1. INTRODUCTION

1.1 This appendix summarises the evidence presented in the Environment Agency’s 10 Impact Assessments on the River Basin Management Plans (RBMPs) and summarises the evidence and the approach they have taken. Particular focus is given to:

- The evidence to support setting of objectives and the selection of measures to meet the objectives of the Water Framework Directive (WFD)
- The evidence relating to the costs and benefits of the plans and the related assumptions including the derivation of the reference case and its costs and benefits

1.2 The first part is largely the subject of Annex E of the RBMPs. The second part relates to the Impact Assessments the Environment Agency has drawn up using information from the measures appraisal and objective setting processes.

2. THE EVIDENCE TO SUPPORT SETTING OF OBJECTIVES AND THE SELECTION OF MEASURES TO MEET THE OBJECTIVES OF THE WFD

2.1 Summary

The initial identification and selection of measures was carried out by a series of sector-based or themed working groups representing stakeholders from the water industry, agriculture, industry, navigation and ports, flood defence and planning, non-agricultural diffuse pollution, and fisheries, invasive non-native species and biodiversity benefit areas. This work was done to establish a robust evidence base as part of the Defra/Welsh Assembly Government led preliminary Cost-Effectiveness Analysis (pCEA). Each group considered measures to address their contribution to pressures. Working groups drew on stakeholder expertise to select measures. The measures identified were appraised in light of Defra’s River Basin Management Planning guidance volume.

In summary, this process involved the following steps:

1. The first step was to identify the status of each water body and assess the likelihood that it would meet the default objective by 2015;

2. Where the water body was not likely to meet the default objective, the reference case (baseline) measures (existing activities or measures being undertaken already) were included to see if they are able to bridge the gap
between the current status and the default objectives for the water body by 2015;

3. If this was not the case, additional measures (the policy option measures) were added to see if they could deliver the default objective; and

4. These additional measures were then appraised to see if they were technically feasible and not disproportionately expensive to implement.

In cases where gaps in achieving the objectives remained following the implementation of national measures, a selection of local measures were developed by the Agency’s River Basin Programme Managers in consultation with local stakeholders, through the River Basin District Liaison Panel. According to the EA this process involved using a range of sources and local knowledge to identify the most significant water management issues and appraise prospective measures to address these problems.

This process determined for each water body whether the default objective could be set or if a delay in meeting the objective or an alternative objective was required.

2.2 More detailed summary of measures selection and objective setting

Annex E describes the process the Environment Agency used to identify and appraise measures and to develop proposed water body objectives for the first cycle of river basin management plans. It also provides details on the justifications for setting any alternative objectives. Defra and the Welsh Assembly Government provided guidance to the Environment Agency in carrying out this process in both 2006 and then in 2008 (see http://www.defra.gov.uk/environment/water/wfd/management.htm).

They were also instructed to take account of Common Implementation Strategy Guidance Document Number 20, which provides Member States with guidance on the use of exemptions to environmental objectives and which contained some guidance which superseded the information provided in 2008. (http://circa.europa.eu/Public/irc/env/wfd/library?f=/framework_directive/guidance_documents/documentn20_mars09pdf/_EN_1.0&a=d)

2.3 The guidance documents emphasise the point that the WFD is, as its name suggest a framework directive – it sets the general direction but there is scope for differences in understanding and application. Defra and Welsh Assembly Government (WAG) in their interpretation of the Directives requirements and in the guidance provided to the Agency have emphasised the possibility for taking different approaches and the need 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. Inevitably however as a summary of so many decisions and the processes behind them transparency could be improved.
Also in accordance with Defra/WAG guidance, the Environment Agency has attempted to phase the implementation of measures to spread the costs of implementation while undertaking demonstrable action in the first cycle and to take account of uncertainty in the estimates of the costs, benefits and effectiveness of measures. Where alternative objectives have been proposed for reasons of affordability, the Environment Agency has considered alternative financing mechanisms to fund necessary and cost-effective action in the first cycle, and in cycles two and three.

The Environment Agency has also attempted to follow the guidance that the analysis of alternative objectives and the cost-effectiveness of measures should take place at the appropriate scale. Often this is the national scale but other times more local assessments have been used. Where aggregated information is used the Environment Agency has tried to make sure this 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.

2.4 In reviewing the approach taken by the Environment Agency it is clear that the single most important factor in the setting objectives and selecting measures has been taking account of uncertainty. The management of uncertainty and its consequences for expected costs and benefits plays large part in the first cycle of river basin management plans as the Environment Agency 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 which are not likely to involve disproportionate costs. As a result many of the actions in the first cycle are investigative. This reflects guidance provided to the Environment Agency and the position of the Member States reflected in Guidance Document 20, which states that:

“Uncertainties should be taken into account in deciding the appropriate action. This action may include further investigation, monitoring and assessment to reduce uncertainties and this could contribute to the justification for the phasing of measures across cycles”

The guidance document goes on to acknowledge the following uncertainties which are relevant:

- 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.
2.5 One of the key ways in which the Environment Agency has managed uncertainty and attempted to avoid unnecessary appraisal cost (where for example further appraisal could not help clarify the decision) is to assess the confidence about the status of water bodies. The Environment Agency has used the following levels to assess confidence.

- Very Certain: they are more than 95% confident that the water body is not at good status (or better)
- Quite Certain: they are 75% to 95% confident that the water body is not at good status (or better)
- Uncertain: they are only 50 to 75% confident that the water body is not at good status (or better)

The Environment Agency has attempted to increase confidence in some classifications by using information from other sources, both quantitative and qualitative. For example by increasing the amount and quality of data, looking at the number of indicators pointing in the same direction, knowledge and experience of practitioners and feedback from interest groups. They have termed this a "weight of evidence" approach.

2.6 The consideration of these uncertainties is relevant to the setting of alternative objectives as they impact on the balance of expected costs and benefits and the technical feasibility of measures. As such these uncertainties can lead to an extended deadline for the reason of technical infeasibility (for example where the Agency do not know the source of a problem) or disproportionate cost (for example where they are not sure a water body isn’t already at good status) because of the impact on cost and benefit estimates and hence the likelihood of disproportionate costs.

2.7 A second way the Environment Agency has attempted to manage uncertainty is to ensure a high level of consultation and engagement with stakeholders and experts. Annex L (Consultation and Engagement) of the RBMPs 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 local (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 enables some of them to be included in this first plan.

