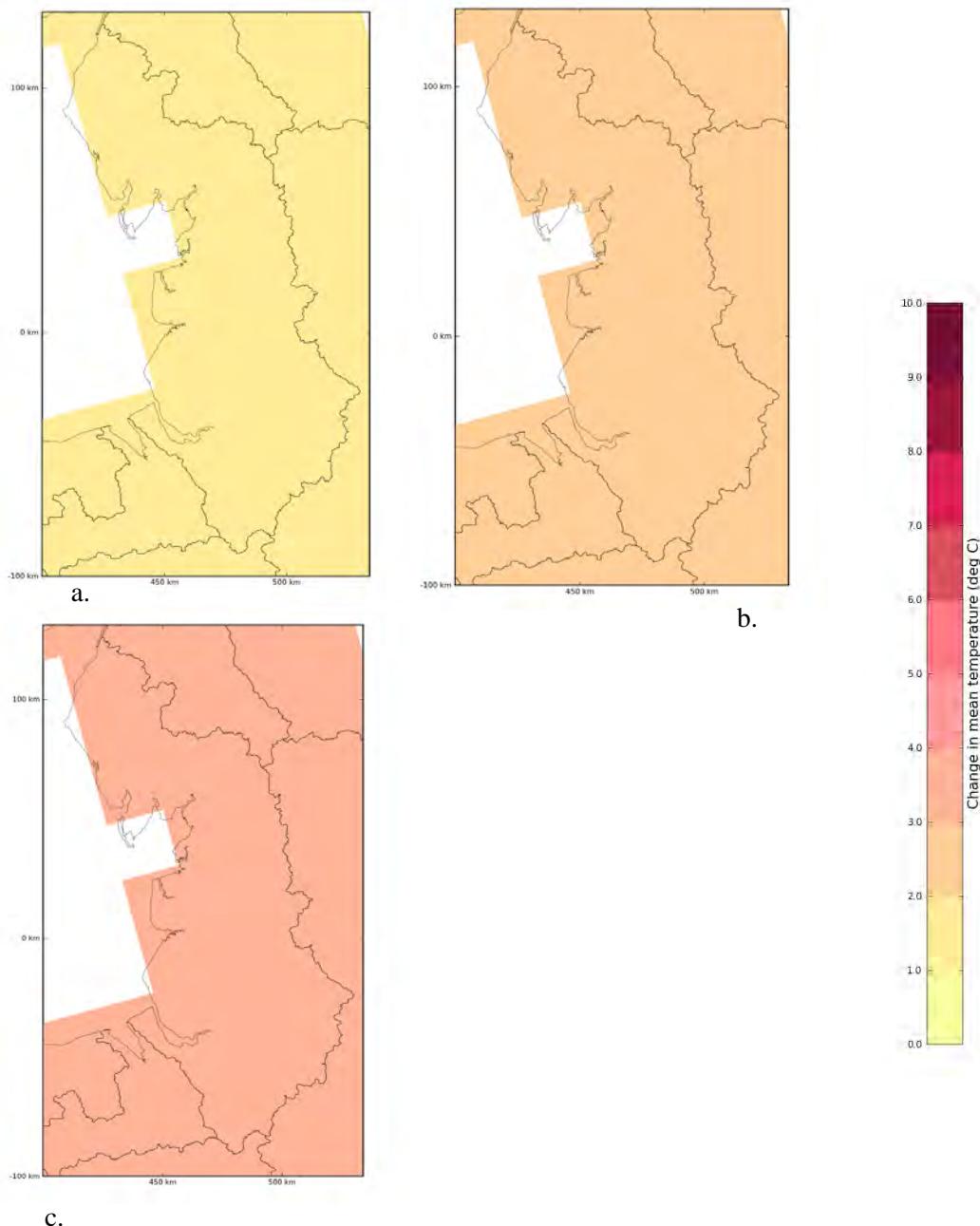


Figure H2 - Change in summer precipitation (per cent) in the 2050s under the Medium emissions scenario for the North West River Basin District for the a.) 10 per cent b.) 50 per cent and c.) 90 per cent probability levels. Results from UKCP09.

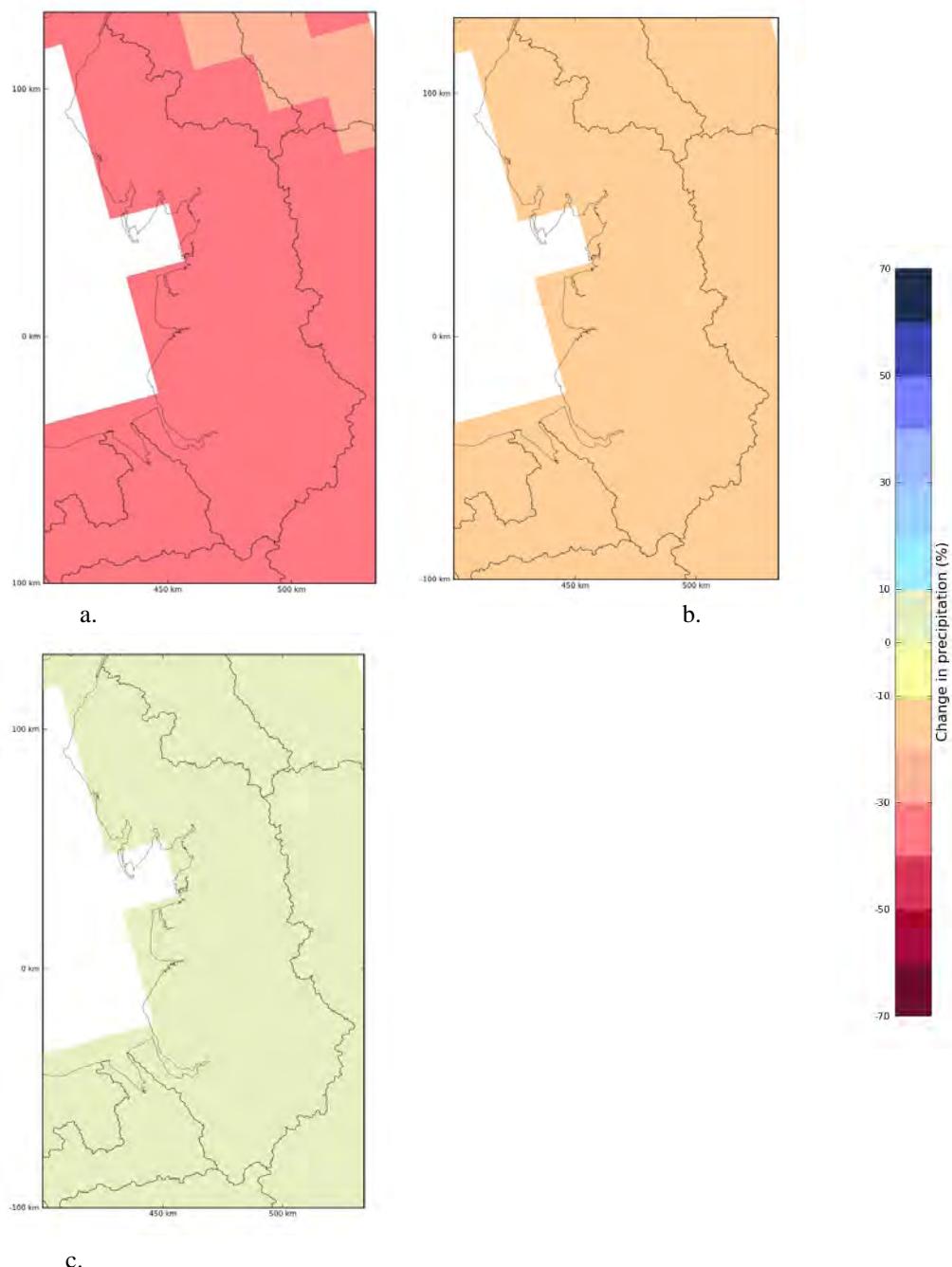
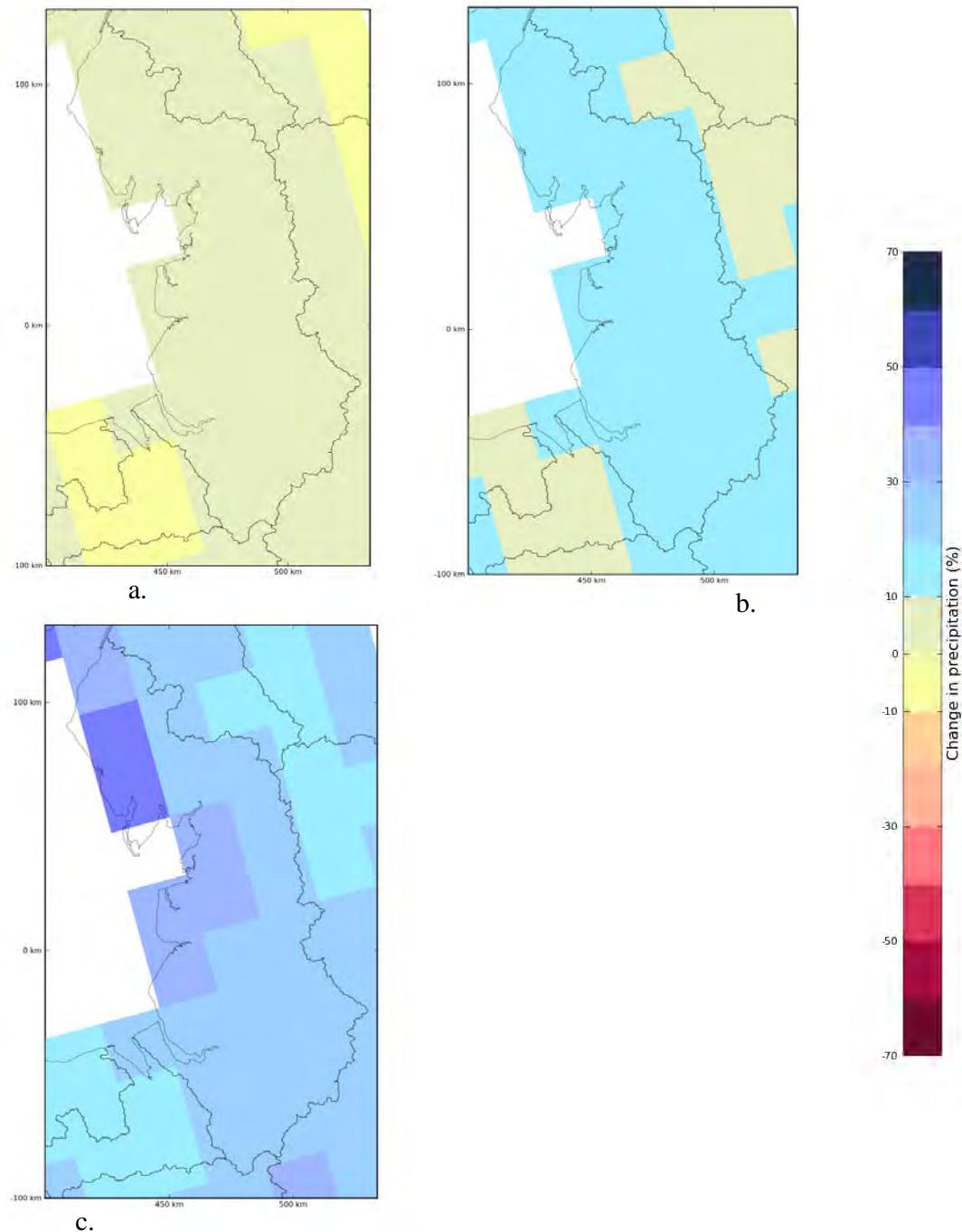


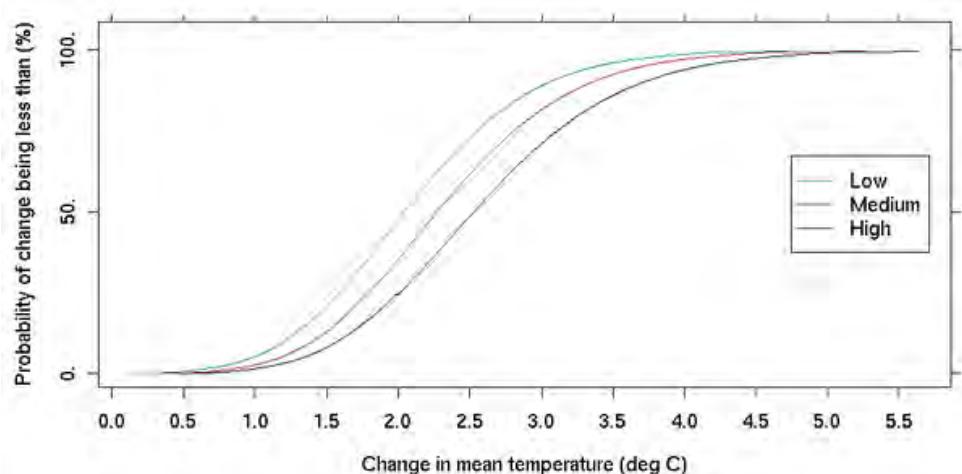
Figure H3 - Change in winter precipitation (per cent) in the 2050s under the Medium emissions scenario for the North West River Basin District for the a.) 10 per cent, b.) 50 per cent and c.) 90 per cent probability levels. Results from UKCP09.



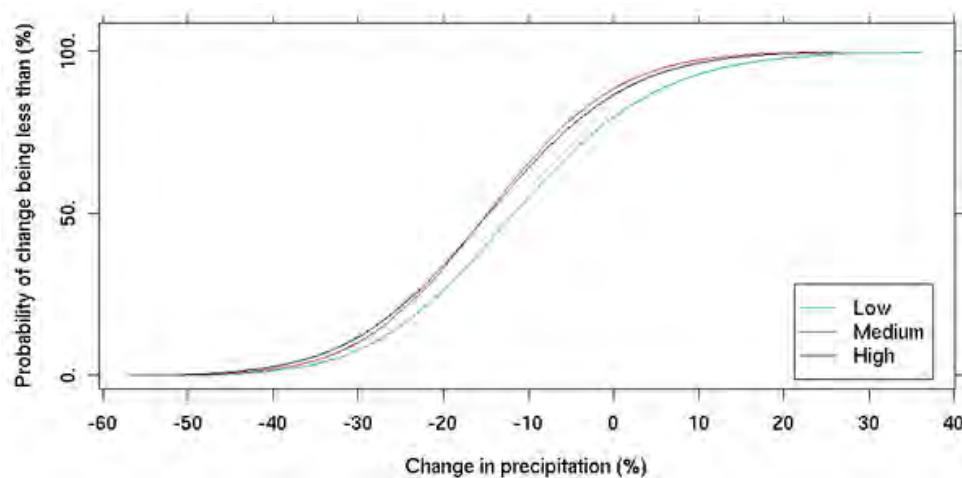
The maps above (figures H1-H3) present only a single possible future climate and do not properly represent the range of possible futures. In preparing for the impacts of climate change we need to consider the range of probabilities and take a risk based approach to our planning (in particular looking for solutions that are robust and cost effective over a wide range of conditions). Figure H4 gives an indication of the range of possibilities for future temperature, summer rainfall (June, July and August) and winter rainfall (December, January and February).

Figure H4 – Change in a.) annual mean temperature (°C), b.) summer precipitation (per cent) and c.) winter precipitation (per cent) in the 2050s for the North West River Basin District plotted as cumulative distribution functions for the low, medium and high emissions scenarios. Results from UKCP09.

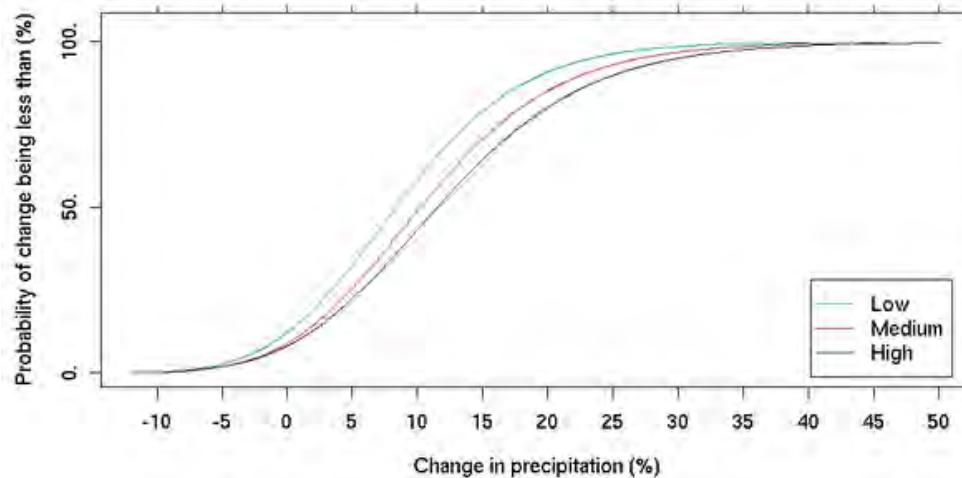
a.



b.



c.



H.4 The impact of climate change on the identified pressures and the ability of measures to perform under future climate conditions

Introduction

We all want to make sure that this River Basin Management Plan brings benefits now and into the future. We do not want the actions that are implemented, and the benefits they deliver in terms of Water Framework Directive objectives, to be undermined by changing climatic conditions.

This section looks at the likely consequences of climate change on the pressures that are being considered in the Northwest river basin district under the Water Framework Directive and then considers if the proposed actions will continue to perform under future climatic conditions.

Firstly, we include here an assessment of the potential impacts of climate change on the individual pressures. These are:

- Abstraction and other artificial flow pressures
- Biological pressures (fisheries management and invasive non-native species)
- Microbiological pressures (including faecal indicator organisms)
- Organic pollution (sanitary determinand) pressure
- Nutrients pressure (nitrogen and phosphate)
- Priority hazardous substance, priority substance and specific pollutant pressure
- Acidification pressure
- Salinity pressure
- Temperature pressure
- Physical modification pressure
- Sediment pressure

The assessments are only qualitative at this stage and give no indication of the severity and timescale over which changes may occur. UKCP has advised the Environment Agency that the new UKCP09 climate projections will not change the generalities of previous pressure trend analyses based on UKCP02. Although only qualitative, this assessment of pressures will help us all prioritise both improving certainty in our risk assessments and our adaptation work. Whilst it is clear that human induced climate change is occurring, predicting the exact impacts on the water environment is difficult. There are a number of levels of uncertainty over, for example, what level of climate change to expect and over the combinations of processes controlling behaviour in water bodies. As we all continue to understand more about these uncertainties we will be able to improve these assessments and develop appropriate responses in future river basin management planning cycles.

Secondly, for each of the individual pressures, we include a summary of how the current or proposed actions are likely to be able to deal with the changes to the pressures due to climate change (that is, how well this River Basin Management Plan is adapted to climate change). The Environment Agency has carried out a systematic screening (or ‘climate check’) for most of the actions which make a contribution to achieving Water Framework Directive objectives to determine if and how they are likely to perform under future climate conditions – or where we need further adaptation, to seek alternatives or to develop additional actions. This screening has assessed both the ‘mechanisms’ in annex F and the ‘actions’ in annex C. This has been repeated since the draft River Basin Management Plan on the revised annex F and C with the new UKCP09 projections.

This screening is to help ensure any increased risk due to climate change does not compromise the benefit of the actions in terms of achieving Water Framework Directive objectives. In doing this we have tried to take a view on the lifespan and permanency of actions.

Because of the uncertainties concerning the impacts of climate change on the water environment we all need to, where possible, choose actions that can cope with a range of future climate conditions. There are a number of viable cost-effective adaptation approaches that we can apply. Applying these approaches will minimise risks associated with implementing actions whose cost-effectiveness at achieving Water Framework Directive objectives could be compromised by climate change even in the face of high uncertainties.

These adaptation options are normally referred to as win-win, no-regrets, low-regrets, and flexible/adaptive management. Actions may include more than one of these approaches. In addition the Environment Agency screening tried to make sure that we are not proposing any unfavourable or regrets options where the action is identified as unlikely to perform under future climate nor be able to be enhanced or modified to deal with future climate change. The way in which actions are likely to cope with climate change are described using the following descriptions:

- **Win-win options**— cost-effective adaptation actions that have the desired result in terms of minimising the climate risks or exploiting potential opportunities but also have other social, environmental or economic benefits. Within the climate change context, win-win options are often associated with those actions or activities that address climate impacts but which also contribute to climate change mitigation or meet other social and environmental objectives. For example, encouraging efficient use of water, and particularly hot water, in the home is a win-win option, reducing demand on water resources and also mitigating climate change by reducing carbon emissions from water heating.
- **No-regrets option** – cost-effective adaptation actions that are worthwhile (that is they bring net socio-economic benefits) whatever the extent of future climate change. These types of actions include those justified (cost-effective) under current climate conditions (including those addressing its variability and extremes) and are further justified when their introduction is consistent with addressing risks associated with projected climate changes. For example promoting good practice in soil management to limit the risks of diffuse pollution is a no regrets option. This is a low risk option.
- **Low-regrets (or limited regrets) option** – adaptive actions where the associated costs are relatively low and where the benefits, although mainly met under projected future climate change, may be relatively large. For example allowing for climate change in assessing headroom in water company plans for managing water resources could be a low regrets option.
- **Flexible adaptation option**— these are actions which are designed to include a capacity to be modified at a future date as climate changes. Influencing the design of a reservoir so its capacity can be increased at a future date if necessary would be an example of flexible adaptation.
- **Regrets** - these are unfavourable options where the action is identified as unlikely to perform under future climate conditions and where it is likely that the action cannot be enhanced or modified to deal with future climate change. It should be noted that this term has been adopted for the purpose of this document and, unlike the other terms, is not commonly used.

Figure H.5 Adaptation options



The majority of the actions proposed within this River Basin Management Plan are identified as no regrets approaches. These are actions that are proposed and justified in the river basin management planning process due to current pressures. They will also bring benefits under future climatic conditions, and should, therefore, rightly be a favoured option. In several cases the actions proposed are highlighted as flexible adaptation – this means that as the climate changes the action can be adapted to cope with these changes. In terms of looking at future cycles of the river basin management process it is recommended that these actions in particular are revisited to assess whether adjustment is needed to cope with new climatic conditions. Few actions were identified as regrets actions. However one area of potential regrets is in the citing and performance of infrastructure within floodplains. Under climate change the frequency and severity of flooding is likely to increase, and it is important that any infrastructure (for example waste water treatment) is located or designed to provide business continuity with this in mind.

An example of our screening of actions is displayed below in Figure H.6 for abstraction and other flow pressures. In the following section we give a summary of the results of the screening, presented for the pressures the proposed actions are acting to address. In section H.6, where applicable we also give a summary of actions we are carrying out to address climate change in relation to some of these pressures.

Figure H.6 - Summary of ability of actions to perform under future climate for abstraction and other artificial flow (an example of the screening is only displayed for this pressure)

Name of action	Mechanism	How is action able to cope with climate change?
Preventing damage to the environment from new development, which helps to achieve good status for surface and groundwater and reduce the effects of flooding.	The Environmental Assessment Directive (85/337/EEC) Town and Country Planning (Environmental Impact Assessment) Regulations 1999 (SI 1999 No. 293) Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999	Regrets – potentially development may add to risks of flooding and drought under climate change if not adequately adapted. Currently there is low confidence that all new developments will be properly adapted to future climate. No regrets options (for example sustainable drainage systems or high levels of water efficiency) should be sought.
Prevent unauthorised abstraction.	Abstraction of water prohibited without a licence with certain exemptions ¹ under Water Resources Act 1991 s24.	No regrets – preventing unauthorised abstraction helps us manage water resources now and under future climate.
Managing abstraction such that it is sustainable, efficient and within environmental limits.	Conditional licences for water abstraction and conditional licences for impoundment under Water Resources Act 1991, Chapter II of Part II (as amended by Water Act 2003) Time limited abstraction licences	No regrets – managing abstraction improves our ability to manage water resources now and under future climate. Flexible adaptation – a flexible licensing system means that abstraction can be modified as necessary as the climate changes through review of licences.

Name of action	Mechanism	How is action able to cope with climate change?
Reduce unacceptable abstraction impact.	Amend or revoke abstraction licences often requiring compensation.	No regrets – reducing abstraction improves our ability to manage water resources now and under future climate. Flexible adaptation – a flexible licensing system means that abstraction can be modified as necessary as the climate changes through review of licences.
Reduce unacceptable abstraction impact through operational arrangements for example for river support schemes.	Agreements under Water Resources Act 1991 s20, 20A and 158.	No regrets – reducing abstraction improves our ability to manage water resources now and under future climate. Flexible adaptation – operational arrangements can be amended further as necessary as the climate changes.
Tighten controls in times of drought.	Drought orders and permits under Water Resources Act 1991, Chapter III of Part II.	No regrets – controls help us manage droughts now and under future climate. Low regrets – action may also be needed to highlight increased risk of drought under climate change (and the higher natural probability of drought than that which we currently plan for) and prepare abstractors. Where drought conditions are reasonably foreseeable under climate change scenarios, drought should not be used as a reason for temporary deterioration.
Mitigation work.	Direct action to maintain, improve/increase flows. Will depend on natural flow conditions.	Flexible adaptation – approach may not be able to withstand future climatic conditions and will therefore need to be reviewed from time to time. Issues of sustainability and carbon emissions relating to water transfers will need to be taken into account. (could be 'Regrets' if not adjusted to future climate).
Demand management actions.	Voluntary agreements, permits, economic incentives (water pricing) water-saving campaigns etc.	Win-win – demand management improves our ability to manage water resources now and under future climate and reduces the carbon footprint of water use. Low regrets – climate change as a driver of the need for demand management should be brought into water-saving campaigns now.
Preservation, maintenance and re-establishment of biotopes and habitats for wild birds.	The Council Directive on the conservation of wild birds (Birds Directive (79/409/EC). Direct action by Natural England or service of management notices or implementation of management agreements under Wildlife and Countryside Act 1981. In some coastal sites, this may be directed by Coastal Habitat Management Plans	No regrets – protection of habitats now likely to give greater robustness to climate change. See for example conserving biodiversity in a changing climate guidance for practitioners ¹⁰
Restricted operations within the Special Protected Areas	The Council Directive on the conservation of wild birds (Birds Directive (79/409/EC). This may be directed by Coastal Habitat Management Plans in some coastal sites.	No regrets – protection of habitats now likely to give greater robustness to climate change.

¹⁰ Conserving biodiversity in a changing climate: guidance on building capacity to adapt, Published by Defra on behalf of the UK Biodiversity Partnership, DEFRA 2007

Name of action	Mechanism	How is action able to cope with climate change?
Designation of Special Protected Areas.	The Council Directive on the conservation of wild birds (Birds Directive (79/409/EC). Conservation (Natural Habitats &c.) Regulations 1994.	No regrets – protection of habitats now likely to give greater robustness to climate change.
On land designated as a Special Area of Conservation or Special Protection Areas designated under the Wild Birds Directive you must comply with requirements to take appropriate steps to avoid deterioration or disturbance of species and habitats and to assess plans and projects likely to have a significant effect on the Special Area of Conservation.	European Community Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora 'Habitats Directive'. Conservation (Natural Habitats &c.) Regulations 1994 – Regulation 3(3) & 3(4) and Regulations 48 & 50.	Variable – dependent on pressure on Special Protected Areas or Special Areas of Conservation. Where pressures from abstraction or diffuse pollution may be high. No regrets and low regrets actions should be sought.
General duties for protecting, managing the quality and sufficiency of supplies and promotion of water efficiency	Section 6(2) Environment Act 1995	Win-Win – demand management improves our ability to manage water resources now and under future climate and reduces the carbon footprint of water supply R- Potential carbon increases from some measures (particularly water quality related infrastructure)
Provisions to encourage water conservation, through installation of water efficient appliances	Water Industry Act 1991	Win-Win – demand management improves our ability to manage water resources now and under future climate and reduces the carbon footprint of water supply
Standards for water efficiency	Government code for sustainable homes. Initiated through Development Plans etc	Win-Win – demand management improves our ability to manage water resources now and under future climate and reduces the carbon footprint of water supply Flexible Adaptation – standards may need to be tightened as climate change progresses (potential for R if standards insufficient in large portion of housing stock)
Review and improve environmental flow indicators (EFI)	Catchment abstraction management strategies	No regrets – Abstraction can be reduced further as necessary with climate change through review of EFIs
Improve flow estimates for surface water bodies	Catchment abstraction management strategies	No regrets – Action should help us manage water resource pressures now and in the future
Programme of investigation of ecological impacts of managed flows in Heavily Modified Water Bodies with water supply use	Catchment abstraction management strategies	No regrets – Action should help us manage water resource pressures now and in the future
Extension of abstraction control to include previously exempt uses.	Water Resources Act 1991	No regrets – Control helps us manage water resource pressures now and in the future
Registration for previously exempt activity: 'water meadows'	Water Resources Act 1991	No regrets – Control helps us manage water resource pressures now and in the future

As well as the consideration of adaptation for individual pressures we all need to consider how pressures link together. We also need to factor in other changes that will change the risk from the pressures such as population change and housing development into risk assessments. For instance Governments in England and Wales are still committed to increase house building to meet demand through new growth points and ecotowns. The greatest demand is often in areas that are already water stressed. It is projected that some of these areas, such as the South-East of England, are likely to experience significant reductions in summer rainfall increasing the risk that water stress will increase. In England the Government's water strategy for England 'Future Water'¹¹ and in Wales the Environment Strategy for Wales¹² identifies water demand and water supply actions and approaches to reduce potential climate effects to reduce this risk. Water companies are expected to incorporate estimations of increased demand from new development within their water resources planning, and this feeds into this River Basin Management Plan.

Partnership working and better integration of different aspects of water management will increase our chances of successfully adapting to climate change. In particular flood risk management, urban planning, and water resource management will need to integrate better with river basin management planning (see Annex J).

Abstraction and other artificial flow pressures

Climate change impact on abstraction and other artificial flow pressures

Water is abstracted from groundwater and surface waters for a variety of purposes such as drinking water, irrigation and industrial uses. This should be managed in a sustainable way so that other uses and the environment are not compromised.

North West is one of the wettest parts of the country, managing our water resources is still a challenge that is likely to increase in the face of future development and climate change. The impact of proposed growth in the region on our water supplies has the potential to cause environmental harm. We therefore need to continue to manage our water resources in a sustainable manner balancing the needs of water users and the environment. This includes taking extra measures during periods of droughts.

Demand for water is likely to increase for domestic, leisure industry, agricultural and industrial uses as a result of rising temperatures. Studies such as Climate Change and the Demand for Water¹³ suggest that agricultural irrigation use, for example, will increase nationally by around 20 per cent by the 2020s and around 30 per cent by the 2050s. Demand in tourist areas may increase as tourism increases due to more predictable warmer and longer summers. There is also likely to be a need for increased abstraction for cooling waters as industrial processes operate at higher ambient air temperatures and as the temperature of abstracted cooling water itself increases at certain times of the year. The proposed house-building programme will also put further pressures on current water resources, particularly in areas which are already water stressed. Water resources are likely to decrease at the same time due to higher temperatures, reduced and changing rainfall and, increased saltwater intrusion into drinking water supplies. Studies have assessed flow change across a wide range of catchments, under different climate model projections¹⁴. By the 2020s flows in winter could increase by between four and nine per cent and summer flows will decrease on average by 11 per cent but this could range from one to 32 per cent depending on the catchment location, land use, soils, geology and model uncertainty. A

¹¹ Future Water- The Governments Water Strategy for England. DEFRA. HM Government Feb 2008

¹² Environment Strategy for Wales. Welsh Assembly Government. 2006

¹³ Downing, T.E., Butterfield, R.E., Edmonds, B., Knox, J.W., Moss, S., Piper, B.S. and Weatherhead, E.K. (and the CCDeW project team) (2003). Climate Change and the Demand for Water, Research Report, Stockholm Environment Institute Oxford Office, Oxford.

¹⁴ Romanowicz *et al.*, 2007

number of organisations, including the Environment Agency, plan to carry out further research to understand, and integrate in water resource planning, the likely impacts of climate change on river flows following the publication of UK Climate Projections (previously named UK Climate Impact Programme 2008).

Reduced available water resources to maintain compensation flows and overall reduction in flows at certain times of the year may reduce the opportunities for fish migration within systems and particularly around or across barriers such as weirs.

In the North West River Basin District the risk of not achieving Water Framework Directive objectives as a result of abstraction and other artificial flow pressures was identified as a significant water management issue. It is acknowledged that climate change is likely to have significant impact on this pressure in the medium to long term. This will be in relation to protected area objectives, status, no deterioration and groundwater level objectives.

Relative severity of impact of climate change on abstraction and other artificial flow pressures **Very high**

Ability of actions for abstraction and other flow pressures to perform under climate change

The Environment Agency and other bodies already do a lot to plan for climate change in managing water resources. For example, water companies are considering the impact of climate change on supply-demand balance, make estimates of their carbon footprint and use the shadow cost of carbon in their comparison of options. The Environment Agency has a role to ensure that all water companies make these assessments. The system for licensing water resources is now flexible and includes time limited licences, meaning that as climate changes adjustments can be made to ensure continued protection of the environment. A further example is the Environment Agency's developing water resources strategy which looks to 2050. Several modules of this strategy are considering how climate change will impact on available water resources and how our management of them might adjust to cope with future pressures.

Within the screening of actions identified in this River Basin Management Plan it is clear that existing and proposed actions are likely to need to change to make sure they deliver Water Framework Directive objectives with changing climatic conditions for this pressure. It is considered that all the actions, related to managing abstraction and flow pressures, help us tackle these pressures now and in a future climate (see Figure H.6). The Environment Agency cannot identify any current or proposed actions in the programme of actions where it would be a significant mistake in terms of managing the pressure now or under a future climate to continue to apply or introduce these actions (this assessment does not consider in detail the impact on carbon emissions. This should be considered in economic assessments of the actions. Also the effects of actions to reduce abstraction pressures on climate change (that is impact on carbon emissions) are presented in the strategic environmental assessment reports which accompany the draft and this River Basin Management Plan).

Furthermore most of these actions can be adapted in the future so that they will be capable of managing any increased risk from climate change. For example, abstraction licences can be modified in relation to volume and abstraction period to adjust to seasonal water availability. Flows in rivers can be augmented by changing management procedures. This depends on individual rivers as their natural flow patterns vary. Flexible adaptation will require a good understanding of how changing conditions increase or decrease the risk that the pressures will prevent us achieving Water Framework Directive objectives. The possibility of the option to adapt the action is purely a technical possibility. Future socio-economic considerations may change this view. For example land take costs could increase such that

adaptation of a particular action that involves land take is no longer the cost-effective approach.

Some of the actions have risks in terms of successful application unless we change policies and operational relationships/ requirements. For instance, abstractors will need to be prepared for a higher probability for the application of drought orders or permits under the Water Resources Act 1991.

Certain actions represent a win-win. For instance, demand management actions will improve our ability to manage water resources now and in the future as well as reduce the carbon footprint from water supply and treatment (see Strategic Environmental Assessment reports which accompany the draft and this River Basin Management Plan).

It is clear, however, that further actions will be required in areas of proposed housing development, particularly in areas which are already water-stressed and where climate change is projected to have greatest impact on water resources (e.g. in the South-East of England).

Biological pressures (Fisheries management and invasive non-native species)

Climate change impact on biological pressures

Fisheries management can represent a risk in terms of direct fish/shellfish removal, impact of competition/predation from managed fisheries on native biology, impact of supplied feeds on nutrient conditions and impacts of removing migratory fish. These were not considered to be significant in the North West River Basin District and, therefore fisheries management was not identified as a current significant issue.

Climate change could result in increased disease levels in managed fisheries which could spread to native plant and animal life. There could be an increased consequence of nutrient impacts from supplied food. Changing water temperatures may bring about changes to stocked species. Reduced flows may increase stocking pressures on native fish. Longer term temperature increases may mean that certain water courses may not be able to support the species for which they are required to achieve a designated water quality standard. In these cases the Environment Agency will take the view, in line with the requirements of the Water Framework Directive that the lack of particular indicator species is no reason to let the quality of the water course deteriorate.

At present these changes are not thought to be significant enough in the North West River Basin District to affect the achievement of Water Framework Directive objectives. It is however acknowledged that further work is needed to assess the sensitivity of the North West fisheries to future climate change impacts.

Relative severity of impact of climate change on fisheries Low/Medium management pressure

Invasive non-native species can be introduced intentionally or non-intentionally as a result of their use as ornamentals, 'hitch-hiking' on ornamentals, washout from ship ballast water and from farming and fishing practices. Species can spread rapidly as a result of these activities, water transfers and transfer between catchments caused by animals and people moving. Invasive non-native species were not considered to be a widespread significant issue in relation to Water Framework Directive objectives in the North West River Basin District. Although they were present in many watercourses there was little evidence of them

impacting on Water Framework Directive objectives. However there are isolated problems with species such as signal crayfish, floating pennywort and Himalayan Balsam.

Climate change will alter the geographical location of the climatic conditions that define many UK habitats, with knock-on effects for the species they support. It is already having a significant impact upon the timing of the developmental cycles of species such as early emergence of certain plant and animal species in spring and early breeding of birds. This includes the survival, variety and extent of non-native species, increasing the risk of their becoming invasive. The range of invasive non-native species may have to be constantly updated as new species are introduced and become established as the climate changes. Further concepts about what constitutes a 'non-natural' species may have to change as our climate and underlying conditions change.

