EXPLANATORY MEMORANDUM TO
THE BATHING WATER REGULATIONS 2008

2008 No. 1097

1. This explanatory memorandum has been prepared by the Department for Environment Food and Rural Affairs ("Defra") and is laid before Parliament by Command of Her Majesty.

2. Description

2.1 The Bathing Water Regulations 2008 ("2008 Regulations") transpose the requirements of EC Directive 2006/7/EC of the European Council and of the Council concerning the management of bathing water quality and repealing Directive 76/160/EEC (OJ L64, 4.3.2006, p.37), the revised Bathing Water Directive ("rBWD"). The 2008 Regulations revoke the legislation (see section 4 below) transposing the EC Directive, 76/160/EEC concerning the quality of bathing water (OJ L31, 5.2.1976, p.1), the current Bathing Water Directive ("cBWD").

2.2 The overall objective of the rBWD remains the protection of public health, but it also provides an opportunity to improve management practices at bathing waters and to standardise information provided to bathers across Europe. The 2008 Regulations primarily place a duty on the Environment Agency ("the Agency") to use its powers to achieve compliance with the rBWD - in particular, to meet the new bathing water quality standards by the end of the 2015 bathing season. Obligations are placed on beach operators to display bathing water quality information on beach signage during the bathing season and to work with the Agency, local authorities and sewerage undertakers during pollution incidents and for each party to take adequate measures to protect bathers' health.

3. Matters of special interest to the Joint Committee on Statutory Instruments

None.

4. Legislative Background

4.1 The cBWD came into force in 1976 to help protect the public's health and the environment from faecal pollution at bathing waters. The cBWD was transposed into national legislation through Regulations, Directions and Notices from the early 1990s onwards (see Annex 1).

4.2 The rBWD came into force in March 2006 and with effect from 31 December 2014 will repeal the cBWD.

4.3 The 2008 Regulations which are made under section 2(2) of the European Communities Act 1972, transpose and implement the requirements of the rBWD and revoke the legislation transposing the cBWD (listed at Annex 1). A transposition note is attached at Annex 2.

5. Extent

5.1 The 2008 Regulations extend to England and Wales.

6. European Convention on Human Rights

6.1 As the instrument is subject to negative resolution procedure and does not amend primary legislation, no statement is required.

7. Policy background

7.1 The cBWD came into force 30 years ago to help protect public health and the environment from faecal pollution at popular bathing waters. The cBWD requires Member States to identify popular bathing areas and to monitor water quality at these bathing waters throughout the bathing season, which runs from mid-May to September in England and Wales. The Directive sets a number of microbiological and physico-chemical standards that bathing waters must either comply with ('mandatory' standards) or endeavour to meet ('guideline' standards). The two main standards used to assess the quality of bathing water are total coliforms and faecal coliforms, which are bacteria found in the guts of humans and other warm-blooded animals, and are indicators of faecal pollution.

7.2 The cBWD was initially transposed in the UK by means of a Government Advice Note issued on 9 July 1979. It was not until the early 1990s that the cBWD was more formally transposed into national legislation through Regulations, Directions and Notices (see Annex 1).

7.3 Member States are required to ensure as a minimum that bathing waters meet the 'mandatory' microbiological water quality standards and must also endeavour to ensure that bathing waters meet the more stringent 'guideline' standards. Since the introduction of the cBWD, significant improvements have been made to the quality of bathing waters in England and Wales, particularly through water industry improvements to the sewerage network. For instance, in 2007, 97.8% of bathing waters in England and 97.5% in Wales complied with the mandatory standards, compared with 79.0% and 78.0% in 1992, respectively. Likewise, in 2007, 72.5% of all bathing waters in England and 86.3% in Wales met the guideline standards compared with 28.7% and 26.0% in 1992, respectively.

7.4 The cBWD has been updated and simplified by the rBWD, which came into force on 24 March 2006. Whilst the overall objective of the rBWD remains the protection of public health, it has also provided an opportunity to improve management practices at bathing waters and to standardise information provided to bathers across Europe. The rBWD takes a new approach to assessing water quality, using fewer but more stringent standards than at present. It establishes 4 new standards of water quality ('excellent', 'good', 'sufficient' and 'poor') and all bathing waters are to achieve at least the 'sufficient' standard by the end of 2015 (with limited exceptions).

7.5 The Government consulted on its proposals for the implementation of the rBWD in England and Wales for twelve weeks from 12 November 2007 to 4 February 2008 to seek the views of those who may be affected or concerned by the new provisions of the rBWD, including, for example, the Agency, the Water Industry, Local Authorities (including beach, leisure and tourism managers and Environmental Health Officers), farmers, private beach operators, NGOs and bathers. The Government received 42 consultation responses. Ten responses were received from the water industry, including a response from Water UK, the trade organisation for the water industry. Six responses were received from academic/research organisations, six from private individuals, five from environmental/social NGOs and five from Local Government including LACORS and the Welsh Bathing Water Sub Group which represent local authorities in England and Wales, respectively. Three responses were received from recreational sports associations, two from commercial businesses and two from Government Agencies, including the Environment

Agency. One response was received from another Government Department and one from the National Farmers' Union, an agriculture industry body representing the interests of farmers.

7.6 Analysis of the responses indicated that on the whole the Government's proposals were supported by stakeholders. However, comments were made in relation to the Government's level of ambition and in light of these, it was concluded that England and Wales should only aim to do the minimum that the rBWD requires (with the use of a prediction system where appropriate) prior to the first bathing water classifications being made at the end of the 2015 bathing season. The costs and benefits associated with the implementation options were questioned and have been revised accordingly. The costs have roughly doubled and the benefits associated with providing better information on beach signage are now approximately one third of their original value. In spite of these adjustments the benefits still significantly outweigh the costs and support the decision to aim to do the minimum (with the use of prediction) prior to 2015.

7.7 The views of respondents were carefully considered and the 2008 Regulations were finalised accordingly. The main features of the 2008 Regulations are as follows –

7.7.1. new water quality standards. The 2008 Regulations require that all bathing waters are to be classified as either 'poor', 'sufficient', 'good' or 'excellent' and that –

i. all bathing waters must be classified as 'sufficient' by the end of the 2015 bathing season; and

ii. realistic and proportionate measures to be taken with a view to increasing the number of bathing waters classified as 'good' or 'excellent'.

The obligation to meet these new standards will fall to the Agency. The Agency will need to exercise its "relevant functions" to ensure that the tighter standards are met, which will primarily involve requiring farmers and local authorities to tackle diffuse water pollution from agricultural and urban sources respectively, as well requiring the water companies to make further improvements to sewerage infrastructure (to reduce point source pollution). The costs to the Water Industry, farmers and others of achieving the required improvements in bathing water quality are relatively low, but are greater than the public health benefits to be gained from improving the bathing water quality (when taken in isolation from the significant health benefits to be gained from advisory information on beach signage – see para 7.7.4). However, failure to address water quality may be regarded as failure to fully implement the rBWD.

7.7.2. poor bathing waters. If a bathing water attains a 'poor' classification, the 2008 Regulations place a duty on the Agency to both identify the causes and reasons for failure, to identify measures to reduce the risks of pollution and to notify the beach operator. The Agency will then need to work with water companies and farmers for example, to tackle the causes of pollution. The 2008 Regulations will also place a duty on beach operators i.e. local authorities and private controllers, to provide information on beach signage, including advice against bathing.