2.8 It should also be noted that the Environment Agency’s monitoring programmes do not give them assessments for all water bodies. This is because they target their monitoring at water bodies at risk of degradation and because they have a roving monitoring programme that moves from one location to the next on an annual basis. By 2010 their roving monitoring programme will complete its first phase and most water bodies will have been monitored. The remainder are typically small water bodies. Where they lack data they have used expert judgements to provide an initial assessment of the water body. Expert
judgement of status was based on risk assessments information from Natural England and the Countryside Council for Wales on the condition of 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. Clearly, such status assessments are uncertain. Classification results based on expert judgement are however clearly marked in the plans.

2.9 The Water Framework Directive’s objectives

The Directive sets out in Article 4 the default environmental objectives that the Environment Agency should plan 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 status;
- 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;

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.

2.10 Alternative objectives

The use of the alternative objectives is the mechanism which the WFD provides for: consideration of other environmental, social and economic priorities alongside water management priorities; and for prioritising action over
successive river basin management planning cycles. As set out in Defra/WAG guidance to the Environment Agency 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.

2.11 In setting alternative objectives the Environment Agency has been guided by the principles set out in the River Basin Planning Guidance and also more recent information summarised in the CIS document 20 on the use of exemptions. The principles in river basin guidance include:

a. The purpose of Disproportionate Cost Analysis is to identify and collate the evidence to support decisions about whether to set an alternative objective. The decisions are made when the RBMPs, including objectives for each water body, are approved by the appropriate authority.

b. Analysis should be undertaken based on the minimum amount of evidence (i.e. lowest level of detail) required to make the decision within acceptable limits of risk and uncertainty, bearing in mind the full consequences of a decision.

c. Analysis should be undertaken at the greatest geographic scale at which it is possible to identify whether costs are disproportionate or not.

d. The initial focus should be on collecting readily available information only. This may be a mix of qualitative, quantitative and monetary information.

e. There is a general presumption against putting monetary values (based on benefits transfer) on certain types of benefits which are not well understood (e.g. non-use values).

f. Disproportionate cost should be assessed with regard to the marginal effects of the WFD only. The effects of measures necessary to implement other EU Directives and national policies, as well as the effects of known environmental and other trends, should be considered as part of the baseline.

g. The way in which uncertainty is taken into account (e.g. any judgements or assumptions made) should be made clear in the evidence presented.

h. The H.M. Treasury Green Book underlies the basis of all analyses.

In addition to these points of general guidance the Environment Agency was also guided that:

- there are two main elements which the Environment Agency should consider when assessing disproportionate costs
  a) economic efficiency (the overall balance between costs and benefits, which includes economic, social and environmental) and
b) distribution (comparison of who pays and who benefits – winners and losers).

Both considerations are important. When considering proposing an alternative objective on grounds of distribution, the Agency should also assess economic efficiency aspects, and consider whether the distributional consequences are significant in relation to the economic efficiency arguments. Where distributional issues are not considered to be important these should not be analysed in any detail.

- In general, something should be considered to be disproportionate where the negative consequences (compliance costs, impacts on non-water outcomes, distributional issues) outweigh the positive consequences (benefits of water status improvements). No margin between negative and positive consequences is needed, but account should be taken of the fact that costs may be known with more certainty than benefits, and hence an objective is not necessarily disproportionate if the costs exceed the quantified or monetised benefits. It is important however, to reflect any uncertainty in the costs which can sometimes be difficult to monetise.

- The Environment Agency must ensure that when assessing disproportionate cost and using it as the basis for exemptions, the reasons for doing so are clearly set out within the river basin management plan. Any underlying data and assessments used to inform the decision must be available to the public. In cases where the deadline will be extended or the objectives lowered; the river basin management plan must contain, a description of the relevant reasons for using the disproportionate cost justification, an explanation of the consideration of alternative financing mechanisms and an indication of the benefits that will not be achieved due to derogating from the default objectives and how these will be addressed in the future.

2.12 This CIS Guidance Document 20 provided further clarity on a number of aspects which the Environment Agency was asked to take into account – in particular in relation to affordability – confirming that affordability can be an element for justifying the decision on a time extension, subject to appropriate analysis (including the availability of alternative financing mechanisms). However the document also notes a disagreement between the Commission and some Member States regarding the application of affordability to the setting of less stringent objectives and to the consideration of public versus other agent’s budgets.

2.13 In attempting to follow this guidance and the associated conditions the Environment Agency has developed a list of simplified reasons for setting alternative objectives. These are summarised below

2.13.1 Technically infeasible
(1) No known technical solution is available – This has been applied where there is no practical technique for making the necessary improvement. This 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.

(2) Cause of adverse impact unknown This 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.

(3) Practical constraints of a technical nature prevent implementation of the measure by an earlier deadline This includes administrative constraints in terms of commissioning, gaining permission for, and undertaking the necessary works. It does not include constraints due to a lack of legislative mechanisms or of funding.

(4) Problem cannot be addressed because of lack of action by other countries The applicability is very limited in the UK.

2.13.2 Disproportionately expensive

(1) 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.

(2) 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 there is low confidence that a particular water body is adversely affected.

(3) Disproportionate burdens. This 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.

2.13.3 Natural conditions

(1) 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.

(2) 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.

2.14 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.

2.15 The Environment Agency has categorised measures in four broad groups to help simplify the river basin management planning process.

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 (see below).

M3 (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.

M3 (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 Catchment Sensitive Farming new catchments, catchment scale water protection zones).
M4 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.

Note that the reference case includes M1, M2, M3a, M3b (that are already happening) and M4 (that are already happening). The policy option is M3b (new measures) and M4 (new measures).

2.16 The process by which the Environment Agency has appraised measures is involved but can be summarised in a number of steps, shown below:

- **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.

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

2.17.1 **The national strategic level**

This 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, national benefits survey and Ministerial Guidance. These are discussed further below.

**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;
• which 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 planning will ultimately be more effective and cost-effective than an unphased approach, given current state of knowledge.

National Benefits Survey
The UK Collaborative Research Programme into the Water Framework Directive used 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.

The results have subsequently been used by the EA in measures appraisal (especially water industry measures) and in the IAs.

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/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.

2.17.2 The national/river basin district level

This 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.