Research such as the 'Modelling Natural Resource Responses to Climate Change' (MONARCH) programme, the Marine Biological Association led project 'Marine Biodiversity and Climate Change' and the Environment Agency led project 'Preparing for climate change impacts on freshwater ecosystems' (PRINCE) are helping predict how the composition of plant and animal communities in the UK will change. Increasing air temperatures in a future climate may increase the survival and transport of invasive non-native species. Increasing water temperatures and lower flows may increase their survival, proliferation and spread. The variety and use of invasive non-native ornamental species could increase as more species survive in a future UK climate and as people use their gardens more in warmer summers particularly in terms of water features such as ponds.

The predicted increase in aquaculture across the UK coupled with increased storminess may increase the risk of release of invasive non-native species.

It has been suggested that invasive non-native aquatic macrophytes (for example *Crassula helmsii*) may spread more rapidly if winters become warmer and frost events are less frequent. Invasive non-native animals, such as bullfrogs, may also benefit from warmer weather, with possible serious implications for native amphibians. A large number of marine and estuarine species are already well established. Examples include cord grass, slipper limpet, wire weed and the Chinese mitten crab. New and established marine non native invasives are likely to increase rapidly in number and range as sea temperature increases. These invasives are already having significant impacts on coastal and estuarine native species and/or morphology. It is considered quite possible that invasive non-native species will become a more of an issue under a future climate threatening the no deterioration pressure risk to Water Framework Directive objectives of the Water Framework Directive in the North West.

Relative severity of impact of climate change on invasive Medium non-native species pressure

Ability of actions for invasive non-native species pressure to perform under climate change

It is likely that existing and proposed actions for invasive non-native species will need to be adapted to make sure they meet Water Framework Directive objectives climatic conditions change. It is possible that new actions may be needed due to the increasing risk resulting from climate change. It is considered that all the actions, related to managing invasive non-native species help us tackle this pressure now and in a future climate. The Environment Agency cannot identify any current or proposed actions in the programme of actions where it would be a significant mistake in terms of managing invasive non-native species, now or under a future climate, to continue to apply or introduce these actions. This assessment does not consider the impact on carbon emissions which is considered elsewhere in the Strategic

Environmental Assessment reports which accompany the draft and this River Basin Management Plan. In this respect they are ‘no regrets’ actions. For instance controls on importation and releases will continue to be an essential way to manage invasive non-native species.

Most of these actions can be adapted in the future so that they will be able (in a technical sense) to manage any increased risk from climate change (wider socio-economic considerations may change this view). For example, the range of species restricted for importation could be broadened. Flexible adaptation will require a good understanding of how changing conditions increase or decrease the risk of the pressures of not achieving Water Framework Directive objectives.

Some of the actions have risks in terms of successful application unless we change policies and operational relationships/ requirements. For instance in order to maintain biodiversity, which species we consider as ‘invasive non-native species’ will have to be updated as new species arrive and become established in the UK as the climate warms.

Microbiology (including faecal indicator organisms)

Climate change impact on microbiology pressure

Livestock farming, wastewater treatment and urban runoff (e.g. dog fouling) can all lead to microbial contamination of waterways. In the North West River Basin District there are localised issues with regard to microbial contamination.

Climate change predictions suggest that there is likely to be increased contamination from farmland and urban runoff due to compacted soils and/or less frequent but intense summer rainfall events. These events may also cause an increased frequency of combined sewer overflows overflow and sewage treatment plant flooding. These events can kill fish and other water life, and threaten human health. Although there may be an increase in the number of events that lead to high levels of microbial pathogens in water bodies increased water temperature and ultra-violet light exposure may reduce the survivorship of bacterial pathogens. It is likely that changes in this pressure will increase the risk of not achieving Water Framework Directive objectives in the North West River Basin District, particularly in relation to bathing water and drinking water protected area objectives.

Relative severity of impact of climate change on Medium microbiology pressure

Ability of actions for microbiology pressure to perform under climate change

It is likely that existing and proposed actions for this pressure will need to be adapted to make sure they meet Water Framework Directive objectives with changing climate. It is possible that new actions may be needed due to the increasing risk resulting from climate change, particularly from the increased risk from diffuse sources. Most of the actions, related to managing microbiological pressures, help us tackle these pressures now and in a future climate. For instance effluent treatment at sewage works will continue to be an essential way to manage this pressure. However, the Pitt review and Environment Agency reviews of the summer 2007 floods identified that a lot of water sector critical infrastructure is in the floodplain. Investing considerable funds in ‘climate vulnerable’ sewerage treatment and water treatment plants could represent a significant risk to not achieving Water Framework Directive objectives. Therefore although most actions are ‘no regrets’ actions there are some possible ‘regrets’ actions.

Most of these actions can be adapted in the future so that they will be capable (in a technical sense) to manage any increased risk from climate change (wider socio-economic considerations may change this view). For example there is the possibility of improving effluent treatment at sewage treatment works, changing standards and fitting improved storm tank capacity. However this will only be possible where there is capacity or space to do this. Therefore any investment in new works or managing current sites should allow for the opportunity for flexible adaptation. Unless this is done this is a case of possible 'regret'. This will have to be bought to any operator's attention. It is recommended that water companies use the guidance provided by Water UK 'A Climate Change Adaptation Approach for Asset Management Planning'. Flexible adaptation will require a good understanding of how changing conditions increase or decrease the risk of the pressures of not achieving Water Framework Directive objectives.

Organic (sanitary determinand) pressure

Climate change impact on organic (sanitary determinand) pressure

Organic pollution such as ammonia and substances resulting in high biological oxygen demand come from sources such as sewage and industrial effluent discharges, urban runoff and runoff from farmland and farm premises. Pollution caused by discharges from industry and sewerage systems have been identified as significant pressures in the North West River Basin District.

Climate change predictions suggest that there is likely to be increased contamination from organic pollutants from farmland and farm premises. This is due to washout during intense rainfall events from compacted soils and from urban environments at first-flush during intense rainfall events. It is possible that increased disease outbreaks amongst livestock as a consequence of climate change may lead to higher levels of organic pollution from high stock densities where movement and/or slaughter is restricted and where disease control culls are undertaken. The risk of this is not known at the moment. Intense rainfall events and increased flooding may also cause an increased frequency of combined sewer overflow. On the other hand the performance of sewage treatment works could increase under higher temperature reducing the biological oxygen demand burden. Ammonia concentrations in rivers will also potentially reduce due to greater nitrification.

It is likely, that changes in this pressure will increase the risk of not achieving the Water Framework Directive objectives in the North West River Basin District.

Relative severity of impact of climate change on organic Medium pressure

Ability of actions for organic (sanitary determinand) pressures to perform under climate change

The approach to consenting of discharges to water courses, together with the Periodic Review system for the investments of water companies, allow us to adapt, to some degree, to climate change as it progresses. However it is particularly important that climate change is adequately factored into decisions for investments that will have a long lifetime to avoid regrets in the future.

For the organic pollutant pressure it is likely that existing and proposed actions will need to be adapted to make sure they meet Water Framework Directive objectives with changing climatic conditions for this pressure. It is possible that new actions may be needed due to the increasing risk resulting from climate change, in particular from the increased risk from

diffuse sources. It is considered that most of the actions, related to managing organic pollution help us tackle these pressures now and in a future climate. For instance discharge licensing of point source discharges will continue to be an essential to manage this pressure. However, investing considerable funds in sewage treatment and water treatment plants built on floodplains could represent a significant risk to not achieving Water Framework Directive objectives as these will be vulnerable to flooding as a result of the consequences of climate change. Therefore although most actions are 'no regrets' actions there are some possible 'regrets' actions.

Most of the actions can be adapted in the future so that they will be capable (in a technical sense) to manage any increased risk from climate change. Wider socio-economic considerations may change this view. For example discharge consents can be modified in relation to biological oxygen demand. However, this will only be possible where there is capacity or space to do this within waste water treatment works. Carbon implications of tightening standards in this way would also need to be considered and options other than end-of-pipe (for example the phasing out of phosphate in detergents) may be preferable. The Environment Agency is currently assessing the carbon costs of wastewater management options, and will be looking to include some of the 'quick wins' from this work in the Periodic Review 2009. Therefore, any investment in new works or the management of current sites should allow for flexible adaptation. Unless this is done, this is a case of possible 'regret'. This will have to be bought to operators attention. Flexible adaptation will require a good understanding of how changing conditions increase or decrease the risk of the pressures of not achieving Water Framework Directive objectives.

Some of the actions have risks in terms of successful application unless we change policies and operational relationships/ requirements. For instance, dischargers may require improved codes of practice to account for changing climatic conditions. The same is true for farmers in terms of slurry and soil management for instance.

Nutrients pressure (nitrogen and phosphate)

Climate change impact on nutrient pressure

Diffuse nutrients such as nitrogen and phosphate compounds can come from sources such as unsatisfactory combined sewer overflow, leakage from sewerage systems, urban runoff (for example animal and bird faeces) and runoff of fertilisers and animal sludge from agricultural land and premises. Nutrients pressure has not been identified as a significant issue for the North West River Basin District. However diffuse pollution from agriculture sources and pollution from sewage systems have been identified as significant issues.

The Environment Agency have recently been working with Reading University using the 'Integrated catchment' suite of water quality models (Integrated Nutrient in Catchment model) to assess the potential impacts of water quality on river systems in the UK. The models have been used to simulate flow, total and soluble phosphorus, nitrate (as N), ammonia, sediments, and ecology (macrophytes and epiphytes). Results show that a number of factors controlling nutrient concentration will be affected by climate change. Under all climate change scenarios water quality will be affected by changes in flow regime with lower minimum flows giving less volume for dilution and hence higher concentrations downstream of point discharges. Increased storm events, especially in summer, could give more frequent incidences of combined sewer overflows discharging highly polluted waters into receiving water bodies. The potential impacts on urban water quality will be largely driven by these changes in short duration rainfall intensity overwhelming drainage systems, as well as rising sea levels affecting combined sewage outfalls. For diffuse inputs there is likely to be increased contamination from organic pollutants from farmland and farm premises. This is due to washout during intense rainfall events particularly in winter.

Climate change predictions suggest that there is likely to be increased contamination from nutrients from farmland due to compacted soils and less frequent but intense rainfall events. These intense rainfall events are also likely to cause high-levels of 'first-flush' pollution from urban areas. Intense rainfall events and increased flooding may also cause an increased frequency of combined sewer overflows, overflow, sewage plant flooding, flooding of industrial and commercial premises and wash-in from silage pits. The seasonality of changes in nutrient inputs is likely to vary between rivers dependent on the balance between urban and rural inputs, but overall nutrient loads are expected to increase.

Prolonged growing seasons may result in increased use of fertilisers. However this should be compensated by increased uptake by plants. The impact of nutrients from eutrophication may be worsened due to enhanced algal growth as a result of increased sunlight and water temperatures. This may be offset to some extent by improved breakdown of nutrient compounds in sewage treatment works due to higher temperatures and increased functioning of microbes and increased denitrification within rivers.

Loss of baseflow during summer months could lead to a reduction in dilution of effluent from sewage treatment works increasing in-stream concentrations. This is a particular concern where a large proportion of streams are fed by groundwater aquifers. Lower flows, reduced velocities and, therefore, higher water residence times will increase the potential for algal blooms. Some blooms cause toxicity issues and/or water deoxygenation killing other native species.

This is particularly in relation to bathing water and drinking water protected areas objectives. Decreasing quality of abstracted water will increase the risk of not achieving Article 7 objectives (avoid deterioration in their quality [water bodies] in order to reduce the level of purification treatment required in producing drinking water). There is already a rise in the need for groundwater blending and treatment to achieve drinking water standards for nitrate.

Relative severity of impact of climate change on nutrient pressure High

Ability of actions for nutrient pressures to perform under climate change

Similar to organic pressures it is likely that existing and proposed actions for nutrient pressures will need to be adapted to make sure they meet Water Framework Directive objectives with changing climate. It is possible that new actions may be needed due to the increasing risk resulting from climate change, in particular from the increased risk from diffuse sources. It is considered that all the actions, related to managing nutrient pollution help us tackle these pressures now and in a future climate. The Environment Agency cannot identify any current or proposed actions in the Programme of Actions where it would be a significant mistake in terms of managing the pressure now or under a future climate to continue to apply or introduce these actions (this assessment does not consider in detail the impact on carbon emissions). This should be considered in economic assessments of the actions. In this respect they are 'no regrets' actions. For instance discharge licensing of point source discharges will continue to be an essential way of continuing to manage this pressure.

Furthermore, most of these actions can be adapted in the future so that they will be capable (in a technical sense) to manage any increased risk from climate change. Wider socio-economic considerations may change this view. For example discharge consents can be modified in relation to the loads and concentrations of nutrients. However, this will only be possible where there is capacity or space to do this. Implications for greenhouse gases of

tightening standards in this way would also need to be considered and options other than end-of-pipe (for example the phasing out of phosphate in detergents) may be preferable.

Some of the actions have risks in terms of successful application unless we change policies and operational relationships/ requirements. For instance, dischargers may require improved codes of practice to account for changing climatic conditions. The same is true for farmers in terms of fertiliser use, slurry management and soil management for instance.

Priority hazardous substances, priority substances and specific pollutants

Climate change impact on priority hazardous substances, priority substance and specific pollutant pressure

At the England and Wales scale the main source of priority hazardous substances, priority substance and specific pollutants is from the chemical, pharmaceutical and manufacturing sectors. They also come from sewage discharges, contaminated land runoff and urban runoff. Generally, hazardous substances were not identified as a significant issue in the North West River Basin Districts. However, there are localised problems, involving copper, mercury, permethrin and tributyltin.

Any change in risk as a result of climate change will be substance/ groups of substance specific and depend on issues such as sources and uses. It is unlikely that climate change will significantly increase the risk from industrial point sources. It is also unlikely that the risk for substances such as Tributyl Tin will significantly change from either point or diffuse sources. However more frequent and intense rainfall events may cause significant first-flush spikes in some chemicals such as oils from urban and land runoff and inputs resulting from flooding of combined sewer overflows and industrial and commercial premises.

Available dilution may decrease as a result of reduced precipitation and reduced summer flows, again meaning chemical spikes occur which could exceed set limits. This could be the case for substances including pesticides and polycyclic aromatic hydrocarbons.

Cropping patterns may change as a result of climate change. This may influence the types of pesticides used and therefore the levels detected in water. For example, pesticides used on oil seed rape are now being found more frequently and at higher levels as the market for biofuel crops increases.

It is thought that changes in this pressure, due to the affects of climate change, will not lead to a large increase in risk of not achieving Water Framework Directive objectives in the North West River Basin District.

Relative severity of impact of climate change on priority Low substances pressure

Ability of actions for priority hazardous substances, priority substance and specific pollutant pressure to perform under climate change

It is possible that existing and proposed actions for this pressure may need to be adapted for controls on certain substances to make sure they meet Water Framework Directive objectives with climate change. It is possible that new actions may be needed due to the increasing risk resulting from climate change, in particular to address the increased risk from diffuse sources. It is considered that all the actions, related to managing priority substances help us tackle these pressures now and in a future climate. The Environment Agency cannot identify any current or proposed actions in the programme of actions where it would be a significant mistake to continue to apply or introduce these actions (this assessment does not

consider in detail the impact on carbon emissions. This should be considered in economic assessments of the actions. Also the effects of actions to reduce hazardous substances pressures on climate change (that is impact on carbon emissions) are presented in the strategic environmental assessment reports which accompany the draft and this River Basin Management Plan). In this respect they are 'no regrets' actions. For instance, discharge licensing of point source discharges will continue to be an essential way to manage this pressure.

There are potential win-win actions. For instance better storage and handling of toxic substances in industrial and commercial premises reduce the risk of wash-in during high rainfall or flooding events while also potentially improving health and safety and/or resource use issues in relation to industrial raw materials and wastes.

Furthermore, most of these actions can be adapted in the future so that they will be able (in a technical sense) to manage any increased risk from climate change. For example, standards can be modified (wider socio-economic considerations may change this view so other more cost-effective actions may be needed). Flexible adaptation will require a good understanding of how changing conditions increase or decrease the risk of the pressures of not achieving Water Framework Directive objectives.

Some of the actions have risks in terms of successful application unless we change policies and operational relationships/ requirements. For instance, we may need to change codes of practice for the using and disposing of materials containing hazardous substances.

Acidification

Climate change impact on acidification pressure

Possible sources of acidification are emissions of sulphur and nitrous oxides from power stations and road transport and ammonia emissions from agriculture. These sources were not considered significant in the North West River Basin District and therefore acidification was not identified as a current significant issue.

Reductions in sulphur emissions since the 1980s have lead to a decrease in acid deposition across the country, but some studies warned of future problems associated with increased N deposition and climate change (Wilby R.L., 1993¹⁵). Climate variables that could affect acidification include higher temperatures, increased summer drought, wetter winters, reduced snow pack, simultaneous changes in hydrological pathways, and more frequent sea-salt deposition events. Intense rainfall and wetter winter conditions favour acidic episodes (Wright R.F., 2007¹⁶).

Droughts can make acidification even worse by lowering water tables, creating aerobic conditions and enhancing the oxidation of sulphur to sulphate (Dillon P.K. et al, 1997¹⁷; Wilby R.L., 1994¹⁸). Acid anions are exported during subsequent storm events along with heavy metals (Tipping E. et al, 2003¹⁹).

¹⁵ Wilby, R.L. 1993. The influence of variable weather patterns on river water quantity and quality regimes. International Journal of Climatology, **13**, 447-459.

¹⁶ Wright R.F. 2007. Hydrology and Earth System Sciences Discussions, vol., 4, 2945-2973.

¹⁷ Dillon P.K. et al. 1997. Environmental Monitoring and Assessment., vol 46, 105-111

¹⁸ Wilby, R.L. 1994. Exceptional weather in the Midlands, UK during 1988-1990 results in the rapid acidification of an upland stream. Environmental Pollution, **86**, 15-19.

¹⁹ Tipping E. et al. 2003. Environ. Pollution. Vol., 123, 239-253.

Seawater has been shown to be a significant sink for carbon absorbing 27-34 per cent of the CO₂ emitted into the atmosphere since the industrial revolution²⁰. This has already had a significant impact on ocean chemistry, with estimates of mean surface ocean pH decrease of approximately 0.1 (equivalent to an approximately 30 per cent increase in hydrogen ion (H⁺) concentration), from a value of approximately 8.18 around the time of the industrial revolution. This pH drop is significantly larger than the seasonal pH variability of 0.03 to 0.04 due to changes in temperature and photosynthesis. This is making seawater more acidic threatening marine life. By 2100, atmospheric CO₂ concentrations could reach more than 800 parts per million without any mitigation of emissions causing an additional surface water pH decrease of ~0.4 pH units.

However for the North West River Basin District these changes are not thought to be significant enough to affect the achievement of Water Framework Directive objectives in this cycle. Monitoring will be able to identify if this situation changes, and, if necessary, update the pressure in future river basin management planning cycles accordingly.

Relative severity of impact of climate change on acidification pressure	Low for freshwater. Medium/High for marine waters
--	--

Ability of actions for acidification pressure to perform under climate change

Actions, related to acidification help us tackle these pressures now and in a future climate. Furthermore, most of these actions can be adapted in the future so that they will be capable (in a technical sense) of managing any increased risk from climate change.

Salinity

Climate change impact on salinity pressure

The main sources of saline inputs to water courses included runoff of de-icing salts from roads and urban surfaces and industrial sources.

Freshwater surface water can become more saline as a result of incursion (high tide and surge impacts) and intrusion (inland migration of saline front) from marine waters. Likewise groundwater can be impacted by intrusion. Furthermore reduced rainfall in summer may reduce freshwater flows to estuaries increasing their salinity.

Salinity was not identified as a significant pressure in the North West River Basin District however, diffuse pollution from roads and urban areas was identified as a significant issue

Climate change predictions suggest that there are likely to be higher peaks of salinity as a result of first-flush high rainfall events from roads and urban areas after extended dry periods. However, the use of de-icing salts is likely to decrease due to milder winters and fewer snowfall events. Industrial sources will probably not change significantly.

Increasing sea levels and storm surges are likely to cause increased saline intrusion into surface freshwaters, but more importantly into groundwater systems. Although some freshwater habitat may be lost, the most significant impact will be on groundwater resources.

²⁰ Turley, C, Findlay, HS, Mangi, S, Ridgwell, A and Schimdt, DN. (2009) CO₂ and ocean acidification in Marine Climate Change Ecosystem Linkages Report Card 2009. (Eds. Baxter JM, Buckley PJ and Frost MT), Online science reviews, 25pp. www.mccip.org.uk/elr/acidification

It is likely, therefore, that changes in this pressure, due to the affects of climate change, will increase the risk of not achieving Water Framework Directive objectives in the North West River Basin District.

Relative severity of impact of climate change on salinity Medium pressure

Ability of actions for salinity pressure to perform under climate change

It is likely that existing and proposed actions will need to be adapted to make sure they meet Water Framework Directive objectives for this pressure with climate change. It is possible that new actions may be needed due to the increasing risk resulting from climate change. It is considered that all the actions, related to managing salinity pressure help us tackle this pressure now and in a future climate. The Environment Agency cannot identify any current or proposed actions in the programme of actions where it would be a significant mistake in terms of managing the pressure now or under a future climate to continue to apply or introduce these actions (this assessment does not consider in detail the impact on carbon emissions. This should be considered in economic assessments of the actions. Also the effects of actions to reduce abstraction pressures on climate change (that is impact on carbon emissions) are presented in the strategic environmental assessment reports which accompany the draft and this River Basin Management Plan). In this respect they are 'no regrets' actions. For instance discharge licensing will continue to be an essential way of continuing to manage this pressure.

Most of the actions can be adapted in the future so that they will be able (in a technical sense) to manage any increased risk from climate change. There may be exceptions. For instance environmental controls on new developments and infrastructure (for example roads) may not have adequate requirements for applying sustainable urban drainage systems and road runoff treatment and maintaining this treatment to cope with future conditions.

In the longer term, there is little we will be able to do to avoid sea level rise having an impact on coastal aquifers. In future cycles of river basin management planning it may be necessary, therefore, to redefine reference conditions. The implications of salinisation of coastal aquifers on increasing demands on alternative water resources will need to be considered.

Temperature

Climate change impact on direct temperature pressures

It should be noted that in this section 'temperature pressure' refers to the release of point source effluents which are of a higher temperature than the receiving water as opposed to the direct effects of climate change on water temperature. 'Heated' point source effluents can originate from power station and industrial cooling waters and sewage discharges. However it is believed that the nature of higher temperature discharges will not change to a large extent as the result of climate change. Heated discharges were not identified as a significant issue in the North West River Basin District.

Climate change will cause a rise in water temperatures regardless of these direct sources of higher temperature waters. The potential impact in areas that receive heated discharges may be increased due to the increased temperature of the receiving water resulting directly from climate change

Increased air temperatures may require larger volumes of industrial cooling waters for plants to operate at optimal conditions and increase temperatures of sewage discharges. In the North West River Basin District, this is not considered to significantly increase the risk from this pressure

Relative severity of impact of climate change on direct Low temperature pressures

Ability of actions for temperature pressure to perform under climate change

Most, if not all, actions for this pressure can be adapted in the future so that they will be capable (in a technical sense) to manage any increased risk from climate change. This is mainly controlled through discharge licensing.

The most immediate reaction to climate change is expected to be in river and lake water temperatures. There is little we can do now to avoid at least some increase in temperatures. In future cycles of river basin management planning it may therefore be necessary to redefine reference conditions.

Physical modification

Climate change impact on physical modification pressure

Many of the regions rivers were altered during the industrial revolution, particularly in East Lancashire and Greater Manchester. Reservoirs were built in the headwaters and many rivers were channelised or culverted. Numerous weirs were also built during that period, which now act as an obstruction to migratory fish. An extensive network of canals was built, including the Manchester Ship Canal, and several rivers were modified for navigation.

Physical modification is not restricted to just urban areas. Agricultural and forestry practices can cause high volumes of sediment to enter rivers disturbing the natural ecology. The construction of flood defences has also effected the ecology of many of our rivers and coastlines. This pressure has been identified as a significant issue in the North West River Basin District.

Climate change could change patterns of development and the physical pressures this imposes on water bodies. For instance coastal areas may develop because of increased tourism due to warmer drier summers.

The increased chance of extreme events leading to flooding, rising sea levels and storm surges is likely to mean flood defences and surface water drainage will need upgrading. This could threaten achieving not only good status but also good potential in water bodies designated as heavily modified water bodies. However, all new flood defences would be required to satisfy Article 4.7 of the Water Framework Directive, which will ensure that the best environmental option is considered for the flood risks posed.

Alternative strategies to deal with high flows, described in documents such as Defra's 'Making space for water' and the Welsh Assembly Government Environment Strategy may reduce the need for hard engineered modifications whilst having additional benefits in terms of water management in catchments.

Reduced availability of water to maintain compensation flows and overall reduction in flows may result in fewer opportunities for fish migration within systems particularly around or across barriers such as weirs. This increases the significance of this pressure.

There is a possible increased risk from dredging as more marine aggregate material is required for flood defences to protect against increased flood risk as a result of climate change. However, currently most marine aggregate regions are well offshore from the closest coastal water body such that any changes in marine aggregate production may not affect Water Framework Directive compliance.

It is likely, therefore, that changes in this pressure as a result of climate change will increase the risk of not achieving Water Framework Directive objectives in the North West River Basin District.

Relative severity of impact of climate change on Medium physical modification pressure

Ability of actions for physical modification pressure to perform under climate change

It is likely that existing and proposed actions will need to be adapted to make sure they meet Water Framework Directive objectives with changing climatic conditions for this pressure. It is possible that new actions may be needed due to the increasing risk resulting from climate change. It is considered that all the actions, related to managing physical modifications help us tackle these pressures now and in a future climate. For instance codes of practice and impact assessment will continue to be an essential way to manage this pressure. However these actions may have negative impacts for other pressures (see section 5.5.) which are increased as a consequence of climate change. Therefore careful consideration is needed to assess if there are any potential negative consequences in relation to achieving Water Framework Directive objectives of implementing these actions.

Most of these actions can be adapted in the future so that they will be able (in a technical sense) to manage any increased risk from climate change (wider socio-economic considerations may change this view).

There are a number of possible situations where climate change represents a significant risk to any investment in actions (that is a ‘regrets’ situation). For instance investment in fish passes or lifts could be wasted and bring no benefits in relation to meeting Water Framework Directive objectives if reduced flows in a future climate prevent them from operating properly. Climate change effects would have to be factored into their effectiveness, design and operation.

Certain actions represent a win-win situation. For instance, ‘Green infrastructure’ (the managed interconnected network of open spaces and natural areas, such as greenways, wetlands, parks, woodland and native plant vegetation, that naturally manages stormwater, reduces flooding risk and improves water quality), river restoration and regeneration could reduce the impact of physical modification pressures whilst bringing about other significant benefits such as reducing the carbon footprint from ‘old infrastructure’ and improved quality of life in urban environments (see strategic environmental assessment reports which accompany the draft and this River Basin Management Plan). Similarly these actions could improve habitat conditions such that the biology is better able to cope and migrate with changing climatic conditions.

Sediments

Climate change impact on sediment pressure

Excessive levels of sediments in water bodies can result from runoff from agricultural and urban areas, sewage discharges and combined sewer outputs, industrial waste management procedures, construction and forestry activity. Sediment pressure was not identified as a

significant issue in the North West River Basin District however, diffuse pollution from rural sources and roads/urban areas and discharges from industrial process and sewerage systems were.

Climate change predictions suggest that there is likely to be increased contamination from sediments from farmland and farm premises and from urban environments. This will be due to washout during intense rainfall events from compacted soils and from urban environments after first-flush releases during intense rainfall events. Changing crop types and seasonal patterns of agriculture and forestry may also change sediment runoff. Increased winter cropping is already having an effect on sediment runoff. Promotion of tree planting (for shading rivers from UV and for carbon storage for instance) may have positive affects in relation to reducing sediment runoff. Localised runoff from construction sites could also increase in intense rainfall events. There will also be changes in stream power during storm events and hence enhanced sediment loads due to channel erosion and enhanced resuspension. The Integrated Nutrient in Catchment framework model mentioned in the nutrients section above has been used to predict phosphorus and sediment movements and loads. In this model sediment release was described as a function of previous climate conditions and the rate of change of flow conditions. Climate change is likely to increase the rate of change of flow conditions and therefore sediment movement and loads. This will lead to higher sediment loads to lakes. Stream power between events may be reduced, causing higher rates of sediment deposition higher up the stream systems. Intense rainfall events and increased flooding may also increase the frequency of combined sewer overflow. The Defra soil strategy and soil action plan and the proposed Welsh Assembly Governments draft soil action plan are acting to help reduce this risk.

Future climate change will affect this pressure and plans are to address sediment issues by improved land management practices. In current situation sediment pressure is thought to increase the risk of not achieving Water Framework Directive objectives in the North West River Basin District.

Relative severity of impact of climate change on sediment High pressure

Ability of actions for sediment pressure to perform under climate change

Existing and proposed actions will need to be adapted for controls to make sure they meet Water Framework Directive objectives with changing climatic conditions for this pressure. It is possible that new actions may be needed due to the increasing risk resulting from climate change, in particular from the increased risk from diffuse sources. It is considered that all the actions, related to managing sediments help us tackle these pressures now and in a future climate. However the effectiveness of some actions may be compromised if climate change is not considered in their design and implementation. For instance any proposed sediment traps or sustainable urban development systems may need to be designed and operated to cope with increased sediment loads to prevent blocking and to maintain their effectiveness at achieving Water Framework Directive objectives. If this is not done this would represent a 'regrets' situation.

Furthermore, most of these actions can be adapted in the future so that they will be capable (in a technical sense) of managing any increased risk from climate change.

Sediment and soils store carbon. Managing soils and sediments better will ensure soil carbon is not released to the atmosphere increasing climate change. Also soil and the minerals and nutrients it contains are retained for agriculture. This represents a win-win situation (see Defra soil strategy).

H.5 Interaction of management action for pressures

Management action to address one pressure may increase the risk of not achieving Water Framework Directive objectives for another pressure. Climate change may increase this risk further. For example, removing weirs to remove obstacles to the movement of native flora and fauna may increase the risk of allowing the spread of invasive species where the suitable habitat of these invasives is broadened because of climate change.

Further climate change adaptation action for one issue and/or in one location may in itself cause problems elsewhere. For instance managed retreat may reduce the risk from morphological pressures but increase the risk of saline intrusion, particularly where lower groundwater and surface water levels and flows are reduced as a consequence of climate change.

Because many of these risks are higher because of climate change the interaction of climate change and management action for different pressures needs to be considered. There is unlikely to be an ideal set of actions. ‘Trade-offs’ between different management actions for different pressures and drivers need to be considered. This highlights the need for integrated catchment thinking when managing different pressures under the Water Framework Directive. This point was made by several consultees in the various Water Framework Directive consultations.

There will also have to be significant trade-offs in relation to particular outcomes in catchments such as those for conservation, agriculture and water supply. Trade-offs will also need to be considered in relation to adaptation actions and the outcomes these deliver. This is nothing new. These trade-offs have to be considered in sustainability appraisals. Political priorities, however, may affect the methodology that is used and decisions made. Transparency, in relation to appraisal methodologies and decision-making, are therefore important to ensure a consensus on the balance that is struck between competing outcomes and priorities.

H.6 Adaptation strategies

A number of organisations will play a part in delivering the objectives of the Water Framework Directive. This annex considers the implications of climate impacts on the effectiveness of the actions to deliver these objectives. It is important that everyone is involved in developing and implementing effective adaptation action for actions in order that we are all able to meet Water Framework Directive objectives.

Several organisations involved in the River Basin Management process are developing and acting on strategies for adapting their activities to address climate change. Generally these are targeted at a wide range of responsibilities including those under the ‘umbrella’ of the Water Framework Directive. Much of the activity will be to better understand risks and appropriate responses in the first instance. This work should rapidly develop into effective adaptation action to ensure we all meet Water Framework Directive objectives as planned. The Environment Agency would expect that organisations that have not taken on-board planning for adaptation for areas of the Water Framework Directive for which they are responsible, should start to do this as part of river basin management planning and implementation of plans. The Environment Agency as competent authority for Water Framework Directive implementation will review if this is happening.

The Environment Agency, for example, has developed an organisational climate change adaptation and mitigation strategy. The different parts of the Environment Agency are now developing action plans to enact this strategy and to embed adaptation into the

environmental management of sectoral activities. These will be published at a later date but include the following:

- Identifying good practice in terms of adaptation and making sure this is communicated.
- Updating our risk information using new 2009 UK Climate Projections (previously named UK Climate Impact Programme 2008).
- Ensuring water companies consider the impact of climate change on the supply-demand balance.
- Developing a map of the impact of climate change on river flows across England and Wales and examining the impact of climate change on demand for water in the 2020s, 2030s and 2050s.
- Looking at the carbon cost of different water supply actions, including the carbon footprint of operating the water supply system.
- Looking at how people value water, and alternative ways of allocating resources that will help us respond to increasing water scarcity as a result of climate change.
- Progressing research to look at, for example, the use of probabilistic climate scenarios on water supply and ecology, changes in water quality and failures of water quality standards, discharges, effluent treatment and chemical processes; the spatial coherence of European droughts in the past and in the future and the impact of future droughts on water supply management.
- Considering how to take on board climate change in our 'Time limiting of abstraction licence' policy and improving water efficiency requirements in our abstraction licences.
- Improving the resilience of water supplies to climate change through involvement in the Water Saving Group.
- Ensuring climate change adaptation is embedded into fisheries practices and invasive species strategies.
- Looking for opportunities in joint working to manage and adapt for a range of pressures.
- Reflecting the long term costs of climate change in the way decisions are made to maintain or improve water quality. Make sure options are assessed by Net Present Cost, taking account of operating costs to perpetuity and, in this, the estimates that have been advised for the social costs of carbon.

As part of river basin management planning it will be important to co-ordinate activity on adaptation as part of the Water Framework Directive. Therefore the Environment Agency would like to hear of any developed or developing strategies, plans or activities which are occurring for adaptation across the North West River Basin District, particularly where these have relevance to planning and implementing actions under the Water Framework Directive and/or achieving Water Framework Directive objectives. As identified in section H1 the Environment Agency and other UK representatives are working within the EC common implementation strategy to help deliver guidance and tools for how climate change should be considered in the steps of the river basin management process. This will help ensure we all take a consistent approach in the way we address climate change risks and adaptation across water management activities.

H.7 Adaptation in relation to underlying conditions and biology

Work is needed to understand how changes in underlying 'natural' environmental conditions and the impacts of man-made pressures as a consequence of climate change will impact on the biology in the water environment. This is needed to ensure we all implement the most cost-effective actions to meet Water Framework Directive objectives, particularly those for biology. Those organisations involved in the river basin management process who have direct responsibilities for managing the natural environment need to consider the

consequences of climate change and the need for adaptation in the context of delivering biological outcomes. The Environment Agency, for instance, is starting to set out its adaptation action plan for ecology and conservation. This includes the following actions:

- Develop the 'landscape ecology approach' to identify and protect key habitats, open up new habitats and develop and maintain wildlife corridors. Reduce habitat fragmentation and protect and restore areas of floodplains and wetlands.
- Work with Natural England and Countryside Council for Wales on their review of protected area designation criteria and on managing changing conservation objectives for designated sites.
- Work with others to develop better understanding of climate space. Map current and future climate spaces and the vulnerability and impacts for priority species and environments. Develop robust case on the future ranges of key species and how reducing current risks and adaptation actions may affect their viability.
- Target action to build environmental resilience in relation to both existing and climate change pressures.
- Work with partners to identify those species and environments at greatest risk, prioritise policies and strategies for action and identify and make changes in management practices and policies that may help freshwater ecosystems and habitats to adapt to climate change.
- Ensure we all build environmental resilience and restore damaged habitats to ensure salmon and trout species are to remain in existing localities. We will also seek to protect the habitat conditions for glacial relict fish species such as Char and White Fish which have little opportunity to adjust or move from their rare and isolated lake habitats and are therefore at significant risk of local extinction.

Further the Environment Agency intend to commission research to understand if, and over what timescales, the variables on which the characteristics of waterbodies are determined will change, how this could change such things as waterbody type or category and whether or how best to modify tools, analyses, and management as a consequence.

H.8 Summary

It is likely that the risk to not achieving Water Framework Directive objectives from a number of man-made pressures will increase as a result of climate change. . In the North West the relative severity may be particularly high for abstraction and flow pressures and diffuse pressures from both rural and urban sources. We think other pressures such as invasive non-native species, microbiology, organic pollution, salinity and physical modification will be increased but less severely. We consider the relative severity for hazardous substances, acidification and temperature to be low.

Therefore we all will be at more risk of failing Water Framework Directive objectives in the future unless we use adapted actions that continue to bring benefits (in terms of Water Framework Directive objectives) in a future climate. In our screening analysis of actions the Environment Agency consider that the vast majority of actions will help us tackle pressures now and in a future climate (there are few current or proposed actions in the programme of actions where it would be a significant mistake to continue to apply or introduce them). Most actions can be adapted as the climate changes. Therefore most represent a 'no regrets' and/or 'flexible adaptation' option. Any investment in new works or managing current sites should include adaptation or allow for the opportunity for flexible adaptation. Unless this is done this is a case of significant possible 'regret'. Of particular significance here is infrastructure where the effectiveness could be compromised by flooding.