In the case of a bathing water that is classified as 'poor' for 5 consecutive years, the 2008 Regulations require the Agency to introduce permanent advice against bathing. The Agency will notify the appropriate beach operator that permanent advice against bathing must be introduced at their bathing water and the beach operator will advise the public on beach signage not to bathe. However, permanent advice against bathing can be introduced earlier if it is thought that the achievement of 'sufficient'

would be infeasible or disproportionately expensive. Where the Agency considers this to be the case, the Regulations require the Agency to first consult the local authority or private controller that controls the bathing water and secondly to advise the Secretary of State or Welsh Ministers. Where the Agency's advice is accepted the local authority or private controller will need to provide permanent advice against bathing.

7.7.3. prediction and discounting system. The 2008 Regulations will provide a further means of protecting bathers' health by enabling the Agency and beach operators to make use of a prediction system at bathing waters. The 2008 Regulations allow the Agency to establish procedures to predict water quality at bathing waters subject to short term pollution (i.e. periods of 'poor' water quality not expected to last more than 72 hours) and beach operators to advise the public against bathing during such pollution events. Where advice against bathing has been provided the Agency is able to disregard ('discount') samples taken during this period, since the public will not be bathing, potentially enabling the bathing water to achieve a higher classification than would otherwise be the case. It has been found that the benefits associated with a prediction system could significantly outweigh the set up and running costs.

7.7.4. better public information. The 2008 Regulations require clear, consistent bathing water information to be provided on beach signage including the bathing water's most recent classification, a general non-technical description of the site and any advice currently applicable against bathing. The general description will provide an indication of the expected water quality at all bathing waters, which will enable bathers to make a more informed choice about whether or not to bathe. Although this would not provide 'real time' water quality information, as would be available where a prediction system has been adopted, it would be beneficial since it would indicate to the public when there is the greatest potential for pollution at the bathing water, for example following stormy weather. The majority of the benefits arising from the implementation of the rBWD are associated with providing the public with better information on beach signage.

The responsibility to disseminate the information relating to each bathing water falls to beach operators, which will mainly be local authorities, although there are a small number of privately operated sites. As many beach operators already provide beachside signage on various aspects of their bathing waters, the rBWD's new requirements are intended to integrate with this wherever possible and be phased into the normal cycle of sign replacement and updating for the start of the 2012 bathing season. This should result in minimal cost to most beach operators.

7.7.5. new parameters. The 2008 Regulations require the Agency to monitor two types of bacteria (intestinal enterococci and *Escherichia coli*) as indicators of the risk of mild gastrointestinal illness in bathers (unlike the current regime which requires the Agency to test for ten parameters).

7.7.6. transitional arrangements. The 2008 Regulations require the bathing water classifications to be made on the basis of 4-year data sets. The Agency will commence monitoring of the new rBWD parameters in 2012, but until a first classification can be made in 2015, the 2008 Regulations include transitional provisions which allow the data from 2012, 2013 and 2014 to be back-converted to the cBWD parameters, to enable the bathing water quality data to be reported to the Commission.

7.7.7. management measures at bathing waters subject to pollution incidents. The 2008 Regulations place duties on the Agency, sewerage undertakers and beach operators to take action to protect bathers' health where a bathing water is subject to –

i. an unexpected pollution incident (for example, a failure at a sewage treatments works);
ii. a proliferation of cyanobacteria, macro-algae or marine phytoplankton;
iii. the presence of waste (including tarry residues, glass, plastic or rubber); and
iv. any other incident that poses a risk to bathing water quality and bather's health.

7.7.8. enforcement. The 2008 Regulations place a duty on local authorities and private controllers to provide bathing water information on beach signage by the 2012 bathing season (other than the classification which will not be available until after the 2015 bathing season). The Agency will check (whilst taking routine bathing water samples early in the bathing season) that local authorities and private controllers are displaying the required information on their beach signage. If a local authority or private controller is found not to be discharging any of its public information obligations the Secretary of State or Welsh Ministers may, by notice given to the local authority or private controller specify the measures which must be taken to comply with the 2008 Regulations and the deadline by which those measures must be taken. If the measures have not been taken by the specified deadline, the Secretary of State or Welsh Ministers may apply to the courts for an order requiring that the local authority or private controller comply with the Regulations or take the measures themselves.

7.7.9. bathing water profiles. The 2008 Regulations require the Agency to establish, for the first time before the 2011 bathing season a bathing water profile for every bathing water and keep it under review. The 2008 Regulations set out the information which should be incorporated into the profile and includes, for example, a description of the physical, geographical and hydrological characteristics of the bathing water, identification and assessment of causes of pollution and assessments of the potential for proliferation of cyanobacteria, macro-algae and phytoplankton.

7.8 Defra considers that the 2008 Regulations are consistent with the principles of better regulation and keep the burden placed on industry and other parties (in particular the Agency) to a minimum. The 2008 Regulations include some compensatory simplification measures. For instance, the 2008 Regulations will:

i. replace the existing legislation, directions and notices removing the need to refer to several documents;
ii. require the Agency to monitor fewer microbiological indicators when assessing bathing water quality (compared to the current regime); and
iii. give the Agency the option to reduce the number of monitoring visits undertaken per bathing water, but only where it does not jeopardise compliance with the rBWD.

8. Impact

8.1 The main impact of the policy falls on the water and farming industries.

8.2 An Impact Assessment is attached. Copies can be obtained from Defra, Water Quality Division, Zone 2A/B, Ergon House, Horseferry Road, London, SW1P 2AL or from the Defra website at

www.defra.gov.uk/environment/water/quality/bathing/revision.htm

9. Contact

9.1 James Biott at Defra (Zone 2A/B, Ergon House, Horseferry Road, London SW1P 2AL, telephone 020 7238 5324 and e-mail james.biott@defra.gsi.gov.uk).

Annex 1

Regulations, Directions and Notices transposing the current Bathing Water Directive, 76/160/EEC, into national legislation

- The Bathing Waters (Classifications) Regulations (SI 1991 No. 1597)

- The Bathing Waters (Classifications) (England) Regulations 2003 (SI 2003 No. 1238)

- The National Rivers Authority (Bathing Waters) Directions 1992 for England and Wales.

- Notices issued by the Secretary of State for the Environment on:
  - 5 May 1992
  - 14 February 1997 and
  - 13 June 2003

Department for Environment, Food and Rural Affairs

Transposition of the Bathing Water Directive (2006/7/EC)

The Bathing Water Regulations 2008

1. This Transposition Note has been prepared by the Department for Environment, Food and Rural Affairs ("Defra") to show how the main elements of the Bathing Water Directive (that is, Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC)[1] have been transposed in England and Wales.

2. This Note has been published to accompany the Bathing Water Regulations 2008 ("the Regulations"), which were laid before Parliament in April 2008. The Regulations also revoke the Bathing Waters (Classification) Regulations 1991[2] and the Bathing Waters (Classification) (England) Regulations 2003[3], and make consequential amendments to the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003[4] and the Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004.[5] Transitional provisions provide for the continued operation of the Bathing Waters (Classification) Regulations 1991 for certain purposes during the period until the Regulations come into full operation.

The Bathing Water Directive

3. The main object of the Bathing Water Directive is to protect human health from the adverse effects of any contamination of bathing water. It sets up a standard classification of bathing water quality, and requires regular monitoring for microbial contamination and other measures of quality. Bathing waters that fail to meet the standards must be managed appropriately.