2.17.3 The local level

The Environment Agency also worked with Liaison Panels and other stakeholders to identify a range of locally applied measures. The Environment Agency 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.

2.18 The Environment Agency has attempted to provide an appropriate balance between these levels which involve differences in costs and confidence of outcome. The national level assessment has been relied on in some cases and in others more local information has been collected and used.

2.19 Identifying objectives

The measures appraisal process has enabled the Environment Agency 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). They have used these expected outcomes to propose default or alternative objectives for each water body (see annex B). In carrying out these processes, they 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 they 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’ they have set alternative objectives.

2.20 A table for the current status for each of the river basin districts and the number of water bodies in each.

2.21 For water bodies adversely affected by multiple pressures (e.g. physical modifications to the bed and banks; over abstraction; etc), they have separately assessed the timescale needed to tackle each impact preventing the achievement of good status. They 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). Using this information they 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.

2.22 In identifying objectives, the Environment Agency has attempted to use the best information currently available. Their 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 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.

2.23 Where the Environment Agency has set an objective using an extended deadline, they 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 they feel currently unable to say which water bodies these will be.

2.24 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).

The Environment Agency are planning investigations to

- confirm the current status, where this is uncertain;
- gaining 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.

Where possible, these investigations will take place before 2013 so that the results are known in time for the formal review of the plans by 2015. This will allow the Agency to identify which specific water bodies will be able to achieve good status by 2021.

A proportion of investigations will lead to improvement action that will 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.

3. EVIDENCE RELATING TO THE COSTS AND BENEFITS OF THE PLANS

3.1 Reference case methodology and data sources

The Environment Agency has developed a reference case which is defined as “what is already happening and what will happen without the first River Basin Management Plan”. The costs of the Reference case measures are significant and are actually in excess of the costs of the first cycle plans themselves. They represent a substantial investment which will contribute to meeting the WFD aims but which is not dependent upon approval of the WFD plans for implementation.

| TABLE 1: Total costs of the Reference Case by RBD £m 2008 prices |
|------------------------|-----|-----|
| RBD                   | PV  | EAV |
| Anglian               | 2,570 | 111 |
| Dee                   | 310  | 13  |
| Humber                | 4,260 | 184 |
| North West2           | 5,000 | 216 |
| Northumbria           | 590  | 26  |
| Severn                | 1,770 | 76  |
| South East            | 2,710 | 117 |
| South West            | 1,500 | 65  |
| Thames3               | 5,340 | 230 |
| Western Wales         | 1,150 | 50  |
| England & Wales       | 25,200 | 1,087 |
Notes: Costs discounted until 2052 (43 years), except for Habitats Directive measures (6yrs), Fish Passage (6yrs), Phosphates in detergents (15yrs), Revised Bathing Water Directive (25yrs) and Catchment Sensitive Farming (3 yrs - until 2011).

3.2 As noted by the Environment Agency the majority of reference case costs (75%) are water industry measures decided through the periodic review/business planning process. The costs of the reference case include the following activities:

- reducing nitrogen pollution in nitrate vulnerable zones (NVZs) (Nitrates Directive)
- protecting and monitoring ground waters (Groundwater Directive)
- protecting water resource supplies through abstraction licensing (Habitats Directive)
- local sustainable urban drainage schemes (SUDS) to alleviate flood risk (Flood & Water Bill)
- protecting and improving the quality of rivers and lakes and encouraging healthy fish populations (Freshwater Fisheries Directive)
- removing barriers to fish passage / migration (e.g. Freshwater Fish Directive/Salmon & Freshwater Fisheries Review)
- removing phosphates from detergent
- improving coastal bathing water quality (Revised Bathing Water Directive)
- reducing diffuse pollution from agriculture in sensitive catchments (England Catchment Sensitive Farming Delivery Initiative)
- improving water quality & resources by implementing Water Protection Zones

3.3 It should be noted that:

- The figure for Thames RBD includes £900m of capital costs for Thames Water for the Thames Tideway project.
- PR09 costs exclude those which result directly from the WFD – these are captured in the Policy Option costs.
- The cost included here in the Reference Case for WPZ are the administrative costs to the EA associated with the WPZ programme.

3.4 According to the EA the total costs for the Reference Case can be split by policy driver as in Table 2 below:

<table>
<thead>
<tr>
<th>Policy</th>
<th>PV</th>
<th>EAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR04</td>
<td>12,600</td>
<td>544</td>
</tr>
<tr>
<td>PR09</td>
<td>8,100</td>
<td>349</td>
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<td>Sustainable Urban Drainage Schemes &amp;</td>
<td>2,100</td>
<td>91</td>
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<tr>
<td>reservoir safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrate Vulnerable Zones</td>
<td>760</td>
<td>33</td>
</tr>
<tr>
<td>Fish passage</td>
<td>470</td>
<td>85</td>
</tr>
</tbody>
</table>
3.5 The Environment Agency believe that the cost estimates for the Reference Case are underestimates and in considering the evidence it should be borne in mind that:

- many of the costs at river basin district level are based on an apportionment of the cost of a national programme to the river basin district based on different criteria – such as the size of the river basin district. Hence the national totals are considered more robust than the river basin district numbers.
- It has not been possible for the Environment Agency to capture all of the reference case measures due to uncertainty on the scale or apportionment to WFD objectives. This includes for example, the wide range of legislation that will impact on certain types of both point and diffuse pollution associated with emissions, discharges and losses of priority hazardous substances. Much of this legislation is driven by action at the EU level and it is not possible to apportion costs in relation to WFD requirements opposed to other environmental and human health drivers. For example EU Eel Regulation, Mine water remediation schemes already agreed and being implemented by the Coal Authority.
- It has not been possible for the Environment Agency to cost some measures for example flood risk management measures to carry out managed realignment of flood defences. In addition, the water resources costs for Habitats Directive driven measures may be underestimates and the Habitats Directive measures in Wales (Natura2000 measures) are not included for the Welsh river basin districts.
- Some of the costs from existing legislation have different time frames which makes it difficult to compare PVs, however the EAV is also presented which avoids this problem.

| Water Resources for Habitats Directive | 340 | 62 |
| Freshwater Fisheries Directive | 290 | 13 |
| Groundwater | 90 | 4 |
| Phosphates in detergent | 60 | 5 |
| Bathing Water Directive | 70 | 4 |
| Catchment Sensitive Farming | 40 | 14 |
| Other existing policies | 280 | 12 |
| **Total** | **25,200** | **1,087** |

### 3.1 POLICY OPTION BENEFITS

#### 3.1 Benefits data sources and methodology

#### 3.1.1 Data sources
The National Water Environment Benefit Survey (NWEBS) produced estimates of non-market benefits generated from improving the ecological quality of all water body types (rivers, lakes, estuaries and transitional and coastal waters). These results were used by NERA to derive the unit benefit value (£/wb/yr) for improvements from low to high, low to medium and medium to high status for each of the water bodies.