We should all be looking for win-win type actions. It is clear that a number of these exist. It is also clear that actions for different pressures can be counterproductive particularly in a context of a changing climate. This highlights the need to think and plan in a more integrated and catchment based way.

The issues raised in this annex need to be progressed in terms of improving understanding and certainty through management action. Organisations involved in River Basin Management are starting to identify positive action to do this. However this work must be accelerated if we are all to ensure delivery of Water Framework Directive objectives to the Water Framework Directive timescale.



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex I: Designating artificial and
heavily modified water bodies

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I.1 Introduction

This annex explains the criteria used to designate water bodies in the North West River Basin District as artificial or heavily modified. The criteria used for designation of freshwater water bodies can be found in section I.2 and the criteria for estuarine and coastal water bodies can be found in section I.3. Section I.4 discusses how results of a liaison panel consultation on designation were incorporated and further quality checks made to results. Section I.5 outlines how designation of new and split water bodies was made and I.6 maps the artificial and heavily modified water bodies in the North West River Basin District.

The need to designate water bodies as heavily modified or artificial

Article 4(3) of the Water Framework Directive (WFD) states that water bodies may be designated as artificial or heavily modified in the river basin management plans. The WFD recognises that some water bodies have been significantly physically modified to support various uses which provide valuable social and economic benefits. In many cases these modifications cannot be removed without having a major negative effect on the social and economic benefits that these uses bring. If achieving 'good status' would require changes to a water body's hydromorphology that would have significant adverse effects on the social or economic activity, then it can be designated as a artificial or heavily modified water body. Before designation it also needs to be established that due to technical or disproportionate cost reasons there is no significantly better environmental option for delivering the social and economic benefits (European Union CIS guidance document no. 4, 2003). The WFD also recognises that many artificial bodies of water need to be managed in terms of their environmental quality and hydrology.

Artificial and Heavily Modified Water Bodies (AWB/HMWBs) have to achieve an alternative objective of "good ecological potential" (GEP). The objective of GEP is similar to good status but takes into account the constraints imposed by the social and/or economic uses.

Definitions

Article 2 (8) of the WFD defines an artificial water body as a 'body of surface water created by human activity'. Article 2 (9) defines a heavily modified water body as a 'body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of Annex II (of the WFD).'

The definitions presented in the WFD are expanded on further in Common Implementation Strategy guidance documentation. In order to address the challenges of WFD in a co-operative and coordinated way, the Member States, agreed on a Common Implementation Strategy (CIS). CIS Guidance documents and technical reports have been produced to assist member states in implementing the WFD. CIS guidance document no. 4 focuses on the 'Identification and Designation of Heavily Modified and Artificial Water Bodies' and can be found at:

http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/guidancesnos4sheavilysmo/ EN 1.0 &a=d

Paragraph 3.1.1 of CIS guidance No. 4 ("the CIS guidance") states that:

'In order to be a heavily modified water body, a water body must be:

- Physically altered by human activity;
- Substantially changed in character;
- Designated under Article 4(3)'.

In general, the changes to the hydromorphology need to be long-term and alter the morphological and hydrological characteristics in order to represent a substantial change in the character of a water body.

Paragraph 3.1.2 of the CIS guidance interprets an Artificial Water Body as:

'A surface water body which has been created in a location where no water body existed before and which has not been created by the direct physical alteration or movement or realignment of an existing water body'.

The guidance clarifies that this does not mean that there was only dry land present before. Minor ponds, tributaries or ditches may have been present, which were not regarded as discrete and significant elements of surface water. Significant water bodies that have changed water category due to modifications are considered to be heavily modified water bodies. For instance a river dammed to form a reservoir is a heavily modified river not an artificial lake.

I.2 Freshwater water bodies

Introduction

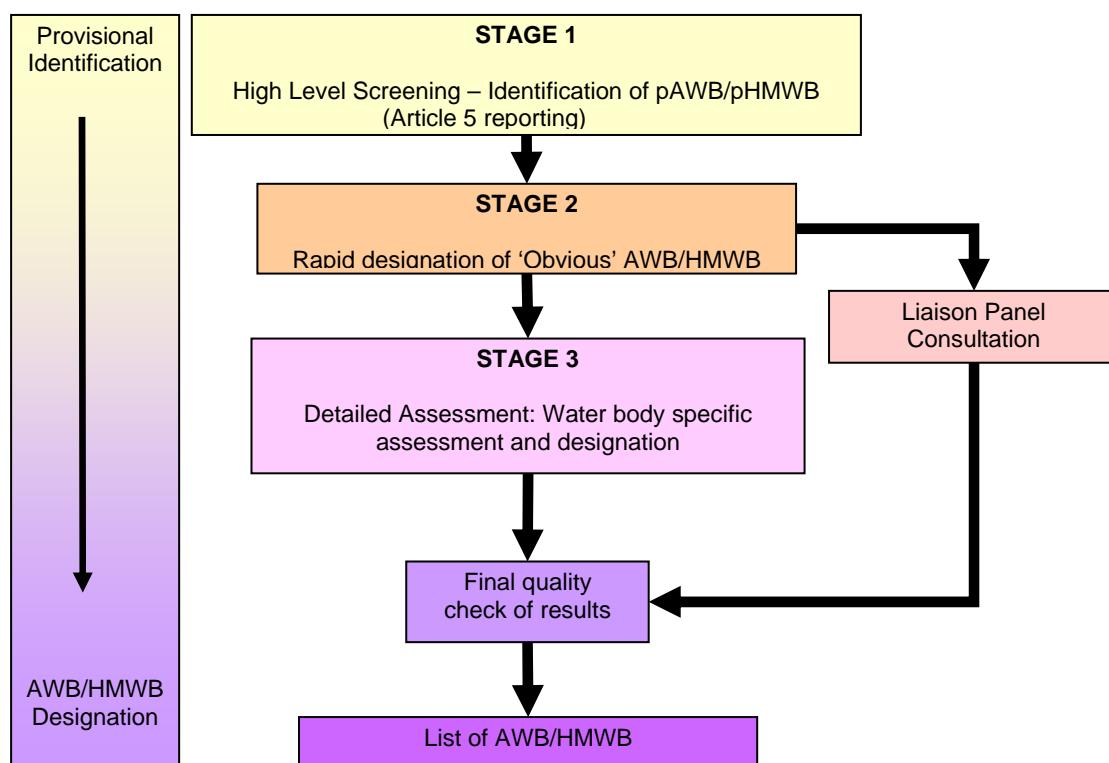
A two-stage approach was developed to apply the Article 4(3) designation tests to those water bodies provisionally identified as AWB/HMWB for Article 5 reporting (Figure I.1). This list of provisional AWB/HMWBs (pAWB/pHMWBs) was formed of water bodies that were at risk of failing good ecological status due to morphological pressures. The risk assessment was completed as part of the river basin characterisation process. Further detail on the risk assessment approach is discussed in Annex G. The two-stage designation process comprised of a rapid designation stage to identify 'obvious' AWB/HMWBs followed by a second more detailed assessment stage.

The rapid designation stage applied the 4(3) tests to a small number of priority water body uses. The rapid designation stage was developed following the principles outlined in the UK TAG paper, 'Criteria and Guidance for the Designation of heavily modified water bodies':

www.wfdruk.org/tag_guidance/article_4/heavily_modified_wb/view

For water bodies where it was not possible to designate using the rapid process a further detailed process was applied. The detailed designation process also applied the Article 4(3) tests but to a wider set of water body uses and gathered more supporting information and justifications for designation. The process is described in Figure I.1.

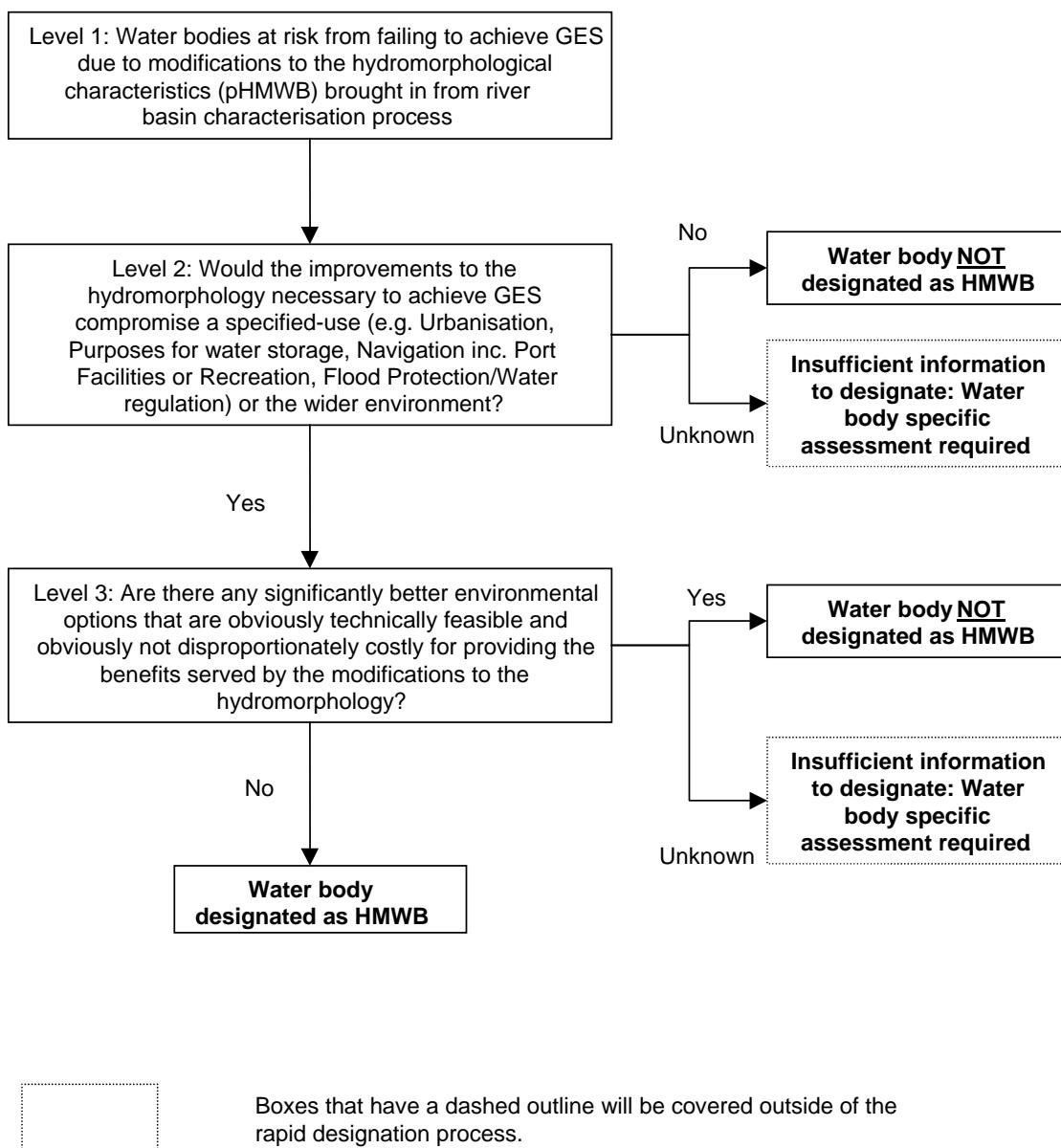
Figure I.1 Summary of steps in the designation of artificial water bodies and heavily modified water bodies for freshwater water bodies



Overview of the rapid designation process for heavily modified water bodies

The process is described in Figure I.2:

Figure I.2 Outline of the rapid designation process for freshwater heavily modified water bodies



Further specified uses were addressed in the detailed designation process.

Overview of the rapid designation process for artificial water bodies

A water body should be designated as artificial if the ability to achieve ‘good ecological status’ is limited through the designated use or through changes necessary for this use.

However, not all man-made water bodies have to be designated. Paragraph 6.8.1 of the CIS guidance explains:

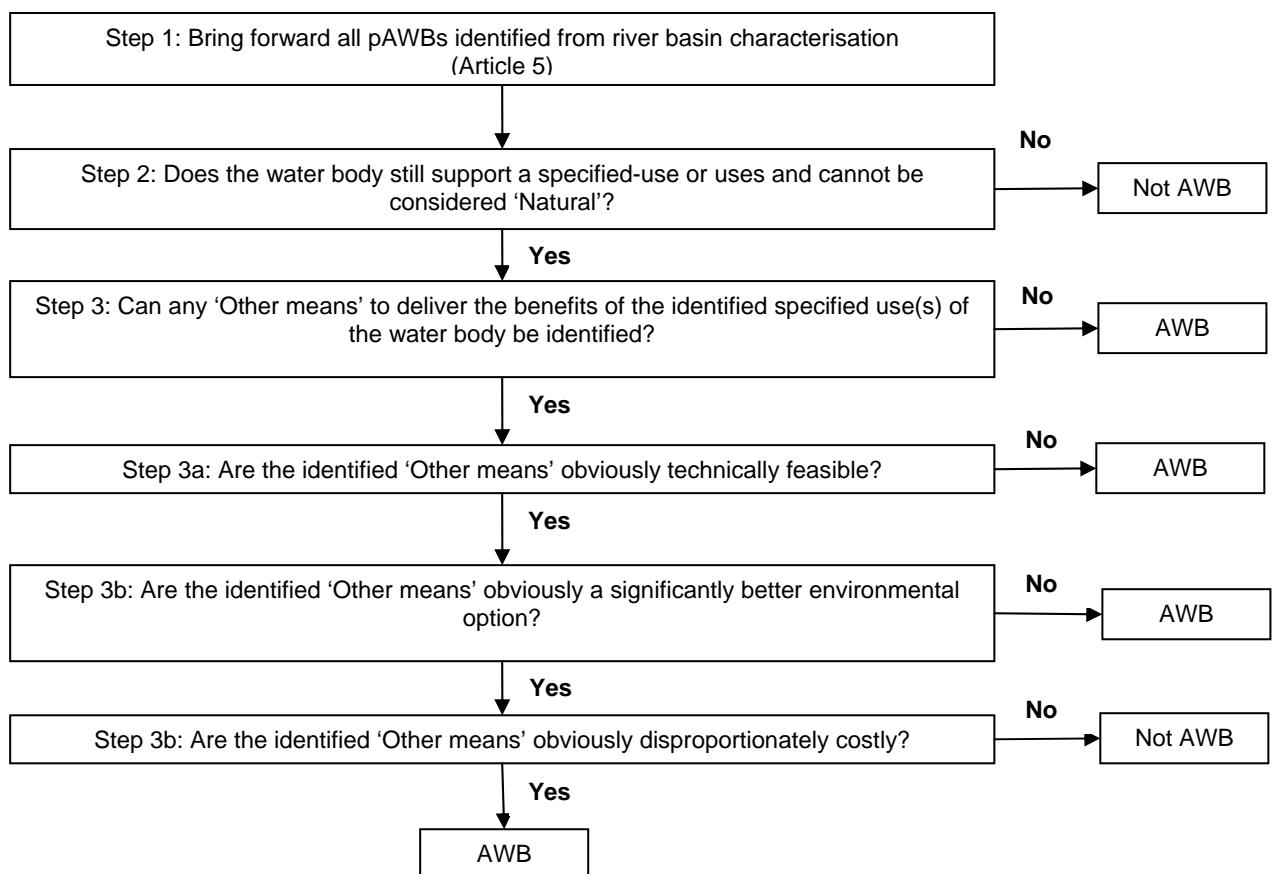
‘There may be some circumstances where long established water bodies, which are subject to little or no pressures, are indistinguishable from natural waters. Under such circumstances it may be appropriate to consider their current biological condition as high ecological status (HES) or good ecological status (GES).’

Water bodies that are considered as provisional artificial water bodies are shown in Figure I.3. The process for designating ‘obvious’ artificial water bodies is shown in Figure I.4

Figure I.3 Water bodies that are considered as provisional artificial water bodies

Category	Types	Includes
Lake	Lake	Flooded gravel pits Flooded surface mine workings Flooded clay pits Flooded peat workings Large ornamental lakes Large recreational lakes Pumped storage reservoirs Drainage ditches/channels
River	Canal Surface water transfers (open channels only)	Completely artificial dug canals Water diversions Leats Reservoir feeders
Estuarine and coastal waters	Docks and Harbours	Dug docks Flooded clay pits (which experience some saline intrusion) Storage reservoirs

Figure I.4 Outline of rapid artificial water body designation process



Overview of the detailed designation process

Where a decision on designation was not possible using the rapid process, water bodies were fed through to the detailed designation process.

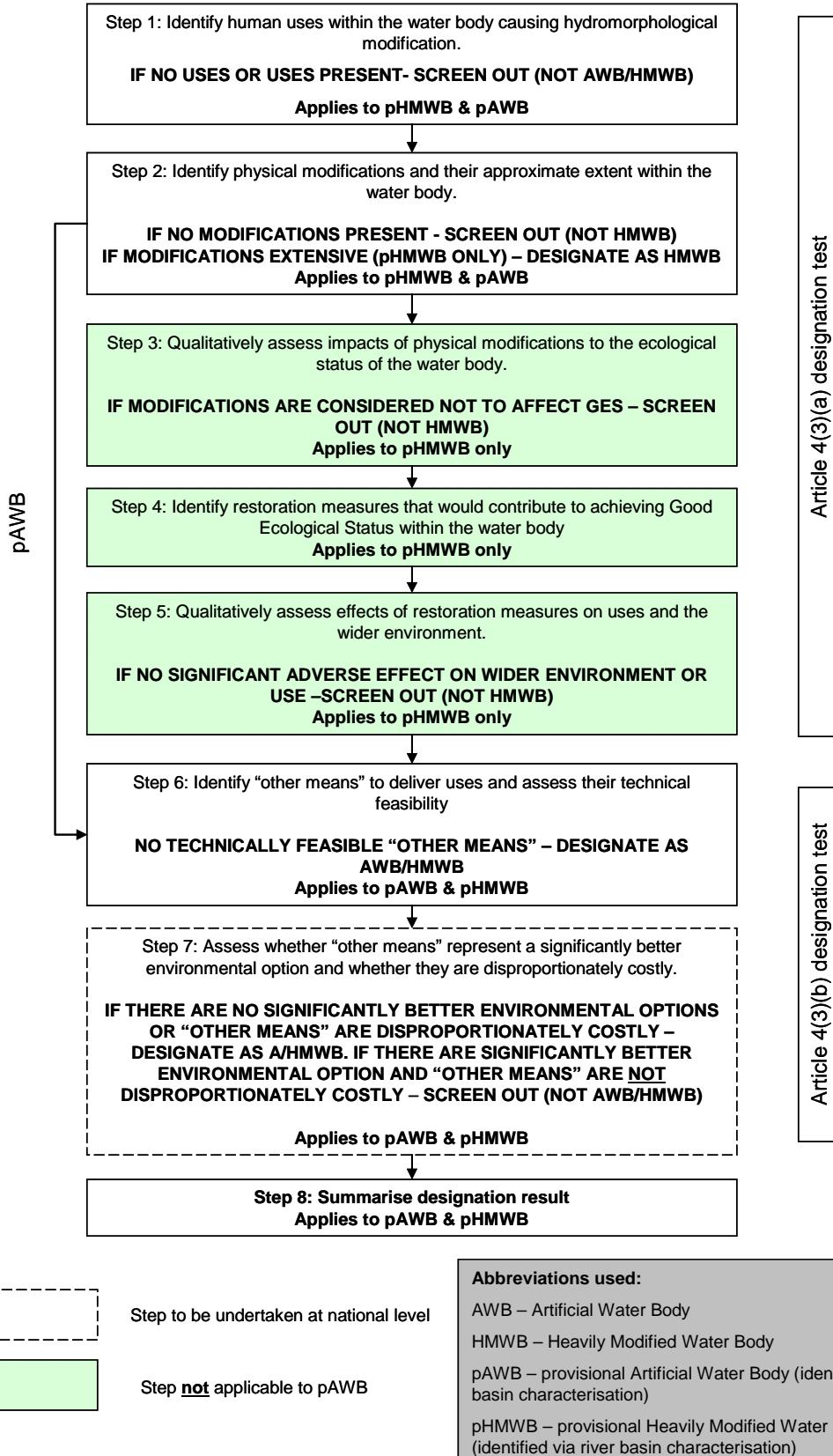
The detailed designation process took into account all eleven specified uses outlined in Article 4(3);

1. Wider environment
2. Navigation including port facilities
3. Recreation
4. Drinking water supply
5. Power generation
6. Irrigation
7. Water regulation, subdivided into i) strategic water transfers and ii) impoundment releases
8. Flood protection
9. Land drainage
10. Urbanisation
11. Other equally important sustainable human development activities

Several specified uses may be extensive within a water body. For example a riverine water body may be used extensively for Navigation, Flood Protection and Urbanisation.

The detailed artificial and heavily modified water body designation process comprised of eight steps (Figure I.5). The steps highlighted in light green did not apply to artificial water bodies. Further detail on the steps can be found below.

Figure I.5 Outline of detailed artificial and heavily modified water body designation process



Further detail on the steps outlined in Figure I.5:

- Step one involved setting out the links between the pressures identified in the provisional identification of artificial and heavily modified water bodies, and the human uses associated with these pressures. Where water bodies did not have a specified use (and therefore could not have Article 4(3) tests applied), the water body was screened out from further assessment. The water bodies screened out were passed back into the broader river basin management process and have a target objective of good ecological status. Those which are not screened out remained as provisional artificial and heavily modified water bodies and continue to step two.
- Step two involved the identification of those physical modifications that could result in changes to the hydromorphology of the water body. These changes needed to be long-term and substantially alter the water body morphological and hydrological characteristics. These modifications also needed to have a specified use as determined in Article 4(3). If there were no such physical modifications then the water body was screened out as not heavily modified. For provisional heavily modified water bodies, if there were extensive modifications present that had an associated specified use then it was assumed they would meet the Article 4(3) tests and the water body could be designated as heavily modified and screened out from further tests, provided the justification for the designation was recorded. For provisional artificial water bodies, as the water bodies are artificial, by default there must be extensive modifications associated with the water body, therefore it was not appropriate to apply this step.
- Step three involved bringing together information regarding morphological modifications (from step two) and expert judgement from the Environment Agency ecology and biodiversity teams regarding the perceived ecological status of the water body. These teams were asked to assess how morphological modifications are affecting ecological status. Where water bodies are thought to be able to achieve good ecological status with existing hydromorphological modifications, the water body was screened out as not heavily modified. Those which were not screened out remained as provisional artificial or heavily modified water bodies and continued to step four.
- Step four identified any potential hydromorphological restoration actions that could result in the water body achieving good ecological status. This step was informed by the expert knowledge of linkages between modifications and the ecology identified in step three.
- In step five, information that had been gathered from earlier steps is pulled together in order to qualitatively assess the effects of restoration actions on the specified uses or the wider environment. Water bodies where restoration actions would not significantly affect the use or the wider environment in a negative way were screened out as not designated. These restoration actions to achieve good ecological status should go forward to the river basin management process (and be assessed as to their technical feasibility and cost effectiveness). The remaining water bodies were then assessed further in step six.
- Step six looked for ‘other means’ of delivering the benefits of the specified uses. If the ‘other means’ for providing the intended uses benefits were found to be technically infeasible then the water body can be designated as artificial or heavily modified as the water body had met the requirements of Article 4(3)(b). Otherwise the water body is assessed further in step seven.
- Step seven considered the environmental benefit and monetary cost of any ‘other means’. Where the ‘other means’ were disproportionately costly or a worse environmental option, then water bodies could be designated as artificial or heavily

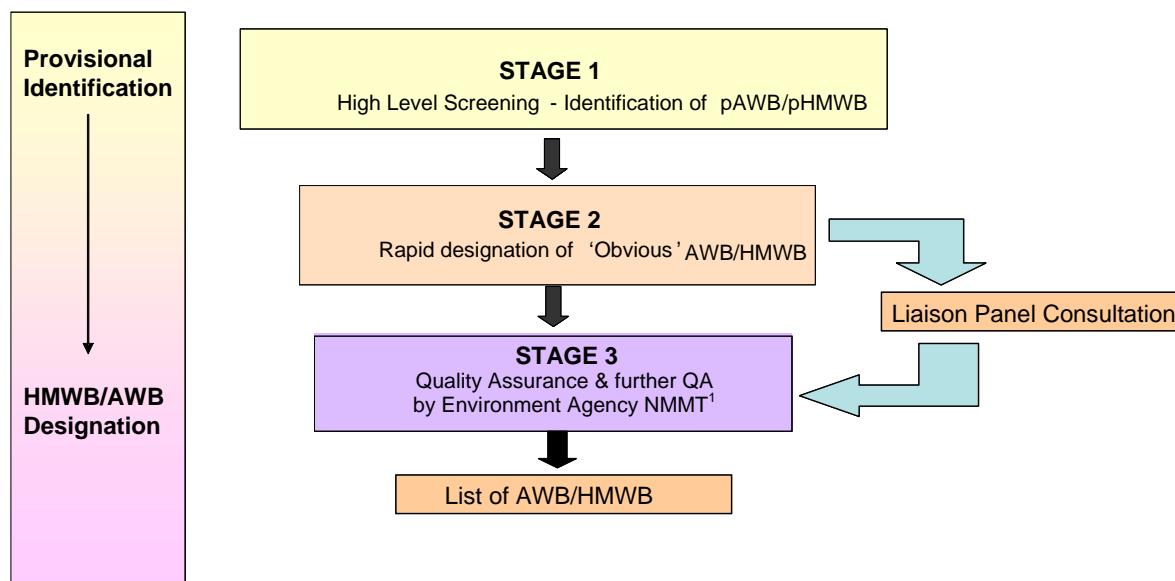
modified. If the ‘other means’ identified were a better environmental option and were not disproportionately costly then the water body could not be designated and screened out of further assessment. Only a small number of water bodies reached step seven to undergo these economic tests, most had been screened out at earlier stage.

- The final step (step eight) compiled all the steps undertaken during the detailed assessment and reports whether the water body was designated as an ‘artificial water body’, ‘heavily modified water body’ or ‘not artificial or heavily modified water body’ and any relevant comments supporting the designation.

I.3 Estuarine and coastal waters water bodies

The designation of Artificial and Heavily Modified Water Bodies for Estuarine and Coastal Waters process is described in Figure I.6 below.

Figure I.6. Summary of steps in the designation of estuarine and coastal water bodies
(¹National Marine Monitoring Team)



Estuarine and Coastal Water Bodies were designated as Artificial and Heavily Modified Water Bodies for the following uses (outlined in the following sections)

- Flood protection use
- Navigation, ports and harbours use
- Coast protection use
- Marine aggregate extraction use
- Marine shell and fin fisheries use

The thresholds that were applied to the relationships between physical pressures, morphological change and ecological impacts were based on expert judgement.

Flood protection use

Water bodies were assessed that had significant flood risk management assets that modify the hydromorphological characteristics to protect land. The removal of these assets could therefore compromise the benefits provided by flood protection.

The assessment was based on three separate elements relating to:

- the extent of reclaimed land protected by shoreline flood protection assets;
- barrages and barriers across the width of the main water body or forming a boundary with another water body which provide flood protection benefits; and
- sluices across the width of the main water body or forming a boundary with another water body which provide flood protection benefits.

It is recognised that there are a large number of sluices associated with coastal and estuarine flood protection structures but these generally do not form the boundary with an adjacent water body. The view has been taken that such structures are only likely to be significant in the context of heavily modified water body designation where they span the width of the main water body or form a boundary with an adjacent water body. In addition to barrages/barriers and sluices, there are also a number of weirs in estuarine and coastal waters. However, none of these are considered to provide any flood protection benefit. Their main purpose has generally been to maintain water levels in the vicinity of upstream towns/villages, and they are therefore not considered further in the assessment.

Navigation, ports and harbours use

Water bodies were assessed that had a significant navigation, ports or harbour use that modifies the hydromorphological characteristics of the water body.

The assessment tested whether the actions to achieve good ecological status in these water bodies would compromise the benefits of navigation or ports and harbours.

The key criteria that have been used for the assessment were:

- the extent of navigation dredging in the water body - maintenance of navigable depth in previously deepened areas is critical to maintenance of the navigation use;
- the extent and intensity of dredge material disposal in the water body - disposal of dredge material is critical to the maintenance of the navigation use; and
- the extent of reclaimed areas behind quay lines - loss of quay line will directly affect specified use (unless there is significant long-term spare capacity).

Where the answer to any question was uncertain, the decision on whether to designate as a heavily modified water body for navigation or port and harbour use was deferred and the water body designated using expert judgement from Environment Agency area and national staff (taking into account any stakeholder comments available for the water body).

Coast protection use

Water bodies were assessed that contained significant coast protection structures/structures associated with the manipulation of sediment transport. The assessment examines whether the actions to achieve good ecological status in these water bodies would compromise the benefits provided by the coast protection structures.

The key criteria that have been used for the assessment were:

- the extent of influence of manipulators of sediment transport on inshore waters within the water body; and
- the extent of infrastructure development afforded protection by coast protection structures.

They typically include soft cliff protection structures (linear defences) and beach erosion structures (groynes, offshore breakwaters). In some locations, coast protection is also delivered through beach nourishment. In some instances coast protection structures may also provide a flood defence function.

Where the answer to any question was uncertain, the decision on whether to designate as a heavily modified water body for reasons of coast protection was deferred and subject to more detailed assessment during the Environment Agency quality assurance and stakeholder consultation.

Marine aggregate extraction use

Water bodies were assessed that were subject to marine aggregate extraction. Where such pressures were deemed to be significant, the assessment tested whether the actions to achieve good ecological status in these water bodies would compromise the benefits provided by the activity.

The key criteria that have been used for the assessment were:

- the extent of water body area licensed for marine aggregate extraction (Marine aggregate extraction generally occurs offshore and most licensed sites are out of the 1nm from baseline WFD boundary). However, a small number of extractions do take place within WFD water body boundaries including:
 - sub tidal extraction of sand and gravel;
 - intertidal extraction of sand; and
 - subtidal extraction of marl.
- the extent of water body area subject to active extraction or sediment disturbance in the past decade.

Where the answer to any question is uncertain, the decision on whether to designate as a heavily modified water body for reasons of marine aggregate extraction was subject to a more detailed examination using expert judgement from Environment Agency area and national staff (taking into account any stakeholder comments available for the water body).

Marine shellfisheries use

Water bodies were assessed that were subject to marine shellfisheries use. Where such pressures are deemed to be significant, the assessment tested whether the actions to achieve good ecological status in these water bodies would compromise the benefits provided by the activity.

The criteria that has been used for the assessment was the extent of the shell fishing beds within designated shellfish waters within the water body.

The main hydromorphological impacts of shellfisheries include presence of structures (for cultivated shellfisheries) and bed disturbance during harvesting of shellfish (dredging, suction dredging). The alleviation of the pressures associated with shellfisheries can be achieved through reductions in the amount and intensity of harvesting and/or through controls on harvesting methods.

The assessment was based on the following information:

- extent of shellfish beds within designated shellfish waters in the water body; and
- threshold of 15% of total water body area to identify whether the water body is at risk of failing good ecological status.
- whether the shell fishing activities within the water body are likely to cause significant seabed disturbance and cover an area of greater than 15% of the water body area, (information supplied by the local Sea Fisheries Committee)

Where a water body is at risk from shellfisheries bed disturbance pressures (either alone or in combination with other forms of physical modification), two further specific tests need to be applied for a water body to be designated as heavily modified:

- would a reduction in extent of harvesting activity or change in harvesting method have a significant adverse effect on shellfisheries activity;
- would all environmentally better and technically feasible alternatives be disproportionately costly?

Consultation with Sea Fisheries Committees has indicated that the answer to both of these questions would generally be “Yes”. For the purposes of this assessment, if a water body has been identified as “at risk” because of shellfisheries pressure, it has been designated as a heavily modified water body.

Where responses have not yet been provided by the relevant Sea Fisheries Committees, the water body was flagged as “Unsure” and the final designation decision was made taking into account any received stakeholder and Environment Agency area comments before quality assurance.

Marine fin fisheries use

Water bodies were assessed that were thought to be supporting significant fin fisheries activities. The criterion used for the fin fisheries assessment was:

- the extent of fin fishing activities including Otter and Beam trawling known to cause significant seabed disturbance

Where responses were not provided by the relevant Sea Fisheries Committee, the water body was flagged as “Unsure”. These were then further assessed as part of the Environment Agency quality assurance using any additional information from the stakeholder consultation.

I.4 Liaison panel review and further quality check of results

Liaison panel review

After the rapid designation stage was complete, these interim results formed the basis of a liaison panel consultation. Liaison panels were invited to comment on the results from the rapid designation and provide any additional evidence they held on water bodies. Any information provided by the liaison panels was used to augment the existing information held within the Environment Agency. Where designation results from the liaison panels and the rapid designation process were contradictory the water body information was reviewed and designation results were modified where appropriate.

Quality check of designation results

A further quality check of the designation results was undertaken as part of the ecological potential classification process. This was the first time the water body designations were used operationally in order to classify artificial and heavily modified water bodies. Through this process various corrections were made where designations were found to be inaccurate.

Cross check with ecological status of the water body

After the designation process was completed the Environment Agency made a cross check of the designation results and the ecological status of the water body. In some cases it was found that a water body has been designated as heavily modified yet the biological elements surveyed are showing good ecological status. Where this was the case the HMWB designation was removed. Further biological monitoring will be carried out between 2010 and 2012 to confirm that it was right to remove the designation.

I.5 Designation of Additional Water Bodies

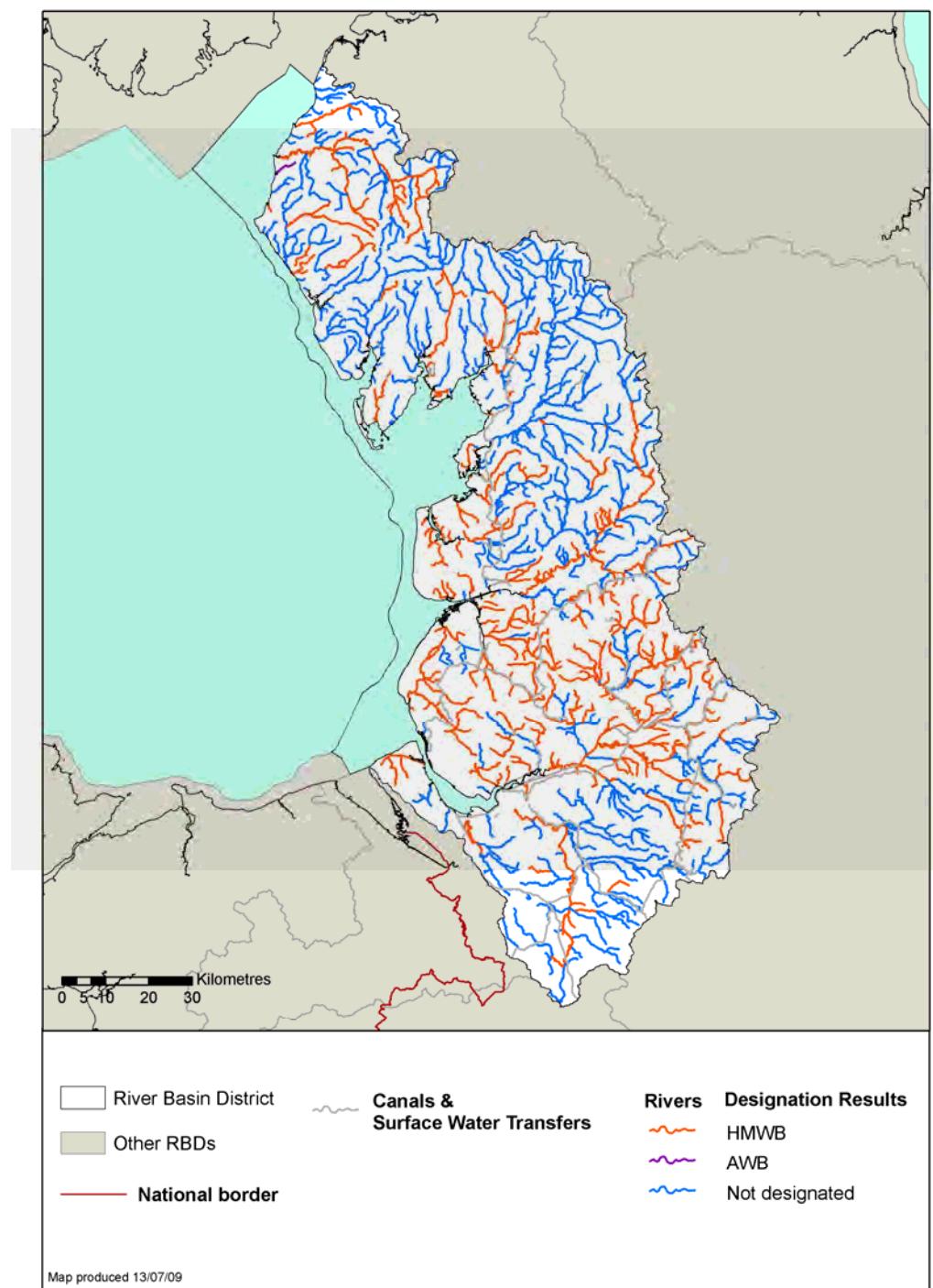
In March 2008, the Secretary of State agreed to the inclusion of additional water bodies and the re-delineation or splitting of a small number of existing water bodies. These water bodies were not identified in time to be included in the designation process described above. Due to resource constraints and limited data availability, these water bodies have been assessed as part of a much simpler designation process, largely based on the results of the hydromorphology risk assessments. Annex G discusses risk assessment in more detail.