4. The Bathing Water Directive requires Member States to ensure that adequate information is available to bathers regarding the quality of bathing water.

Means of transposition of the main elements of the Bathing Water Directive

5. The following table sets out how the main elements of the Bathing Water Directive (called "the Directive" in the table) have been transposed by the Regulations.

Article	Objective	Implementation	Responsibility
3.1	Member States to identify bathing waters and bathing seasons	Regulations 3 and 4	For England, the Secretary of State and the Environment Agency; for Wales, the Welsh Ministers and the Environment Agency

[1] OJ No L64, 4.3.2006, p.37.
[2] S.I. 1991/1597.
[3] S.I. 2003/1238.
[4] S.I. 2003/3242.
[5] S.I. 2004/99.

Article	Objective	Implementation	Responsibility
3.2	Member States to ensure monitoring of bathing water quality for the parameters set out in Annex 1 according to the methods described in Annex IV	Regulation 8 and Schedule 3	The Environment Agency
3.3	Fixes the general locations of monitoring points	Schedule 3 paragraph 1	The Environment Agency
3.4 and 3.5	Requirement to establish a monitoring calendar for each bathing water	Schedule 3 paragraphs 2 and 3	The Environment Agency
3.6, 3.7 and 3.8	Suspension of monitoring during short-term pollution and abnormal situations	Regulation 14(5) and Schedule 3 paragraph 2(2)	The Environment Agency
4.1	Requires Member States to compile sets of bathing water quality data by monitoring certain parameters	Regulation 8 and Schedule 3	The Environment Agency
4.2	Requires quality assessments to be carried out after the end of each bathing season in accordance with the procedure in Annex II	Regulation 10 and Schedule 4	The Environment Agency
4.3, 4.4	Requires the sampling procedure set out in Annex II to be used and prescribes when particular samples can be disregarded	Regulations 8, 14(5) and 14(6)	The Environment Agency
4.5	Provides for grouping of bathing waters	Regulation 7(2)	The Environment Agency
5	Establishes the scheme of classification of bathing waters as “poor”, “sufficient”, “good” or “excellent”	Regulation 11 and Schedule 4	The Environment Agency
6	Requires Member States to establish bathing water profiles for each bathing water or group of contiguous bathing waters	Regulation 7 and Schedule 2	The Environment Agency
7	Requires Member States to ensure that timely and adequate management measures are taken in the event of unexpected situations that could have an adverse effect on bathers’ health	Regulation 12	The Environment Agency and the controller of the bathing water concerned

Article	Objective	Implementation	Responsibility
8.1	Requires appropriate monitoring when there is potential for cyanobacterial proliferation	Regulation 8(3) and Part 2 of Schedule 3	The Environment Agency
8.2	Requires adequate management measures, including public information, to be taken in the event of cyanobacterial proliferation	Regulation 12	The Environment Agency and the controller of the bathing water concerned
9.1	Requires investigation of acceptability and possible health risks where there is a tendency for proliferation of macro-algae or marine phytoplankton, and requires adequate management measures	Regulations 8(4) and 12 and Part 3 of Schedule 3	The Environment Agency
9.2	Requires inspection for tarry residues, glass, plastic, rubber etc, and requires adequate management measures	Regulations 8(5) and 12 and Part 4 of Schedule 3	The Environment Agency
10	Requires transboundary cooperation in relation to river basins	Not applicable—no need to transpose	—
11	Requires Member States to encourage public participation in the implementation of the Directive	Regulation 6	The Secretary of State, the Welsh Ministers and the Environment Agency
12	Requires Member States to ensure that specified information and information of specified kinds is publicly available	Regulations 9 and 14	The Environment Agency and the controller of each bathing water
13.1 to 13.3	Requires Member States to report certain information to the European Commission	Regulation 5(5) provides for the Environment Agency to report to the Secretary of State (for bathing waters in England) or the Welsh Ministers (for bathing waters in Wales). It is intended that the information will be used to make the necessary reports to the Commission	—

Article	Objective	Implementation	Responsibility
17	Repeals directive 76/160/EEC	Regulation 19 revokes the Regulations that transpose the repealed Directive and makes consequential amendments; regulations 5(3) and 5(4) make consequential amendments to regulations that refer to the revoked Regulations; regulation 18 contains transitional provisions	—

Annex 3

Impact Assessment

SUMMARY: INTERVENTION & OPTIONS

Department for Environment, Food and Rural Affairs	Impact Assessment for the revised Bathing Water Directive (2006/7/EC) concerning the management of bathing water quality and repealing Directive 76/160/EEC, adopted on 15th February 2006.	
Stage Final Proposal	**Version** Final	**Related Publications** None

Available to view or download at: www.defra.gov.uk/corporate/consult/bathingwaters/index.htm
Contact name for enquiries: James Biott
Telephone number: 020 7238 5324

What is the problem under consideration? Why is government intervention necessary?

The current Bathing Water Directive (76/160/EEC), which is now over 30 years old, has been updated and simplified to take into account lessons learnt from its implementation, developments in science and knowledge about the risks of bathing and the environmental protection offered by more recent EU water legislation. A revised Bathing Water Directive (rBWD) came into force on 24 March 2006 and must be transposed into UK law within two years. Key changes include a tightening of water quality standards to further protect public health (whilst bathing) and the provision of standardised information to the public.

What are the policy objectives and the intended effects?

The objective of the rBWD is to protect public health whilst bathing by improving water quality and by providing information to the public. This fits well with the Government's (Defra and Welsh Assembly Government) wider objectives. For example 'Water Availability and Quality' is a high impact policy area under Defra's Water Strategy, which links directly to the Government's high level goals of avoiding dangerous climate change and protecting and enhancing the natural asset base. The Strategy aims, through sustainable water management, to improve standards of service and quality whilst achieving a balance between environmental impacts, water quality of surface and ground waters, supply and demand, and economic and social effects.

The rBWD requires Member States to ensure that by the end of the 2015 bathing season, all bathing waters (BWs) are at least 'sufficient' (with limited exceptions). Currently there are a small number of bathing waters in England and Wales which may fail to achieve (or are at "high risk" of failing to achieve) the 'sufficient' classification. Measures will need to be taken to improve the water quality at all of these sites to ensure that they comply with the rBWD. The rBWD also requires Member States to provide bathing water information to the public on beach signage and via the internet. This information will enable the public to make an informed choice on whether to bathe or not.

What policy options have been considered?

The Government consulted from 12 November 2007 to 4 February 2008 on three main options for implementing the rBWD:

- Scenario 1A – aimed to meet the minimum requirements of the rBWD
- Scenario 1B – aimed to meet the minimum requirements of the rBWD with the use of prediction/ discounting at a small number of bathing waters

- Scenario 2 – explored the costs and benefits of going beyond the minimum requirements of the rBWD.

The costs and benefits associated with each of the scenarios have been updated in light of the responses received to the public consultation.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

The rBWD requires that all bathing waters must achieve the 'sufficient' classification by 2015. However, the rBWD does allow, under certain circumstances (see Article 5(4)), a bathing water to be classified as 'poor' for 5 consecutive years before it has to be de-listed, which means that if needed England and Wales could have until the end of the 2019 bathing season to achieve the 'sufficient' classification at some bathing waters. It is proposed that the policy review should take place once all bathing waters in England and Wales have met the 'sufficient' classification which would mean that the earliest the review could take place would be 2016 and the latest 2020. This timing would also tie in well with the Commission' review of the rBWD, which is to be completed (and legislative proposals presented if necessary) by 2020.