The Environment Agency used the most up-to-date classification results and predicted outcome for 2015 for each water body have been used in the benefit calculations. More information on the water bodies classification results and methodology is given in Annex A of the first RBMPs.

3.1.2 Methodology

Unit benefit values (£/wb/yr)

- The unit benefit values are based on the lower bound middle point between the payment card contingent valuation (PCCV) and dichotomous choice contingent valuation (DCCV) values obtained from the NERA survey.
- The Environment Agency added 200 lakes to the original NERA water body set. Unit benefit values for these additional water bodies were derived; and the unit value for the existing water bodies re-estimated to ensure that the budget constraint was not violated (the maximum willingness-to-pay estimated by the National benefit survey in 2007).
- In the final Impact Assessment the benefits values have been estimated for each of the five WFD water bodies status: bad, poor, moderate, good and high

3.1.3 Actual benefits

- The Environment Agency has used the unit values derived as described above in combination with the water status improvement at water body level. The benefits are estimated by comparing the classification results and the predicted outcomes for each of the water bodies. There is a benefit only when there is a change in water body’s status.
- As the change in water body’s status is due to the implementation of measures belonging to both the reference case and the policy option, a percentage split has been assumed to derive the policy option benefits from NERA model results (see assumption section for more information on percentage split).

3.1.4 Intra-class improvements

- Intra-class improvements have been estimated by the Environment Agency by splitting the NERA medium class into the poor and moderate WFD classes and the NERA high class into the good and high WFD classes. This conversion allows the previously unaccounted medium intra-class improvement to be estimated using the poor to moderate improvement value.
The Environment Agency note that due to data limitations the element improvements are not captured by the model.

### 3.2 Assumptions related to monetised benefits

The Environment Agency made the following assumptions in developing the estimates of monetised benefits:

a) Time period
   The Environment Agency has assumed that benefits are realised and sustained from 2013 to the end of the appraisal period. In some instances, measures may yield benefits before this period but these have not been taken into account. By the same token, some measures might yield benefits after this date.

b) Missing water body classification data
   Where data was missing for water body classification results the Environment Agency have estimated these by applying a distribution approach using the available classification data.

c) Breakdown of NERA benefits between the reference case and the policy option
   The EA have assumed that the measures undertaken under the baseline Reference Case will generate approximately 88% of benefits with 12% of benefits attributed to the Policy Option. The Policy Option benefits are obtained by multiplying the NERA model outputs by 12%.

   The 12% assumption was estimated by comparing the length of river improved for the elements phosphorus, ammonia and dissolved oxygen in the Reference Case and additional measures in the Policy Option. These percentages were also confirmed by Environment Agency expert judgements at a workshop held in June 2009.

d) Mapping WFD water bodies classes into NERA classes
   The three classes in the original NERA model (low, medium and high) have been translated in the five WFD water body classes: bad, poor, moderate and high by making the following assumptions:

   - The WFD bad to poor improvement is equivalent to 60% of the NERA Low to Medium improvement;
   - The WFD moderate to good improvement is equivalent to the NERA medium to high improvement; this assumes that the improvement from WFD good to high is zero.

   These assumptions were informed from a combination of expert judgement and using the WRc report which was used to construct the three original NERA classes.

### 3.3 Non-monetised benefits
3.3.1 It has not been possible for the Environment Agency to quantify all the benefits of the WFD either because the impacts are not yet understood or they cannot easily be estimated with currently available data. The Environment Agency believe that the main un-monetised benefits associated with the implementation of the WFD include:

- Benefits associated with increased resilience of the aquatic environment. By increasing the proportion of water bodies at good/high status, the resilience of aquatic environments to unforeseen shocks and changes in environmental condition (e.g. climate change) will be increased both at water body and catchment level. An example of potential benefits are the savings in adaptation costs, which is the specific case of climate change, might be significant.
- Where the WFD brings about improvements of shoreline nursery habitats, a number of commercial species such as bass may benefit.
- Compliance to the polluter/user-pays and control at source principle, which in the short term will translate into increased efficiency and effectiveness of water policy; and in the long term into, for example, increased innovation.
- Introduction of integrated river basin management will help authorities to design more cost-effective measures to meet the environmental objectives of other EU legislation (for example the Nitrates, Urban Wastewater Treatment and IPPC Directives).
- The promotion of sustainable management of water resources creates new jobs in sustainable industries, environmental technologies and nature conservation sectors; this may help, in the long term, shaping a more sustainable and solid economy as a whole and in the short term fighting against recession.
- By addressing and managing all demands on water resource in a consistent and comparable way will reduce conflicts and ensure equitable treatments of all water users, which might translate in lower policies’ enforcement costs.

3.3.2 Below are listed the un-monetised benefits, which previous studies have shown to be not significant at national level, but that might be relevant at a local level:

- Lower operating and maintenance costs for water users due to a reduced need for water treatment; evidence suggests these are not significant at a national level, but these may make a difference at a individual water body level. For example, Water Protection Zones will be used to address water pollution pressures in specific areas where existing regulatory and voluntary measures are insufficient to achieve WFD objectives. The water treatment savings have not been quantified, due to uncertainty about the measures that will be taken forward and their environmental outcomes. Nonetheless, these will be assessed as part of the impact assessment for each WPZ.
- Improvements in water quality and morphology resulting in increased fish numbers and diversity, and so having a positive impact on commercial fisheries and shellfisheries through increased volumes and/or value of commercial catches, has been suggested by evidence to be not significant, although further research is needed in this area.
• Local economic benefits which although important for the region in the RBD, represent transfers of costs from other regions and hence are ignored in this analysis.