Any water body with an 'at risk' or 'probably at risk' classification from the hydromorphology risk assessment process is designated as a provisional HMWB. Further map and aerial photography based analysis is used to identify provisional AWBs (based on physical indicators) which may include changing a previously identified pHMWB to a pAWB. An additional map-based assessment was used to provide a 'reality check' on the provisional designation status before the water bodies are finally identified as HMWBs or AWBs.

Water body use (or reason for designation) is based on the pressures identified in the hydromorphology risk assessment process and any further available information relating to use (e.g. conservation designation, drinking water protected area or freshwater fisheries protected area). The list of uses assigned to freshwater and coastal/estuarine water bodies is the same as that used in the full designation process described above.

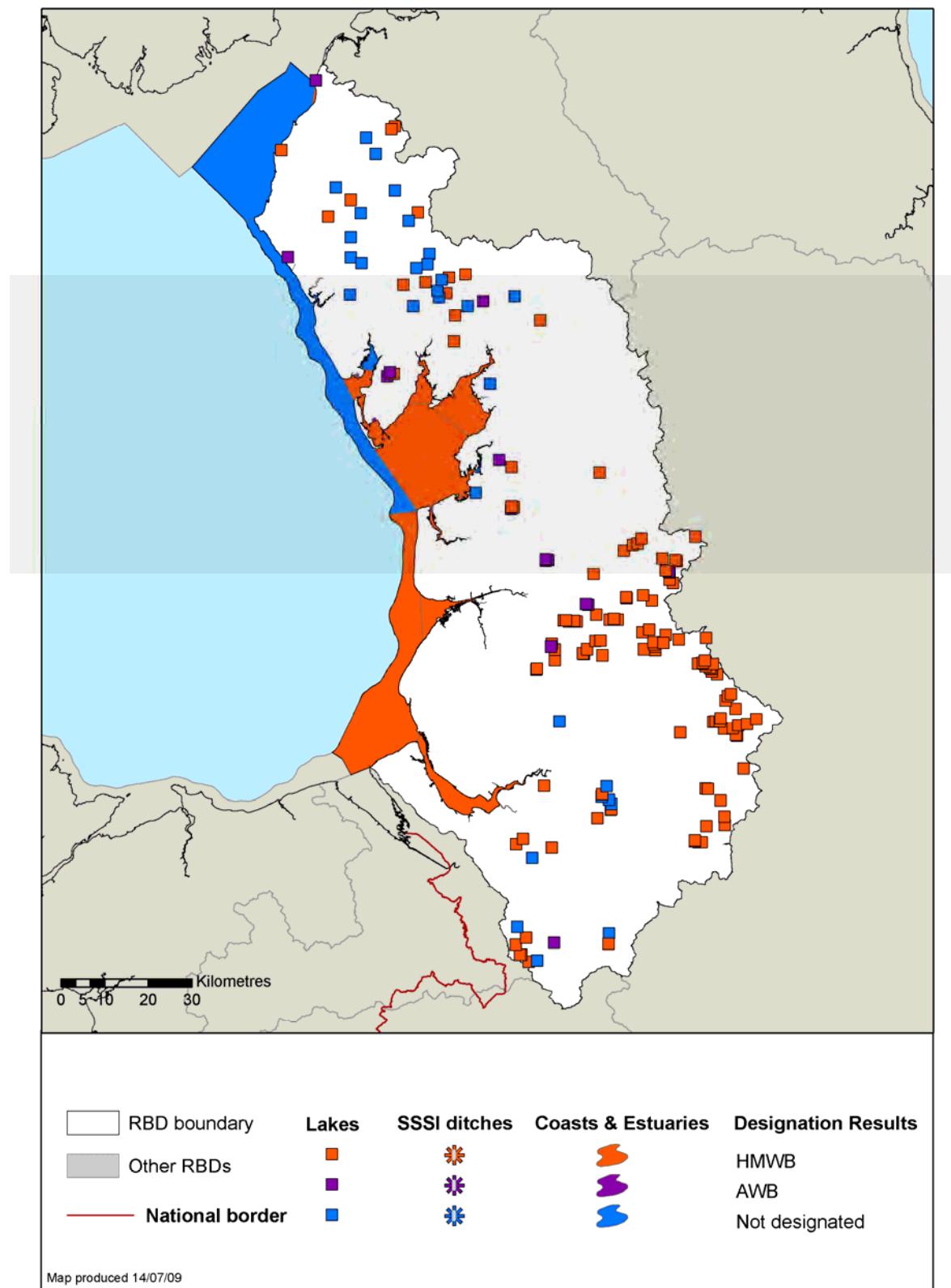
I.6 Results

Figure I.7 The designation status for riverine water bodies



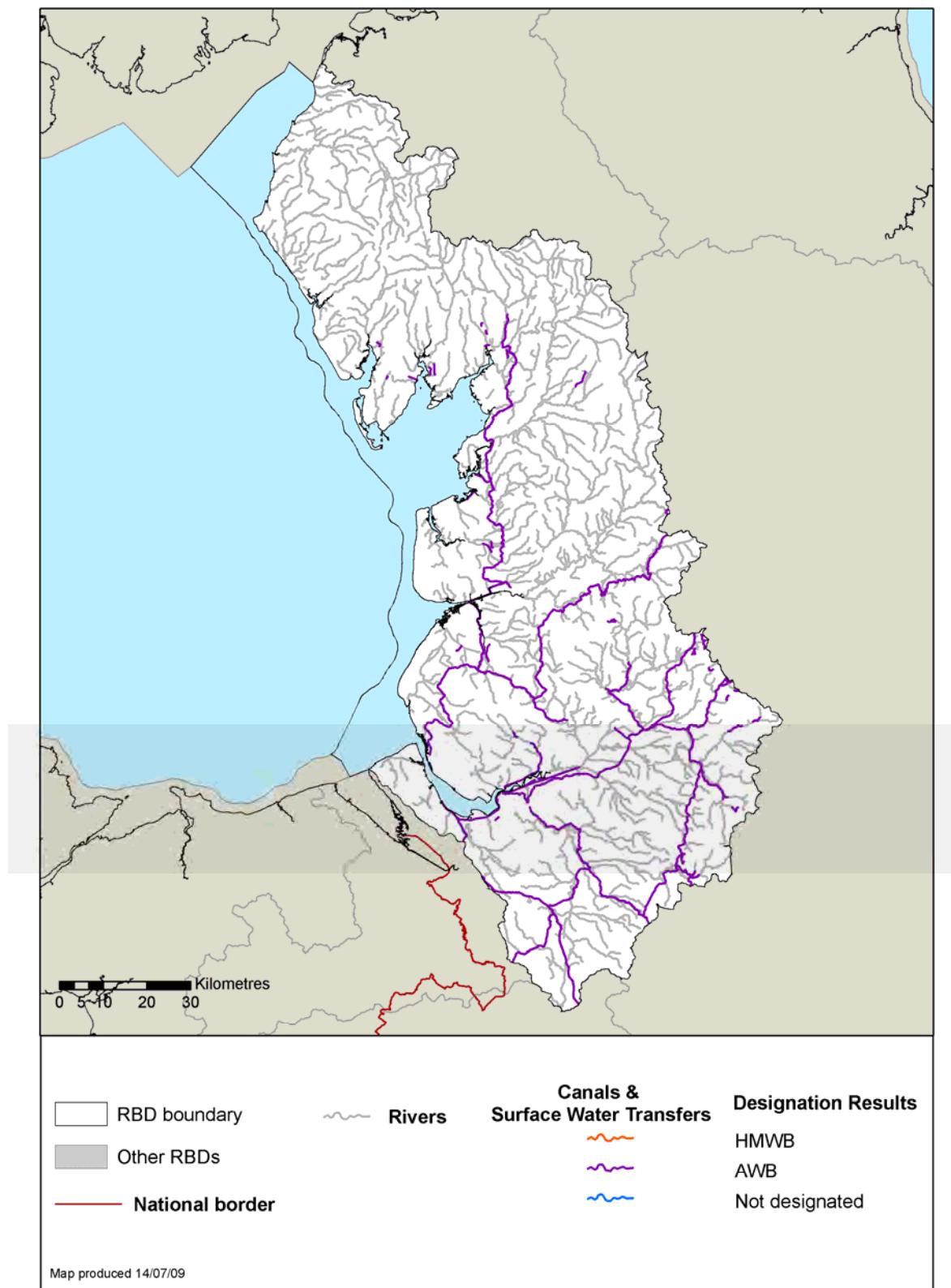
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Figure I.8 The designation status for lake, estuarine and coastal water bodies and SSSI ditches



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Figure I.9 The designation status for canals & surface water transfer water bodies



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Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex J: Aligning other key
processes to river basin
management

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J.1 Introduction

Purpose of annex

Ministerial guidance on river basin planning¹ identifies that a large part of river basin management will involve reviewing the wide range of existing policies, plans and measures and amending them where necessary, to meet Water Framework Directive objectives. This includes those for which the Environment Agency is responsible, and some which are the responsibility of other organisations.

This annex starts to identify where and how relevant policies, planning processes, management processes, programmes, initiatives and methods are being better aligned to deliver more sustainable outcomes for the water environment. The annex focuses on key planning processes that operate at a regional level, which are linked to the river basin management process, namely,

- Urban and rural land use planning; and
- Flood and coastal erosion risk management.

Marine planning is also covered because of ongoing developments with the Marine Bill and alignment to river basin management.

The Annex identifies both national alignment of generic processes as well as more targeted local work.

Alignment, in some respects, represents a measure or an action in itself. It should help deliver more widespread and sustainable outcomes, more quickly, for on-going river basin management. This annex is not intended to be comprehensive, rather more illustrative, with the intention that this alignment should and will continue as part of on-going river basin management. Annex F identifies many of the key legislation, policies, plans and programmes that can help to deliver Water Framework Directive objectives.

Drivers for alignment

Government and a number of public bodies have a duty to help deliver sustainable development and most other organisations, whether public or private, have made commitments to carry out their activities with sustainable development in mind. In doing this the environmental dimension of sustainability must be balanced against economic and social dimensions. The general aim of the Water Framework Directive is to deliver sustainable water management. Any significant policy, planning process, management process, initiative or programme which has the potential to impact on water or the water environment should therefore consider the philosophy (Water Framework Directive, pre-amble), aims (Water Framework Directive, Article 1) and objectives (Water Framework Directive, Articles 4 & 7) of the Water Framework Directive.

Likewise, in delivering sustainable water management, implementation of the Water Framework Directive will need to consider economic and social dimensions while planning to deliver environmental outcomes. The main processes and mechanisms to do this are through the economic appraisal processes required to justify alternative objectives (Water Framework Directive, Article 4(3-7)) and the supporting impact assessments and recommendations from the Strategic Environmental Assessment reports which accompany the draft and this first River Basin Management Plan.

¹ River Basin Planning Guidance. Department for Environment, Food and Rural Affairs & Welsh Assembly Government. 2006

In the Regulations² implementing the Water Framework Directive in England and Wales there is a general legal duty on all public bodies, in exercising their functions, so far as affecting a river basin district, to have regard to the River Basin Management Plan and any supplementary plans.

Article 4(7) of the Water Framework Directive sets out the circumstances under which a deterioration in water body status or failure to meet Water Framework Directive objectives is permitted, where certain conditions are met. River basin management will involve reviewing the wide range of existing policies, plans and processes, discussed in this annex, in order to manage new physical modifications. Managing new modifications will require an assessment of the potential impact of the modification on water body status and an application of Article 4(7) where appropriate. The Environment Agency will review its own policies, plans and processes to incorporate a new process to manage new modifications through environmental assessment. The Environment Agency will provide guidance and advice to external organisations to ensure that no deterioration and water body objectives are met where new modifications are proposed, and an Article 4(7) defence is applied where necessary. The baseline water body status against which deterioration will be assessed is that reported in this River Basin Management Plan (see Annex B).

All new physical modifications occurring in water bodies between December 2006 and March 2009 have been assessed according to Art 4(7) requirements. Where a physical modification was identified as likely to have caused a deterioration in status or prevented a water body from meeting its water body objectives, then the Article 4(7) tests were applied. The results of this assessment are reported in Annex B of this plan. The list of physical modifications considered as part of the assessment was compiled from Environment Agency functions and external bodies (for example British Waterways and the Association of Inland Navigation Authorities).

Ministerial guidance on river basin management planning³ identifies that the Environment Agency should:

- promote and encourage awareness of impacts that activities and policies of other public bodies have on the water environment;
- work with other public bodies to develop good links between river basin [management] planning and other relevant plans and strategies, especially those plans that have a statutory basis (for example Regional Spatial Strategies and Local Development Frameworks/ Local Development Plans);
- promote and encourage the inclusion of Water Framework Directive considerations in public bodies' plans, policies, guidance, appraisal systems and casework decisions;
- take action to integrate and streamline its own plans and processes.

The guidance identifies that this should be a two way process.

Ministerial guidance on classification and standards for water⁴ identifies the environmental standards that must be embedded into Environment Agency policies, planning processes and classification schemes.

European and UK policies on climate change adaptation are also developing on the basis not only that climate change considerations need to be aligned into existing processes but also

² The Water Environment (Water Framework Directive)(England and Wales) Regulations 2003, Statutory Instrument 2003 No. 3242

³ River Basin Planning Guidance. Department for Environment, Food and Rural Affairs & Welsh Assembly Government. 2006.

⁴ Water Framework Directive: Directions to the Environment Agency on Classification of Water Bodies Department for Environment, Food and Rural Affairs & Welsh Assembly Government 2009

that aligning existing processes should, in itself, help deliver significant benefits for climate change adaptation (see Annex H).

This annex addresses almost unanimous stakeholder support⁵ for the principle of better alignment and where possible integration of relevant processes to:

- help deliver more sustainable water outcomes more quickly;
- identify synergies and the possibility of more radical multiple-benefit solutions;
- deliver more efficient stakeholder engagement.

Opportunities for alignment

There are considerable overlaps between the aims, objectives and processes of many existing activities to those of the Water Framework Directive^{6,7}. This means there are significant opportunities for alignment. However there are issues which make this alignment complex such as differences in: responsible parties; spatial and temporal scale of planning and implementation; processes and tools; source funding restrictions and priorities. However significant progress can be made if parties are willing and clearly guided.

Alignment can be performed through better integration of policy (EU and UK), the consideration of the objectives and outcomes of different processes through planning **and** implementation activities and the embedding of process steps (e.g. option appraisal and justification of alternative objectives) and standard methods in existing processes. It is important that this alignment is ongoing through close working between key stakeholders at different organisational levels from national to local.

Figure J1 illustrates some of the key processes, which have an impact on sustainable water management and where they might sit, in terms of emphasis, in the three key dimensions of sustainability: environmental, societal and economic.

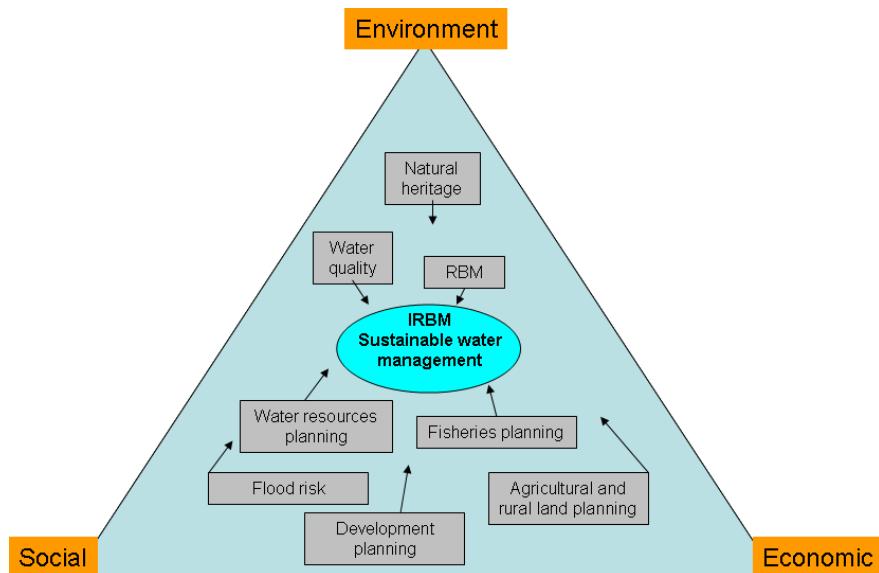


Figure J1: Some of the key processes which have an impact on sustainable water management.

⁵ Water for life and livelihoods. A framework for river basin planning in England & Wales. Environment Agency. Feb 2006

⁶ A research study into the production of Registers of Strategic Management Plans and Stakeholders. Feb 2002. For the Environment Agency by Land Use Consultants (in association with Conlan Consulting)

⁷ Consistent Economic Appraisal Approaches with Respect to the Water Framework Directive River Basin Management Plans. Collaborative Research Programme on Water Framework Directive economics Final report. Jan 2006. For the Welsh Assembly Government and Water Framework Directive Collaborative Research Programme by Jacobs in association with ADAS

The Strategic Environmental Assessment reports which accompany the draft and this first identifies some of the potential positive and negative interactions between other regionally strategic plans and policies with river basin management process and vice-versa.

J.2 Building, town & country planning and regeneration

Introduction

In England despite the current economic conditions, the National Housing and Planning Advice Unit feels that housing affordability and unsatisfied housing need has not lessened the demand for new homes and associated infrastructure (roads, schools, waste management and utilities etc). The Government still expects the number of new homes to rise significantly with three million additional homes proposed by 2020. This represents an increase of up to 40 percent over existing housing development rates and these are reflected in the latest rounds of Regional Spatial Strategies. Recent National Housing and Planning Advice Unit advice has suggested a possible need to consider even higher rates of housing delivery in England. This would be tested through revisions to Regional Spatial Strategies or the new Single Regional Strategies required under the Local Democracy, Economic Development and Construction Bill.

The impacts of all these new homes on the water environment and achieving Water Framework Directive objectives would be tested through the spatial planning system and its examination and appraisal processes as outlined below. For example, some of this development is in already water-stressed areas. The Government's Strategy for Water in England "Future Water"⁸ identifies that water efficiency will be taken into account in planning and delivery of housing growth.

Main aims of the spatial planning system

Under Section 39 of the Planning & Compulsory Purchase Act 2004, planning in England and Wales has the statutory purpose of contributing to the achievement of sustainable development as set out in the UK Sustainable Development Strategy⁹ and the Welsh Assembly Government's Sustainable Development Scheme for Wales¹⁰. The planning and management of development must therefore protect and improve the environment, respect environmental limits and contribute to a healthy and just society.

The spatial planning system has a direct and legitimate role in addressing the potentially significant sustainability implications of growth and development, particularly those arising through increased house building rates. This includes the very real impact new development can have on the water environment.

Local Authorities in England and Wales, Regional Assemblies in England, the Greater London Authority, National Parks Authorities and the Broads Authority constitute Planning Authorities. They are required to develop spatial land use plans to guide development and land use activity within their areas.

At the level of the English Regions and Greater London this is through Regional Spatial Strategies and the London Plan, respectively. These set policies in relation to development and land use, including the setting of specific house building targets for local authorities within their areas. Below these are local authority produced Local Development Frameworks. These identify locations for certain types of developments, including a 5 year

⁸ Future Water- The Government's Water Strategy for England. Defra. HM Government, Feb 2008.

⁹ Securing the future- delivering the UK sustainable development strategy. Defra Mar 2005.

¹⁰ <http://wales.gov.uk/topics/sustainabledevelopment/publications/onewalesoneplanet/?lang=en>

supply of housing sites to meet their housing targets and policies to control certain aspects of their form, location and, potentially, timing of development.

Together these represent the ‘development plan’ which provides the policy framework against which development must be assessed

These plans are subject to Sustainability Appraisal (incorporating Strategic Environmental Assessment) and will be tested through an Examination in Public.

Guiding the overall operation of this system is a range of planning policy guidance provided by Planning Policy Statements.

The new Infrastructure Planning Commission and National Policy Statements

Major infrastructure projects such as ports, power stations and transport schemes may have significant potential impacts on the water environment. Currently these are dealt with through other planning regimes¹¹.

The Planning Act 2008 creates a new system of development consent for certain types and scales of nationally significant infrastructure. Part 3 of the Act outlines the types and scales of development which will be covered by this new consent regime. This has established the formation of an Infrastructure Planning Commission who will examine and determine these proposals. To guide them a set of National Policy Statements covering these infrastructure types is currently being developed and, when in force, will set the framework for the Infrastructure Planning Commission’s decisions.

Spatial Planning and the delivery of the Water Framework Directive

The role of spatial planning is hugely important in improving the water environment, and as a minimum, the activities of all public bodies must not lead to a deterioration of the water environment. Regional and sub-regional and local plans and activities have a far-reaching influence on local business and communities.

The sustainable development duty which underpins spatial planning provides a real opportunity for the control of development to ensure we get the right type and quality of development, in the right place and at the right time. The spatial planning system can therefore be better aligned with Water Framework Directive to take Water Framework Directive objectives into account through national guidance and local processes. For example, it is essential that sustainable water management is incorporated into spatial plans and local guidance (such as Supplementary Planning Documents) and the control of applications for planning permission (such as Planning Conditions and section 106 Agreements). One way to ensure this happens is through their Strategic Environmental Assessment, for which the Environment Agency is one of the statutory consultees.

Public bodies should also identify opportunities for improvements and restoration work to maximise any contribution to meeting the Water Framework Directive objectives. Key areas of work are flood risk, land management and transport. Tools such as Water Cycle Studies (in England) at a project level can help identify and realise significant benefits for the water environment.

These spatial plans are also subject to Habitats Regulations Assessment which will assess their impact on and need to avoid and reduce impact to water-based Natura 2000 sites.

¹¹ These regimes include the Transport & Works Act 1992, the Electricity Act 1989, the Highways Act 1980, the Gas Act 1965, the Harbours Act 1964, and the Pipelines Act 1962.

The table below identifies the main Water Framework Directive pressures affected by growth and development and how spatial planning can contribute to addressing these.

Table J1- Main Water Framework Directive pressures affected by growth and development and how spatial planning responses can contribute to addressing these.

Water Framework Directive pressure	Contribution of growth and development to pressure	What spatial planning may be able to do address this
Point Source pollution	<ul style="list-style-type: none"> increased loads for waste water treatment, including Biological Oxygen Demand, nutrients, chemicals. Additional flows from new development areas putting pressure on sewerage capacity. 	<ul style="list-style-type: none"> timing and phasing development to coincide with delivery of additional capacity to meet demands from urban growth and industry. include policies in spatial planning documents (e.g. for sustainable drainage systems) and place conditions on the grant of planning permission to control the rate of runoff from new development into combined sewer systems – reducing frequency of storm overflow discharges. use of water cycle strategies early in development planning. ensure that development is designed to integrate these principles from the outset.
Diffuse non-agricultural pollution	<ul style="list-style-type: none"> during construction (mobilisation of contaminants, sedimentation, pollution incidents etc). afterwards through biological, chemical and other pollutants/sediments washing off from hard standing areas into watercourses. risk of misconnections 	<ul style="list-style-type: none"> where land may be affected by contaminants, include policies in development plan documents which encourage sustainable remediation techniques which reduces/removes/render them harmless. encourage good construction practices. require sustainable drainage systems which improve the quality of runoff rather than just controlling its quantity/rate.
Pressure on the quantity of water	<ul style="list-style-type: none"> abstraction and other artificial flow pressures arising from need to supply water to new developments. developments leading to physical modification of water courses, affecting the quantity and dynamics of flow (the hydrological regime). 	<ul style="list-style-type: none"> slow the increasing demand for water, e.g. through water efficiency policies (the code for sustainable homes and BREEAM incl. water efficiency measures). production and promotion of design guidance including retro-fitting. timing and phasing development to coincide with delivery of enhancements to water storage, transfer systems and local supply networks. use of water cycle strategies early in development planning.
Other impacts on the status of water	<ul style="list-style-type: none"> pressure for physical modification of watercourses (morphology). development in areas of flood risk (or development which increases flood risk elsewhere). biological pressures - including fish stocking, biota removal, invasive non-native species. 	<ul style="list-style-type: none"> spatial planning documents to include policies which protect natural water bodies from modification, and the improvement and naturalisation of heavily modified water bodies. applying Planning Policy Statement 25 (flood risk) by locating development sites outside of flood risk areas, controlling the rate and impact runoff downstream and mitigating the potential impacts of flood defences, drainage works and surface water management on water bodies. seek the inclusion of green infrastructure

Water Framework Directive pressure	Contribution of growth and development to pressure	What spatial planning may be able to do address this
	<ul style="list-style-type: none"> • increased pressure from Recreation (e.g. boating, fishing). • loss and fragmentation of habitats and green space • soil sealing (extensions, drives patios) 	policies within spatial planning documents. Green infrastructure can help deliver sustainable water management to help address existing issues and mitigate the effects of new development.

Each of the responses outlined above can be addressed sequentially at different stages of the planning process. For example, to address water resources it is necessary to analyse capacity and major infrastructure in a region (within Regional Spatial Strategies), consider local infrastructure and housing and other growth delivery trajectories in particular locations (Local Development Frameworks and Plans), and influence water efficiency in buildings through master-planning and the planning application process.

However, it should be noted that spatial planning does not generally influence the performance of existing development and the significant and ongoing impacts this will have on the water environment. There may be some exceptions where, to be sustainable, new development is subject to ‘neutrality’ policies which require efficiencies (i.e. water use) to be made within existing development. However initially the Environment Agency expect only a limited number of these situations. Other mechanisms will be required to manage this impact¹². It is clear however that more needs to be done, with Local Authorities, in housing renovation programmes. Work is ongoing to develop and ensure the implementation of appropriate actions to address this.

Aligning spatial planning and river basin management planning

As a statutory consultee, the Environment Agency already has much involvement in the spatial planning system through its existing work. Whilst the Spatial Planning system provides structures and mechanisms for delivering some of the outcomes of the Water Framework Directive, further work is already underway to better align these so they support the delivery of Water Framework Directive objectives.

To properly align river basin management and spatial planning to achieve the objectives of each regime we will all have to apply new standards, and over a period of time, review external guidance and policy and our advice to spatial planners so that development plans and planning applications become Water Framework Directive compliant.

There are three main areas in which spatial and river basin management can be better aligned. These are set out below:

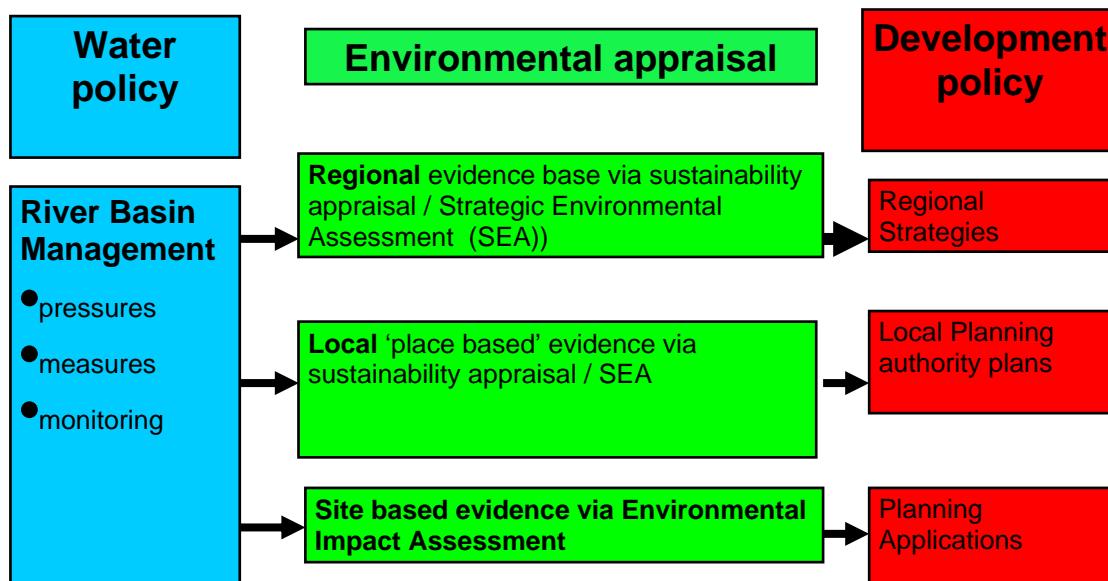
- **Providing evidence support to the spatial planning system through river basin management**

River basin management under the Water Framework Directive and the River Basin Management Plans provide key information on the pressures on the water environment. As

¹² See “Future Water: The Government’s water strategy for England. HM Government. Feb 2008

such the river basin management process can provide a robust evidence base to help the key planning stages of spatial plan options development and site allocations. It will also provide confidence in the deliverability and soundness of plans and be an invaluable input into any public examinations, including technical seminars and evidence sessions. A key way align the spatial and water planning systems is to ensure the analysis done for river basin management (and the River Basin Management Plans) feeds into the evidence and appraisal process required for all plans and the consideration of individual planning applications (see below).

Figure J2 – Proposed interaction of river basin management with the planning system



- **Providing Planning Guidance**

Further work by Government (supported by the Environment Agency) is already underway to clarify the implications for spatial planning and delivery of planned development. In England, primarily, this will occur through the production of a Water and Planning guide by Communities and Local Government – aimed for publication in late 2009 or early 2010. This guidance will set out government policy on water relevant to spatial planning and specifically what considerations local authorities and others involved in planning should take. It will also detail steps local authorities should or could take to reflect these considerations in local spatial plans.

Additionally, through the public consultation on National Policy Statements (and their accompanying Appraisals of sustainability) the impacts of these significant infrastructure projects on Water Framework Directive objectives will have to be embedded into this policy framework which will guide the Infrastructure Planning Commission's decisions.

- **Providing spatial planning advice as statutory consultee**

There is also a need to ensure Water Framework Directive objectives are better aligned with existing Environment Agency processes for engaging with spatial planning and the advice we provide to planning authorities. To these ends the Environment Agency intends to:

- Better co-ordinate its internal spatial planning policy work with other internal policy teams such as Sustainable Communities and river basin management teams;
- Influence Government Departments and national bodies to issue Water Framework Directive guidance and training for the planning profession;
- Review internal Environment Agency processes for dealing with Regional Spatial Strategies, Local development Frameworks/Plans and planning applications and ensure that they meet Water Framework Directive requirements;
- Review and improve our internal guidance to our teams to influence the spatial planning system to take account of Water Framework Directive objectives in spatial planning documents and policies; and
- Review and issue work instructions for our staff on how to take Water Framework Directive objectives into account when responding to planning consultations;
- Make Water Framework Directive information available to planning authorities in a useful format (e.g. Environment Agency “Environmental Information for Decision Makers project”).

Timescales

Overall timescales align, however the timescales for the production and review of regional spatial strategies and local development frameworks and the production and publication of the first River Basin Management Plans do not.

There is much variation on the production and adoption of spatial planning documents across England and Wales. Many spatial planning documents will have reached the submission stage before the first River Basin Management Plan has been published. This means that the emerging first River Basin Management Plans will have less weight in planning terms and may not have fully influenced the spatial planning documents. However, as adopted spatial plans are reviewed and the first River Basin Management Plan is published in December 2009, the spatial planning system will have to consider how to “have regard to the River Basin Management Plans” and how much weight to give to these in the decision making process.

North West River Basin District activity on alignment of building, town & country planning and regeneration for Water Framework Directive

Here we identify some specific examples of alignment of building, town & country and regeneration planning that has occurred in the North West River Basin District.

European Network of Municipalities and Rivers Project (ENMaR)

The European Network of Municipalities and Rivers (ENMaR) project was an international programme that ran from 2005 to 2007. It was designed to inform local authorities in five European countries about the Water Framework Directive and to help local planners understand its impact on their work. In England’s North West, the project held nine seminars and an international conference. It developed an extensive river basin district wide professional and practitioner network of spatial and water planners. Awareness of water and planning issues has been significantly increased within this network and this is being taken forward into further North West River Basin District projects called Waterproof Northwest. This follow-on project is an identified measure within the River Basin Management Plan.

Water cycle scoping studies for the North West Growth points

The five new growth points which fall wholly or partly within the North West River Basin District are required by Government to undertake a water cycle study for their area. The aim

of a water cycle study is to identify tensions between growth proposals and water services infrastructure capacity and environmental requirements, and identify potential solutions to addressing them. Because of the high levels of growth proposed and the interconnected nature of the catchments for three of the growth points, the Environment Agency North West commissioned Halcrow's to undertake a joint scoping study on behalf of the growth points. The final report has outlined the potential water management issues for the growth points and identified relevant steering group structures and stakeholders to take more detailed work forward.

Habitats Regulation Assessment of the North West Regional Spatial Strategy

The process of the Habitats Regulation Assessment (HRA) of the Regional Spatial Strategy identified several potential water management impacts from proposed growth on European Protected sites within the North West River Basin District. Careful integration of the Habitats Regulation Assessment outputs into the Regional Spatial Strategies has resulted in significant changes to policy wording which has strengthened the plans ability to ensure that growth proposals do not adversely affect the water environment. The Habitats Regulation Assessment process has also resulted in a much better understanding of these issues by spatial planners at a regional level and these are being considered right from start of the development of the North West's new Single Regional Strategy.

Regional Strategy 2010

Government legislation requires a move from a Regional Spatial Strategy (RSS) and a Regional Economic Strategy (RES) to a single integrated strategy for North West Region – RS2010. The implications will be, that the emphasis could shift away from regional planning, towards local planning. It is therefore crucial that we maintain and strengthen our links with Local Development Frameworks to integrate the principles of river basin planning into sustainable development in the region.

J.3 Rural planning and agriculture

Introduction

Because of the long-term risk of agricultural activities to the water environment, water supplies and to the quality of groundwater, it has recently been the focus of new policy development and programmes.

The current planning process for rural areas in England and Wales

The Town and Country Planning system (See Spatial Planning above) provides the most significant controls over land use planning in rural areas. However agricultural land managers still retain many permitted development rights for built development and are able to use land for different types of agriculture, or manage it in different ways which change environmental impacts. The current planning system for development does not address agricultural impacts on water.

Public incentive and subsidy led programmes

There are a variety of programmes, which provide substantial incentives and subsidies for land managers for a range of purposes, which can create a very strong motivation for changing land management or land use.

Programmes with a clear relevance to the river basin management process include:

- The Single Farm Payment of the Common Agricultural Policy and the design and implementation of the associated cross-compliance conditions;
- The Rural Development Programme for England;
- The EU Structural Fund programmes.

Regional Government offices, Regional Development Agencies, Natural England and the Forestry Commission are in charge of a large proportion of the planning and implementation of areas of work regarding rural development.

Single Farm Payments and the Rural Development Programme for England, operate on different funding cycles to the Water Framework Directive, making coordinated planning more difficult. Water Framework Directive objectives are included in agri-environment schemes, but it is a relatively recent driver for investment. The England Catchment Sensitive Farming Delivery Initiative, currently funded by Defra separately from the Rural Development Programme for England, aims to address biodiversity and water quality issues related to diffuse water pollution from agriculture and will also help to meet Water Framework Directive objectives. The Government's Land Use Foresight Project will look at how to address the impacts of water and land on each other in the longer term.

Coordination of the rural planning system

Planning for rural areas is co-ordinated largely through Regional Spatial and Economic strategies which include both urban and rural issues. Delivery bodies in the Regions tend to plan individually. In order to deliver successfully in rural areas, river basin management will need good co-operation between delivery bodies.

Rural planning processes that can potentially be aligned to the river basin management process, at a *policy and planning* level, are:

- Future diffuse pollution reviews, scientific evidence and related strategies and policy development that will derive from them;
- Future development of agriculture-specific and forestry-specific regulations addressing issues of significant risk;
- EU Common Agricultural Policy health check challenge agenda and periodic reviews of cross-compliance regulatory requirements;
- Future development of cross-compliance standards under the reformed Common Agricultural Policy;
- Future review of Rural Development Programmes particularly further development of Land Management Schemes and Catchment Sensitive Farming initiatives;
- Future reviews of National and regional strategies for trees, woodland and forestry focusing on the use of broadleaf woodland to reduce pollution risk.

There are also numerous, more specific, strategies which will offer an opportunity for future alignment with the river basin management process to reflect water planning objectives.

Strategy developers should be encouraged to accept the link between activities on land and their effect on water quality and the water environment. They should increase their emphasis on protection and improvement of soil and water quality and resources, make specific reference to the need of promoting better water quality outcomes and to the roles of agriculture and forestry in meeting Water Framework Directive objectives. Where possible, they should seek development of integrated strategies covering both agricultural and forestry management for each country, and provide a consistent message to land managers.

North West River Basin District activity on alignment of rural planning and agriculture for Water Framework Directive

Here we identify some specific examples of alignment of rural planning and agriculture that have occurred in the North West River Basin District.

North West Regional Implementation Plan

Resource protection and specific reference to delivering Water Framework Directive objectives is included in the North West Regional Implementation Plan for the Rural Development Programme for England. Delivery of The North West Livestock Programme, Environmental Stewardship Schemes and future local delivery will all contribute to improving rural land management.

Bassenthwaite Reflections

Bassenthwaite Reflections is a major partnership initiative working to improve the water quality of the Lake. The main focus of the initiative is to address diffuse pollution from all sources. These include land management (agriculture & forestry), highways run off and tourism. A similar project is now being worked up by the Lakes Partnership for Windermere.