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options

Signed by the responsible Minister:

Phil Woolas

Date: 16 October 2007

Ministerial Sign-off For final proposal/ implementation stage Assessments:

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) that the benefits justify the costs.

Signed by the responsible Minister:

Phil Woolas

Date: 3 April 2008

SUMMARY: ANALYSIS & EVIDENCE

Policy Option 1A	All Bathing Waters at least *sufficient* by the end of the 2015 bathing season

ANNUAL COSTS

One off (Transition) **£ 0.2 M** Yrs **7**

Average Annual Cost (excluding one-off)

£ 14.1 M – 17.8 M

Description and scale of key monetised costs by 'main affected groups'

Agriculture (livestock farming practice) significant cost; water companies (wastewater infrastructure improvements) significant cost; business (wastewater infrastructure improvements) moderate cost; Local Authorities (local pollution control measures) minor cost; Environment Agency (investigative studies) minor cost; beach operators (public information) negligible cost.

Total Cost (PV) **£ 159 M – 238 M**

Other key non-monetised costs by 'main affected groups'

None identified as significant.

ANNUAL BENEFITS

One off **£ zero** Yrs **n/a**

Average Annual Benefits (excluding one-off)

£ 51.8 M – 126 M

Description and scale of key monetised benefits by 'main affected groups'

Public health protection benefit from reduction in risk of gastrointestinal illness from bathing at up to 56 bathing waters and from better public information at all bathing waters

Total Benefits (PV) **£ 854 M – 2,068 M**

Other key non-monetised benefits by 'main affected groups'

None identified as significant.

Key Assumption/Sensitivities/Risks

Identification of suitable bathing waters based on historic data. Programme of measures for water quality improvements based on best judgement – the range, number and scale of measures was indicative only. Limitations of unit costs for improvement measures. Limitations of transferability of willingness to pay studies for monetisation of benefits.

Price Base Year 2007	Time Period Years 25	Net Benefit Range (NPV) £ +616 M to +1,909 M	Net Benefit (NPV Best estimate) £ +1,279 M

What is the geographic coverage of the policy/option?	England & Wales
On what date will the policy be implemented?	2015
Which organisation(s) will enforce the policy?	Environment Agency
What is the total annual cost of enforcement for these organisations?	£ 0.2 M per annum
Does enforcement comply with Hampton principles?	Yes
Will implementation go beyond minimum EU requirements?	No
What is the value of the proposed offsetting measure per year?	£ 0.1M per annum
What is the value of changes in greenhouse gas emissions?	+230 tonnes CO_2/year
Will the proposal have a significant impact on competition?	Minor impact

Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Med	Large
	£492	£733	Zero	£1.3M
Are any of these organisations exempt?	None	None	None	None

Impact on Admin Burdens Baseline (2005 Prices)				£ (0)	
Increase of £	0	Decrease of £	0	Net Impact	0
Key:		Annual Cost: Constant Prices		(Net) Present Value	

SUMMARY: ANALYSIS & EVIDENCE

Policy Option 1B	All BWs at least *sufficient* by the end of the 2015 bathing season including the prediction approach to discounting poor water quality samples

ANNUAL COSTS

One off (Transition) **£ 0.49 M** Yrs **7**

Average Annual Cost (excluding one-off)

£ 11.6 M – 14.8 M

Description and scale of key monetised costs by 'main affected groups'

Agriculture (livestock farming practice) significant cost; water companies (wastewater infrastructure improvements) significant cost; business (wastewater infrastructure improvements) moderate cost; Local Authorities (local pollution control measures) minor cost; Environment Agency (investigative studies) minor cost; beach operators (public information) negligible cost.

Total Cost (PV) **£ 118 M – 187 M**

Other key non-monetised costs by 'main affected groups'

None identified as significant.

ANNUAL BENEFITS

One off **£ zero** Yrs **n/a**

Average Annual Benefits (excluding one-off)

£ 52.7 M – 128 M

Description and scale of key monetised benefits by 'main affected groups'

Public health protection benefit from reduction in risk of gastrointestinal illness from bathing at up to 56 bathing waters and from better public information at all bathing waters, including the 5 bathing waters with a prediction system in place

Total Benefits (PV) **£ 868 M – 2,108 M**

Other key non-monetised benefits by 'main affected groups'

Recreational opportunities and amenity dis-benefit to visitors and local users of any temporary advice against bathing at the 5 BWs included for illustrative purposes in the discounting approach.

Key Assumption/Sensitivities/Risks

Identification of suitable bathing waters based on historic data. Programme of measures for water quality improvements based on best judgement – the range, number and scale of measures included and excluded was indicative only. Limitations of unit costs for improvement measures. Limitations of transferability of willingness to pay studies for monetisation of benefits.

Price Base Year 2007	Time Period Years 25	Net Benefit Range (NPV) £ +681 M to +1,990 M	Net Benefit (NPV Best estimate) £ +1,357 M

What is the geographic coverage of the policy/option?	England & Wales
On what date will the policy be implemented?	2015
Which organisation(s) will enforce the policy?	Environment Agency
What is the total annual cost of enforcement for these organisations?	£ 0.2 M per annum

Does enforcement comply with Hampton principles?				Yes
Will implementation go beyond minimum EU requirements?				No
What is the value of the proposed offsetting measure per year?				£ 0.1M per annum
What is the value of changes in greenhouse gas emissions?				+230 tonnes CO_2/year
Will the proposal have a significant impact on competition?				Minor impact
Annual cost (£-£) per organisation (excluding one-off)	Micro £492	Small £733	Med Zero	Large £1.3M
Are any of these organisations exempt?	None	None	None	None
Impact on Admin Burdens Baseline (2005 Prices)			£ (0)	
Increase of £ 0	Decrease of £ 0		Net Impact	0
Key:	Annual Cost: Constant Prices		(Net) Present Value	

SUMMARY: ANALYSIS & EVIDENCE

Policy Option 2	Increase the number of BWs classified as *excellent*

ANNUAL COSTS

One off (Transition) **£ 0.2 M** Yrs **7**

Average Annual Cost (excluding one-off)

£ 22.0 M – 29.3 M

Description and scale of key monetised costs by 'main affected groups'

Agriculture (livestock farming practice) significant cost; water companies (wastewater infrastructure improvements) significant cost; business (wastewater infrastructure improvements) moderate cost; Local Authorities (local pollution control measures) minor cost; Environment Agency (investigative studies) minor cost; beach operators (public information) negligible cost.

Total Cost (PV) **£ 264 M – 425 M**

Other key non-monetised costs by 'main affected groups'

None identified as significant.

ANNUAL BENEFITS

One off **£ zero** Yrs **n/a**

Average Annual Benefits (excluding one-off)

£ 60.0 M – 140 M

Description and scale of key monetised benefits by 'main affected groups'

Public health protection benefit from reduction in risk of gastrointestinal illness from bathing at up to 136 bathing waters and from better public information at all bathing waters

Total Benefits (PV) **£ 989 M – 2,309 M**

Other key non-monetised benefits by 'main affected groups'

None identified as significant.