3.3.3 Some of the non-market benefits associated with the implementation of the Policy Option have not been translated into monetary values by the benefits model for the following reasons:

• Some local measures that have costs applied in the final impact assessment have not been included in the assessment of the water bodies’ predicted outcomes. As a result the benefits from these measures are not captured in the model and not monetised.
• The one-out-all-out rule, which is used to estimate a water body’s overall status, does not capture the improvements that occur at element level.

3.2 POLICY OPTION COSTS

5.1 Cost methodology and data sources

Unit costs for ‘standard’ types of measures are derived from four sources:

• The pCEA 2C database (Entec, 2006), which provides capital and operating costs for specific ‘hard’ infrastructure interventions to address water bodies status problems, for example treatment of abandoned mines pollution.
• The pCEA 2E database (Metroeconomica, 2006), which provides unit costs for ‘softer’ interventions and delivery mechanisms that are required to deliver WFD objectives, such as land use planning to introduce environmental measures and bye-laws to enforce additional restrictions.
• The Environment Agency commissioned report ‘Economics Support for the Water Framework Directive’ (GHK, 200823) that provides unit costs for a range of measures to tackle TBT, for example the cost to the Environment Agency of issuing permits to ensure good practice and control emissions.
• Specific ‘unit cost/river basin district data came predominantly from national office but also from costs of local measures developed by River Basin Programme Managers.

5.2 Measures were assigned to ‘measure categories’ based on available data sources. According to the Environment Agency the process of assigning measures to these categories was informed by the data provided by the Environment Agency on “what will happen” and “means of delivery”. For the purpose of consistency across river basin districts, where possible, the Environment Agency has allocated similar measures to the same measure category. As the language and terminology used for local measures is not standardised, unlike the national measures, there has been greater scope for different interpretations of the type of activity and thus for some inconsistency in this categorisation. Checks have been made however to ensure consistency to the degree possible. The measures that were costed for these Impact Assessments were the measures provided as the final programme of measures at the beginning of July 2009. The Environment Agency note that any changes
that may have been made to measures after this date e.g. local measures, have not been taken into account in the Impact Assessments.

In the Environment Agency’s view the ideal approach to estimating the costs of measures is to cost both the measure (the action to be taken) and the delivery mechanism (mechanism for delivery of that measure). However they note that this has only been possible to a limited degree due to data constraints and insufficient information on the nature of the activities to be undertaken. The total costs of implementation are unlikely to be captured, therefore, in the estimates presented in the plans. The Environment Agency do not believe it is possible, however, to estimate the significance of this underestimation due to information constraints.

In accordance with Defra guidance, the costs of measures involving capital costs to the private sector were calculated to reflect the potential risks borne by non-public agents in delivering public policy.

5.3 The administration and monitoring costs borne by the Environment Agency has been included in the impact assessment. Such costs may also fall on other organisations; however, these are uncertain and so the Environment Agency has not included them. The costs to the Environment Agency associated with meeting the requirements of the WFD are assumed to be moderate.

5.4 In order to estimate costs, the Environment Agency has applied a number of assumptions:

a) Unit costs:
   - The mean (average) estimate of costs has been applied;
   - Staff time is estimated based on standard staff costs for the Environment Agency. These costs have also been assumed to be applicable across other sectors;

b) The interpretation of the nature of the measure and assignment to a standard category:
   - Standard costs for measures such as investigations, encouragement of best practice, partnerships, etc have been developed and to a large extent are applied across all pressures and sectors; in some cases, more pressure specific figures are used, to reflect variations in technical requirements or different levels of input being necessary (e.g. a minewaters investigation has a higher per unit cost than an investigation in relation to other pressures);
   - All information campaigns have been categorised as ‘targeted information – pollution prevention’. This category was developed for point source targeted information campaigns but is assumed to be applicable to other such measures including where the objective is, for instance, to promote water efficiency.
   - Measures that require the development of guidance, management plans, strategies etc have been categorised as ‘management plans’ and costed
based on information provided from River Basin Programme Managers. What is assumed to be required in the development of a management plan may vary across pressures and whether that plan is for a river basin district, a catchment or a water body.

c) The timing of the measure – both its commencement and the duration:

- Unless otherwise specified the Environment Agency assumes measures are implemented by 2012. Where a measure, such as an investigation, will take place over a number of years, it is assumed it will be completed by 2012.
- It is assumed water companies' operating costs are ongoing throughout the appraisal period.
- All measures where site investigations are required have been categorised as 'investigative monitoring' or as an investigation. It has generally been assumed that these investigations will take three years to complete (although there are some exceptions, for example, for water companies undertaking chemicals related investigations).
- The category of 'desk investigation' includes all office based investigations or small research projects. These are generally undertaken within one or two years.

d) The incidence of measures and their application rates.

- According to the Environment Agency measures may occur once per water body, once per catchment or once per river basin district. In some cases, it is not clear at what scale a measure is most likely to be applied, for example, at the catchment or river basin district level. In such cases, an application rate of one is used per occurrence of a measure. As recognised by the Agency this may result in an underestimation of costs.
- It has been assumed that only one investigation will be undertaken for a given site where the measures information highlights the need for investigations for a number of chemicals separately in that site.

e) The sector financing measures

- Where multiple sectors are identified as the financing sector, the Environment Agency has identified a lead financing sector. For example, it is assumed that for most measures aimed at reducing water abstraction pressures the financing sector is the water industry.
- Where national cost estimates have been disaggregated to river basin districts, lead financing sectors have also been identified.
- When information on the lead organisation has not been provided, gaps have been filled based on expert judgement. This could result in costs being attributed to sectors incorrectly. However, given the nature (mainly investigations) of many of these measures, the Environment Agency believes significance of this potential error is low.
- Where the measure is the development of a partnership or a forum it has been assumed that all partners identified carry a similar cost.
f) Cost savings from investigation measures

• Costs of investigations in the first cycle account for a large proportion of the total policy option cost. According to the Environment Agency this represents a step change in the level of R&D investment in water research with the expectation that it will lead to cost savings in future cycles via efficiency improvements from better targeting of measures. Due to uncertainty in technology it is not possible to quantify the magnitude of the potential savings across all of the pressure categories at this time. However, the Environment Agency believe that the expected efficiency improvements will at a minimum cover the cost of these research investments in future RBMPs.

5.5 Other key non-monetised costs by sector or the main affected groups

The Environment Agency’s Impact Assessments have not considered the costs of compliance to other sectors as a result of measures implemented by public agencies. The time or opportunity costs for businesses and other actors, such as farmers, in applying best practice are also not captured.