Sustainable Catchment Management Planning

The Sustainable Catchment Management Planning (SCAMP) is a significant programme being delivered by United Utilities and the Royal Society for the Protection of Birds. The project looks to implement land management conducive to meeting SSSI condition and water quality standards.

Catchment Sensitive Farming

In the North West River Basin District the Wyre, Bassenthwaite Lake, Kent / Levens, Ribble, and selected catchments of the Cheshire Meres and Mosses form the England Catchment Sensitive Farming Delivery Initiative priority catchments. Under the Catchment Sensitive Farming project, farmers have made a significant contribution towards reducing sediment and nutrients entering watercourses through the production and implementation of soil and nutrient management plans. Working in partnership, farmers identified their potential to reduce inorganic fertiliser inputs, target manures more effectively. This reduces excess nutrient application to land and the potential to transfer sediment or nutrients to watercourses.

J.4 Forestry management

Both commercial and recreational forestry activities deliver significant economic and social benefits, but they can also impact on the environment.

Forest management and planning falls outside the boundaries of development planning regulation and the Environment Agency is not a statutory consultee on forestry issues. A key element for successful implementation of the Water Framework Directive will therefore be the establishment of appropriate links between the river basin management and the forest planning and regulation systems in England and Wales. The Environment Agency is currently able to comment on a non-statutory basis on license applications submitted to the Forestry Commission. The Environment Agency also serves on steering groups involved with the Regional Forestry Frameworks and can exert influence via this route too.

Operational issues

The Forestry Commission produced (in conjunction with a working group) the 'Forests and Water Guidelines'. These guidelines provide the basis for sustainable management of the water environment by forest planners and managers. The fourth edition of these guidelines is currently being revised, and will take into account the Water Framework Directive. In order to ensure the sustainable management of the water environment by forest planners and managers it is important to bring about the widespread adoption of the "Forests and Water Guidelines", both in terms of management practices and in the planning of new forests.

The Forestry Commission administer part of the England Rural Development Plan funds to offer forestry grants to landowners. These grants encourage both the management of existing woodland and the creation of new woodland. Correctly located native woodland can help deliver Water Framework Directive objectives – an example of partnership working to target woodland management is the work done around Bassenthwaite Lake where land at risk of causing sedimentation is a priority target for woodland grants.

Going forward we will all have to build on our assessments of the extent and types of pressures affecting the aquatic environment in forested catchments. Parties will need to work in partnership to implement river basin management in relation to both planning and management and influence forestry management practices with appropriate agreed management actions.

J.5 Flood and coastal erosion risk management

EU Floods Directive

Implementation of the EU Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) will be closely co-ordinated with the Water Framework Directive. The assessment and management units (e.g. river basin districts) and the planning cycles for the two directives will be closely aligned. The EU Common Implementation Strategy for the Water Framework Directive also supports the implementation of the Floods Directive, through Working group F on Floods. This group is co-ordinating implementation as a core activity in its work-programme. As well as administrative co-ordination, the Floods Directive requires that the environmental objectives of the Water Framework Directive are taken into account in flood and coastal erosion risk planning.

Flood and Coastal Erosion Risk Management Strategies

The government, through the draft strategy for Flood and Coastal Erosion Risk Management (FCRM), 'Making Space for Water'¹³, has expressed the intention to move towards a more holistic approach to FCRM that takes into account all sources of flooding.

Their stated aim is to manage risks by employing an integrated portfolio of approaches which reflect both national and local priorities, so as to:

- reduce the threat to people and their property; and
- deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles.

This shift in emphasis fits in with the concept of integrated river basin management that the Water Framework Directive seeks to establish. However there are other FCRM initiatives that are already moving the sector towards this way of working and that will help to deliver Water Framework Directive objectives and measures.

Flood and Coastal Erosion Risk Management Outcome Measures

From 1st April 2008 "Outcome Measures" became the new performance framework to measure the overall benefits of FCRM investment in England. The outcome measures have been developed as part of the "Making Space for Water" programme, to provide greater clarity on what policies and funding for FCRM intended to achieve. As well as providing criteria for the prioritisation of projects, the outcome measures have also been used to set targets for FCRM over the current spending review period.

Through the delivery of outcome measures 4 and 5 (table J2), FCRM activities already contribute to delivering more sustainable water outcomes for river basin management.

¹³ First Government response to the autumn 2004 Making space for water consultation exercise, March 2005

Table J2: “Making Space for Water” outcome measures 4 & 5

Outcome Measure	Description
Outcome measure 4. Nationally important wildlife sites	This measure will record, through liaison with Natural England and Countryside Council for Wales, the delivery of flood, water level and coastal management remedies which contribute to the government target to have 95 per cent of Sites of Special Scientific Interest in favourable condition by 2010.
Outcome measure 5. UK Biodiversity Action Plan habitats	This measure will record the overall increase in Biodiversity Action Plan habitat achieved through flood and coastal erosion risk management activities by March 2011. This is to contribute towards delivery of the Environment Agency Wetland Policy to ‘conserve, enhance and re-create the wetland capacity of catchments as part of our contribution to rebuilding biodiversity on a landscape scale’.

Pitt Review

The Pitt Review provided recommendations following flooding which struck much of the country in England and Wales in June and July 2007. The floods were extreme, affecting hundreds of thousands of people and was the most serious inland flood since 1947.

The Review contains 92 recommendations that are addressed to the Government, Environment Agency, local authorities, Local Resilience Forums, providers of essential services, insurers and others, including the general public¹⁴.

The Government supports all of the recommendations in the Review. Recommendations that could affect the delivery of River Basin Management Plans are mostly concerned with improvements to the spatial planning system, or high level flood risk management planning processes that could lead to diffuse pollution from urban sources and working better with natural processes whilst delivering flood risk management. The Environment Agency has already acted on many of these recommendations.

Surface Water Management Plans

The Pitt Review (recommendation 18) concluded that surface water management plans should provide the basis for managing local flood risk. A Surface Water Management Plan is a framework through which key local partners with responsibility for surface water and drainage work together to understand the causes of surface water flooding and agree the most cost effective way of managing that risk.

The Surface Water Management Plan can also provide a framework for the management of urban water quality (e.g. the control of discharges from combined sewer overflows, surface water drainage outfalls, sustainable drainage systems and the urban surface generally). Solutions which can address both flood and pollution risk have dual benefits, and can contribute to fulfilling improvements and compliance in ecology, water quality and habitats required under the Water Framework Directive.

Integration of Water Framework Directive objectives through environmental assessment

FCRM plans and projects will try to deliver river basin management objectives and measures in parallel where an opportunity exists to do this. Environmental assessment and compliance under the Environmental Impact Assessment and Strategic Environmental Assessment

¹⁴ ‘Learning lessons from the 2007 floods’, Sir Michael Pitt, June 2008

Directives entails that FCRM projects already take account of the Water Framework Directive, and this requirement is supported by Guidance on the Appraisal of FCERM¹⁵.

A number of research and development projects are being conducted to support this work including: Defra's FD2609 research project 'Water Framework Directive and Expert Assessment' will set out appropriate ways of assessing the ecological impact of a FCERM; The 'Mitigation Measures Manual for FCERM and Land Drainage' will provide an online toolkit for project managers to design appropriate hydromorphological mitigation measures into FCERM schemes; and the Environment Agency project 'Mitigation Measure Trials' will put in place a programme of trialling and monitoring of a number of mitigation measures (e.g. Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution; Increase in-channel morphological diversity etc).

Taking river basin management into account in high-level Flood and Coastal Erosion Risk Management planning

River basin management will be taken into account in all levels of Flood and Coastal Erosion Risk Management planning (see figure J3- for England).

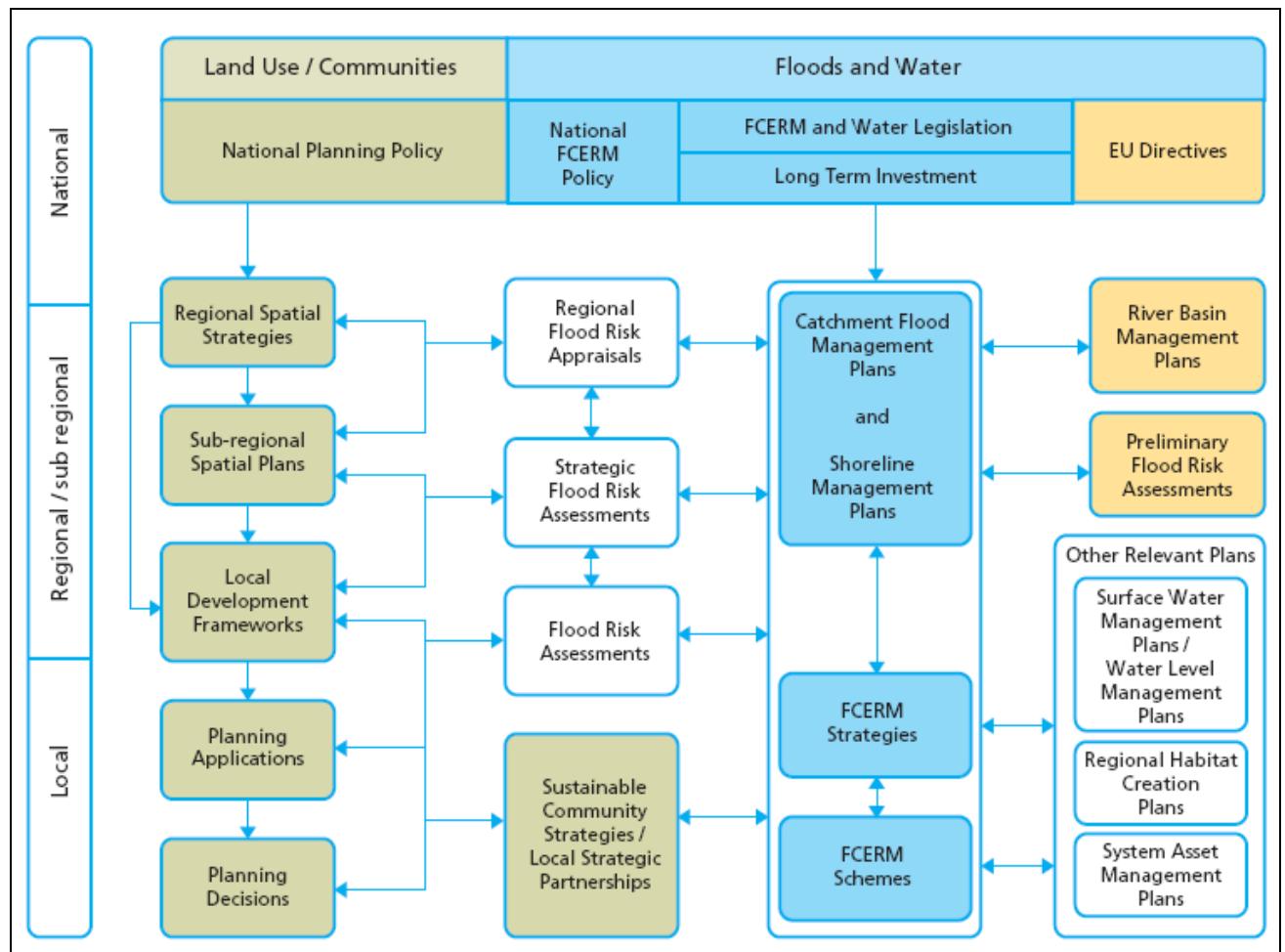


Figure J3- The flood and coastal erosion risk management planning framework for England

¹⁵ Appraisal of flood and coastal erosion risk management - A Defra policy statement, June 2009

Shoreline Management Plans (SMPs): The second generation of Shoreline Management Plans are currently being developed. Guidance has been published that enables these plans to take Water Framework Directive objectives into account¹⁶. The guidance also requires a high level assessment of the ecological impact of each Shoreline Management Plans policy, to ensure that any conflict with the objectives of the Water Framework Directive are flagged up as early as possible in the coastal FCRM planning process.

Catchment Flood Management Plans (CFMPs): Policies and their supporting actions that have been set out in the recently published CFMPs will move FCRM towards a catchment-based approach that will help to deliver sustainable water objectives. However these actions are not yet funded and will be subject to further planning so cannot be included as measures within the River Basin Management Plans.

The Environment Agency has carried out an exercise to determine where CFMP policies may present opportunities and constraints in each River Basin Management Plan. The generic CFMP policies and their possible ramifications for river basin management are listed below in table J3. A river basin district specific analysis of the distribution of these policies is found in table J4.

Table J3 – Catchment Flood Management Plan policies

Policy	Description of policy	Interaction with River Basin Management Plans
1	Areas of little or no flood risk where the Environment Agency will continue to monitor and advise	This policy unit is unlikely to be currently managed for flood risk so no change.
2	Areas of low to moderate flood risk where the Environment Agency can generally reduce existing flood risk management actions	Opportunities to remove or allow the natural decay of existing physical modifications. Maintenance may be reduced, so pressures stemming from biota removal and other maintenance activities could be addressed. Diffuse and point source pollution may increase with the effects of climate change (such as increased storminess), as will sedimentation.
3	Areas of low to moderate flood risk where the Environment Agency are generally managing existing flood risk effectively	May require the same level of physical modification to be sustained. The frequency of instances of point source pollution are likely to remain similar, but there may be more diffuse pollution and sedimentation in line with increased storminess from climate change leading to more run-off from agricultural and urban infrastructure.
4	Areas of low, moderate or high flood risk where the Environment Agency are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change	Level of physical modification may have to increase to cope with increased risk from climate change. However, more holistic solutions may be found to compliment existing structures and minimise increases in run-off, possibly providing opportunities for diffuse pollution and sedimentation reduction. Biota removal and other maintenance activities might also be increased or decreased.
5	Areas of moderate to high flood risk where the Environment Agency can generally take further action to reduce flood risk	Probable increase rather than reduction in the level of physical modification, but the area is likely to already be designated as 'heavily modified'. Biota removal and other maintenance activities may increase. Complimentary Flood and Coastal Erosion Risk Management solutions may be promoted that improve the way land is managed, or utilise natural flood storage on tributaries that contain less risk.

¹⁶ Assessing shoreline management plans against the requirements of the Water Framework Directive, April 2009

		This could offer opportunities for the reduction of pressure on water bodies from diffuse pollution and sedimentation.
6	Areas of low to moderate flood risk where the Environment Agency will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits	Opportunities to reduce pressure from diffuse pollution and sedimentation. Levels of physical modification may increase or decrease in these policy units as flood storage may be natural floodplain storage or artificially created flood storage. Maintenance activities such as biota removal could also increase or decrease depending on the type of flood storage required.

North West River Basin District activity on alignment of flood risk and coastal erosion risk management for Water Framework Directive

Here we identify some specific examples of flood risk and coastal erosion risk management that have occurred in the North West River Basin District.

Shoreline Management Plan development

Many of the coastal and estuarine waters in the North West have been designated as heavily modified due to their use as ports or the presence of sea defences. The Shoreline Management Plans set out strategies for managing coastal flood risk. As part of the review of Shoreline Management Plans we are assessing how, in delivery, they can help us all to achieve the aims of the River Basin Management Plans.

Strategic Environment Assessment

Strategic Environment Assessment is integral to CFMPs preparation, therefore environmental considerations and impacts are built into the strategy process to some degree. We are working with FCRM planning processes in developing strategies to identify opportunities for 'multiple objective projects', for example habitat creation, delivery of river channel enhancements or water quality improvements. By involving staff in scoping these projects we have been able to provide an early assessment of risk associated with River Basin Management Plan objectives.

Catchment Flood Management Plans

Our recently developed Catchment Flood Management Plans (CFMPs) set out the long term direction of flood risk management for individual catchments. They set holistic policies for managing flood risk for the next 50-100 years, taking into account changes such as climate change, urbanisation and land management.

Each of the six generic policies found in CFMPs offer different opportunities and constraints for delivery of the Water Framework Directive. The generic CFMP policies and their possible ramifications for river basin management are listed above in table J3.

We have analysed the distribution of CFMP policies in each catchment of the North West River Basin District see where these opportunities and constraints are, the results are found below in table J4. The figure represents the proportion of water bodies in each catchment of the river basin district that could be affected* by each generic CFMP policy.

*those where 20 per cent or more of the water body is located within a CFMP policy type.

Table J4 – Distribution of Catchment Flood Management Plan policies in North West River Basin District

North West River Basin District - Catchment Name	Number of water bodies	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5	Policy 6
Alt/Crossens	14	0%	0%	36%	64%	0%	29%
Derwent (NW)	39	0%	69%	3%	0%	8%	36%
Douglas	20	5%	5%	15%	50%	20%	50%
Irwell	32	0%	0%	0%	50%	44%	44%
Kent/Leven	44	0%	36%	64%	11%	9%	0%
Lune	53	0%	0%	13%	57%	21%	13%
Mersey Estuary	31	0%	48%	3%	23%	13%	26%
Ribble	74	45%	0%	36%	20%	16%	0%
South West Lakes	41	0%	2%	5%	0%	10%	80%
Upper Mersey	46	0%	0%	24%	50%	17%	15%
Weaver/Gowy	69	0%	1%	4%	13%	12%	93%
Wyre	22	0%	18%	14%	23%	14%	50%
North West River Basin District	485	7%	13%	19%	27%	15%	35%

National Indicators

In meeting one of the overall aims of Water Framework Directive; reducing the effects of floods, we are working with flood and coastal erosion risk management staff to tie into the delivery of Local Government National Indicator 189 FCRM.

This performance measure identifies the need for local authorities to deliver actions within CFMPs relevant to them. Local Authorities also have a duty to have regard to the River Basin Management Plans. Local Authorities are identified as one of the key external partners that can help us all deliver actions within the River Basin Management Plans. By identifying relevant actions within the CFMPs and prioritising Local Authorities according to our artificial and heavily modified water bodies we are able to be more proactive in our engagement and delivery of environmental improvements.

Surface Water Management Plan Pilot

In response to the Pitt review of the summer of 2007 flooding, the Government (Defra) is funding the development of guidance on the preparation of Surface Water Management Plans (SWMPs). A SWMP is a framework to help key local partners with responsibility for surface water and drainage to work together to understand the causes of surface water flooding, and agree the optimum way of managing the flood risk in their area. The guidance is being developed and tested through pilot studies that are currently underway. In the North West, Warrington Borough Council is preparing its First Edition SWMP in conjunction with United Utilities the Environment Agency and supported by WRc plc.

J.6 Marine

The Marine and Coastal Access Bill introduces a new strategic planning framework for the marine environment across England and Wales. Marine plans will be underpinned by a UK-wide Marine Policy Statement that will provide a consistent policy steer for decision makers and a mechanism to achieve the Governments' High Level Marine Objectives for achieving sustainable development in the marine area. They will help deliver the Government's vision of 'clean, safe, healthy, productive and biologically diverse oceans and seas by guiding licensing decisions for activities in the marine area. Achievement of good status required by

the Water Framework Directive, along with Good Environmental Status for Marine Strategy Framework Directive are two stated measures of success for achieving this vision.

Work to develop the Marine Policy Statement and marine planning guidance is underway. The Marine Policy Statement will be published within two years of Royal Assent and marine plans will follow on a phased basis (to be determined). Marine plans will set out in detail how the Marine Policy Statement will apply in specific parts of UK waters, and guide licensing decisions for activities in the marine area (marine plans will apply up to Mean High water spring). The new Marine Management Organisation will be responsible for producing marine plans and issuing licences in English inshore and English offshore areas. Welsh Ministers will be responsible for marine planning and for most marine licensing in the Welsh inshore region. They will also be responsible for marine planning in the Welsh offshore region. The Marine Management Organisation will issue licences in the Welsh offshore region.

Links to other plans and policies

The Marine Policy Statement will be consistent with the new National Policy Statements for nationally significant infrastructure projects that the Infrastructure Planning Commission will licence.

There will be overlaps at the coast between marine plans and other planning regimes, including terrestrial plans, Shoreline Management Plans and River Basin Management Plans. In 2008 Defra published "A strategy for promoting an integrated approach to the management of coastal areas in England" that recognises progress made to date with joining up management at the coast and sets the direction for future work.

Development of marine plans will involve producing a Statement of Public Participation and a large amount of consultation. Marine plans covering transitional and coastal waters will play an important role in supporting achievement of River Basin Management Plans through setting out what activities may or may not be permitted in particular areas. It will be important to ensure that the aims of River Basin Management Plans and Shoreline Management Plans are complemented by marine plans, particularly as the cycles for each planning regime are not aligned.

The Environment Agency are working closely with Defra, Welsh Assembly Government and others to ensure that development of the Marine Policy Statement and marine planning guidance is consistent with, and supports delivery of River Basin Management Plan measures to achieve good water status. The Environment Agency has also undertaken partnership projects with Natural England, the Countryside Council for Wales and the National Trust to investigate what marine planning at the coast and across administrative borders will mean for all our organisations. As marine plans are developed and implemented the Environment Agency will work closely with the Marine Management Organisation, Welsh Assembly Government and other coastal interests to ensure there is compatibility with River Basin Management Plans and Shoreline Management Plans.

North West River Basin District activity for the marine environment

The North West Coastal Forum

The North West Coastal Forum is a multi-agency partnership bringing together stakeholders from the public, private and voluntary sectors working to promote and deliver integrated management for our coastal areas to ensure their long term sustainability. The Forum is a unique regional organisation, which has been promoted as a model of good practice in the UK.

J.7 Other processes

Other key national planning and management processes that are currently and/or need to be further aligned, which are not discussed further here, include:

- Water quality;
- Water resources;
- Natural heritage (conservation and biodiversity);
- Fisheries;
- Navigation and recreation;
- Transport planning and management;
- Energy;
- Industry (e.g. Integrated Pollution Prevention and Control).

Addendum 1 (to this annex) identifies some of the specific policies, processes and plans for the processes identified in J.2-J.7.

J.8 Local processes

There are numerous specific initiatives which have a significant effect on the water environment which are not guided or constrained by national policies, frameworks or a strategic governing body. Some of these were identified in the “River Basin Planning: Working together” consultation documents published in 2007. These cannot be directly aligned through national policies in the first instance. Rather, they need to be influenced locally to ensure they align (if they are not aligned already) to help deliver sustainable water outcomes. This could include the initiatives of regional development authorities, local environment groups, local waterways groups, farming groups, broad and fenland management groups and land owners.

Here we identify some of the more significant local initiatives in the North West River Basin District.

Mersey Life

The Mersey Life Project aims to realise the social, economic and ecological potential of the rivers of the Mersey Basin through a phased programme of river restoration focussing initially on the Upper Mersey, River Bollin & River Goyt. Its aims are to restore degraded habitats, improve access to rivers and develop sustainable fisheries. Delivery of the project will be through partnership agreements bringing together organisations & groups with influence, knowledge, physical resources and access to funding. In delivering this it will help deliver River Basin Management Plan.

Water Resources strategy

To enable the aims and objectives of the national water resource strategy to be implemented in the North West, the Environment agency has produced the Regional Action Plan.

The Regional Action Plan considers local pressures and prioritises and illustrates how we intend to meet the specific challenges facing water resources in the North West – both in the short and long term linking directly to river basin management planning.

The specific regional actions needed to meet the overall aims and objectives of the national water resource strategy are aligned and closely correspond with other programmes and initiatives in the region. The actions contained in this plan are either new actions or are

extensions of existing actions from other programmes of work, such as the North West River Basin Management Plan.

J.9 Summary

Alignment of policies, planning processes and initiatives related to water management was a key driver for the development of the Water Framework Directive. This was seen as essential to the effective and efficient delivery of sustainable water management.

Some processes are already reasonably well aligned in terms of intent (e.g. water quality). Others have made significant progress in terms of taking on board the need to protect the water environment as a valuable asset (flood risk and coastal erosion risk management). Others have made steps in the right direction (development planning and rural land management in Wales) while others need to change quite significantly (e.g. rural land management in England). A significant effort is required by all involved and interested parties in ongoing river basin management to review and if possible amend existing policies, plans and measures. In many cases this will require influencing European developments and amending them where necessary, to meet Water Framework Directive objectives. This includes those for which the Environment Agency is responsible, and some which are the responsibility of other organisations.

Ministerial guidance to the Environment Agency¹⁷ has made it clear that a large part of river basin management should involve reviewing and aligning the wide range of existing policies, plans and measures to meet Water Framework Directive objectives. The Environment Agency will drive this agenda forward both internally and externally. We have already reviewed a large number of internal and external processes to look at commonality in objectives and processes. We will be working with key stakeholders to propose and guide this alignment where we can at European, England and Wales and local levels through policy development to implementation “on the ground”.

¹⁷ River Basin Planning Guidance. Department for Environment, Food and Rural Affairs & Welsh Assembly Government. 2006

Addendum J1: Specific policies, processes, plans which may require alignment to river basin management.

Adapted from "Consistent Economic Appraisal Approaches with Respect to the Water Framework Directive River Basin Management Plans. Collaborative Research Programme on Water Framework Directive economics final report. Jan 2006. For the Welsh Assembly Government and Water Framework Directive Collaborative Research Programme by Jacobs in association with ADAS"

Sector	Policy, programme, process or plan	Main aim (of relevance to river basin management)	Lead England and Wales organisation	Key partner organisations
Agriculture	Common Agricultural Policy	Framework for financial support of agriculture: food and fuel production; agricultural economy; rural development	Defra / Welsh Assembly Government	Rural Payments Agency (RPA), Natural England, Rural Inspectorate Wales, Environment Agency, Farming Unions
	Cross Compliance – Good Agricultural and environmental Conditions, Perm Pasture, Soil Protection Review and Statutory Management Requirements	Avoidance of pollution, soil erosion, environmental damage	Defra / Welsh Assembly Government	Rural Payments Agency, Rural Inspectorate Wales, Natural England, Countryside Council for Wales, Environment Agency
	England Catchment Sensitive Farming Delivery Initiative	Reduce diffuse water pollution	Defra	Environment Agency, Natural England
	Environment Agency Wales catchment coordinators initiative	Provide and co-ordinate advice to land managers that will allow them to improve environmental performance. Integrating diffuse pollution mitigation with habitat creation, flood risk management and fisheries issues	Environment Agency	Farming Unions, land managers
	The EU Structural Fund programmes Objectives 1 and 2	Major EU funding mechanism for supporting social and economic restructuring across the EU.	Defra / Welsh Assembly Government	Government Offices, Regional Development Agencies
	Nitrate Vulnerable Zones and Nitrate Action Programme	To reduce nitrate pollution from agriculture	Defra / Welsh Assembly Government	Environment Agency
	Rural Development Programme / Plan	Framework for operation of integrated schemes to protect and improve rural environmental, social and economic development	Defra / Welsh Assembly Government	Natural England, Countryside Council for Wales, Farming Unions and Regional Development

			Agencies	
	Wales Environment Strategy	To reduce pollution, including diffuse pollution from soil erosion	Welsh Assembly Government	Environment Agency, Countryside Council for Wales, Forestry Commission Wales
	Soil Strategy for England	To reduce pollution, including diffuse pollution through soil erosion	Defra	Environment Agency, Natural England
	Agri-environment schemes England	Protect and enhance biodiversity, protect and enhance natural resources, protect historic environment	Defra	Natural England, Farming Unions, Royal Society for Protection of Birds, Environmental NGOs
	Agri- environment schemes Wales. Tir Gofal Tir Cynnal Organic Farming / organic entry level Tir Mynydd The above schemes will all cease in 2012 to be replaced by the new Glastir land management scheme (for all new entrants).	Protect and enhance biodiversity, protect and enhance natural resources, protect historic environment The new Glastir land management scheme will also deliver on the EU CAP Health Check Challenge Agenda for soil carbon and improved water quality and quantity management	Welsh Assembly Government	Environment Agency, Countryside Council for Wales, Farming Unions, Royal Society for Protection of Birds, Environmental NGOs Organic Centre Wales
	Energy Crops Scheme (Short Rotation Coppice)	Reduce greenhouse gas emissions	Defra / Welsh Assembly Government	
	Organic Farming Scheme	Increase area of organic farming	Defra	Organic certification bodies,
	Environmentally Sensitive Areas Scheme (ESAS)	Landscape preservation	Defra / Welsh Assembly Government	
	Woodland Grant Scheme (WGS) / English Woodland Grant Scheme (EWGS)	Encourage establishment of areas of woodland on farms which can be positioned to reduce diffuse pollution	Forestry Commission	Natural England, Countryside Council for Wales, Environment Agency
	Farm Woodland Premium Scheme (FWPS)	N/A	Defra	Forestry Commission
	Integrated Regulation of Agriculture (IRAP).	Targeted effort and inspections to areas and activities that pose the greatest environmental risk.	Environment Agency	
	Sustainable Farming and Food Strategy	Published in December 2002, sets out how industry, Government and consumers can work together to secure a sustainable future for our farming and food industries, as viable industries contributing to a better environment and healthy and prosperous communities	Defra	

	Farming Food and Countryside-Building a Secure Future Strategy/Farming for the Future	Welsh Assembly Government's strategy aimed at helping secure a viable future for farming in Wales - sustainable economically, environmentally and socially	Welsh Assembly Government	Farming Unions, Environment Agency, Countryside Council for Wales, Royal Society for Protection of Birds
	The Defra Whole Farm Approach project	One of several initiatives that see a long term integration in delivering Defra's Sustainable Farming and Food Strategy. Developed as an electronic only system, it uses a questionnaire system intended to make form filling easier and provides convenient links to best practice advice and guidance.	Defra	Farming industry, the wider Defra network (including Environment Agency, Rural Payments Agency) and other regulators including Food Standards Agency and the Health and Safety Executive.
Water resources and quality	Future water	Defra water strategy for England	Defra	
	Periodic Review Process (PRP)	Process to agree set of management and investment plans plus associated water tariffs over a 5 year period.	Ofwat (the Water Services Regulatory Authority)	Environment Agency, Water Companies
	Asset Management Plans (AMP) (incl. Drainage Area Plans) and Water Cycle Strategies (WCS)	Forms part of the Periodic Review Process and this looks at quality improvements required and the most cost effective way of achieving these. They also identify additional price rises required to deliver the plans recommendations. Water Cycle Strategies provide plan, programme and costs of Water Services Infrastructure implementation for major developments.	Water Companies	Ofwat (the Water Services Regulatory Authority), Environment Agency, English Nature, Countryside Council for Wales, Defra, Drinking Water Inspectorate, Welsh Assembly Government
	Water Company water resource management plans	Plan which specifically outlines the balance between water supply and demand in a socially/ environmentally acceptable way (including efficiency of use). Used to inform the periodic review of prices	Water companies	Defra and Welsh Assembly Government (receive plans). Environment Agency -review of social and environmental aspects; Ofwat (the Water Services Regulatory Authority)-economic issues
	Water Resources Strategies	A broad strategy for a region for 15-20 years covering water resources. In Wales, the current strategy is to 2050 and beyond.	Environment Agency	Stakeholders
	Restoring Sustainable Abstraction (RSA) Programme (Environment Agency) incl. Low flow alleviation plans/ programmes and Abstraction licence review/consenting process	Catalogues wetlands and rivers that may be at risk from abstraction (as identified by Catchment Abstraction Management Strategies). Programme of investigations, appraisal of options and implementation of solutions where abstraction identified as an impact.	Environment Agency	Abstraction licence holders

	Water Company and Environment Agency Drought Contingency Plans	Operational management tool to look at water shortage scenarios	Water companies, Environment Agency	Defra/Welsh Assembly Government (receive plans) Environment Agency -review drought plans
	Catchment Abstraction Management Strategies (CAMS)	Identifies discrete licences that may be impacting upon the environment to guide management of abstraction licences.	Environment Agency	Abstraction Licence Holders e.g. Water Companies, CBI, National Farmers Union etc Local Authorities, Environmental Groups
	Groundwater protection policy (Groundwater regulations)	Risk based policy. Water Framework Directive has three elements related to Groundwater: classification of status; identification of pollution trends in Groundwater; prevention of input of pollutants to GW. The details of these elements are expected to be in the Groundwater Directive.	Environment Agency	Environmental Groups, and Industries
	Eutrophication Control Action Plan	Local plans - pilot exercise assessing eutrophication and identifying measures to tackle problems	Environment Agency	Local Key Stakeholder
	Chemical strategy pollution reduction plans	Tackle issue at a substance level and are not location based. Water, air, land - all mediums considered.	Environment Agency	Defra own Existing Substances Regulations
	Endocrine disrupting substances in the Environment strategy	A consultation exercise urging companies to take precautionary measures to protect the environment from endocrine disrupting chemicals.	Environment Agency	
Flood Risk Management	Shoreline Management Plans	Shoreline Management Plans set out strategic guidance designed to assist coastal defence decision making for a defined length of coast over the next 50 years	Environment Agency	Defra and Welsh Assembly Government
	Catchment Flood Management Plans	Plan to identify future measures needed to ensure management of flood risk within river catchments	Environment Agency	Defra and Welsh Assembly Government
	Flood and Coastal Erosion Risk Management Appraisal Guidance – Practitioner's Guide	This will provides the framework for decision making in Flood and Coastal Erosion Risk Management strategies and schemes.	Environment Agency	Defra, other Flood and Coastal Erosion Risk Management operating authorities
	System Asset Management Plans (SAMPs)	A management plan to address assets and maintenance of assets.	Environment Agency	
	Coastal Habitat Management Plans (CHaMP)	CHaMPs relate to shoreline management of flood defences in relation to the Habitats and Birds Directives in a limited number of locations (pilot sites) on the east and south coast (7 locations). Coastal Squeeze element of Shoreline Management Plans.	Defra/ Welsh Assembly Government	Defra and Welsh Assembly Government

	Drainage Area Planning (surface water)	Carried out by Internal Drainage Boards (IDBs)	Internal Drainage Boards	Overseen by Defra
	Water level management plans	Plan for wetland SSSIs to balance water needs of conservation, flood defence and other needs (e.g. recreation/agric/industry). Requirements of other organisations or other parts of Environment Agency. Conservation is the main objective and give operational requirements to other parties	Environment Agency/Internal Drainage Boards	
	Surface water management plans	Framework through which key local partners with responsibility for surface water and drainage in their area work together.	Local authorities	Environment Agency
	Regional habitat creation programmes	A strategic approach to habitat re-creation for projects and as compensation for coastal squeeze caused by sea-level rise. Co-ordinates achievement of Defra Outcome Measures 4 and 5 and corporate Biodiversity targets.	Environment Agency	Land owners
	Managed realignment plans	Habitat creation programmes		
Development and Land use	National Policy Statements	National Policy Statements will set out the justification for major infrastructure projects and provide guidance on how to implement them. National Policy Statements will be subject to an 'appraisal of sustainability' where they give location information for projects. National Policy Statements will be prepared by the government department responsible for that type of project.	Welsh Assembly Government, Communities and local Government /Infrastructure Planning Commission	
	England Rural Development Programme	Funded by the European Commission and the Department for Environment, Food and Rural Affairs (Defra). The majority of programme funds are allocated to improving the environment through Environmental Stewardship - administered by Natural England and the English Woodland Grant Scheme - administered by the Forestry Commission.	Communities and local Government	Forestry Commission, Natural England
	Wales Rural Development Plan	Joint Welsh Assembly Government/European Union (EU) strategy to improve Welsh environment and encourage sustainable economic development.	Welsh Assembly Government	
	Planning Policy Statements (England)	Planning Policy Statements explain statutory provisions and provide guidance to local authorities and others on planning policy and the operation of the planning system.	Communities and local Government	
	Regional spatial strategies (RSS)	With the objective to contribute to the achievement	Regional planning	Government Office

	England , the Wales Spatial Plan and the London Plan	of sustainable development, the RSS, incorporating a Regional Transport Strategy (RTS), provides a broad development strategy for the region for a fifteen to twenty year period. It covers housing, environment, transport, waste, minerals issues and informs other more local spatial plans	bodies	
	Local Development Frameworks (LDFs) including Local Development Documents (LDD) England	A Local Development Framework is a suite of documents that sets out how the local area may change over the next 10-15 years. Will also cover issues of waste and minerals for relevant authorities. Local Development Frameworks must be in general conformity with RSS	District and Borough Authorities and Unitary Authorities	Government Office
	Waste and mineral development frameworks	Cover issues of waste and minerals for relevant authorities.	Counties (in two-tier areas) and unitary authorities	
	Planning Policy Wales	Current land use planning policy is contained in 'Planning Policy Wales' (March 2002) which provides the strategic policy framework for the effective preparation of local planning authorities' development plans. 'Planning Policy Wales', the Technical Advice Notes (TANs) and the circulars, may be material to decisions on individual planning applications and will be taken into account by the National Assembly for Wales and Planning Inspectors in the determination of called-in planning applications and appeals.	Welsh Assembly Government	
	Technical Advice Notes (TANS) (Wales)	Planning policy Wales is supplemented by 20 topic based Technical Advice Notes (Wales) (TANs) which provide procedural guidance on interpreting the policy and operation of the planning system in Wales.	Welsh Assembly Government	
	Local Development Plans (Wales)	Local Development Plans should provide for an adequate and continuous supply of land to meet society's needs in a way that is consistent with overall sustainability principles and objectives. In doing this these plans must set out an authority's objectives for the development and use of land in its administrative area and general policies to implement them.	Local Authorities	Welsh Assembly Government

	England Sustainable Communities Strategy	Prepared by local strategic partnerships as a set of goals and actions which they, in representing the residential, business, statutory and voluntary interests of a local area, wish to promote. The community strategy should inform the local development framework and act as an umbrella for all other strategies devised for the local area and promote or improve the economic, social and environmental well-being of their areas, and contributing to the achievement of sustainable development in the UK	Local Authorities	Dept. for Communities and Local Government
	Port Development Plans	Business plans for port development which usually consider environmental issues	Port Authorities	
Natural Heritage	Habitats Directive Assessment of plans and projects	All proposals affecting Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) must be assessed to show no adverse effect on site integrity. There is also a requirement to review some types of plans and projects that existed before the implementation of the Habitats Directive to assess their implication on the sites conservation objectives.	Natural England Countryside Council for Wales	All competent authorities are responsible for assessing plans and projects
	Special Sites of Scientific interest (SSSIs) improvement programme	In England there is a Public Service Agreement (PSA) target to have 95 per cent of the SSSI area in favorable or recovering condition by 2010. The SSSI remedies programme identifies the organisation that has prime responsibility for resolving or 'remedying' the reason for unfavourable condition on each SSSI unit. Financial incentives are available to support some of the work, these are usual tied into a contractual management agreement between Natural England and the landowner/occupier. Wales Environment Strategy (WES) Outcome 21 aims to restore 95 per cent of international sites by 2010, 95 per cent of SSSIs by 2015, and all sites by 2026	PSA target is led by Defra and its delivery is co-ordinated by Natural England. WES is led by Welsh Assembly Government	Organisations responsible for resolving the reason for unfavourable condition on each SSSI unit. e.g. individual site owners, central and local government, private companies, non government organisations. Delivery is co-ordinated by the Countryside Council for Wales.