Key Assumption/Sensitivities/Risks

Identification of suitable bathing waters based on historic data. Programme of measures for water quality improvements based on best judgement – the range, number and scale of measures included and excluded was indicative only. Limitations of unit costs for improvement measures. Limitations of transferability of willingness to pay studies for monetisation of benefits.

Price Base Year 2007	Time Period Years 25	Net Benefit Range (NPV) £ +564 M to +2,045 M	Net Benefit (NPV Best estimate) £ +1,338 M

What is the geographic coverage of the policy/option?	England & Wales
On what date will the policy be implemented?	2015
Which organisation(s) will enforce the policy?	Environment Agency
What is the total annual cost of enforcement for these organisations?	£ 0.2 M per annum
Does enforcement comply with Hampton principles?	Yes
Will implementation go beyond minimum EU requirements?	Yes
What is the value of the proposed offsetting measure per year?	£ 0.1 M per annum

What is the value of changes in greenhouse gas emissions?				+600 tonnes CO_2/year
Will the proposal have a significant impact on competition?				Minor impact
Annual cost (£-£) per organisation (excluding one-off)	Micro £492	Small £733	Med Zero	Large £2.2M
Are any of these organisations exempt?	None	None	None	None
Impact on Admin Burdens Baseline (2005 Prices)			£ (0)	
Increase of £ 0	Decrease of £ 0		Net Impact	0
Key:	Annual Cost: Constant Prices		(Net) Present Value	

Evidence Base for Summary Sheets

SUMMARY: INTERVENTION & OPTIONS

1 What is the problem under consideration? Why is government intervention necessary?

The current Bathing Water Directive (cBWD) (76/160/EEC)[6], which is now over 30 years old, has been updated and simplified to take into account lessons learnt from its implementation, developments in science and knowledge about the risks of bathing and the environmental protection offered by more recent EU water legislation. A revised Bathing Water Directive (rBWD)[7] came into force on 24 March 2006 and must be transposed into UK law within two years. Key changes include a tightening of water quality standards to further protect public health (whilst bathing) and the provision of standardised information to the public.

2 What are the policy objectives and the intended effects?

The objective of the rBWD is to protect public health whilst bathing by improving water quality and by providing information to the public. This fits well with the Government's wider objectives. For example 'Water Availability and Quality' is a high impact policy area under Defra's Water Strategy, which links directly to the Government's high level goals of avoiding dangerous climate change and protecting and enhancing the natural asset base. The Strategy aims, through sustainable water management, to improve standards of service and quality whilst achieving a balance between environmental impacts, water quality of surface and ground waters, supply and demand, and economic and social effects.

The rBWD requires Member States to ensure that by the end of the 2015 bathing season, all bathing waters (BWs) are at least 'sufficient' (with limited exceptions). Currently there are a small number of BW in England & Wales which may fail to achieve (or are at "high risk" of failing to achieve) the 'sufficient' classification. Measures will need to be taken to improve the water quality at all of these sites to ensure that they comply with the rBWD. The rBWD also requires Member States to provide bathing water information to the public on beach signage and via the internet. This information will enable the public to make an informed choice on whether to bathe or not.

3 What policy options have been considered?

The Government consulted from 12 November 2007 to 4 February 2008 on three main options for implementing the rBWD:

- Scenario 1A – aims to meet the minimum requirements of the rBWD;

[6] Council of the European Communities 1976 Directive 76/160/EC (OJ No. L 160 5.2.1976) (concerning the quality of bathing water)

[7] European Parliament and Council of the European Communities 2006 Directive 2006/7/EC (OJ No. L 64 4.3.2006) (concerning the management of bathing water quality and repealing Directive 76/160/EEC)

- Scenario 1B – aims to meet the minimum requirements of the rBWD with the use of prediction/ discounting at a small number of bathing waters;
- Scenario 2 – explores the costs and benefits of going beyond the minimum requirements of the rBWD.

The costs and benefits associated with each of the scenarios have been updated in light of the responses received to the public consultation.

4 When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

The rBWD requires that all bathing waters must achieve the *sufficient* classification by 2015. However, the rBWD does allow, under certain circumstances (see Article 5(4)), a bathing water to be classified as *poor* for 5 consecutive years before it has to be de-listed, which means that if needed England & Wales could have until the end of the 2019 bathing season to achieve the *sufficient* classification at some BWs. It is proposed that the policy review should take place once all BWs in England & Wales have met the *sufficient* classification which would mean that the earliest the review could take place would be 2016 and the latest 2020. This timing would also tie in well with the Commission' review of the rBWD, which is to be completed (and legislative proposals presented, if necessary) by 2020.

SCENARIO 1A ALL BATHING WATERS AT LEAST 'SUFFICIENT' BY THE END OF THE 2015 BATHING SEASON

1 Scenario description

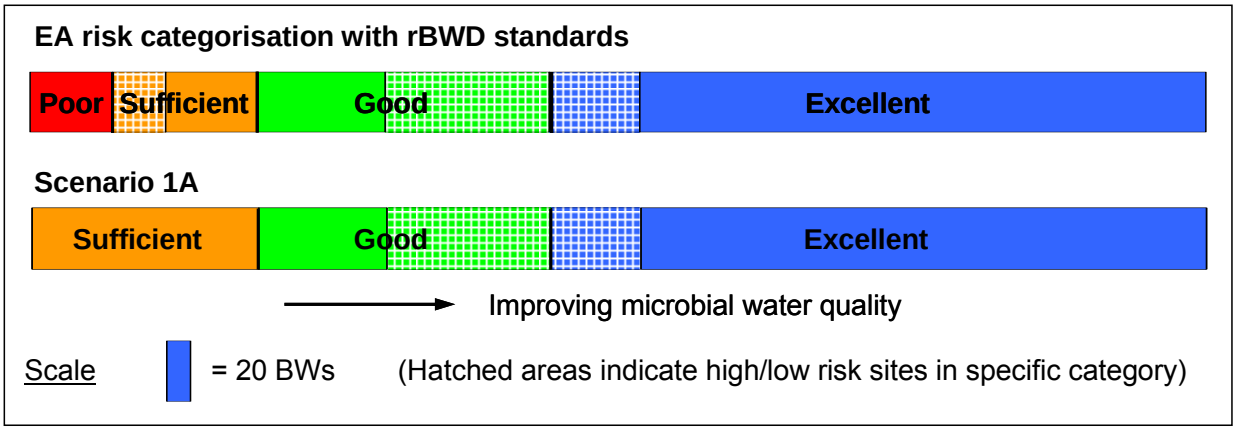
The Government consulted on three scenarios in its "Consultation on the implementation of the revised Bathing Water Directive" from 12 November 2007 to 4 February 2008. The costs and benefits associated with each of the scenarios have been updated in light of the responses received to the public consultation.

Scenario 1A looked to address the minimum requirement of the rBWD for Member States to ensure that by the end of the 2015 bathing season, all BWs are at least *sufficient*. The EA had previously undertaken predictive work through re-interpretation of microbial water quality data collected for the cBWD for the 2003 – 2006 bathing seasons and identified BWs that would be classified as *poor* or *sufficient* using these data and the rBWD standards. BWs classified as *poor* and selected *sufficient* BWs at high risk of deteriorating to *poor* were proposed as those requiring a programme of measures (PoMs) to achieve the objectives of Scenario 1A.