5.6 Uncertainty related to costs

According to the Environment Agency the key areas of uncertainty include:

• Uncertainty about the costs of measures. Although the Environment Agency has tried to cost all measures some measures do not have costs attributed to them. This is estimated to be between 1-3% of measures. Morphology pressure has the highest proportion of measures without costs.
• Uncertainty about which sector will finance the costs.
• Uncertainty about the duration of measures.
• Uncertainty on the application rate, for example in the case of habitat creation, information is required on the area to which it will be applied in order to estimate robust total costs; however, this information is not readily available and has meant that standard cost estimates based on a typical scheme have had to be used.
• Uncertainty regarding the reliability of applying standard unit costs for different pressures, elements, sectors, and geographical locations.
• Temporal uncertainty, this relates to the possibility that future costs associated with measures might be different or measures themselves might not be needed in the same format, for example due to technological advances.
APPENDIX 3

REVIEW OF INVESTIGATIONS PLANNED IN CYCLE 1 OF THE RIVER BASIN MANAGEMENT PLANS

1. Introduction
In October the EA published the draft Impact Assessments for the first River Basin Plans. This note explains the rationale for the investigations and what benefits they are expected to deliver for future rounds of River Basin Planning.

2. Background
A significant proportion (36% of the total) of the cost of the proposed measures in the first River Basin Plans are investigations. This is because in many cases the Environment Agency do not know what is causing a water body to not achieve Good Ecological Status or the best way to get the water body to GES. The investigations will help the EA to answer these sorts of questions. This is expected to save money by not doing things that are unnecessary or inefficient, and will help the Agency adhere to the principles of better regulation. Carrying out investigations in the first cycle was also recommended in the preliminary Cost Effectiveness Analysis (pCEA) as a way of dealing with the high level of uncertainty around measures.

3. Investigations for the first RBPs

3.1 How has the need for investigations been established
The Environment Agency has identified that investigations are needed when there is a lack of information or where we are uncertain about:

- A water body’s current water quality;
- Why a water body is failing to meet the standard of GES, or
- What measures would be appropriate for the water body to achieve GES.

Investigations are carried out to provide evidence that will enable the Environment Agency to plan and implement the necessary measures in future cycles or set alternative objectives.

3.2 What are the investigations in the first RBP?
Table 1 shows the number and cost of investigation measures split out by pressure. The table shows that the majority of the cost of investigations is to address questions relating to point source pollution. This is primarily costs born by the water industry for investigations into chemical/priority hazardous substances pollution from sewage treatment works, and how to remove it.
Table 1 Breakdown of investigation measures by pressure

<table>
<thead>
<tr>
<th>Pressure</th>
<th>No.</th>
<th>%</th>
<th>Cost £m PV</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstraction</td>
<td>46</td>
<td>0.17</td>
<td>16.69</td>
<td>0.10</td>
</tr>
<tr>
<td>Alien Species</td>
<td>6</td>
<td>0.02</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Diffuse Pollution</td>
<td>74</td>
<td>0.28</td>
<td>2.21</td>
<td>0.01</td>
</tr>
<tr>
<td>Fisheries</td>
<td>14</td>
<td>0.05</td>
<td>2.68</td>
<td>0.02</td>
</tr>
<tr>
<td>Groundwater</td>
<td>90</td>
<td>0.33</td>
<td>4.53</td>
<td>0.03</td>
</tr>
<tr>
<td>Morphology</td>
<td>6</td>
<td>0.02</td>
<td>0.10</td>
<td>0.00</td>
</tr>
<tr>
<td>Point Source Pollution</td>
<td>33</td>
<td>0.12</td>
<td>82.07</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>269</strong></td>
<td></td>
<td><strong>108</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 – Breakdown of investigation measures by financing sector

<table>
<thead>
<tr>
<th>Financing Sector</th>
<th>No</th>
<th>%</th>
<th>Cost £m PV</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Rural Land Management</td>
<td>3</td>
<td>0.01</td>
<td>0.04</td>
<td>0.00</td>
</tr>
<tr>
<td>Angling and Conservation</td>
<td>4</td>
<td>0.01</td>
<td>0.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Central Government</td>
<td>6</td>
<td>0.02</td>
<td>0.18</td>
<td>0.00</td>
</tr>
<tr>
<td>Environment Agency</td>
<td>210</td>
<td>0.78</td>
<td>27.31</td>
<td>0.25</td>
</tr>
<tr>
<td>Industry, Manufacturing and other Business</td>
<td>4</td>
<td>0.01</td>
<td>0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Local Government</td>
<td>8</td>
<td>0.03</td>
<td>0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Urban and Transport</td>
<td>3</td>
<td>0.01</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>Water Industry</td>
<td>31</td>
<td>0.12</td>
<td>80.55</td>
<td>0.74</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>269</strong></td>
<td></td>
<td><strong>108</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note – Apart from the EA and the Water Industry, the other sectors % contributions are all less than half of a percent of the total cost.

3.3 To what extent do the investigations represent a significant increase in investment in the knowledge base?

The water company investigations are expected to increase the knowledge base very significantly. Around 65% of Water Industry investment into investigations aims to quantify the loading of priority substances from sewage discharges, and identify options where discharges are confirmed as posing a risk to the achievement of WFD objectives.

There are three types of chemicals investigations – effluent screening, assessment of treatment efficacies and catchment surveys. Effluent screening will establish
concentrations of priority substances, specific pollutants and "emerging" substances in sewage discharges. Note – Environmental Quality Standards have not previously been available for many of these substances, so we have never had to consent them - but our monitoring data indicates a significant level of non-compliance for some of these substances, e.g. polyaromatic hydrocarbons (PAHs). Investigations into treatment efficacy and sources to the sewer catchment will identify whether end of pipe treatment or source control are appropriate measures to address chemicals in sewage effluents and will include assessments of cost-effectiveness, technical feasibility and disproportionate cost. These investigations entail one-off costs to establish measures and consenting approaches and will not need to be repeated in future planning cycles.