	England River Basin Biodiversity Framework	Summary and Geographic Information System (GIS) presentation of water-related biodiversity targets and assets in each river basin, for inclusion in WFD River Basin Management Plans where appropriate.	Environment Agency and Natural England	Royal Society for the Protection of Birds, Wildlife Trusts, Defra
	UK Biodiversity Action Plan	UK Biodiversity Action Plan is a plan for dealing with biodiversity conservation in response to the Convention on Biological Diversity 1992 which called for the creation and enforcement of national strategies and action plans to conserve, protect and enhance biological diversity.	UK Biodiversity Partnership	UK Biodiversity Partnership comprises a wide range of people from those who provide funds, amateur and professional experts to those who are interested in the wildlife and natural They are private individuals, business, government and non government representative Environment Agency lead on action plans for many freshwater habitats and species.
	Local Biodiversity Action Plans (LBAPs)	Action plans to safeguard biodiversity features. Each Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets	Local Biodiversity Action Plan Partnerships	Natural England, Local Authorities, Environment Agency, Countryside Council for Wales
	Site management plans for Natura 2000 sites	The designation of a site under the 'Birds' or 'Habitat' Directives will often lead to the production of a management plan for the site in question.	Natural England, Countryside Council for Wales	Site owners and managers
	Wetland Vision for England	Wetland Vision is a partnership project which describes how the partners would like England's wetland landscapes to be in 50-years time.	Wetland Vision Partnership	English Heritage, Environment Agency, Royal Society for the Protection of Birds, Natural England, Wildlife Trusts
	The Invasive Non Native Species Framework Strategy for Great Britain.	This is a co-ordinated plan to reduce the threat to Britain's native biodiversity from invasive non-native species To help prevent introductions in the first place by raising awareness of the risks and increasing understanding of the impacts; to better enable early detection and rapid response to introductions before they become major	Defra Welsh Assembly Government The Scottish Government	

		<p>problems; and,</p> <p>to develop longer-term control programmes based on sound science.</p> <p>The GB Strategy also contains measures to improve the effectiveness of legislation, to improve integration of activities and programmes and to better focus research effort.</p>		
Transitional and coastal	Marine Protected Area strategy (draft)	Delivering an ecologically coherent network of Marine Conservation and Zones and European Marine Sites by 2012.	Defra / Welsh Assembly Government	Joint Nature Conservancy Council (JNCC), Natural England, Countryside Council for Wales
	Marine Policy Statement (MPS) and marine planning	Will be introduced through Marine and Coastal Access Bill and set strategic framework for management and protection of the marine environment in England and Wales. Marine licensing decisions for development activities will have to conform with marine plans which will overlap with RBMPs in estuaries and coastal waters.	Defra/ Welsh Assembly Government	Environment Agency, Local Authorities
	Integrated Coastal Zone Management (ICZM)	ICZM is a management approach not a plan. The purpose of ICZM is to bring stakeholders together with a common interest often to resolve conflict. In 2007, the Welsh Assembly Government produced Making the Most of Wales' Coast - the Integrated Coastal Zone Management Strategy for Wales. The document provides an overview for the development of actions that will bring together the coastal policies and activities in Wales. In 2008 Defra published "A strategy for promoting an integrated approach to the management of coastal areas in England" that recognises progress made to date with joining up management at the coast and sets the direction for future work.	Defra / Welsh Assembly Government	All groups with regulatory, management, commercial, recreational or other interests at the coast

Fisheries	Common Fisheries Policy	Sustainable fisheries management driven through the ecosystem approach.	EU UK delivery through Defra and devolved administrations	Marine and Fisheries Agency/Sea Fisheries Committees/ Environment Agency, Welsh Assembly Government
	Freshwater Fish Directive Designations	Statutory water quality protection for designated cyprinid and salmonid fisheries.	EU England and Wales delivery through Environment Agency	Water Utilities.
	Fisheries Action Plans	Consultative processes to develop wide stakeholder engagement in freshwater fisheries management	Environment Agency	Angling organisations
	Salmon Action Plan	Catchment based strategic plans to deliver sustainable salmon management	Environment Agency	NASCO, Salmon and Trout Association and many others
	National Trout and Grayling Strategy	National Strategy to deliver sustainable species management	Environment Agency	Salmon and Trout Association, Grayling Society.
	Eel Management Plan	National strategy to deliver sustainable species management within the European Environment Agency context.	Environment Agency	
	Fisheries Strategy	National Strategy to provide an overview for the functional plan and related plans and policies.	Environment Agency	National Angling Bodies
Forestry	Forest Strategy	The Strategy was prepared in 1997-98 and provides a vision for forestry for the medium to long term (i.e. 20-50 years). It was prepared before the WFD was implemented in the UK.	Defra	Forestry Commission
	Regional Forestry Frameworks	Charts a route to help develop a vibrant sector to maintain and enhance the tree, woodland and forestry assets that can bring social, environmental and economic benefits to a region	Forestry Commission	
	The Strategy for England's Trees, Woods and Forests	Shows how we can meet the opportunities and challenges of making trees and woodlands productive, healthy and attractive	Defra	
	The Woodlands for Wales Strategy.	Establishes the role that woodlands sustaining the wider environment and in providing opportunities for people and communities in Wales and establishes importance of woodland management	Welsh Assembly Government	Forestry Commission Wales

	'Forests and Water Guidelines'	Provide the basis for sustainable management of the water environment by forest planners and managers	Forestry Commission	Forestry Commission, Forest Research, Environment Agency, Scottish Environment Protection Agency, Joint Nature Conservation Committee, Forest Service (Northern Ireland)
Industry/ chemicals	Integrated Pollution Prevention and Control (IPPC) permits	To ensure industrial installations have minimal environmental impacts and emissions are regulated	Environment Agency	
Transport	Transport Strategy	A vision for transport development in the medium to long term.	Dept. for Transport	
	The Wales Transport Strategy	Sets out the steps to achieve delivery of sustainable transport networks	Welsh Assembly Government	Local Authorities
	Regional Transport Strategies	These are part of Regional Spatial Strategies	Dept. for Transport	Environment Agency
	Local Transport Plans	Local Authority driven plans that take account of Regional and National transport plans	Dept. for Transport	Local Authorities
	Individual Transport Schemes	Scheme over £5M that require funding from Dept. for Transport.	Dept. for Transport	Developer
Recreation and Navigation	British Waterways Strategy	Management of 2,000 miles of canals and rivers in England, Wales and Scotland.	British Waterways	Defra and Welsh Assembly Government
	'A better place to Play' Environment Agency strategy for water-related sport and recreation.	Strategy to plan and promote water-related sport and recreation to achieve the maximum economic, social and environmental benefits.	Environment Agency	
	Action plan for navigation		Environment Agency	
	Waterways for tomorrow	For inland waterways to see an improving quality of infrastructure; a better experience for users through more co-operation between navigation authorities; and increased opportunities for all through sustainable development.	Defra	

	National Parks Management Plans	Overarching strategic document and central to the future of the National Park to: show co-ordination and integration with other plans,, strategies and actions in the National Park where they affect the National Park purposes and duty; indicates how the National Park purposes and associated duty will be delivered through sustainable development; sets the framework for all activity pursued in the National Park by stakeholders.	National Parks	
	Waterways development plans, strategies, frameworks	Various documents associated with waterways regeneration and management	Various	
	Bank protection policies	Policies to give sufficient structural strength to the bank, to protect the bank from erosion (both on the waterline and from the user on the path) and to prevent leaks.		
	Green-blue initiative	The 'Green Blue' initiative gives examples of good environmental practice for boaters.	British Marine Federation and the Royal Yachting Association.	Environment Agency, Scottish Environment Protection Agency, Scottish Natural Heritage, Welsh Assembly Government, Crown Estate, Countryside Council for Wales



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex K: Economic analysis of
water use

Content

K1 Economic Analysis of Water Use

K2 Key points about the economic analysis of water use

K3 Data to be provided

K4 Other information

K1 Economic Analysis of Water Use

Department for Environment, Food and Rural Affairs (Defra), Welsh Assembly Government (WAG), the Environment Agency and partners¹ have been engaged in a comprehensive economic analysis of water use to support the implementation of the Water Framework Directive. At the highest level this involved participation in the **Common Implementation Strategy for the Water Framework Directive** (WATECO) group and subsequent drafting groups (ECO1 and ECO2). These groups were given a remit by the Water Directors under the Common Implementation Strategy to develop information and guidance materials to assist in interpreting the requirements of Article 5 and Annex III of the Directive as well as provide methodologies and share experiences in relation to cost-effectiveness assessment and disproportionate cost assessment.

One of the earliest contributions was a series of economic analysis reports to support the reporting under Article 5 of the economic analysis of water use. Four reports were developed with the help of the Economic Steering Group and the Economic Advisory Stakeholder Groups for England and Wales; these were²:

- Report on the Economic Importance and Dynamics of Use for River Basin Characterisation
- Report on Cost Recovery and Incentive Pricing
- Report on Cost-Effectiveness Analysis and Developing a Methodology for Assessing Disproportionate Cost
- Report on Private Water Services

¹ Of special note has been the work of the Collaborative Research Programme on River Basin Management Planning Economics which undertook a programme of research between 2003 and 2007. Work by the Cross Government Economics Steering Group and the Economic Advisory Stakeholder Group should also be noted.

² Available at

<http://webarchive.nationalarchives.gov.uk/20080305115859/http://www.defra.gov.uk/environment/water/wfd/economics/index.htm#eco>

These reports provided the basic information with which to develop the Article 5 reports, details of which can be found at the following link:
<http://webarchive.nationalarchives.gov.uk/20080305115859/http://www.defra.gov.uk/environment/water/wfd/economics/index.htm#eco>

Each Article 5 report provides information relevant to the reporting guidance of the Water Framework Directive. It takes account of various guides and other documentation produced through the Common Implementation Strategy (CIS).

In line with this guidance, the following areas are covered by each report:

- Driving forces: This section sets out the socio-economic characteristics of each river basin district and provides forecasts for population, number of households, output (in gross value added terms) and employment to 2015;
- Pressures: This section reports on the attempts to link economic information with the most important activities for the characterisation of water bodies and associated risk assessment;
- Water services and cost recovery: This section presents information received from the Water Services Regulation Authority (Ofwat) on the financial cost of public water supply and sewerage services within each river basin district. Details are also provided on the level of environmental expenditure by the water and sewerage companies in the river basin district;
- Cost-effectiveness: This section details the progress made towards ensuring cost-effectiveness in implementing the programme of measures (PoMs). The gaps that exist are also identified; and
- Improving knowledge and the information base: The final section sets out the research programme needed to support further work under the Water Framework Directive.

The Article 5 reports represented a landmark in terms of undertaking a comprehensive, river basin district-based, economic analysis of water use. However, they represented only a beginning of a much longer and more in depth analysis. Each of the Article 5 reports and their supporting economic analysis was accompanied by a draft programme of research to take forward the main analytical gaps. This was based on the development of a research programme to be taken forward by the Collaborative Research Programme on River Basin Management Planning Economics (CRP)³. The main outputs of the CRP were:

Project 1a – Economic Analysis and Decision Making for programme of measures under the Water Framework Directive – Initial Identification of Processes and Issues. This project was instrumental in developing an approach which built as far as possible on existing analysis and decision making processes.

Project 1b – Consistent Economic Appraisal Approaches with respect to the Water Framework Directive river basin management plans. This report examined in detail the appraisal frameworks to determine the extent to which they developed the analysis required for decision making for river basin planning.

³ Outputs of the CRP can be accessed here: www.wfdcrp.co.uk

Project 1c – Screening of water pricing policies, cost recovery mechanisms and economic instruments for inclusion in programme of measures and in relation to Article 9 of the Water Framework Directive. This report looked in detail at possible measures that might be needed to fulfil the requirements of Article 9 and the aims of the Directive in terms of Incentive Pricing.

Project 2a/2b – Development of a methodology to determine the cost effectiveness of measures and combinations of measures for the Water Framework Directive. This project developed an initial methodology for undertaking cost-effectiveness analysis.

Project 2c – Benchmark costs database and guidance on the application of the cost-effectiveness methodology. This provided a database of unit costs for use in cost-effectiveness analysis. Two detailed associated reports were prepared for the Water Industry entitled:

- Water Framework Directive: Economic analysis of water industry costs, and
- Review of econometric cost modelling of chemical phosphorus removal works

Project 2e – Deriving the Costs and Effectiveness of Delivery Mechanisms. This extended the 2c cost database to cover delivery mechanisms as well as measures.

Project 3 – Report on guidance on the evidence required to justify disproportionate cost decisions under the Water Framework Directive. This Project provided guidance on what information should be provided and how it should be presented in order to use the exemptions in the Directive related to disproportionate costs.

Project 4a – Workshop report on CRP Strategic Approach to Benefits. This report set out the approach to the assessment of Environmental and Resource Costs which was to be taken for the first planning round given the absence of information on benefits generally and limitations of the science of assessing status against standards and predicting improvements from measures. It dealt in particular with the problem of quantifying benefits of a national programme versus site specific improvements.

Project 4bc – Report on The Benefits of Water Framework Directive Programmes of Measures in England and Wales. This report presented the finding of a stated preference study into the benefits (measured as willingness to pay) for Water Framework Directive objectives. As a measure of achieving good status it represents a measure of the environmental and resource costs of water bodies which are at less than good status. It presents a national picture of benefits and hence an envelope within which action to meet the objectives of the Directive can be regarded as being proportionate.

Project 4d – Prioritisation. Project 4bc provides an envelope for the total benefits estimate; however, further information is required in order to undertake prioritisation of actions within that envelope. This project attempted to examine possible rules for this type of prioritisation to aid the Environment Agency and partners in developing the most value for money programmes of measures.

Project 4e – Direct Market Benefits. While Project 4bc looked at total non-market benefits, this study addressed direct market benefits. A range of potential benefits were examined although most were found to be significant at the national level.

Project 4f – Valuation of recreational benefits of improvements in water quality – potential benefits and data requirements. This project provides a blueprint for future benefits valuation for the Water Framework Directive. Demonstrating the data requirements of possible approaches to developing a revealed as opposed to stated preference approach to benefit estimation, with a view to improving the robustness of future benefits estimation for river basin management planning.

A series of related reports were prepared during the period of operation of the CRP. These included: reports looking at whether and how differences in the cost of capital should be taken into account for the purpose of cross-sectoral cost-effectiveness analysis (where availability of financing might be a relevant consideration in judging the cost-effectiveness of measures. These reports were entitled Economic analysis for the Water Framework Directive Discounting and the calculation of the present value (Phase 1 – Theory and Phase 2 – Practical methods).

Following on from the work to prepare a cost-effectiveness analysis under the CRP a related study was undertaken for transitional and coastal waters. This study was entitled Scoping of Economic Impacts and Issues in Transitional and Coastal Waters.

Related work on agriculture was undertaken as part of the development of policies related to Catchment Sensitive Farming. This includes a cost-effectiveness manual and work related to the benefits of agricultural measures⁴. Similarly an analysis of potential measures to control non-agricultural diffuse pollution was also undertaken⁵.

A detailed study was undertaken during the period of operation of the CRP into baselines and trends. This study was entitled: Water Framework Directive Economic Analysis: Information On Trends To Improve The Baseline Scenarios. It provided a substantial synthesis of information regarding possible baseline issues and trends which could be incorporated into River Basin Planning.

Further economic analysis was performed in relation to the Daughter Directives on Groundwater and on Priority Substances including Impact Assessments. Information from these analyses was integrated into the overall economic analysis of water use through the National Impact Assessment⁶.

⁴ <http://www.defra.gov.uk/foodfarm/landmanage/water/csf/programme.htm>

⁵ <http://www.wfdcrp.co.uk/pdf%5CNADWP%20pCEA.pdf>

⁶ <http://www.defra.gov.uk/environment/quality/water/wfd/daughter-dirs.htm>

The above represents a fairly comprehensive analysis of the economics of water use in England and Wales, although it is the use of this analysis which is perhaps most relevant. The following paragraphs attempt to explain the main ways in which this information was used in preparing the river basin management plan (RBMP) documents.

The main use of the above information was to inform two sets of guidance to the Environment Agency as the competent authority for river basin management planning⁷. This guidance provided the framework within which river basin management planning could take place. The second volume of guidance was accompanied by an Impact Assessment. This National Impact Assessment used the outputs of the economic analysis of water use discussed above to consider a series of strategic options for the first set of river basin plans. The Guidance required the Agency to perform similar analysis (Impact Assessment) for each of the RBMPs.

The National Impact Assessment was the first time that the cost, benefits and other impacts of the Directive had been considered in full since the transposition of the Directive and the publication of the Water Framework Directive regulations in 2003⁸. Transposition of the Directive was accompanied by a Regulatory Impact Assessment (RIA) which was the first comprehensive attempt to assess the potential costs and benefits of the Directive. The key finding of this RIA was that the Directive could be cost-beneficial for the UK but this depended to a large degree on finding a way of targeting requirements to areas where actions were most cost-effective and benefits highest.

Prior to the National Impact Assessment a Preliminary Cost-Effectiveness Analysis was undertaken. The pCEA was carried out by Defra with technical inputs from the Environment Agency and significant stakeholder involvement, starting in autumn 2006 and continuing until summer 2007. The pCEA to the extent possible used the outputs from the CRP analysis and built on this wherever necessary. The pCEA aimed to identify the most cost effective package of measures across sectors that will achieve the requirements of the Water Framework Directive, taking into account the level of uncertainty associated with the different packages, their distributional and affordability implications and the potential for phasing implementation over the three river basin planning rounds, from 2009-2027.

The National IA used information from the pCEA together with a model of benefits developed from Project 4bc of the CRP to undertake a national assessment of options for implementing the Directive. Two main options were considered:

- Option 1 ‘Not Phased’ – all technically feasible measures are initiated with the aim of meeting Water Framework Directive good status objectives by 2015 and to meet the progressive reduction/cessation requirements for chemical status, or as soon as possible due to natural conditions. This implies that provisions in the Water Framework Directive to extend deadlines and set less stringent objectives when costs are disproportionate are not used at all.

⁷ See <http://www.defra.gov.uk/environment/quality/water/wfd/management.htm>

⁸ <http://www.defra.gov.uk/environment/quality/water/wfd/transposition.htm>

- Option 2 ‘Phased’ – phased implementation to ensure an adaptive, cost-effective and proportionate long term approach meeting all Water Framework Directive requirements by 2027 or as soon as possible thereafter given feasibility, proportionality and natural conditions. It assumes that alternative objectives (less stringent objectives and extended deadlines) are set to meet Water Framework Directive good status requirements by 2027, where appropriate, and to meet the progressive reduction/cessation requirements.

The National IA also provided an analysis of the consequences of introducing the environmental quality standards and associated methods developed by United Kingdom Technical Advisory Group (UKTAG) to support good status. The main conclusion of this analysis was that, given the standards, there was a clear case for phasing the costs of the Directive in order to ensure that its implementation was proportionate. Numerous measures were ruled out as either technically infeasible or likely to be disproportionate. This information was subsequently used by the Environment Agency to prepare the more detailed Impact Assessment which accompanies the RBMPs.

K2 Key points about the economic analysis of water use

The following provides a commentary on key issues relating to the economic analysis of water use to assist in interpreting the work done and the way in which it has supported river basin management planning.

2.1 Have Member States prepared a comprehensive economic analysis including all elements of and being consistent with the Directive?

The United Kingdom has provided a comprehensive economic analysis. This is demonstrated through:

- the Article 5 report economic analysis supporting documents,;
- preliminary cost effectiveness analysis;
- collaborative research programme reports; and
- various Impact Assessments that have been undertaken on the Water Framework Directive.

Further details of this information can be found on the Department for Environment, Food and Rural Affairs website at the following link:
<http://www.defra.gov.uk/environment/quality/water/wfd>

2.2 Where necessary, have estimates of the volume, prices and costs associated with water services been provided?

Estimates of the volume, prices and costs associated with water services have been used within the economic analysis at various stages. In particular this information was used to determine the extent of recovery of the costs of water services as set out

in the report on cost recovery and incentive pricing⁹ and the associated Article 5 Economic Analysis supporting documents¹⁰. Up to date information on these financial costs and revenues is provided by water companies annually to the economic regulator for the water industry in England and Wales (Ofwat) in a report called the June Return. This is available on the Ofwat website at the following link: <http://www.ofwat.gov.uk>. Information on the prices, costs and volumes for private water services is provided in the report on private water services.

2.3 Where necessary, have estimates of the relevant investment including forecasts of such investments been provided?

Estimates of investments and forecasts of investments have been used at various stages during the economic analysis of water use. In particular this information was relevant to the production of the various reports on water industry costs for the CRP cost-effectiveness work (see above) and also the water sector reports for the pCEA.

2.4 How has long term forecasts of water supply and water demand been taken into account in the principle of the recovery of the costs of water services?

In the United Kingdom water service providers recover the costs of providing water services from customers within their water service areas. Revenue in the companies arises from the provision of a range of services that make up the overall water service. These are measured and unmeasured water and sewerage charges, trade effluent charges, large user charges and other sources. The cost recovery mechanism is slightly different in each case but for each source of charge, prices are broadly cost-reflective. The process of recovery of costs guarantees that financial costs are recovered and the five yearly periodic review process internalises environmental costs through the prices paid by customers. The price setting process for the Water Industry (Periodic Review) is the mechanism through which costs are recovered and cost-recovery is on the basis of efficiently incurred costs which are allowed to finance necessary investments as determined during the periodic review process. Details of this process and how it relates to cost-recovery calculations can be found in the report on cost-recovery and incentive pricing (see above).

2.5 Have approaches been identified showing that the economic analysis was used to assist in judging cost effectiveness?

The cost-effectiveness of measures used information developed during the economic analysis of water use. This included information from the pCEA (sector and pressure reports) and the CRP's development of benchmark cost-effectiveness information on measures and mechanisms. In addition the Environment Agency developed further cost-effectiveness information during the development of the RBMP and the IAs (see IAs and Annex E for more detail).

⁹ See

<http://webarchive.nationalarchives.gov.uk/20080305115859/http://www.defra.gov.uk/environment/water/wfd/economics/pdf/cripreport.pdf>

¹⁰ See

<http://webarchive.nationalarchives.gov.uk/20080305115859/http://www.defra.gov.uk/environment/water/wfd/economics/index.htm>

2.6 What progress that has been made since 2005 to address the uncertainties and data gaps in the economic analysis?

Each of the 2005 Article 5 supporting economic analysis reports contains information on improving the knowledge and information base. These sections detail how the proposed work of the CRP aimed to address uncertainties and knowledge gaps. Hence the CRP and associated outputs represent the main response to the uncertainties and data gaps revealed by the initial economic analysis.

2.7 Have Member States ensured that the measures to implement Article 9 address all three main elements of Art 9: i) incentive pricing; ii) adequate contribution to cost-recovery including environment and resource costs, iii) polluter pays principle?

The main way in which the measures to implement Article 9 have considered the three elements of Article 9 has been through the analysis to screen potential water pricing policies and cost-recovery mechanisms. The original work to undertake this screening is summarised in the report: Screening of water pricing policies, cost recovery mechanisms and economic instruments for inclusion in programme of measures and in relation to Article 9 of the Water Framework Directive.

This report screened water pricing policies, cost recovery mechanisms and economic instruments which may be included in programmes of measures to achieve compliance with the Water Framework Directive in England and Wales. This included:

- Compliance of candidate mechanisms with cost-recovery and incentive-pricing objectives set out in Article 9 of the Water Framework Directive;
- Cost-effectiveness in furthering Article 4 objectives, that is in mitigating environmental pressures arising from abstraction, point-source pollution, diffuse pollution, morphological impacts and alien species.

In terms of compliance of candidate economic mechanisms with Article 9 the report screened charging policies and cost-recovery mechanisms against the Article 9 requirements that they provide for, i.e.:

- Adequate incentives for users to exploit water resources efficiently and thereby contribute to Article 4 objectives (Article 9.1., 2nd sentence, 1st indent);
- An adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of costs of water services, based on the economic analysis conducted according to Annex III and taking account of the polluter pays principle (Article 9.1., 2nd sentence, 2nd indent).

The analysis found that most, if not all, mechanisms were broadly aligned with or not immediately relevant to Article 9 obligations. It was noted however that questions may arise in relation to a number of mechanisms in particular abstraction charging arrangements; changes for industrial discharges to sewer; surface water drainage

charges and metering/volumetric charging measures. In all cases further work was recommended following the screening exercises.

In terms of compliance with cost-effectiveness with regard to Article 4 environmental objectives, the study examined economic mechanisms based on polluter pays principles and incentive pricing approaches that might be used to drive necessary measures. The starting point was a compilation of a list of economic mechanisms used or which had previously been considered and rejected in England and Wales or Scotland to address each of the five pressures identified in the Water Framework Directive, i.e. abstraction, point-source pollution, diffuse pollution, physical change and alien species. The initial assessment of mechanisms proposed or implemented in the UK suggests that further work was needed in relation to: abstraction and discharge charging regimes, surface water charging and metering and volumetric charging.

Since the publication of this report further work has been ongoing in these areas. The issues raised by this initial screening as part of the economic analysis of water use were included within Government's proposed strategy for water (Future Water)¹¹ in particular in relation to charging for water, competition and surface water drainage policy. Future Water announced two independent reviews to take forward these issues in the form of the Cave and Walker Reviews.

Professor Martin Cave led an independent review of competition and innovation in water markets between March 2008 and April 2009. The Review published its final report on 22 April 2009 with recommendations to the UK and Welsh Assembly Governments and sectoral regulators (Ofwat, the Environment Agency and the Drinking Water Inspectorate). The Cave Review¹² aimed to:

- deliver benefits to both business and household customers. This could be through lower bills, better service and more responsive products; and
- increase the efficiency and sustainability of water use; through assessing the scope for competition and innovation throughout the water and sewerage industries.

As part of the Review Cave examined abstraction and discharge policy and made a number of recommendations which Government is currently considering how to take forward. The outcomes of this work will have important implications for future river basin management planning and are likely to provide a range of alternative mechanisms which may be used to meet Water Framework Directive targets.

Anna Walker led an independent Review of Household Charging and Metering for Water and Sewerage Services in the UK. Terms of reference for this review were to:

- examine the current system of charging households for water and sewerage services;
- assess the effectiveness and fairness of current and alternative methods of charging; and

¹¹ <http://www.defra.gov.uk/environment/quality/water/strategy/pdf/future-water.pdf>

¹² <http://www.defra.gov.uk/environment/quality/water/industry/cavereview/documents/cavereview-finalreport.pdf>

- consider and make recommendations on any actions that should be taken to ensure that England and Wales has a sustainable and fair system of charging in place.

The Review looks at social, economic and environmental concerns. An interim report was published on 29 June 2009¹³. Government is currently awaiting the final report from the Review which, as with the Cave review, will have important implications for future river basin plans in relation to Article 9.

Both the Cave and Walker Reviews commissioned research on cross subsidies, price structures and competition in the water industry¹⁴.

Together these reports show that the UK is taking the issue of incentive pricing seriously and demonstrate the UK's commitment towards a continual process of improvement. This will ensure that water prices in the UK more fully reflect the true environmental and social cost of abstraction and provide greater incentives for water to be used efficiently, thus satisfying the aims of Article 9.

Agricultural diffuse pollution was explicitly outside the scope of the initial screening research as all measures related to agricultural diffuse pollution were under consideration during the development of the Catchment Sensitive Farming Initiative. This considered the balance between voluntary, regulatory and economic incentive based approaches. It began with an initial screening of potential measures¹⁵ and concluded that the most appropriate package was a combination of advisory services, use of agri-environment schemes and the development of a new mechanism based on Water Protection Zones¹⁶. During the development of this policy a substantial evidence base was developed relating specifically to the economic analysis of agricultural water use¹⁷.

2.8 How has the definition of water services and uses been implemented in practice?

In the United Kingdom the definition of water services encompasses the Water Industry: i.e., services provided by the water and sewerage industries.

2.9 How have water pricing policies provided adequate incentives for users to use water resources efficiently?

The economic analysis of water use has examined the way in which pricing policies provide adequate incentives for users to use water resources efficiently. The main analysis has been with respect to CRP Project 1c (as detailed above). The outcomes of this screening of pricing policies and cost-recovering mechanisms were incorporated into the Future Water Strategy and further work undertaken as part of the Cave and Walker Reviews (see above).

¹³ <http://www.defra.gov.uk/environment/quality/water/industry/walkerrereview/documents/walker-call-for-evidence.pdf>

¹⁴ <http://www.defra.gov.uk/environment/quality/water/industry/cavereview>

¹⁵ <http://www.defra.gov.uk/foodfarm/landmanage/water/csf/document-archive.htm>

¹⁶ <http://www.defra.gov.uk/foodfarm/landmanage/water/csf/documents/diffuse-consult-govresponse.pdf>

¹⁷ <http://www.defra.gov.uk/foodfarm/landmanage/water/csf/document-archive.htm>

2.10 Which approach was taken to ensure that water uses are providing an adequate contribution to the recovery of the costs of water services?

The methodology for undertaking cost recovery of water uses is explained in each of the river basin district Article 5 reports and in more detail in the report on cost-recovery and incentive pricing. Further work in relation to the need for changes to cost-recovery mechanisms is summarised in the CRP Project 1c report.

2.11 Whether future plans have been put in place to address any continuing uncertainties and data gaps on the recovery of the costs of water services?

Further work on the recovery of the costs of water services will take place as a result of the Cave and Walker Reviews. In addition there are plans to undertake further longer term work on benefits assessment. This will provide better evidence on what the level of environmental and resource costs relevant to the recovery costs of water services. This research is being scheduled by Defra to deliver answers in time for the 2nd river basin management planning process.

K3 Data to be provided

3.1 Volumes abstracted/discharged per water service

This information is available for water company areas but not on a river basin district basis. Data are contained in the relevant Article 5 report or can be obtained from the Ofwat website at the above link.

3.2 Estimated investments for water services

The estimated investment costs for water services relevant for the Water Framework Directive are set out in the RBD impact assessment documents that will be published at the same time as the plan documents on 22nd December 2009.

3.3 Costs of water services

This information is available on a water company basis not on an river basin district basis. Data is contained in the relevant Article 5 report or can be obtained from the Ofwat website at the above link.

K4 Other information

Hyperlinks to more detailed supporting documents including references to legal documents or methodology documents should be provided.

Article 5 reports for the UK River Basin Districts:

<http://webarchive.nationalarchives.gov.uk/20080305115859/http://www.defra.gov.uk/environment/water/wfd/economics/index.htm#eco>

River Basin Management Planning guidance document:

<http://www.defra.gov.uk/environment/quality/water/wfd/documents/riverbasinguidance.pdf>

Ofwat website:

<http://www.ofwat.gov.uk>

Department for Environment, Food and Rural Affairs website on Water Framework Directive

<http://www.defra.gov.uk/environment/quality/water/wfd>

Cave report findings:

<http://www.defra.gov.uk/environment/quality/water/industry/cavereview/documents/cavereview-finalreport.pdf>

Walker review interim report

<http://www.defra.gov.uk/environment/quality/water/industry/walkerreview/documents/walker-call-for-evidence.pdf>

The UK would like to work with the Commission to produce common methods for reporting on economic analysis across Member States. This is relevant in the context of the planned workshop for next year to consider methods for improving the process.



Water for life and livelihoods

River Basin Management Plan
North West River Basin District

Annex L: Record of consultation
and engagement

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L.1 Introduction

This annex presents a summary of the steps taken nationally and within the North West River Basin District to ensure that the River Basin Management Plan (RBMP) has been produced through consultation and engagement with interested parties.

It is an important principle of the Water Framework Directive (WFD) to encourage a wide range of stakeholders to be involved in improving the water environment. As a first step to securing meaningful engagement stakeholders and the public need access to the information about the work in hand. Significant efforts to make information easily accessible have been made and they are described below under the heading “Public access to information”.

As a step on from making information available, and in order to gain a more detailed insight into the views of stakeholders on different aspects of river basin management, there have been a number of consultations on general and specific aspects of implementation. Some of these were led by the Department for Environment, Food and Rural Affairs and the Welsh Assembly Government, some by the Environment Agency, and some by other bodies such as the United Kingdom Technical Advisory Group. Some of the consultations have had a river basin district focus and some have been for England and Wales (“national” in the context of this chapter). All of these consultations have helped develop the proposals for river basin management and provided the benefit of wide geographical, sectoral and stakeholder coverage, and linked into a number of groups focussed on specific water management issues. All these activities are listed below under the heading of “Consultations” along with a summary of their outcomes.

Finally, the process of producing this River Basin Management Plan has benefited from the active involvement in the planning process itself by many different stakeholders. These have taken place at the national (England and Wales) and at the regional level through very wide ranging activities, which include for example the work of the national stakeholders, the river basin district liaison panels and many local groups. These forms of engagement are listed and described below under the heading “Involvement in the planning process”. Because this engagement has been extensive over a number of years this list is not exhaustive.

L.2 Public access to information

Means of dissemination	Activities
Environment Agency	<ul style="list-style-type: none"> • Technical waterbody level information on objectives, classification status and identified risks as presented in the draft River Basin Management Plans - December 2008 • Initial Article 5 information (River Basin Characterisation outputs) on 'What's in your backyard' (WIYBY) – 2005
Environment Agency website	<p>A river basin management web page has been set up and is updated regularly. Information on website includes:</p> <ul style="list-style-type: none"> • Background documentation used in river basin district liaison panel meetings and the minutes of meetings • All consultation documents and supporting information posted on the web site (different sites depending on the lead organisation for each consultation) • Posting of all statement of response to consultations • The internet address of the online consultation was promoted to local stakeholders' websites to enable web links to be created • Use of electronic consultation to facilitate responses • Technical supporting information including further characterisation (risk assessment) outputs, classification, objectives and measures as presented in the draft River Basin Management Plans. • Contact details for Environment Agency staff involved in river basin management
Use of public libraries	<ul style="list-style-type: none"> • No public libraries were used in the North West district • Copies of all Environment Agency led consultation documents were made available free of charge at the Head Office in Bristol and in the area and region offices in the North West River Basin District at <ul style="list-style-type: none"> - Richard Fairclough House, Knutsford Road, Warrington, WA4 1HG - Ghyll Mount, Gilian Way, Penrith 40 Business Park, Penrith, Cumbria, CA11 9BP - Appleton House, 430 Birchwood Boulevard, Warrington, Cheshire, WA3 7WD - Lutra House, Dodd Way, Walton Summit, Bamber Bridge, Preston, Lancashire, PR5 8BX.