The EA identified, through their prediction work, 33 BWs in England and 1 BW in Wales which were predicted to be classified as *poor* under the rBWD. As a minimum therefore, PoMs would be required at these BWs to improve the BW quality to *sufficient* by 2015.

The EA also identified 60 BWs (52 in England, 8 in Wales) which were predicted to be classified as *sufficient* under the rBWD. Of these BWs 22 (19 in England, 3 in Wales) had been assessed as having a greater than 25% probability of failing to achieve the *sufficient* classification (i.e. could deteriorate to the *poor* classification) and termed high risk *sufficient* BWs. The Government felt that it was important to include these 22 BWs in this scenario 1A (and subsequently in the WFD PoMs) to ensure that they retain their *sufficient* classification.

Using the EA risk categorisation with rBWD standards, the diagram below shows the assessed current categorisation (upper bar) and anticipated improvements from the PoMs under Scenario 1A (lower bar). The length of the bar represents the number of BWs of each standard and shows no change in the number of *good* or *excellent* BWs. Scenario 1A improves *poor* (red) BWs to *sufficient* (orange) reduces the risk to high risk *sufficient* (hatched orange) BWs, bringing these to *sufficient* (orange).



Annex A details the 56 BWs included in Scenario 1A and Annex B identifies the main microbial pollution pressures affecting these BWs from a semi-quantitative analysis undertaken by the EA. The EA found that very few BW are impacted by a single pollution pressure and the majority of BWs are affected by water company discharges, urban diffuse and agricultural diffuse pollution. It will therefore be necessary to tackle a number of pressures within PoMs at the majority of BWs in order to achieve the objectives of Scenario 1A.

Whilst the aim of the PoMs will be to improve/ maintain all of these BWs at *sufficient*, there may still be some BWs which may fail to achieve the *sufficient* classification by the end of 2015. The rBWD does allow, in certain circumstances, a BW to be classified as *poor*. However, if a BW is classified as *poor* for five consecutive years, the rBWD states that permanent advice against bathing should be introduced. Member States may introduce permanent advice against bathing before the end of the five-year period if it considers that the achievement of *sufficient* would be infeasible or the costs of implementing additional measures is disproportionately expensive.

It is worth noting that England and Wales need to continue to comply with the cBWD whilst the Government implements the rBWD. Therefore, some BWs will benefit from improvements that are already planned to meet the cBWD, for example:

- there will be instances where new work must be undertaken to remain in compliance with the cBWD e.g. if a new bathing water is identified and it does not meet the mandatory standards, measures would have to be taken to improve the quality of the bathing water.
- following a Periodic Review in 2004 (PR04) of water price limits, water company Asset Management Plans (AMP4) were drawn up for 2005 to 2010 and measures were included in these plans to reduce the risk of failing mandatory standards at bathing waters impacted mainly by water company discharges. There are also plans in Wales to bring some bathing waters up to guideline standards or reduce the risk of failing guideline standards.

AMP4 funded improvements at these BWs have been identified by the EA (see Annex B) and removed from the costed PoMs under Scenario 1A.

2 Annual costs

2.1 Description and scale of key monetised costs by 'main affected groups'

The EA (2006)[8] source apportionment work identified potentially suitable measures, at each BW, which may reduce the risk to microbial water quality from contributing sources. A contribution scale (high/medium/low) and the confidence in the assessment was also provided by the EA. The nature (baseload contribution or intermittent peaks) and magnitude of improvement required at each Scenario 1A BW was identified from 2003-2006 EA BW monitoring data. Each BW's risk profile was used to tailor the selection of improvement measures from the EA list of BW-specific

[8] Environment Agency (2006) Semi-quantitative assessment of pollution source inputs to Bathing Waters predicted to be classified as poor and sufficient

options. Further detail is included in Annex A and the indicative Scenario 1A PoMs included in Annex B.

Prior to implementation of the PoMs, detailed investigative studies will be required at each Scenario 1A BW or cluster of adjacent BWs.

Modelling studies would be required to investigate the contribution of key sources and identify the exact level of improvement required at each source. Unit costs for modelling studies were provided by Ofwat from collated Water Company submissions in the 2004 Periodic Review (PR04), ranging from £73k to £1.5M with a mean of £0.27M. The water industry acknowledged (in their responses to the consultation) that the costs provided for PR04 were low; would need to be integrated into an urban pollution management approach in many cases; and did not factor modelling climate change. The water industry were unable to provide more representative costs, therefore, following a precautionary approach, the PR04 mean value was doubled to provide a unit cost for modelling studies of £0.54M/BW. The approximate total capital cost to water companies for BWs in England would be £28M and £2.2M for BWs in Wales. In addition reciprocal costs of £10,000 per BW were considered for the EA.

2.1.1 ***Water Companies***

EA (2006) source apportionment work identified BWs where Water Company assets (WwTW and CSOs) together with sewerage cross-connections are considered to present a risk to microbial water quality, see Annex B.

Modelling studies required at each of the 56 Scenario 1A BWs would be to the approximate total capital cost of £28M to water companies for BWs in England and £2.2M for BWs in Wales.

2.1.1.1 WwTW improvements

WwTW can provide a continuous, point source of faecal microbes to BW. Unit costs for improvement measures were provided by Ofwat from collated Water Company submissions in the 2004 Periodic Review (PR04), using the Water Company submitted cost as indicative. The unit costs were banded by WwTW size and assume improvement from primary or secondary treatment to tertiary treatment (disinfection). The size (population equivalent) and current treatment standard of each contributing WwTW in the Scenario 1A PoMs were identified by the EA (see Annex B Table B2).

A summary of Water Company WwTW improvement costs, incorporating optimism bias correction[9], for Scenario 1A is presented below:

	WwTW Size band	
	20-1,000pe	1,000-2,000pe
Capital cost per WwTW	£0.92 M	£1.19 M
Annual recurring cost per WwTW	£0.011 M per annum	£0.039 M per annum
No. WwTWs	7 in England, 0 in Wales	3 in England, 0 in Wales
Capital cost	£10.1 M in England, £0 in Wales	
Annual recurring cost	£0.14 M per annum in England, £0 in Wales	

[9] Using the standard civil engineering capital expenditure optimism bias upper bound (44%) presented in HM Treasury (2007) Supplementary Green Book Guidance: Optimism Bias, http://www.hm-treasury.gov.uk./media/D/B/GreenBook_optimism_bias.pdf

2.1.1.2 CSO improvements

CSOs can provide an intermittent, diffuse source of faecal microbes to BW, associated with overloading of the sewerage network, typically during high rainfall events. Unit costs for improvement measures were provided by Ofwat from collated Water Company submissions in the 2004 Periodic Review (PR04), using the Water Company submitted cost as indicative. From 18 AMP4 capital schemes submitted through BWD drivers, incorporating optimism bias correction[5], the median capital cost was £1.3M, inter-quartile range £0.4-1.6M. From 10 AMP4 schemes submitted through BWD drivers with additional operating costs, the median additional annual recurring cost was £0.008M, inter-quartile range £0.002-0.015M.

CSO improvements were identified at 45 BWs in England and 3 in Wales. Section 4.2.2.2 identifies that several of these improvements may take place to achieve the requirements of the Shellfish Waters Directive (SWD)[10] prior to 2015. Using this approach, the CSO improvement costs associated with 9 BWs in the North West and South West RBDs were removed.