3.4 Are there examples of where investigations have reduced costs/increased benefits?
An example of potential cost savings from research and investigations is described in the PCEA Synthesis report for mines\(^1\). For coal mines, the costs for dealing with the remaining pollution problems over the three cycles are estimated at £274 million until 2027. This figure rises to £487 million if all measures are implemented in the first cycle because of the increased annual operating costs. For non-coal mines, remediation in the first cycle would require reliance on tried and tested measures that would cost a total of £928 million to 2027. Investigations into innovative measures at Welsh sites have indicated that phasing of remediation, targeting the high priority sites first, would allow costs to be spread but also allow innovative treatment methods to be developed at a significant saving. Total costs with this approach would be £130 million to 2027, a saving of 85% over the first option.

These figures show that significant savings can be made by phasing implementation of measures over the three cycles. These savings can come from the development of new techniques, greater certainty on the causes of the problems as well as savings in operational costs. While we cannot assume that savings will be as high for all pressures, there are strong indications that the savings would be significant.

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\(^1\) PCEA Synthesis report – Mines
APPENDIX 4

SUMMARY OF THE ALTERNATIVE OBJECTIVES AND THEIR JUSTIFICATIONS

The following table summarises the number of times different criteria have been used for setting alternative objectives. The justification of most alternative objectives depends upon the risk of disproportionate costs. In all 5059 water bodies have an alternative objective set.

Table X: Summary of the use of alternative objectives within the plans

<table>
<thead>
<tr>
<th>Alternative objective reason</th>
<th>Sub-reason</th>
<th>No. of water bodies in England &amp; Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technically infeasible</td>
<td>No known technical solution is available</td>
<td>1705</td>
</tr>
<tr>
<td></td>
<td>Cause of adverse impact unknown</td>
<td>1911</td>
</tr>
<tr>
<td></td>
<td>Practical constraints of a technical nature</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Number of water bodies in England and Wales where technically infeasible has been used</strong></td>
<td><strong>3258</strong></td>
</tr>
<tr>
<td>Disproportionately expensive</td>
<td>Unfavourable balance of costs and benefits</td>
<td>327</td>
</tr>
<tr>
<td></td>
<td>Significant risk of unfavourable balance of costs and benefits</td>
<td>2771</td>
</tr>
<tr>
<td></td>
<td>Disproportionate burdens</td>
<td>121</td>
</tr>
<tr>
<td></td>
<td><strong>Number of water bodies in England and Wales where disproportionately expensive has been used</strong></td>
<td><strong>3007</strong></td>
</tr>
<tr>
<td>Natural conditions</td>
<td>Ecological recovery time</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Groundwater status recovery time</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Number of water bodies in England and Wales where natural conditions has been used</strong></td>
<td><strong>28</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total number of water bodies in England and Wales with an alternative objective (extended deadline and/or less stringent status objective)</strong></td>
<td><strong>5059</strong></td>
</tr>
</tbody>
</table>

The reasons/justifications for all of the alternative objectives are set out in Annex E to the plans. The following summarise the information from Annex E by providing an example of each type of justification.
• **Example 1: Technically infeasible; no known technical solution is available:** Morphology (codes M3a to M3h) - Technical solutions to address the ecological impact caused by the physical modification are under development and their effectiveness is not known.

• **Example 2: Technically infeasible; cause of adverse impact unknown:** Biological elements (code B2a) - The pressure causing the failure is unknown

• **Example 3: Disproportionately expensive; unfavourable balance of costs and benefits:** Hydrology (code HR4a) - Likely unfavourable balance of costs and benefits of achieving good ecological status

• **Example 4: Disproportionately expensive; significant risk of unfavourable balance of costs and benefits:** Phosphate and Dissolved Inorganic Nitrogen (codes P1a, N1a) - There is not sufficient weight of evidence to confirm the need to control eutrophication risk

• **Example 5: Disproportionately expensive; disproportionate burdens:** Fish (barriers to migration; code M5a) - If implemented before 2015 the required measure would impose a disproportionate burden. We are considering possible relevant alternative financing mechanisms

• **Example 6: Natural conditions; ecological recovery time:** Biological elements (code B3a) - The biology will not recover to good status until after 2015

• **Example 7: Natural conditions; groundwater status recovery time:** DrWPA, General chemical assessment (code GC6a) - The measures will not result in good status by 2015 but will by 2027

Copied below are the actual justifications used in the pans for each of the above examples.
### Example 1: Technically infeasible: no known technical solution is available

<table>
<thead>
<tr>
<th>Reference</th>
<th>M3a to M3h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element predicted not to achieve good by 2015</td>
<td>Morphology</td>
</tr>
</tbody>
</table>
| Reason for failure         | M3a = Confirmed - physical modification flood protection  
                           | M3b = Confirmed - physical modification urbanisation  
                           | M3c = Confirmed - physical modification land drainage  
                           | M3d = Confirmed - physical modification water storage and supply (including for power generation)  
                           | M3e = Confirmed - physical modification ports and harbours  
                           | M3f = Confirmed - physical modification flood and coastal erosion protection  
                           | M3g = Confirmed - physical modification inland navigation  
                           | M3h = Confirmed - physical modification recreation |
| Alternative objective      | Extended deadline           |
| Reason for alternative objective | Technically infeasible: no known technical solution |

#### Justification for alternative objective

**Technical solutions to address the ecological impact caused by the physical modification are under development and their effectiveness is not yet known.**

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.

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.

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.

For artificial and heavily modified water bodies, mitigation measures have been identified as necessary in order to achieve GEP. The feasibility of these measures 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.

<table>
<thead>
<tr>
<th>Investigation type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate feasibility of measures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Example of investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible future measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>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:</td>
</tr>
<tr>
<td>• Removal of barriers to fish passage.</td>
</tr>
<tr>
<td>• River enhancement/restoration schemes</td>
</tr>
<tr>
<td>• Restoration of natural flows through habitat management &amp; removal of impediments to flow.</td>
</tr>
<tr>
<td>• Revised sediment management strategies</td>
</tr>
<tr>
<td>• More widespread use of Sustainable Drainage Systems.</td>
</tr>
<tr>
<td>• Codes of Practice / General Binding Rules for operational activities/boat traffic.</td>
</tr>
<tr>
<td>• Opportunistic habitat enhancements on the back of capital and maintenance works</td>
</tr>
</tbody>
</table>

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
**Example 2: Technically infeasible; cause of adverse impact unknown**

<table>
<thead>
<tr>
<th>Reference</th>
<th>B2a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element predicted not to achieve good by 2015</strong></td>
<td>Biological elements</td>
</tr>
<tr>
<td><strong>Reason for failure</strong></td>
<td>Unknown – reasons for failure unknown</td>
</tr>
<tr>
<td><strong>Alternative objective</strong></td>
<td>Extended deadline</td>
</tr>
<tr>
<td><strong>Reason for alternative objective</strong></td>
<td>Technically infeasible - cause of adverse impact unknown</td>
</tr>
</tbody>
</table>

**Justification for alternative objective**

**The pressure causing the failure is unknown**

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.