Means of dissemination	Activities
Direct mail outs	<ul style="list-style-type: none"> • Copies of 'The Water Framework Directive – Guiding Principles on the Technical Requirements' mailed to National stakeholders • 180 electronic copies of the consultation document 'River Basin Planning: Working Together' sent to stakeholders. • 180 electronic copies of 'River Basin Planning: Summary of Significant Water Management Issues' sent to stakeholders. • 3 paper copies of the 'draft North West River Basin Management Plan' sent to stakeholders. • E-bulletin sent out to over 300 key stakeholders in the North West including information about the consultation and key information • Paragraph about the dRBMP consultation included in all renewal letters to Abstraction Licence Permit holders (Later included in all national letters to various permit holders) • 300 postcards signposting consultation included in letters to regulated business and industry • 20 NGOs received email invite to workshop which included link to consultation • Approx 25 individual, tailored emails to targeted audience
Public notices	<ul style="list-style-type: none"> • Notice published in London Gazette for one day stating submission on 22 September 2009 of the 'River Basin Management Plans 2009-2015' to Ministers for approval, under Regulation 13(1)(b) of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. • Notice of consultation on the 'draft North West River Basin Management Plan' published in the published in Westmoreland Gazette, Liverpool Echo, Manchester Evening News and Lancashire Evening Post for two consecutive weeks from 8 January 2008. • Notice of consultation on 'River Basin Planning: Summary of Significant Water Management Issues' published in the Lancashire Evening Post, the Liverpool Daily Echo and the Westmorland Gazette for two weeks from 27 July 2007 • Notice of consultation on 'River Basin Planning: Working Together' published in the Lancashire Evening Post and the London Gazette for two weeks from 22 December 2006
Technical pamphlets/information sheets	<ul style="list-style-type: none"> • General Water Framework Directive introductory material distributed at conferences • Issue/ sector based briefing sheets distributed at conferences <ul style="list-style-type: none"> Sector specific briefings for : - Drainage (Jan 08) - Chemical Sector (Nov 07) - Envirowise (Oct 07) - Fisheries (June & Oct 07) • 100 x email to chemical manufacturers and users of DEHP (Di(2-ethylhexyl)-phthalate) and nonylphenol about Water Framework Directive, Pollution Reduction Plans and consultation
Publicity material	<ul style="list-style-type: none"> • Photography competition launched in April 2009 for Under 16s to promote the value of water

Means of dissemination	Activities
Interviews/articles in local media	<ul style="list-style-type: none"> • River basin district e-bulletin sent quarterly to 300 stakeholders from Jan 2007 • Publication of leaflets and postcards to publicise and promote participation in consultations • 16000 x 'Way forward for Water' Leaflets produced with general water planning messages for use • 2500 x Postcards promoting the consultation • Advert in delegate guide at the Chemicals North West awards (attended by approx 270 people). • British Farmer and Grower. Article on Catchment Sensitive Farming and Water Framework Directive • North West Article in European Network of Municipalities and Rivers (EnMAR) newsletter • Lake District National Park, Lakes Messenger magazine. Article on Significant Water Management Issues consultation • Lancashire Environment Forum, Essence Newsletter. Article on Water Framework Directive and developing Significant Water Management Issues response • Confederation of British Industry, NW Business Review magazine. Article on business and Water Framework Directive. • Utility Week. Article on catchment modelling project with United Utilities and Leeds University. • Mersey Basin Campaign, Source Magazine. Article on Significant Water Management Issues. • North West Regional Assembly, Vista Newsletter. Article on and link to Significant Water Management Issues consultation • Chemicals Northwest, monthly e-bulletin. Water Framework Directive Key messages included in bulletin. • Article on National Farmers Union North West web pages about dRBMP consultation • Article in Bolton news about dRBMP consultation • Article in Cumberland and Westmorland Herald about dRBMP consultation • Article on Wigan Today website about classification • Article in Wigan evening post about classification • Article in 4NW weekly newsletter about dRBMP consultation • Article on Mersey Basin Campaign Website about dRBMP consultation • Information posted on Chemicals Northwest Website about dRBMP consultation • Article in Chemicals North West Newsletter about dRBMP consultation • Article on Lake District National Park website about dRBMP consultation • Article in Chemicals Northwest e-newsletter about dRBMP consultation

Means of dissemination	Activities
Public meetings/drop in events, other	<ul style="list-style-type: none"> • Article on Ribble Catchment Conservation Trust website about dRBMP workshop for NGOs • Meeting at Lancashire Environment Forum to discuss local action • Meeting with local Association of Rivers Trusts to discuss local actions • Attending Fisheries Consultative meetings • Presentation at Morecambe Bay Partnership conference Workshop held for eNGOs
Other	<ul style="list-style-type: none"> • Offer for translations of documents to be made available on request • Approx 30 meetings/phone calls with individual stakeholders to discuss Water Framework Directive • Approx 57 meetings attended engaging over 1230 people

Department for Environment, Food and Rural Affairs

Publication of background documents on the economic aspects of implementation	<ul style="list-style-type: none"> • Scoping study for Water Framework Directive Annex III (economic analysis) • Regulatory Impact Assessment on potential costs and benefits associated with new environmental standards • Report on economic importance and dynamics of use of River Basin Characterisation led by the Department for Environment, Food and Rural Affairs, Welsh Assembly Government involved. • Report on cost recovery and incentive pricing led by the Department for Environment, Food and Rural Affairs, Welsh Assembly Government involved. • Report on cost-effectiveness analysis and methodology for assessing disproportionate costs led by the Department for Environment, Food and Rural Affairs, Welsh Assembly Government involved • Report on private water services • Groundwater daughter directive partial Regulatory Impact Assessment - covers England and Wales • Priority substances partial Regulatory Impact Assessment
Department for Environment, Food and Rural Affairs website	<ul style="list-style-type: none"> • Article 5 reports • Advert for the draft River Basin Management Plans consultation and links to details on the competent authority websites.

United Kingdom Water Framework Directive Technical Advisory Group

United Kingdom Water Framework Directive Technical Advisory Group website	<p>Access to information on technical interpretation of Water Framework Directive requirements including</p> <ul style="list-style-type: none"> • Environmental standards • Classification
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L.3 Consultations

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
Led by the Environment Agency			
Draft North West River Basin Management Plan	<p>This document presented the main issues for the North West River Basin District and briefly set out the actions proposed to deal with them. The annexes to the document gave much more detail on the conditions in the river basin district, the actions proposed and the mechanisms that can be used to take these actions forward.</p>	<p>There were 112 responses to the consultation received. The main themes of the comments received were:</p> <ul style="list-style-type: none"> • The Size and presentation of the draft plan • Low level of ambition in the first cycle • Queries on the assessment of the health of water bodies • The need to engage a wider range of sectors, organisations and people in the delivery of the plan. • The need to secure funding for those unfunded measures that were included in the plan • Present a clear view of the links between all the different legal requirements that apply to the water environment and how these link to other plans • The need to provide more information on the links between Water Framework Directive and other legislation such as Habitats Directive, Water Resources Acts and the Marine Bill. <p>As a result of the comments made, the</p>	December 2008 – June 2009

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
		<p>Environment Agency has:</p> <ul style="list-style-type: none"> • Increased the level of ambition in the first cycle • Updated and reviewed the current status and future objective for every waterbody • Reviewed the local and national measures, including feedback from consultation response • Reviewed the content and presentation of the main document and annexes <p>Further detail is provided in 'draft River Basin Management Plans, a consultation response for the North West River Basin District'</p> <p>http://wfdconsultation.environment-agency.gov.uk/wfdcems/en/northwest/Intro.aspx</p>	
Strategic Environmental Assessment Environmental Reports for the draft River Basin Management Plans	<p>The Water Framework Directive requires the production of River Basin Management Plans across the United Kingdom. These plans require assessment under the Strategic Environmental Assessment (SEA) Directive (2001/42/EC) to identify wider effects on the environment.</p> <p>The environmental report presented the methodology we used in the SEA, an explanation of how environmental factors have been considered</p>	<p>1 opinion was received relating directly to the North West Plan. A summary of comments across all river basin districts included:</p> <ul style="list-style-type: none"> • The importance of ensuring the maintenance of water supplies to canals and the need to maintain canals open for navigation and at suitable depth. Concerns were also raised about measures that may require the screening of abstractions and 	December 2008 – June 2009

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	within the decision-making, and the results and conclusions of the SEA process.	<p>transfers to supply water to reservoirs and canals.</p> <ul style="list-style-type: none"> • The importance of river basin management process in delivering habitat creation, green infrastructure, reinstatement of habitat, and the enhancement of protected and UKBAP, LBAP and other locally important species. • Concerns were raised about how the SEA has considered the historic environment (including historic landscape character, historic built environment, archaeological remains and deposits). Sensitivities include: changes in water quality, water levels, habitat restoration schemes, managed realignment and pollution. • Respondents wished to see further evidence of how the SEA had influenced the Plan process and how it may be possible to influence other 	

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
		<p>future plans and strategies.</p> <p>Further detail and the action the Environment Agency has taken to all comments is provided in the 'Strategic Environmental Assessment Statement of Particulars'.</p> <p>http://wfdconsultation.environment-agency.gov.uk/wfdcems/en/northwest/Intro.aspx</p>	
Strategic Environmental Assessment Scoping Reports consultation	<p>The Water Framework Directive requires the production of River Basin Management Plans across the United Kingdom. These plans require assessment under the Strategic Environmental Assessment Directive (2001/42/EC) to identify wider effects on the environment. The Scoping Reports set out the information to be included in this assessment</p>	<p>The results of the consultation were considered in finalising the approach to the Strategic Environmental Assessment. Further details for each river basin district can be obtained on the Environment Agency website.</p>	October to November 2007 (extended to January 2008)
River Basin Planning – Summary of Significant Water Management Issues [North West River Basin District]	<p>This document sets out what The Environment Agency believe are the most significant issues that face the North West Basin District. The Environment Agency has worked together with the members of the North West River Basin District liaison panel to identify the significant</p>	<p>The majority of responses disagreed with the proposals. As a result of the comments made, the Environment Agency have:</p> <ul style="list-style-type: none"> • Added 'Abstraction and Flow' issues in terms of climate change and future growth as the districts sixth significant water management issue • Added additional pressures which 	July 2007 to January 2008

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	<p>water management issues. To identify the significant issues for this report, a list of pressures or 'potential issues' was assessed</p>	<p>underline the 'headline' issues</p> <ul style="list-style-type: none"> • Added additional organisations and suggested measures relevant to the appropriate significant water management issue. 	
River Basin Planning – Working Together [North West River Basin District]	<p>Further detail is provided in 'River basin planning: Summary of significant water management issues, a consultation response for the North West River Basin District'</p> <p>Many varied and constructive responses were received, with many suggesting improvements to the Environment Agency's proposals. As a result of the comments made, the Environment Agency has:</p> <p>This document presented information and proposals about the way river basin planning could work in the North West River Basin District and how and when people interested in participating in this process could do so.</p>	<ul style="list-style-type: none"> • Increased the number of publications consultation notices are published in. • Added additional stakeholders to the database. • Added additional plans and strategies relevant to river basin planning • Added further detail to 'River basin planning: working together, a consultation response for the North West River Basin District' to make method statements clearer; • Refined and corrected the assessments for authorised point and diffuse sources, where necessary; 	December 2006 to June 2007

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
		<ul style="list-style-type: none"> • Updated morphological pressure assessments where new information was available; • Improved assessment of non-native species risks to surface waters; and chemical and quantitative risks to ground water. <p>Further detail is provided in 'River basin planning: working together, a consultation response for the North West River Basin District'</p>	
Water for life and livelihoods – a strategy for River Basin Planning in England and Wales	<p>This document set out proposals for how the Environment Agency was planning to work to develop river basin management plans and implement the Water Framework Directive. In particular how it would engage with and encourage participation from stakeholders at national, regional and local level; and how it would integrate different aspects of managing the water environment</p>	<p>Responses were received from many different stakeholders. These contributed to refining the planned approach to river basin management, particularly in relation to the terms of reference for stakeholder engagement. This consultation process also helped the process of aligning the thinking about implementation of the Directive between the Department for Environment, Food and Rural Affairs, the Welsh Assembly Government and key stakeholders.</p>	January to April 2005
River Basin Characterisation	<p>District based consultation on River Basin Characterisation (Water Framework Directive Article 5)</p>	<p>There were many varied and constructive responses, with many suggesting improvements to the proposals. As a result of these comments, the Environment Agency have:</p> <ul style="list-style-type: none"> • made method statements clearer; • refined and corrected the assessments for 	September to November 2004

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
		<p>authorised point and diffuse sources, where necessary;</p> <ul style="list-style-type: none"> • updated morphological pressure assessments where new information was available; • improved assessment of non-native species risks to surface waters; and chemical and quantitative risks to ground water. 	
The Water Framework Directive – Guiding Principles on the Technical Requirements	<p>This document presented the Environment Agency's interpretation of the technical requirements from Annex II and V of the Water Framework Directive. Aspects covered by these annexes included the characterisation of surface and groundwater body types; identification of pressures and impacts; review of impacts of human activity; classification of surface water and groundwater bodies; and the design of monitoring programmes.</p>	<p>Responses were received from a number of the main stakeholders. These allowed a common understanding of the technical requirements of the Directive to be achieved and informed the work undertaken to complete the Characterisation Reports; the design of the monitoring programmes; and the approach to status classification for water bodies.</p>	June to September 2002

Led by the Department for Environment, Food and Rural Affairs and Welsh Assembly Government

Consultation on the Draft Flood and Water Management Bill	<p>The draft Flood and Water Management Bill will:</p> <ul style="list-style-type: none"> • deliver improved security, service and sustainability for people and their communities 	<p>http://www.defra.gov.uk/corporate/consult/flood-water-bill/index.htm</p>	April to July 2009
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Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	<ul style="list-style-type: none"> • it will be clear who is responsible for managing flood risk • protect essential water supplies • modernise the law for managing flood risk and reservoir safety • encourage more sustainable forms of drainage • enable water companies to control more non-essential uses of water during droughts • make it easier to resolve misconnections to sewers <p>The overall effect will be a healthier environment, better service and greater protection for people, their communities and businesses.</p>		
Consultation on the second phase of Environmental Permitting Programme (EPP2)	<p>EPP2 is a Better Regulation initiative designed to reduce costs for operators and the regulator by cutting unnecessary red tape, while continuing to protect the environment and human health. This consultation proposes to extend the single EP system formed under EPP1 to create a common system of risk-based environmental permitting and compliance for an extended range of regimes. These include:</p>	http://www.defra.gov.uk/corporate/consult/env-permitting/letter.htm	February to May 2009

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	<ul style="list-style-type: none"> • Water Discharge consents: Permits to control certain discharges to surface water; • Groundwater Authorisations: Permits to control the disposal of specific substances into groundwater, and; • Radioactive Substances Regulation: permits for keeping and use of radioactive materials; and for accumulation and disposal of radioactive waste. 		
Consultation on new arrangements for establishing Water Protection Zones	<p>For England, the principle of new Water Protection Zone arrangements was included in all options for the consultation on Catchment Sensitive Farming. A Welsh consultation will consider the need for new Water Protection Zone arrangements alongside other agricultural diffuse pollution measures.</p>	<p>http://www.defra.gov.uk/corporate/consult/water-protection-zones/index.htm</p> <p>http://wales.gov.uk/consultations/environmentandcountryside/waterprotectionzones/?lang=en&status=closed</p>	Catchment Sensitive Farming consultation in England ended in November 2007
Consultation on Directions to the Environment Agency on Classification of Water Bodies	<p>This consultation is the final stage in a process of developing the environmental quality standards and other criteria recommended for use in classification in the first river basin planning cycle. It also includes recommendations on methodologies for the use of those standards and criteria to classify</p>		December 2008 to March 2009

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
Ministerial Guidance - Consultation on River Basin Planning Guidance Volume 2	<p>all WFD water bodies.</p> <p>Consultation seeks views upon draft guidance in relation to standards, objectives, emerging policy trends, issues around technical feasibility and disproportionate cost; and impact assessments associated with the Water Framework Directive.</p>	<p>http://www.defra.gov.uk/environment/quality/water/wfd/documents/consult-guidance-response-letter.pdf</p>	February to May 2008
Consultation on Implementation of European Union Legislation in England and Wales: Aquatic Animal Health Directive	<p>This paper asks to:</p> <ul style="list-style-type: none"> • note the provisions in the Directive which are obligatory; • comment on the interpretation; • respond on the proposals relating to the areas of choice. <p>The Directive and the implementing proposals generally cover the aquatic animals when they are caught, kept or moved by humans. There are also some obligations in relation to aquatic animals in the wild.</p>	<p>http://www.defra.gov.uk/corporate/consult/khv/khv-consultation-doc.pdf</p>	December 2007 to March 2008
Consultation on the implementation of the revised Bathing Water Directive	<p>The purpose of this Consultation paper was to seek views on:</p> <ul style="list-style-type: none"> • the number and type of bathing waters where measures should be taken to improve the water quality; • the development of a prediction and discounting system; and • the development of public information for beach signage. 	<p>http://www.defra.gov.uk/environment/quality/water/waterquality/bathing/documents/summary-responses.pdf</p>	November 2007 to February 2008
Consultation on	This consultation		November 2007 to

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
the review of schedule 9 to the Wildlife and Countryside Act 1981 and a ban on the sale of certain species	sought comments on proposals for a prohibition on the sale of certain species. The prohibition will be achieved by an Order made under section 14ZA of the Wildlife and Countryside Act 1981.	http://www.defra.gov.uk/wildlife-pets/wildlife/management/non-native/documents/consultation.pdf	January 2008
Consultation on Non-Agricultural Diffuse Pollution	General binding rules for non-agricultural diffuse pollution; Control on phosphates in laundry detergents; Sustainable Urban Drainage Systems: permeable surfaces, filter strips and swales, infiltration devices, basins and ponds.	Various steps are being considered and the Consultation on options for controls on phosphates in domestic laundry cleaning products in England has been launched.	February to May 2007
Consultation on mechanisms to deliver Water Framework Directive Requirements on hydromorphology	This document looks at the range of legislative, economic and voluntary mechanisms that are available in England and Wales for delivering measures to avoid or reduce effects resulting from hydromorphological pressures, and whether they are sufficient to meet Water Framework Directive requirements.	The majority who responded welcomed the consultation and most provided practical and constructive comments.	February to May 2007
Article 5 economic analysis of water use supporting document	Article 5 (characterisation) requirement for River basin district based assessments of the	The idea of a catchment restoration fund is being actively considered to address the physical restoration of a number of water bodies.	March 2005
		Reports summarising, for each River basin district, the analysis required by Article 5 of the Directive have been reported by	

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	'Economic analysis of water use'.	the Department for Environment, Food and Rural Affairs (on behalf of the United Kingdom) to the European Commission. http://www.defra.gov.uk/environment/quality/water/wfd/characterisation.htm	
Consultation on Guidance for River Basin Planning	This guidance set out the expectations of the Department for Environment, Food and Rural Affairs in relation to river basin planning.	Set out in two parts. See Ministerial Guidance Consultation.	December 2004 to March 2005
Second consultation on the Water Framework Directive	This second consultation invited views on the key issues arising from transposition and implementation of the Water Framework Directive into national legislation.	The summary of responses and the response to them is detailed in the document below, from pages 14 – 53. http://www.freshwaterlife.org/servlet/BinaryDownloaderServlet?filename=1060944568091_WFD_consult3_chapters_only.pdf	October 2002 to January 2003
First consultation on the Water Framework Directive	This consultation invited views on key issues arising from the implementation of the Water Framework Directive. It was the first step, including discussions with the principal affected parties. It also served as an introduction to the Directive's provisions and principal obligations.	In addition to the main themes, the role of wetlands and the degree to which they could be protected under the Water Framework Directive and the definition and timing of the "no deterioration" in status requirement were discussed.	March to June 2001
		As a result of the comments made the Department for Environment, Food and Rural Affairs and Welsh Assembly Government: <ul style="list-style-type: none">• agreed that it's important to develop techniques to trace and monitor	

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
		<p>diffuse sources of pollution.</p> <ul style="list-style-type: none"> • gave their intention to implement the Water Framework Directive by means of secondary legislation (regulations). 	
Led by the Department for Environment, Food and Rural Affairs			
Consultation on proposals for time limiting of water abstraction licenses	<p>This consultation is to gather views on proposals for time limiting of water abstraction licenses. The time limiting of existing abstraction licenses is vital in ensuring water resources can be managed and allocated efficiently, in order to cope with the anticipated impacts of climate change and achieve water quality objectives set out in the UK Government's 2008 water strategy for England <i>Future Water</i>.</p>	http://www.defra.gov.uk/corporate/consult/water-abstraction/consultation.pdf	May to August 2009
Consultation on implementing the abstraction elements of the Water Act 2003	<p>This consultation is to seek views on draft proposals from Defra and the Welsh Assembly Government on the removal and creation of various exemptions from license control. The proposed new Regulations to bring these proposals into force will implement the remaining abstraction provisions of the Water Act 2003.</p>	http://www.defra.gov.uk/corporate/consult/water-act/index.htm	April to July 2009
Environmental Standards for Farming - Consultation on	<p>This consultation is to seek your views on a range of proposed changes to cross</p>	http://www.defra.gov.uk/corporate/consult/gaec/index.htm	February to May 2009

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
proposed changes to standards in cross compliance Good Agricultural and Environmental Condition (GAEC) and related measures in England	compliance following the conclusion of the review of the Common Agricultural Policy (CAP Health Check). These proposals relate to cross compliance standards and related measures in England, including recapturing the environmental benefits of set-aside.		
Consultation on modernisation of salmon and freshwater fisheries legislation; new order to address the passage of fish	Proposals to improve the free passage of fish and to allow free access to breeding, nursery and feeding grounds for fish in England and Wales. These proposals follow recommendations made in the Salmon and Freshwater Fisheries Review, published in 2000, and were included in the consultation which started in February 2007 on "Mechanisms to Deliver Water Framework Directive Requirements on Hydro-morphology" and in the new water strategy for England, Future Water on 7 February 2008.	http://www.defra.gov.uk/corporate/consult/fisheries-legislation/letter.htm	January to April 2009
Consultation on Draft Statutory Instrument to amend provisions of the Water Resources Act 1991 for Water Protection Zones, and related Draft Statutory Guidance for the Environment Agency	This consultation follows on from one on diffuse water pollution from agriculture that was conducted in 2007. Defra concluded in the light of that earlier consultation that the need to provide a power to regulate where necessary to implement the Water Framework Directive would be best met by simply updating the	http://www.defra.gov.uk/corporate/consult/water-protection-zones/	December 2008 to March 2009

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	<p>existing power to designate Water Protection Zones. This power would be available for use where appropriate under the river basin management plans now being developed by the Environment Agency with the aim of achieving good chemical and ecological status in inland and coastal waters by 2015. Parts of this consultation will also apply in Wales.</p>		
Consultation on improving surface water drainage	<p>This consultation develops some of the key policy proposals set out in the Government's new Water Strategy, <i>Future Water</i>. The strategy sets out a vision for more effective drainage of surface water, in order to resolve existing problems and prepare for the impacts of climate change. The floods last summer brought into sharp focus the real damage that surface water flooding can cause. The interim report from the Pitt Review on lessons learned has urged early action to improve the way that surface water is managed, particularly in high risk areas.</p>	<p>http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/swmp-consult.pdf</p> <p>http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/swmp-consult-sum.pdf</p>	February to April 2008
Consultation on the future of the Pesticides Safety Directorate (PSD)	<p>This consultation paper sought views on the future of the Pesticides Safety Directorate, following recommendations made by the 2005</p>		November 2007 to January 2008

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	<p>Hampton Review, which aimed to make Government's inspection and enforcement functions simpler and more customer focussed.</p>		
Protection of Waters Against Pollution from Agriculture	<ul style="list-style-type: none"> • The purpose of this Consultation paper was to seek views on: • proposals for revised Action Programme measures to control pollution caused by nitrogen from agricultural sources. • whether to apply these measures within discrete Nitrate Vulnerable Zones (as revised) or throughout the whole of England. 	<p>http://www.defra.gov.uk/environment/quality/water/waterquality/diffuse/nitrate/documents/consultation-supportdocs/consultation.pdf</p>	August to December 2007
Consultation on the revised Code of Good Agricultural Practice to protect water, soil and air quality.	This consultation invited views on the draft revised Code of Good Agricultural Practice.	<p>http://www.defra.gov.uk/goodfarm/landmanage/cogap/documents/summary-responses.pdf</p>	August to November 2007
Consultation on diffuse sources of water pollution from agriculture.	<p>Three policy packages are presented for consideration for inclusion in Programme of measures: supportive, regulatory and economic. Also whether Water Protection Zones should be merged with Nitrate Vulnerable Zones.</p>	<p>Government response: http://www.defra.gov.uk/goodfarm/landmanage/water/csf/documents/diffuse-consult-govresponse.pdf</p>	August to November 2007
Consultation on options for controls on phosphates in domestic laundry cleaning products	This consultation paper covers the need to take action on phosphates in the water environment and the contribution that		February 2007 to April 2008

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
in England	controls on domestic laundry cleaning products might make to that process.		
Consultation on draft statutory social and environmental guidance to the Office of Water Services (Ofwat)	This consultation delivers on a commitment made by the Government in the Regulatory Impact Assessment which accompanied the Water Act 2003, that a full public consultation would take place on the draft Guidance.		February 2007 to April 2008
Partial Regulatory Impact Appraisal	This Regulatory Impact Assessment concerns environmental quality standards for implementation of the Water Framework Directive. The Directive requires the United Kingdom administrations to introduce environmental standards and conditions to help with the classification and objective setting process that will form the basis for the river basin management planning required to meet the Directive objectives.	http://www.defra.gov.uk/environment/quality/water/wfd/documents/pdf-ria-draft/ria-wfd-excludingannexes.pdf	2007
Consultation: <i>Making Space for Water:</i> Environment Agency strategic overview – strengthening our strategic approach to sea flooding and coastal erosion risk management	This consultation paper seeks views on the proposals of the Department for Environment, Food and Rural Affairs for the way in which the Environment Agency will exercise a strategic overview in relation to sea flooding and coastal erosion risk management. A separate consultation will take place at a later	<i>Note: the United Kingdom Water Framework Directive Technical Advisory Group issued their initial proposals for standards for stakeholder review in early 2006. This Regulatory Impact Assessment takes into account the changes proposed as a result of the stakeholder review and reflects the final recommendations made.</i>	August to November 2006

Title	Brief description of document	Key outputs of consultation and actions	Period of consultation
	stage regarding the Environment Agency's strategic overview in relation to inland sources of flooding.		
Led by United Kingdom Water Framework Directive Technical Advisory Group			
<ul style="list-style-type: none"> • Environmental Standards and Conditions – Phase 1 • Environmental Standards – part 2 • United Kingdom Environmental Standards and Conditions (Specific Pollutants/Groundwater Standards/Surface Water) (SR1-2007) For more information visit http://www.wfd.uk.org/			
Other			
<ul style="list-style-type: none"> • Towards Sustainability (United Kingdom Water Industry Research) For more information visit http://www.ukwir.org/site/web/content/home			

L.4 Involvement in the planning process

Sectors, Groups and networks	Activity																																															
River Basin District Level	<p>The liaison panel was created as a new forum for co-deliverers to discuss and influence the development of the river basin management plan and assist with its implementation. The panel works on a representational system and core membership will be based around the key organisations that are responsible for implementation, and others who can both represent the public and other sectors.</p> <p>The liaison panel is made up of representatives from key stakeholder sectors:</p> <table> <thead> <tr> <th></th> <th>Sector</th> <th>Key Representative</th> <th>Organisation (Role)</th> </tr> </thead> <tbody> <tr> <td rowspan="10">North West River Basin District Liaison Panel</td> <td>Consumers</td> <td>Andrea Cook</td> <td><i>Consumer Council for Water</i></td> </tr> <tr> <td>Environment Agency</td> <td>Tony Dean</td> <td><i>Environment Agency</i></td> </tr> <tr> <td>Local authority</td> <td>Tim Hill</td> <td><i>Bolton Borough Council</i></td> </tr> <tr> <td>Farming</td> <td>Helen Little</td> <td><i>National Farmers Union</i></td> </tr> <tr> <td>Industry</td> <td>Darius Richardson</td> <td><i>Ineos Chlor</i></td> </tr> <tr> <td>Natural England</td> <td>Paul Green</td> <td><i>Natural England</i></td> </tr> <tr> <td>Recreation</td> <td>Bob Cartwright</td> <td><i>Lake District National Park Authority</i></td> </tr> <tr> <td>Regional Development</td> <td>Mark Atherton</td> <td><i>North West Development Agency</i></td> </tr> <tr> <td>Regional Assembly</td> <td>Michael Gallagher</td> <td><i>North West Regional Assembly</i></td> </tr> <tr> <td>Water Companies</td> <td>Perry Hobbs/ Jan Tyson</td> <td><i>United Utilities</i></td> </tr> <tr> <td>Freshwater Fisheries and Riparian Owners</td> <td>Alistair Maltby</td> <td><i>Association of Rivers Trusts</i></td> </tr> <tr> <td>Environmental NGOs</td> <td>Walter Menzies</td> <td><i>Mersey Basin Campaign</i></td> </tr> <tr> <td>Environmental NGOs</td> <td>Peter Robertson</td> <td><i>Royal Society for the Protection of Birds/Envirolink North West</i></td> </tr> <tr> <td>Fisheries</td> <td>Judith Clark (since Nov 2008)</td> <td><i>North West Regional Fisheries, Ecology and Recreation Advisory Committee</i></td> </tr> </tbody> </table>		Sector	Key Representative	Organisation (Role)	North West River Basin District Liaison Panel	Consumers	Andrea Cook	<i>Consumer Council for Water</i>	Environment Agency	Tony Dean	<i>Environment Agency</i>	Local authority	Tim Hill	<i>Bolton Borough Council</i>	Farming	Helen Little	<i>National Farmers Union</i>	Industry	Darius Richardson	<i>Ineos Chlor</i>	Natural England	Paul Green	<i>Natural England</i>	Recreation	Bob Cartwright	<i>Lake District National Park Authority</i>	Regional Development	Mark Atherton	<i>North West Development Agency</i>	Regional Assembly	Michael Gallagher	<i>North West Regional Assembly</i>	Water Companies	Perry Hobbs/ Jan Tyson	<i>United Utilities</i>	Freshwater Fisheries and Riparian Owners	Alistair Maltby	<i>Association of Rivers Trusts</i>	Environmental NGOs	Walter Menzies	<i>Mersey Basin Campaign</i>	Environmental NGOs	Peter Robertson	<i>Royal Society for the Protection of Birds/Envirolink North West</i>	Fisheries	Judith Clark (since Nov 2008)	<i>North West Regional Fisheries, Ecology and Recreation Advisory Committee</i>
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Business Sector	<ul style="list-style-type: none"> Meeting with Damian Waters Confederation of British Industry to discuss Water Framework Directive opportunities Meeting with Stanislav Zizka Envirolink to discuss Water Framework Directive opportunities Selected representatives attended catchment workshops 																																															

Sectors, Groups and networks	Activity
Chemical Industry	<ul style="list-style-type: none"> • Meeting with Roger Langford Chemicals Northwest to discuss Water Framework Directive opportunities • Selected representatives attended catchment workshops • Briefings provided
Water Industry	<ul style="list-style-type: none"> • Meetings with United Utilities to finalise the Water Resource Management Plans • Members of United Utilities attended catchment workshops
Ports	<ul style="list-style-type: none"> • Meetings with representatives of Port, harbour, navigation and dredging sector. <p>Selected representatives invited to attend catchment workshops</p>
Farming	<ul style="list-style-type: none"> • Selected representatives attended catchment workshops • Consulted with National Farmers Union (NFU), Natural England, Water UK, Wildlife link on characterisation • Met Carl Hudspith NFU to discuss Water Framework Directive opportunities
Local Government	<ul style="list-style-type: none"> • Presentation at North West Regional Assembly planners meeting <p>Selected representatives attended catchment workshops</p>
MPs and MEPs	<ul style="list-style-type: none"> • Briefings for MPs and MEPs when appropriate • Event for MEPs
Fisheries	<ul style="list-style-type: none"> • Selected representatives attended catchment workshops • Representatives present at consultatives meeting • Briefings provided
Recreation and biodiversity	<ul style="list-style-type: none"> • Selected representatives attended catchment workshops • Meeting with Susan Clarke Natural England to discuss Water Framework Directive opportunities • Meeting with Alistair Maltby and Fisheries Consultatives to discuss Water Framework Directive opportunities.
<p>Area and Regional Planning and Planning Liaison teams in the North West are continuing to influence the Local Planning Authorities to acknowledge that they need to contribute to the implementation of river basin management plans and to incorporate Water Framework Directive requirements into land use.</p> <p>Information on Water Framework Directive was presented to Cumbria Development Plan Officers Group (DPOG) about river basin management and their role in implementing it.</p> <p>The North West North Area Environmental Planning teams influenced South Lakeland District Council to incorporate river basin management principles in the Sustainability Appraisal Scoping Report for Allocations of Land plans</p>	
National and European level	

Department for Environment, Food and Rural Affairs Water Framework Stakeholder Group	<p>Chaired by the Department for Environment, Food and Rural Affairs. This group was established to promote stakeholder participation in the implementation of the Water Framework Directive. Members of the group are able to raise issues of concern and provide input. The Environment Agency lead on items and provide a detailed Water Framework Directive Programme update for each.</p> <p>Examples of members of the Stakeholder Group are given below.</p>
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Sectors, Groups and networks	Activity
	<p>Members include people representing the water industry, land management, environmental Non-Governmental Organisations and government organisations.</p> <ul style="list-style-type: none"> • Water United Kingdom • Natural England • Office of Water Trading • British Waterways • Forestry Commission • National Trust • Country Landowners Association • National Farmers Union • Royal Society for the Protection of Birds
National Liaison Panel for England	<p>Chaired by the Environment Agency. The National Liaison Panel for England has been set up to complement the river basin district liaison panels. The panel consists of around 20 members based around the key co-deliverers, that is, organisations who are responsible for carrying out actions, and others who can both represent the public and help drive changes in behaviour. The panel works on a representational system. This means the panel members are expected to represent the views of the whole of their sector and act as a two-way channel between the panel and their sector.</p> <p>Five meetings of the liaison panel were held between July 2007 and June 2009. Meeting papers and minutes are available on the website www.environment-agency.gov.uk/wfd. Members of the public are welcome to attend meetings as observers, by appointment with the Chair.</p>
Collaborative research programme on economics (CRP)	<p>The Collaborative Research Programme provided a consistent UK-wide basis for the environmental economics assessments for Water Framework Directive implementation. It was managed by the Department for Environment, Food and Rural Affairs and included participation from key interested groups:</p> <ul style="list-style-type: none"> • Department for Environment, Food and Rural Affairs, Welsh Assembly Government, Scottish Executive, Department of the Environment for Northern Ireland and other Government Departments • Environment Agency, Scottish Environment Protection Agency, Environment and Heritage Service • Natural England (previously English Nature), Office of Water Trading • Industry • Non-governmental organisations <p>The project considered assessment of measures and their benefits, in particular:</p>

Sectors, Groups and networks	Activity
	<ul style="list-style-type: none"> • a methodology to assess both the cost and effectiveness of measures aimed at protecting water resources; • guidance on deciding when costs are likely to be disproportionate to benefits; • a methodology for assessing the benefits - environmental, social and economic - from measures.
Tripartite meetings	<p>Other supporting material was produced, including a database of typical cost ranges for specific measures.</p>
Department for Environment, Food and Rural Affairs Economic Advisory Stakeholder Group (EASG)	<p>The Environment Agency meet regularly with Natural England, Countryside Council for Wales and the Joint Nature Conservancy Council. Discussions are held about key policy and legal issues in the implementation of the Water Framework Directive, as well as nature conservation sub-plans, protected areas and monitoring.</p> <p>The Water Framework Directive Economic Advisory Stakeholder Group in England and Wales met for the first time in December 2003. Established to support the implementation of the Water Framework Directive across in England and Wales. The Economic Advisory Stakeholder Group leads on issues defined as specific to England and Wales. Includes both government, agencies and stakeholders, and complements separate Water Framework Directive arrangements in the devolved administrations. The Economic Advisory Stakeholder Group in England and Wales includes all members of the ESG (government and regulators). Additional non-ESG members are listed below:</p> <p>Aluminium Foundation; Association of Electricity Producers; British Hydropower Association; British Marine Federation; British Water; British Waterways; Chemical Industries Association; The Chartered Institution of Water and Environmental Management; Confederation of British Industry; Confederation of British Wool Textiles; Confederation of Paper Industries; Country Land and Business Association; Crop Protection Association; Department for Environment, Food and Rural Affairs, Communications Directorate; Department for Environment, Food and Rural Affairs, Flood Management; Department for Environment, Food and Rural Affairs, Policy and Corporate Strategy Unit; Department for Environment, Food and Rural Affairs, Regulation Review Team; Department of Business and Regulatory Reform; Environmental Education Forum (EEF); Environmental Campaigns (ENCAMS); Environmental Industries Commission Highways Agency; International Navigation Association (PIANC); Kaolin & Ball Clay Association National Farmers' Union; Royal Society for the Protection of Birds; Royal Yachting Association Salmon and Trout Association; Society of British Water and Wastewater Industries; Surface Engineering Association; Surfers Against Sewage; United Kingdom Centre for Economic and Environmental Development; United Kingdom Major Ports; Water UK; Watervoice; The World Wide Fund for Nature (WWF)</p>

Sectors, Groups and networks	Activity
	<p>Key outputs from group and subgroups have been</p> <ul style="list-style-type: none"> • Preliminary cost-effectiveness analysis
European Union Common Implementation Strategy	<p>Involvement of European Stakeholder groups in development of common European implementation guidance, including European Environment Bureau, WWF, PIANC (ports and navigation), Eureau and other stakeholder groups.</p>
Conferences and seminars	<p>Numerous conferences and seminars including:</p> <ul style="list-style-type: none"> • The Chartered Institution of Water and Environmental Management series • Water UK Water Framework Directive conference 2009 • Specific conference for liaison panel members on economics March 2009 • Defra Ministerial event 19 March 2009
Other	<ul style="list-style-type: none"> • Periodic Review in 2009, England Catchment Sensitive Farming Delivery Initiative



Water for life and livelihoods

River Basin Management Plan
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Annex M: Competent authorities

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M1 Introduction

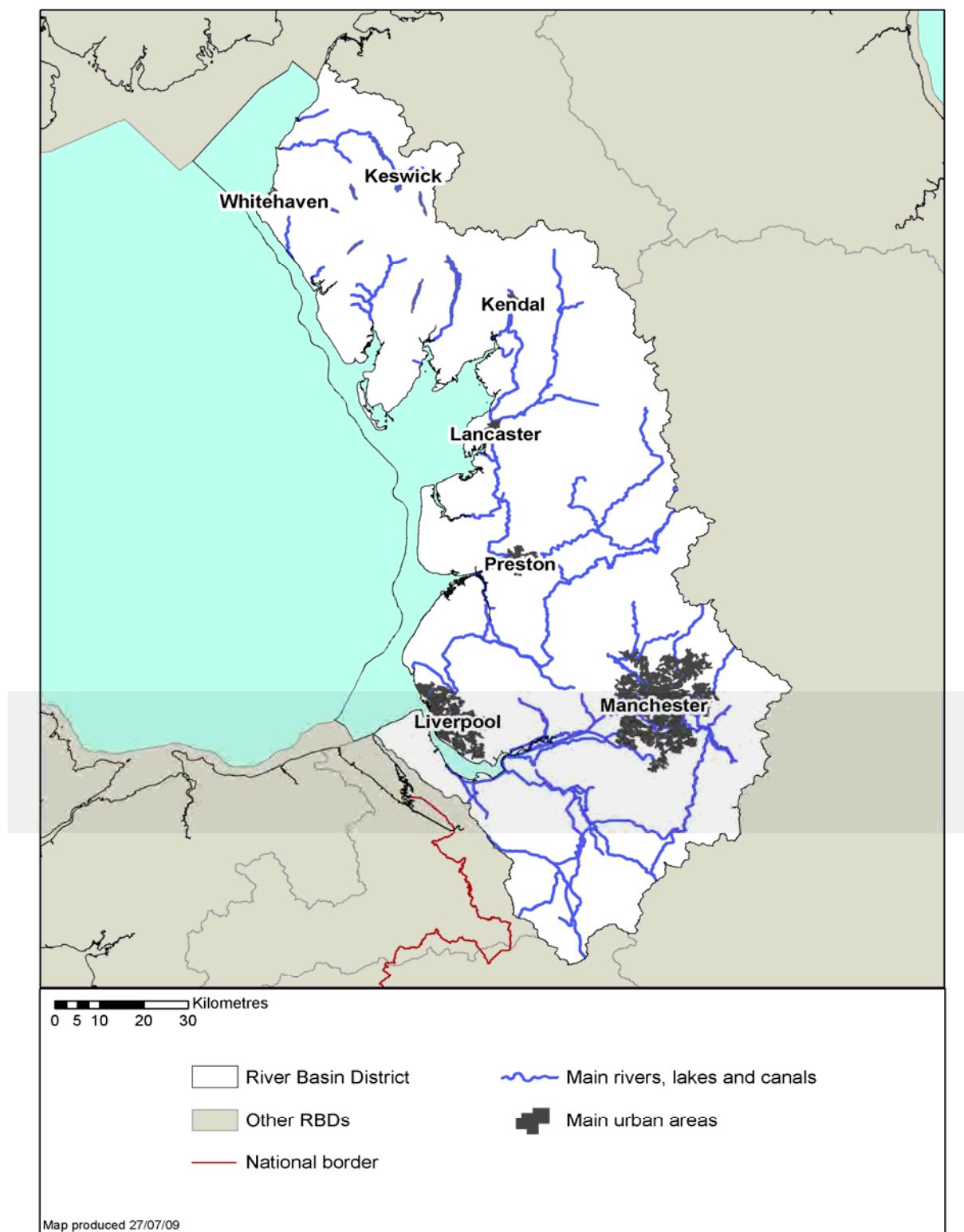
This annex sets out the names and addresses of competent authorities for river basin planning within the river basin district and a note of their legal status and responsibilities. The annex also gives, for external enquirers, our contact points and procedures for obtaining background documentation and information.