In England the capital cost range was derived as £14-57M and best estimate of £44M; annual recurring costs in the range of £0.08-0.53M and best estimate of £0.29M. In Wales the capital cost range was derived as £1.2-4.8M and best estimate of £3.7M; annual recurring costs in the range £0.01-0.04M and best estimate of £0.02M.

The EA (2006) identified potential contributions to risk from CSOs at a further 3 BWs in England and zero in Wales. Following the methodology in Annex 1 and Annex 2, these potential additional improvements were omitted from the PoMs. If they had been included in the PoMs, the Water Companies would incur additional costs. Investigative works are estimated by Ofwat at a further £0.27M per scheme.

2.1.1.3 Removing sewerage cross-connections

Sewerage cross-connections can provide a continuous, diffuse source of faecal microbes to BW, associated with discharge of untreated sewage through the surface water drainage network. Water Company funding provides for a rolling programme of action to investigate and fix cross-connections, but this is not targeted to BW quality or the rBWD.

Sewerage cross-connections were identified at 13 BWs in England and 1 in Wales and suitable for investigation at a further 8 BWs in England and zero in Wales. The EA (2006) identified potential additional contributions to risk at a further 11 BWs in England and zero in Wales.

Current levels of expenditure are generally adequate to maintain current water quality in receiving waters and maintain numbers of pollution incidents at current levels rather than improve water quality standards. Ofwat estimate annual expenditure of around £1M per sewerage undertaker for removing sewerage cross-connections. The costs already included within the existing rolling programme may embrace these

[10] Council of the European Communities 1979 Directive 79/923/EC (OJ No. L 281 10.11.1979) (on the quality required of shellfish waters)

improvements where work can be prioritised to specifically target these BW. However, there may be additional costs which were considered further.

2.1.1.4 First time public sewerage

First time public sewerage costs reciprocate the costs to private individuals presented in Section 2.1.4 below.

2.1.2 Agriculture

Agriculture can provide a diffuse source of faecal microbes to BW, associated with a range of potential sources of faecal contamination, the majority of which are considered to be delivered at times of high flow. These sources include those that are truly diffuse (e.g. runoff from grazed fields), point/intermittent sources (e.g. run-off from farmyards, slurry storage) and direct diffuse sources (e.g. excreta voided directly into streams). Costs are associated with reducing the input load of faecal microbes to the BW catchment area or management options (see Annex C) that address the pathways by which faecal microbes reach watercourses and the BW.

Unit costs for improvement measures were derived from a Defra (2007[11]) study that used the faecal indicator organism – source apportionment (FIO-SA) model to identify the agricultural contribution to non-compliance for the BWs identified by the EA source apportionment work. The list of BWs in Defra (2007) does not exactly match those BWs identified by the EA for Scenario 1A.

There was generally good agreement between the FIO-SA predictions of the agricultural contribution to FC loads (limited to catchments >50km^2 in area) and the EA contribution scale (high/medium/low) used in the source apportionment work. The assessment used year 2000 Agricultural Census data and identified the most important driver to be stocking density.

Defra (2007) made an assessment of the costs of methods for reducing the agricultural contribution to FIO inputs using the 'Diffuse Pollution User Manual' (Cuttle et al., 2006[12]). Scenarios for England were constructed based on packages of policy measures provided by Defra that took into account the likely take-up of the methods and the efficiency of the methods in practice. These include a range of measures intended to be implemented and effective by 2015 through a Business as Usual scenario (incorporating Common Agricultural Policy reform and existing measures to address the Nitrates Directive (i.e. it excludes additional measures now the subject of consultation) delivering an average 25.8% reduction in faecal indicators at BWs under high river flow conditions.

It is difficult to identify further diffuse agricultural pollution improvement measures that may be required at BWs. Further measures, beyond the Business as Usual scenario to reduce agricultural pollution are contained within two enhanced scenarios (see also Annex C):

[11] Defra (2007) Application of the *FIO-SA* Model to Failing Bathing Waters and Shellfish Waters (WT0713)

[12] Cuttle SP, Macleod CJA, Chadwick DR, Scholefield D, Haygarth PM, Newell-Price P, Harris D, Shepherd MA, Chambers BJ and Humphrey R (2006). An Inventory of Methods to Control Diffuse Water Pollution from Agriculture (DWPA) User Manual. Prepared as part of Defra Project ES0203, September 2006.

- Scenario 2: Business as usual plus water protection zones
- Scenario 4: Business as usual plus water protection zones + advice to farmers

These scenarios may include some overlap with the proposed actions (subject to consultation) to address the Nitrates Directive, and therefore represent a worst case scenario of additional improvements. The implementation cost and anticipated faecal indicator reduction of each of these scenarios was estimated across 23 BWs in Defra (2007). For the IA, indicative average annual unit costs per BW have been derived from Defra (2007), by taking the total cost of the additional measures and apportioning it on an average BW basis. Selecting between the Defra (2007) Scenarios provide a range of costs, with Scenario 2 providing a lower tier unit cost of £0.42M per BW (annualised cost), Scenario 4 providing an upper tier unit cost of £0.51M per BW (annualised cost), with a mid-point (best estimate) of £0.46M per BW (annualised cost).

In Scenario 1A, additional agricultural measures were identified at 11 BWs in England and 1 in Wales. In England the annualised cost range was derived as £4.6M-5.6M and best estimate of £5.1M. In Wales were the Welsh Assembly Government to adopt similar enhanced scenarios then the cost range derived would be £0.4-0.5M and best estimate of £0.5M.

The EA (2006) identified potential contributions to risk from diffuse agricultural pollution at a further 20 BWs in England and 3 in Wales. It is expected that measures taken under the Business as Usual scenario would substantially reduce the risk at these BWs from these sources and additional improvements were omitted from the PoMs.

Cumulative burden of regulation

The Government aims to design policies that achieve desired environmental outcomes at minimum costs to businesses. To help achieve this aim, an assessment of the cumulative impact of forthcoming regulatory proposals on the farming industry is routinely undertaken by Defra.

A preliminary assessment of the cumulative regulatory impact in England was carried out in 2005 and updated in December 2006 (Defra, 2006)[13]. This is currently being revised and will take account of further changes in regulatory proposals affecting agriculture. The 2006 assessment estimated that increases in regulatory costs could be in the region of £150 million by 2015, of which just under a third would come from a Nitrates Directive Action Programme (as assessed at that time). The remainder of the cost was predominantly made up of compliance with the EU Water Framework Directive, EU Waste Framework Directive, Integrated Pollution Prevention and Control (IPPC) compliance and permitting costs and EU emissions standards for farm machinery. The effect of these additional costs on farm profitability (for those farms with older cattle) was likely to be partially offset by gains from the lifting of the Over Thirty Month Rule.

Whilst the costs predicted to fall on farmers as part of the implementation of the rBWD are relatively low in comparison to the overall costs of other regulations affecting farmers, they will nevertheless add to the burdens already being faced by farmers (but

[13] Defra (2006): http://www.defra.gov.uk/farm/policy/regulation/charge/pdf/cumulative-burdens.pdf

only in the catchments of bathing waters most affected by diffuse water pollution from agriculture).

2.1.3 Business, Industry and Institutions

EA (2006) source apportionment work identified BW-specific measures to address pollution risk from private WwTW and caravan parks; with costs to businesses, industry and institutions, presented in Annex B.