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.

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.

<table>
<thead>
<tr>
<th><strong>Investigation type</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate cause of failure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Example of investigation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Possible future measures</strong></th>
</tr>
</thead>
</table>
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.

<table>
<thead>
<tr>
<th>Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not possible to identify these at this stage</td>
</tr>
</tbody>
</table>
**Example 3: Disproportionately expensive; unfavourable balance of costs and benefits**

<table>
<thead>
<tr>
<th>Reference</th>
<th>HR4a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element predicted not to achieve good by 2015</strong></td>
<td>Hydrology</td>
</tr>
<tr>
<td><strong>Reason for failure</strong></td>
<td>Confirmed - Abstraction</td>
</tr>
<tr>
<td><strong>Alternative objective</strong></td>
<td>Extended deadline</td>
</tr>
<tr>
<td><strong>Reason for alternative objective</strong></td>
<td>Disproportionately expensive: unfavourable balance of costs and benefits</td>
</tr>
</tbody>
</table>

**Justification for alternative objective**

**Likely unfavourable balance of costs and benefits of achieving good ecological status**

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.

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.

Further investigation is required to identify proportionately costly solutions.

**Investigation type**

investigate feasible measures

**Example of investigation**

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

35
status and the scale of measures required in order to achieve this.

### 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 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 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.
Example 4: Disproportionately expensive; significant risk of unfavourable balance of costs and benefits

<table>
<thead>
<tr>
<th>Reference</th>
<th>P1a, N1a</th>
</tr>
</thead>
</table>
| Element predicted not to achieve good by 2015 | P1a = Phosphate or Total Phosphorus  
N1a = 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

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.

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.

For these water bodies the sources of nutrient are not yet confirmed.

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 – copied below). 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.

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.

The results of the new (from 2007) WFD monitoring programme will be reviewed to improve our understanding of the relationship between failure of nutrient standards and biological impact. If this shows that there is a strong correlation, we need not wait for direct biological evidence to start work to define the sources of the problem and their solution. This will mean that following further consideration of technical feasibility and disproportionate costs, further measures may be implemented in the first cycle.

**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 identify 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 to P5c

<table>
<thead>
<tr>
<th>Reference</th>
<th>P5c</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Element predicted not to achieve good by 2015</th>
<th>Phosphate or Total Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for failure</td>
<td>Confirmed - point source water industry sewage works</td>
</tr>
<tr>
<td>Alternative objective</td>
<td>Extended deadline</td>
</tr>
<tr>
<td>Reason for alternative objective</td>
<td>Disproportionately expensive: unfavourable balance of costs and benefits</td>
</tr>
<tr>
<td>Justification for alternative objective</td>
<td></td>
</tr>
</tbody>
</table>
The discharge causing the phosphorus failure is known and a site specific appraisal has shown the improvement measure available to be currently disproportionately expensive

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.

These appraisals used:
- 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.

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.

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.

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 £6 billion and result in benefits of approximately £2 billion. 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.
**Example 5: Disproportionately expensive; disproportionate burdens**

<table>
<thead>
<tr>
<th>Reference</th>
<th>M5a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element predicted not to achieve good by 2015</strong></td>
<td>Fish</td>
</tr>
<tr>
<td><strong>Reason for failure</strong></td>
<td>Confirmed - physical modification barriers to fish migration</td>
</tr>
<tr>
<td><strong>Alternative objective</strong></td>
<td>Extended deadline</td>
</tr>
<tr>
<td><strong>Reason for alternative objective</strong></td>
<td>Disproportionately expensive - Disproportionate burdens</td>
</tr>
</tbody>
</table>

### Justification for alternative objective

**If implemented before 2015, the required measure would impose a disproportionate burden. We are considering possible relevant alternative financing mechanisms.**

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.

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.

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).

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.

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 benefits 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 changes and should changes arise in the future these will be reflected in later plans.

<table>
<thead>
<tr>
<th>Investigation type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate feasible measures</td>
</tr>
<tr>
<td>Example of investigation</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Investigate cheaper measures and alternative financing mechanisms.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible future measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Explore Axis 4 Leader options in funding action at local catchment level.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measures required to achieve 100% GES/GEP by 2027 that are likely to be technically infeasible or disproportionately expensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of all barriers to fish migration. In most cases we will have to introduce fish passes rather than removing the obstruction.</td>
</tr>
</tbody>
</table>
### Example 6: Natural conditions; ecological recovery time

<table>
<thead>
<tr>
<th>Reference</th>
<th>Biological elements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element predicted not to achieve good by 2015</strong></td>
<td>Biological elements</td>
</tr>
<tr>
<td><strong>Reason for failure</strong></td>
<td>Various pressures and sources</td>
</tr>
<tr>
<td><strong>Alternative objective</strong></td>
<td>Extended deadline</td>
</tr>
<tr>
<td><strong>Reason for alternative objective</strong></td>
<td>Natural conditions - ecological recovery time</td>
</tr>
</tbody>
</table>

#### Justification for alternative objective

**The biology will not recover to good status until after 2015**

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.

An extended deadline for achieving good ecological status is therefore required. This will to allow time for the biology to recover.

#### 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
### Example 7: Natural conditions; groundwater status recovery time

<table>
<thead>
<tr>
<th>Reference</th>
<th>GC6a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Element predicted not to achieve good by 2015</strong></td>
<td>Drinking Water Protected Area General Chemical Assessment</td>
</tr>
<tr>
<td><strong>Reason for failure</strong></td>
<td>Suspected - point and diffuse sources from agriculture and amenity use The failure was caused by the pesticides atrazine and simazine</td>
</tr>
<tr>
<td><strong>Alternative objective</strong></td>
<td>Extended deadline</td>
</tr>
<tr>
<td><strong>Reason for alternative objective</strong></td>
<td>Natural conditions - groundwater status recovery time</td>
</tr>
</tbody>
</table>

**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.