M2 Names and addresses of competent authorities

Secretary of State for Environment, Food and Rural Affairs
Nobel House, 17 Smith Square, London, UK SW1P 3JR

Environment Agency
Rio House, Waterside Drive, Aztec West,
Almondsbury, Bristol, UK BS32 4UD

M3 Geographical coverage of river basin district



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M4 Legal status of competent authorities

Secretary of State:

The Secretary of State is legally part of the Crown and is not established in legislation.

Environment Agency:

The Environment Agency is a non-departmental public body established by the Environment Act 1995.

http://www.opsi.gov.uk/acts/acts1995/Ukpga_19950025_en_1.htm

M5 Responsibilities of competent authorities

In England there are two competent authority roles – the “appropriate authority” role undertaken by the Secretary of State and the “Agency” role undertaken by the Environment Agency.

The “appropriate authority” has general responsibility for ensuring the Directive is given effect. That authority also has specific responsibilities for ensuring that appropriate economic analysis is carried out, approving proposals for environmental objectives and programmes of measures, and approving the draft River Basin Management Plans. The appropriate authority may also give guidance or directions to the “Agency”, and any other public body, on the practical implementation of the Directive. The appropriate authority for a river basin district also has the duty to ensure that the requirements of the Directive are given effect in relation to that district as a whole.

The “Agency” is responsible for carrying out the analysis required for characterisation, monitoring, identifying waters used for the abstraction of drinking water, and establishing a register of those waters and other protected areas. It has to prepare proposals for environmental objectives and programmes of measures for each river basin district, and prepare draft River Basin Management Plans. The Agency must also ensure public participation in preparation of the river basin management plan and make certain information required under the Water Framework Directive accessible to the public.

The competent authorities for North West river basin district are the Secretary of State and the Environment Agency. The Secretary of State has the “appropriate authority” responsibilities and the Environment Agency has the “Agency” responsibilities.

M6 Membership

Not applicable.

(The Water Framework Directive requires us to record if a competent authority acts as a coordinating body for other competent authorities and, if so, what is the membership of that group).

M7 Contact points and procedures

The initial point of contact is the North West river basin district Programme Manager who will co-ordinate a response to queries:

Email at North WestRBD@environment-agency.gov.uk

Phone on 01954 542147

Post to Stewart Mounsey, Environment Agency, Richard Fairclough House, Regional Strategy Unit, Knutsford Road, Latchford, Warrington, WA4 1HT.



Water for life and livelihoods

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Annex N: Glossary

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N1 Introduction

This annex provides a list of technical terms and abbreviations used in the main document and annexes of the River Basin Management Plan.

N2 Technical terms

The following list aims to provide brief explanations of many of the words, phrases and acronyms to which particular meanings are attached in river basin management.

Term	Explanation
Agency	Environment Agency of England and Wales.
Agri-environment scheme	Land management schemes on farmland that are beneficial for example for the environment, natural resources, biodiversity, landscape.
Alien species	Non-native species. Many species of plants and animals have been introduced to this country since Roman times. Several of these non-native species are invasive and have been causing serious problems to the aquatic and riverine ecology and environment. Problems include detrimental effects on our native species, deoxygenation of water causing fish mortalities, blocking of rivers and drainage channels, predation and competition with our native species, and in some cases pose health risks to the public or livestock.
Alternative objectives	In certain circumstances (set out in Article 4.4 and 4.5 of the Water Framework Directive) Member States may deviate from achieving the default objectives (e.g. good status by 2015). Objectives which are different from the default objectives are referred to in this river basin management plan as alternative objectives. The types of alternative objective are: - an extended deadline, e.g. achieving good ecological status by 2027; - a less stringent objective, e.g. achieving moderate ecological status by 2015; - different objectives for heavily modified or artificial water bodies, e.g. good ecological potential.
Angiosperms	The flowering plants. In transitional and coastal waters they include sea grasses and the flowering plants found in salt marshes.
Aquifer	A subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of

	groundwater or the abstraction of significant quantities of groundwater.
Artificial Water Body	A man-made surface water body, rather than a modified natural water body, which supports important aquatic ecosystems. It includes canals, some docks and some man-made reservoirs.
Asset Management Plan	See Periodic Review.
Bathing Waters Directive	European Community legislation – (76/160/EEC) which requires Member States to take all necessary actions to ensure identified bathing waters meet certain quality standards prescribed for the protection of the environment and public health. The new Bathing Waters Directive (2006/7/EC) will repeal the original Bathing Water Directive by end of 2014 at the latest.
Biodiversity Action Plan	National, local and sector-specific plans established under the United Kingdom Biodiversity Action Plan, with the intention of securing the conservation and sustainable use of biodiversity.
Biological element	A collective term for a particular characteristic group of animals or plants present in an aquatic ecosystem (for example phytoplankton; benthic invertebrates; phytobenthos; macrophytes; macroalgae; phytobenthos; angiosperms; fish).
Biological indicators	A parameter that can be monitored to estimate the value of a biological quality element. Indicators may include the presence or absence of a particularly sensitive species.
Biological quality element	A characteristic or property of a biological element that is specifically listed in Annex V of the Water Framework Directive for the definition of the ecological status of a water body (for example composition of invertebrates; abundance of angiosperms; age structure of fish).
Catchment	The area from which precipitation contributes to the flow from a borehole spring, river or lake. For rivers and lakes this includes tributaries and the areas they drain.
Catchment Abstraction Management Strategies	These are developed for the management of water resources at a local level. They provide information on water resources and licensing practice to allow the needs of abstractors, other water users and the aquatic environment to be considered in consultation with the local community and interested parties.
Catchment Flood Management Plans	These are strategic planning tools through which the Environment Agency seeks to work with other important decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Catchment modelling techniques	Methods used to describe and/or predict characteristics of a catchment. Traditionally, these have focused on natural processes or movement of pollutants but they can also include other factors such as demographic, social and economic characteristics.
Characterisation (of water bodies)	A two-stage assessment of water bodies under the Water Framework Directive. Stage 1 identifies water bodies and describes their natural characteristics. Stage 2 assesses the pressures and impacts from human activities on the water environment. The assessment identifies those water bodies that are at risk of not achieving the environmental objectives set out in the Water Framework Directive. The results are used to prioritise both environmental monitoring and further investigations to identify those water bodies where improvement action is required.

Chemical Status (surface waters)	The classification status for the surface water body. This is assessed by compliance with the environmental standards for chemicals that are listed in the Environmental Quality Standards Directive 2008/105/EC, which include priority substances, priority hazardous substances and eight other pollutants carried over from the Dangerous Substance Daughter Directives. Chemical status is recorded as good or fail. The chemical status classification for the water body, and the confidence in this (high or low), is determined by the worst test result.
Chemical Status (groundwater)	An expression of the overall quality of the groundwater body. The classification status for a groundwater body against the environmental criteria set out in the Water Framework Directive and the Groundwater Directive (2006/118/EC), as set out in Common Implementation Strategy (CIS) guidance document No 18. All five of the component tests for chemical status must be assessed as good or poor and the overall chemical status and the confidence in this (high or low) is determined by the worst test result.
Classification	Method for distinguishing the environmental condition or “status” of water bodies and putting them into one category or another.
Coastal Forums	Organisations formed to look at the long-term issues facing coastal areas to promote a sustainable approach to the management, use and development of the coastal zone.
Co-deliverer	Agencies and institutions with statutory powers or who have it in their power to deliver actions needed to implement River Basin Management Plans.
Common Agricultural Policy	A policy that regulates farming activities across the European Union, providing direct subsidies to farmers and land managers. A small part of these funds support rural development actions that mainly relate to agricultural activities, as well as forestry and environmental improvements on farmland.
Common Implementation Strategy (CIS)	This strategy was agreed by the European Commission, Member States and Norway in 2001. The aim of the strategy is to provide support in the implementation of the Water Framework Directive and its daughter directives, by developing a common understanding and guidance on key elements of the Directives.
Competent Authority	An authority or authorities identified under Article 3(2) or 3(3) of the Water Framework Directive. The Competent Authority will be responsible for the application of the rules of the Directive within each river basin district lying within its territory.
Cost effective	In the context of the Water Framework Directive, it describes the least cost option for meeting an objective. For example, where there are a number of potential actions that could be implemented to achieve Good Ecological Status for a water body, Cost Effectiveness Analysis is used to compare each of the options and identify which option delivers the objective for the least overall cost.
Countryside Council for Wales	The Countryside Council for Wales is the Welsh Assembly Government's statutory adviser on sustaining natural beauty, wildlife and the opportunity for outdoor enjoyment in Wales and its inshore waters. The Countryside Council for Wales is the national wildlife conservation authority for Wales.

Cross compliance	A form of conditionality by which, farmers in receipt of public subsidies are required to comply with all legislation affecting their businesses, including European Union environmental legislation. The requirements of Cross compliance are: i) an obligation to maintain agricultural land in Good Agricultural and Environmental Conditions and ii) an obligation to comply with specified Statutory Management Requirements according to European Union legislation, for example the Nitrates Directive, Groundwater Directive.
Delineation (of water bodies)	Identifying the type and defining the boundary of a water body for rivers, lakes, Transitional and Coastal waters and groundwater under the Water Framework Directive.
Diffuse pollution	Pollution resulting from scattering or dispersed sources that are collectively significant but to which effects are difficult to attribute individually.
Disproportionate cost	The determination of disproportionate cost requires a decision making procedure that assesses whether the benefits of meeting good status in a water body are outweighed by the costs.
Drinking Water Protected Areas	Bodies of water that are used or could be used in the future for the abstraction of water intended for human consumption.
Ecological continuum	The persistence of the ecological structure and functioning of aquatic ecosystems over time and space.
Ecological potential	The status of a heavily modified or artificial water body measured against the maximum ecological quality it could achieve given the constraints imposed upon it by those heavily modified or artificial characteristics necessary for its use. There are five ecological potential classes for Heavily Modified Water Bodies/Artificial Water Bodies (maximum, good, moderate, poor and bad).
Ecological status	Ecological status applies to surface water bodies and is based on the following quality elements: biological quality, general chemical and physico-chemical quality, water quality with respect to specific pollutants (synthetic and non synthetic), and hydromorphological quality. There are five classes of ecological status (high, good, moderate, poor or bad). Ecological status and chemical status together define the overall surface water status of a water body.
Economic Advisory Stakeholder Group	A group to coordinate the work going forward in England and Wales in relation to the economic analysis required by the Water Framework Directive.
Environment Agency	Environment Agency of England and Wales.
Estuarine	For our purposes by estuarine we mean transitional (see definition).
Exemptions	The environmental objectives of the Water Framework Directive are set out in Article 4. These include the general objective of aiming to achieve good status in all water bodies by 2015 and the principle of preventing any further deterioration in status. There are also a number of exemptions to the general objectives that allow for less stringent objectives, extension of deadline beyond 2015 or the implementation of new projects. Common to all these exemptions are strict conditions that must be met and a justification must be included in the river basin management plan. The conditions and process in which the exemptions can be applied are set out in Article 4.4, 4.5, 4.6 and 4.7.

Eutrophication	The enrichment of waters by inorganic plant nutrients that results in increased production of algae and/or other aquatic plants, which can affect the quality of the water and disturb the balance of organisms present within it.
Favourable Conservation Status	"Favourable Conservation Status (to protect and, where necessary, improve the water or water-dependent environment to the extent necessary to maintain at or restore to favourable conservation status the water-dependent habitats and species for which the Protected Area is designated". Where this term is used in the River Basin Management Plans, the above definition applies.
Fisheries Action Plans	Fisheries Action Plans are local plans developed in partnership between the Environment Agency and local angling and fisheries groups, with input from conservation and other interest groups. Fisheries Action Plans cover canal and still water fisheries as well as rivers. They may cover a wide range of issues from fish habitat, through to angling promotion and land management. Each Fisheries Action Plan is different and reflects the concerns and priorities of local angling and fisheries interests.
Floods Directive	The purpose of the European Union Directive on flooding (2007/60/EC) is to establish a framework for the assessment and management of flood risks aiming at the reduction of the adverse consequences on human health, the environment, cultural heritage and economic activity associated with floods in the Community. It requires member states to undertake flood risk assessments, flood risk mapping and produce flood risk management plans. The Directive was published in early November 2007 and must be transposed into United Kingdom law by 26 November 2009.
Good chemical status (surface waters)	Means that concentrations of chemicals in the water body do not exceed the environmental standards specified in the Environmental Quality Standards Directive 2008/105/EC. These chemicals include Priority Substances, Priority Hazardous Substances and eight other pollutants carried over from the Dangerous Substance Daughter Directives.
Good chemical status (groundwater)	See chemical status (groundwater). Means the concentrations of pollutants in the groundwater body do not exceed the criteria set out in Article 3 of the Groundwater Daughter Directive (2006/118/EC).
Good ecological potential	Those surface waters which are identified as Heavily Modified Water Bodies and Artificial Water Bodies must achieve 'good ecological potential' (good potential is a recognition that changes to morphology may make good ecological status very difficult to meet). In the first cycle of river basin planning good potential may be defined in relation to the mitigation measures required to achieve it.
Good ecological status	The objective for a surface water body to have biological, structural and chemical characteristics similar to those expected under nearly undisturbed conditions.
Good quantitative status (groundwater)	See quantitative status (groundwater). Means the level of groundwater in the groundwater body meets the criteria set out in Annex V (2.1.2) of the Water Framework Directive.
Good status	Is a term meaning the status achieved by a surface water body when both the ecological status and its chemical status are at least good or, for groundwater, when both its quantitative status and chemical status are at good status.
Groundwater	All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

Habitat Action Plans	See “Biodiversity Action Plans” above.
Hazardous substances	Substances or groups of substances that are toxic, persistent and liable to bioaccumulate, and other substances or groups of substances which give rise to an equivalent level of concern.
Heavily Modified Water Body	A surface water body that does not achieve good ecological status because of substantial changes to its physical character resulting from physical alterations caused by human use, and which has been designated, in accordance with criteria specified in the Water Framework Directive, as ‘heavily modified’.
High ecological status	Is a state, in a surface water body, where the values of the hydromorphological, physico-chemical, and biological quality elements correspond to conditions undisturbed by anthropogenic activities.
Hydromorphology	Describes the hydrological and geomorphological processes and attributes of surface water bodies. For example for rivers, hydromorphology describes the form and function of the channel as well as its connectivity (up and downstream and with groundwater) and flow regime, which defines its ability to allow migration of aquatic organisms and maintain natural continuity of sediment transport through the fluvial system. The Water Framework Directive requires surface waters to be managed in such a way as to safeguard their hydrology and geomorphology so that ecology is protected.
Impact assessment	A tool to enable the Environment Agency to weigh and present the evidence on the positive and negative effects of a plan. For example information on the estimated cost and benefit of proposing actual measures.
Integrated Coastal Zone Management	A voluntary system to manage the complex range of activities in the coastal zone with sustainability and stakeholder involvement at its core. It is a process that brings together all those involved in the development, management and use of the coast within a framework that helps the integration of their interests and responsibilities. The objective is to establish sustainable levels of economic and social activity in coastal areas while protecting the coastal environment.
Integrated River Basin and Coastal Management	A process whereby all pressures in a catchment are assessed and action undertaken in an integrated, proportionate and efficient way. A range of stakeholders are involved in the setting of priorities and their ultimate delivery.
Local Development Frameworks and Plans	Under the Planning and Compulsory Purchase Act 2004, local plans and unitary development plans in England were replaced by Local Development Frameworks. These are made up of a number of statutory and non-statutory local development documents. In Wales, they are called Local Development Plans.
Liaison Panels	A panel consisting of around 15 representatives of strategic co-deliverers including bodies with statutory powers and others who will need to put measures into action for the River Basin District. The panel represents all key interests within the River Basin District and is the primary focus for engagement at the River Basin District level.
Macroalgae	Multicellular algae such as seaweed.
Macrophyte	Larger plants, typically including flowering plants, mosses and larger algae but not including single-celled phytoplankton or diatoms.
Marine Bill	A bill to ensure greater protection of marine resources and to deliver sustainable development in the marine and coastal environment by addressing both the use and protection of marine resources.

Marine Pollution Monitoring Management Group	Group comprising government departments, agencies and government research institutions. They co-ordinate a United Kingdom programme of estuarine and coastal monitoring designed to satisfy a number of requirements including trend monitoring for the Oslo and Paris Convention, compliance with European Commission Directives and international conventions, local needs and for research and development.
Measure	This term is used in the Water Framework Directive and domestic legislation. It means an action which will be taken on the ground to help achieve Water Framework Directive objectives.
Mechanisms	The policy, legal and financial tools which are used to bring about actions (measures). Mechanisms include for example: legislation, economic instruments; codes of good practice; negotiated agreements; promotion of water efficiency; educational projects; research; development and demonstration projects.
Misconnections	Misconnections of foul sewage into surface water drains are a significant source of urban diffuse pollution in those areas where a separate drainage system is used. Misconnections happen when domestic plumbing has been connected into surface water drains instead of the foul sewer. This means untreated dirty water goes directly into rivers/waterways without receiving treatment.
Morphology	Describes the physical form and condition of a surface water body, for example the width, depth and perimeter of a river channel, the structure and condition of the riverbed and bank.
National	This term refers, in this document, to England and Wales. The Environment Agency covers the whole of England and Wales and is the Competent Authority for the Water Framework Directive in both.
National Assembly for Wales	The National Assembly for Wales consists of 60 Members elected throughout Wales. The Assembly has delegated many of its powers to the First Minister, who leads the Welsh Assembly Government. The Assembly decides on its priorities and allocates the funds made available to it from the Treasury. Within its powers, the Assembly develops and implements policies that reflect the particular needs of the people of Wales.
Natura 2000 sites	Protected Areas established for the protection of habitats or species under the Birds Directive (79/409/European Economic Community) (Special Protection Areas) and the Habitats Directive (92/43/European Economic Community) (Special Areas of Conservation).
Natural England	The government-funded body whose purpose is to promote the conservation of England's wildlife and natural features. The previously existing organisations English Nature, the Countryside Agency and Rural Development Service were merged to form Natural England.
Nitrate Vulnerable Zone	The land draining to waters that contain, or are likely to contain, 50 mg/l of nitrate, or waters that are eutrophic or likely to become so. Within these zones an action programme under the Nitrates Directive is put in place which farmers have to observe to reduce nitrate pollution.
No deterioration (in water body status)	None of the quality elements used in the classification of water body status deteriorates to the extent that the overall status is reduced.
Non-hazardous pollutant	Any substance that is not a hazardous substance but is liable to cause pollution in significant quantities.
Non-native species	See Alien species.

Objective (surface waters)	<p>Three different status objectives for each water body. These are:</p> <ul style="list-style-type: none"> • Overall status objective • Ecological status or potential objective; and • Chemical status objective <p>These are always accompanied by a date by when the objective will be achieved.</p> <p><u>Ecological status (or potential) objectives</u> will be derived from the predicted outcomes for the biological elements and physico-chemical elements, plus any reasons for not achieving good ecological status (or potential) by 2015.</p> <p><u>Chemical status objectives</u> will be derived from the predicted outcomes for the chemical elements plus any reasons for not achieving good chemical status by 2015.</p> <p><u>Overall status objectives</u> will be derived from the ecological status and chemical status objectives.</p>
Objective (groundwater)	<p>There are three status objectives for each groundwater body:</p> <ul style="list-style-type: none"> • Overall status objective; • Quantitative status objective; and • Chemical status objective. <p>These are always accompanied by a date by when the objective will be achieved.</p> <p><u>Overall status objectives</u> will be derived from the quantitative status and chemical status objectives</p> <p>In addition to status objectives there are also additional environmental objectives: to prevent deterioration of status, to prevent or limit the inputs of pollutants to groundwater and to reverse any significant and sustained upward trends in pollutant concentrations.</p>
Office of Water Services	The economic regulator for the water and sewerage industry in England and Wales. Office of Water Services has been renamed the Water Services Regulation Authority.
Oslo and Paris Convention	<p>The 1992 Oslo and Paris Convention is the current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. It combined and up-dated the 1972 Oslo Convention on dumping waste at sea and the 1974 Paris Convention on land-based sources of marine pollution.</p> <p>The work under the convention is managed by the Oslo and Paris Commission, made up of representatives from the Governments of the 15 Contracting Parties and the European Commission.</p>
Periodic Review	This is the process, carried out every five years by the Water Services Regulation Authority, to assess the strategic plans for water company spending and investment. The plans include environmental improvements. The investment will often affect water customer charges and incorporates company business plans (called Asset Management Plans).
Phytobenthos	Bottom-dwelling multi-cellular and unicellular aquatic plants such as some species of diatom.
Phytoplankton	Unicellular algae and cyanobacteria, both solitary and colonial that live, at least for part of their lifecycle, in the water column.
Planning Policy Statements	Planning Policy Statements set out the Government's national policies on different aspects of land use planning in England and are produced by the Department for Communities and Local Government (formerly Office of the Deputy Prime Minister).

Point source pollution	Pollution arising from an identifiable and localised area, structure or facility, such as a discharge pipe or landfill.
Pollutant	Any substance liable to cause pollution.
Pollution	The direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or land which: (i) may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems; (ii) result in damage to material property; or (iii) impair or interfere with amenities and other legitimate uses of the environment.
Predicted outcome	The future status of a quality element or water body based on groups of practical and justified measures and the date when this status will be achieved.
Pressures	Human activities such as abstraction, effluent discharges or engineering works that have the potential to have adverse effects on the water environment.
Priority substances	A pollutant, or group of pollutants, presenting a significant risk to or via the aquatic (surface water) environment that has been identified at Community level under Article 16 of the Water Framework Directive. They include 'priority hazardous substances'.
Programme of Measures	A Programme of Measures, as used in the Water Framework Directive, is a group of actions designed to improve the environment in a river basin district and meet the objectives of the Directive.
Protected Areas	Areas that have been designated as requiring special protection under Community legislation for the protection of their surface water and groundwater or for the protection of habitats and species directly depending on water.
Quality element	A feature of an aquatic (surface water) ecosystem that can be described as a number for the purposes of calculating an ecological quality ratio, such as the concentration of a pollutant; the number of species of a type of plant.
Quantitative status (groundwater)	An expression of the degree to which a body of groundwater is affected by direct and indirect abstractions. The classification status for a groundwater body against the environmental criteria set out in the Water Framework Directive and as set out in Common Implementation Strategy Guidance Document No 18. All four of the component tests for quantitative status must be assessed as good or poor and the overall quantitative status and the confidence in this (high or low) is determined by the worst test result.
Ramsar site	A wetland area designated for its conservation value under The 1971 Convention on Wetlands of International Importance, especially as Waterfowl Habitat. The Ramsar Convention seeks to promote the conservation of listed wetlands and their wise use.
Reference conditions	The benchmark against which the effects on surface water ecosystems of human activities can be measured and reported in the relevant classification scheme. For waters not designated as heavily modified or artificial, the reference conditions are synonymous with the high ecological status class. For waters designated as heavily modified or artificial, they are synonymous with the maximum ecological potential class.
Regional Spatial Strategies	These are frameworks in England controlling development across an area or region (for example for tourism, planning, waste, minerals, energy).
Risk	The likelihood of an outcome (usually negative) to a water body or the environment, or the potential impact of a pressure on a water body.

Risk assessment	The analysis that predicts the likelihood that a water body is at significant risk of failing to achieve one or more of the Water Framework Directive objectives.
Risk category	The numerical or descriptive category assigned to water bodies that have been risk assessed, in order to make the risk-based prioritisation of water bodies for action under the Water Framework Directive more manageable.
River basin	A river basin is the area of land from which all surface run-off and spring water flows through a sequence of streams, lakes and rivers into the sea at a single river mouth, estuary or delta. It comprises one or more individual catchments.
River Basin District	A river basin or several river basins, together with associated coastal waters.
River Basin Management	The management and associated planning process that underpins implementation and operation of the Water Framework Directive. It is both an overarching process in terms of existing processes and also defines new sub-processes such as those for hydromorphology. The river basin management plans are plans for river basin management.
River Basin Management Plan	For each River Basin District, the Water Framework Directive requires a River Basin Management Plan to be published. These are plans that set out the environmental objectives for all the water bodies within the River Basin District and how they will be achieved. The plans will be based upon a detailed analysis of the pressures on the water bodies and an assessment of their impacts. The plans must be reviewed and updated every six years.
River Quality Objective	A River Quality Objective is an agreed strategic target, expressed in terms of River Ecosystem Standards, which is used as the planning base for all activities affecting the water quality of a stretch of water. A River Quality Objective is the level of water quality that a river should achieve in order to be suitable for its agreed uses.
Rivers Trusts	Charities and organisations set up to assist in the conservation, protection and improvement of rivers and associated environments.
Rural Development Programme	The England Rural Development Programme and the Rural Development Plan for Wales are schemes in the Government's Public Incentive Programme. These programmes are of major significance for rural land management as they provide substantial funding to land managers conditional on the implementation of environmental (and other) actions.
Safeguard zone	A catchment or other defined zone around a point where the water is abstracted for potable use and where actions may be taken to protect raw water quality and prevent deterioration, so minimising the need for purification treatment. For groundwater they are likely to be based on source protection zones under the Environment Agency's Groundwater Protection Policy.
Saturation zone	Subsurface rock or other geological strata within which the pore spaces between the particles of rock or other strata, and the cracks in those strata are filled with water and for which a water table may be determined.
Significant and sustained upward trend	A statistically significant trend in pollutant concentrations in groundwater that could lead to a future failure of one or more of the environmental objectives for groundwater unless it is reversed.
Site of Special	An area of land notified under the Wildlife and Countryside Act 1981

Scientific Interest	by the appropriate nature conservation body (Scottish Natural Heritage in Scotland) as being of special interest by virtue of its flora and fauna, geological or physiogeographical features.
Source Protection Zone	A zone around a well, borehole or spring where groundwater is abstracted for human consumption (for example drinking water or food production), as defined under the Agency's Groundwater Protection Policy (GP3). Zone 1 (SPZ1) is the area closest to the abstraction, representing the highest risk to the source. Zones 2 and 3 are progressively larger. Risk-based Policies to prevent pollution are applied within these zones.
Spatial planning	Spatial planning is wider ranging than land-use planning based on regulation and control of land, and aims to ensure the best use of land by assessing competing demands. Social, economic and environmental factors are taken into account in producing a decision that is more conducive to sustainable development.
Special Area of Conservation	Natura 2000 sites that are designated under the Habitats Directive.
Special Protection Area	Natura 2000 sites that are designated under the Birds Directive.
Specific Pollutant	A substance considered as being discharged to the aquatic environment in significant quantities at the national level and for which Environmental Quality Standards have been established. As part of the ecological classification criteria, and in places where these pollutants are monitored, these standards must be met, in order for a surface water body to be classified as good ecological status.
Stakeholder	Individuals or groups that are or could become interested in, involved in or affected by our policies and activities. Our stakeholders include regulators, statutory bodies, professional organisations, local organisations and members of the public.
Stakeholder forum	A group of interested parties to guide and advice on river basin planning and management.
Status	The physical, chemical, biological, or ecological quality of a water body.
Strategic Environmental Assessment Directive (2001/42/EC)	European environmental legislation which requires an 'environmental assessment' to be carried out for certain plans and programmes whose formal preparation began after 21 July 2004 (or are prepared but not adopted or submitted by a legislative procedure by 21 July 2006), and which are considered likely to have significant effects on the environment. The term "Strategic Environmental Assessment" is used in United Kingdom guidance to mean an environmental assessment under this Directive.
Summary of Significant Water Management Issues	This is a report on each River Basin District that highlights significant water management issues in that River Basin District which will need to be addressed to achieve environmental objectives under the Water Framework Directive.
Supplementary Plans	Plans additional to the River Basin Management Plan which contain additional detail to that within the River Basin Management Plan but which fits wholly within its strategic principles and policies. Supplementary Plans do not cover issues outside the remit of the Water Framework Directive.
Sustainable Drainage Systems	A system of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques.
Technical feasibility	Is determined through the assessment of whether the implementation

of a measure or programme of measures, designed to achieve the Water Framework Directive objectives, is technically possible either at the national and local level and includes the consideration of uncertainty as well as environmental and socio economic feasibility.

Technical feasibility depends upon the availability of a technical solution and information on the cause of the problem and hence the identification of the solution.

Toolkit of Measures	A variety of measures which consist of actions that when implemented can help deliver Water Framework Directive objectives. These may include basic measures (the minimum set of measures that must be available) and supplementary measures.
Transitional water	A Water Framework Directive term for waters that are intermediate between fresh and marine water. Transitional waters include estuaries and saline lagoons.
Typology	The means by which the Water Framework Directive requires surface water bodies to be differentiated according to their physical and physico-chemical characteristics.
Water body	A manageable unit of surface water, being the whole (or part) of a stream, river or canal, lake or reservoir, transitional water (estuary) or stretch of coastal water. A 'body of groundwater' is a distinct volume of groundwater within an aquifer or aquifers.
Water Framework Directive	European Union legislation – Water Framework Directive (2000/60/EC) – establishing a framework for European Community action in the field of water policy.
Water Framework Directive management catchment	An amalgamation of a number of Water Framework Directive river water body catchments that provide a management unit at which level actions are applied.
Water Framework Directive objectives	The objectives set out in Article 4 of the Water Framework Directive together with objectives set out in paragraphs 2 and 3 of Article 7 of the Directive and which are required to be met.
Water Level Management Plans	Water Level Management Plans provide a means by which water level requirements for a range of activities including agriculture, flood defence and conservation can be balanced and integrated.
Water Protection Zones	Areas designated by the Secretary of State, within which activities polluting the water environment can be restricted or forbidden. Water Protection Zones can be designated at any scale (sub-catchment, catchment or a larger area) and restrictions are enforced to combat point and/or diffuse sources of water pollution, over and above other existing statutory powers.
Water Services	All services which provide, for households, public institutions or any economic activity: (a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater; and (b) waste water collection and treatment facilities which subsequently discharge into surface water.
Water table	The upper limit of the saturation zone.
Water use	Water Services together with any other human activity identified as having a significant impact upon the status of water.
Weight of evidence	A weight of evidence approach integrates results or evidence from several data sources, weighted appropriately, to make risk based decisions.

Welsh Assembly Government	The devolved government in Wales.
Welsh Technical Advice Notes	<i>Planning Policy Wales</i> (2002) sets out the land use planning policies of the Welsh Assembly Government (the Assembly Government). It is supplemented by a series of topic based Technical Advice Notes (Wales). Technical Advice Notes may be material to decisions on individual planning applications and will be taken into account by the National Assembly for Wales and planning inspectors in the determination of called-in planning applications and appeals.

N3 Abbreviations

AMP	Asset Management Plan
AWB	Artificial Water Bodies
BGS	British Geological Survey
BOD	Biological outcomes database
BPA	British Ports Association
CAMS	Catchment Abstraction Management Strategy
CAP	Common Agricultural Policy
CCW	Countryside Council for Wales
CEA	Cost Effective Analysis
CEFAS	Centre for the Environment, Fisheries and Aquaculture Science
CFMPs	Catchment Flood Management Plans
CIS	Common Implementation Strategy
CLA	Country Land and Business Association
CRP	Collaborative Research Project
CSFO	Catchment Sensitive Farming Officers
CSPs	Community Strategic Partnerships
DCLG	Department of Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DrWPA	Drinking Water Protected Area
EASG	Economic Advisory Stakeholder Group
EC	European Community/Commission
EU	European Union
FAPs	Fisheries Action Plans
FCRM	Flood and Coastal Risk Management
FRS	Fisheries Research Services
GAEC	Good Agricultural and Environmental Conditions
GEP	Good Ecological Potential
GP3	"Groundwater Protection: Policy and Practice" documents
GQA	General Quality Assessment
GWD	Groundwater Directive (2006/118/EC).
HMWB	Heavily Modified Water Bodies
IA	Impact assessment (formerly regulatory impact assessment)
ICZM	Integrated Coastal Zone Management
IRBCM	Integrated River Basin Catchment Management
JNCC	Joint Nature Conservation Committee
LDF	Local Development Framework
LDP	Local Development Plan
LEAP	Local Environment Action Plan
LPO	Local Planning Authority
LSPs	Local Strategic Partnerships

MMO	Marine Management Organisation
MPMMG	Marine Pollution Monitoring Management Group
N2K	Natura 2000 sites
NAW	National Assembly for Wales
NFU	National Farmers' Union
NGO	Non-governmental organisation
NMMP	National Marine Monitoring Plan
NMP	National Marine Programme
NVZ	Nitrate Vulnerable Zone
ODPM	Office of the Deputy Prime Minister
Ofwat	Water Services Regulation Authority
OSPAR	Oslo and Paris Convention
pCEA	Preliminary cost effective analysis
PPS	Planning Policy Statement
PoMs	Programme of Measures
PR09	Periodic Review in 2009
PSA	Public Service Agreement
RBC	River Basin Characterisation
RBD	River Basin District
RBMP	River Basin Management Plan
RDR	Rural Development Regulation
RDS	Rural Development Service
RIA	Regulatory Impact Assessment
RQO	River Quality Objective
RRDF	Regional Rural Development Framework
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategies
RSU	Regional Strategy Units
SAC	Special Area of Conservation
SAPs	Salmon Action Plans
SEAD	Strategic Environmental Assessment Directive
SEPA	Scottish Environment Protection Agency
SFP	Single Farm Payment
SMP	Shoreline Management Plan
SMR	Statutory Management Requirements
SNH	Scottish Natural Heritage
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
SoS	Secretary of State
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SSWMI	Summary of Significant Water Management Issues
SUDS	Sustainable Drainage Systems
TANs	Technical Advice Notes
TRaC	Transitional and Coastal
UKCIP	United Kingdom Climate Impacts Programme
UKMPG	United Kingdom Major Ports Group
UKTAG	United Kingdom Technical Advisory Group
UKWIR	United Kingdom Water Industry Research
WFD	Water Framework Directive
WLMPs	Water Level Management Plans
WPZs	Water Protection Zones