2.1.3.1 Private WwTW improvements

Private WwTW and institutional discharges to the sewerage network can provide a continuous, point source of faecal microbes to BW. Unit costs for improvement measures were provided by Defra (2007)[14]. From the range of available measures, recurring costs for "awareness raising" (£16,500 per 5 year plan) and "maintain surface water management plans" (£15,000 annually per company) were considered the most applicable. No guidance is available on transferring the cost to the urban area affecting a BW so a range of 1-5 institutions per BW was used.

Private sewerage improvements were identified as suitable for investigation at 4 BWs in England and zero in Wales; an annual average recurring cost range of £0.07-0.37M and best estimate (mid-point) of £0.22M. The EA (2006) identified potential contributions to risk from private WwTWs at a further 12 BWs in England and 1 in Wales; however, these additional improvements were omitted from the PoMs.

2.1.3.2 Caravan park improvements

Sewage disposal at caravan parks not connected to the main sewerage system or with inappropriate private WwTW can provide a continuous, point source of faecal microbes to BW. Costs for improvement measures have not been sufficiently developed to enable unit costs to be used in this study. An indicative capital cost range of £10,000-£100,000 per BW was therefore used.

Caravan park sewage disposal improvements were identified as suitable for investigation at 4 BWs in England and zero in Wales; a capital cost range of £0.04-0.4M and best estimate (mid-point) of £2.2M. The EA (2006) identified potential contributions to risk from caravan parks at a further 7 BWs in England and 1 in Wales; these additional improvements were omitted from the PoMs.

2.1.4 Private individuals

Costs to private individuals are associated with measures to improve septic tanks where these are considered to present a risk to microbial water quality (EA, 2006). Septic tanks can provide a continuous, diffuse source of faecal microbes to BW. Unit costs to private individuals for improvement measures are estimated in the order of £2,000 per septic tank improvement or connection to a new sewer; with an estimated

[14] Defra (2007) Cost-effectiveness of measures: Analysis of measures to reduce non-agricultural diffuse pollution.

£20,000-£30,000 per property (value provided by Ofwat) for first time public sewerage provision by the water company.

Connection of septic tank properties to the main sewerage system were identified at 1 BW and may be suitable for investigation at a further 3 BWs in England and zero in Wales. The number of appropriate properties can only be estimated for this type of study: a nominal value of 200 properties has been assumed. Costs to private individuals were therefore assumed as £400,000 with a reciprocal cost of £6M to the water company. The EA (2006) identified potential contributions to risk from septic tanks at a further 10 BWs in England and 1 in Wales; these additional improvements were omitted from the PoMs.

2.1.5 Local Authorities

EA (2006) source apportionment work identified BW-specific measures to address pollution risk from contaminated surface sewers, animals and birds, and urban runoff. Costs would be borne by Local Authorities, as detailed in Annex B.

2.1.5.1 Isolating contaminated surface sewers

Contaminated surface sewers can provide a continuous, diffuse source of faecal microbes to BW, associated with wastewater discharge connected to the surface water sewer system. Currently, Local Authorities have the power to remedy misconnections, whilst water companies are also required to deal with misconnections in response to complaints. Unit costs for improvement measures were provided by Defra (2007). From the range of available measures, “awareness raising leaflets” (£1.7M in England & Wales for 23M households) and “more monitoring with current regime” (£234M in England & Wales for 23M households) were considered the most applicable. No guidance is available on transferring the cost to the urban area affecting a BW and a best-estimate of 10,000 households per BW was used. It is assumed that there are no significant additional operational costs once contaminated surface sewers have been isolated.

Contaminated surface sewer improvements were identified at 18 BWs in England and 1 in Wales) and suitable for investigation at a further 5 BWs; a capital cost range in England of £0.01-1.8M and best estimate (mid-point) of £0.95M; in Wales of £0-0.1M and best estimate of £0.05M. The EA (2006) identified potential contributions to risk from contaminated surface sewers at a further 14 BWs in England and zero in Wales; these additional improvements were omitted from the PoMs.

2.1.5.2 Animal/ bird actions

Several BWs are known to have a problem with bird populations that contribute to diffuse faecal pollution. Animal and bird sources of faecal pollution were identified by the EA (2006) as a high contributor at 5 Scenario 1 BWs in England and zero in Wales; medium at 15 BWs in England and 2 in Wales; and low at 5 BWs in England and zero in Wales.

These include for example BWs close to internationally recognised breeding bird colonies. The majority of these sites have internationally recognised habitat status

(Special Area of Conservation and/or Special Protected Area). It is unlikely that much could be done in these circumstances to ameliorate the faecal pollution sources and as a result several BWs may fail to achieve the rBWD *sufficient* standard. It may be appropriate in these circumstances where consistent compliance with the *sufficient* standard cannot be guaranteed, to review the designation of the BW in question. In certain circumstances practicable measures may be available to reduce the source of avian faecal pollution, such as netting the underside of piers.

No animal/bird actions were included in the PoMs. It was not been deemed appropriate to develop costs for practicable measures as these are site-specific and non-transferable. The considerable uncertainty in the resultant faecal pollution reduction of animal/bird actions reduced their suitability for inclusion in a PoMs where the selection criteria were based on least cost for maximum effectiveness at minimum risk.

2.1.5.3 Urban run-off improvements

Urban runoff, for example of dog faeces from pavements and bird faeces from roofs, can provide an intermittent, diffuse source of faecal microbes to BW, associated with a range of potential sources of faecal contamination. Costs for improvement measures have not been sufficiently developed to enable unit costs to be used in this study. An indicative cost of £50,000 per BW, similar to the cost of identification of contaminated surface sewers through increased monitoring (see Section 2.1.5.1) was therefore used. The range of available actions and their cost basis is not currently available.

Urban runoff improvements were identified at 11 BWs in England and zero in Wales and suitable for investigation at a further 3 BWs in England and zero in Wales; the capital costs were estimated as £0.55M.

2.1.6 Environment Agency

Modelling studies required at each of the 52 Scenario 1A BWs in England and 4 in Wales would be to the approximate total one-off transitional cost of £0.52M to EA regions in England and £0.04M to EA Wales. This indicative cost requires further specification.

2.1.6.1 Bathing water profiles

The costs to the EA associated with meeting the requirements of rBWD Article 6 *bathing water profiles* were provided by the EA.

The rBWD requires BW profiles to be established at each BW either separately or collectively for clusters of contiguous BWs. The EA approach to undertaking and reporting the characterisation of faecal pollution sources, through beach profiles, of each BW is under development in collaboration with other EU Member States.

The cost of preparing BW profiles was estimated by the EA to be on average two days per BW. The one-off transitional cost to the EA is estimated at a total of £0.58M for EA regions in England (415 BWs); £0.11M for EA Wales (80 BWs).

Profiles are to be reviewed on fixed timescales: every two years (*poor*), every three years (*sufficient*), every four years (*good*), only on change in status (*excellent*). Following successful implementation of Scenario 1, the EA rBWD risk categorisation identifies 94 *sufficient* BWs (85 in England; 9 in Wales) and 121 *good* BWs (110 in England; 11 in Wales). The annual average recurring cost to the EA is, therefore, estimated to be £0.08M for EA regions in England and £0.01M for EA Wales.

2.1.6.2 Public information

The costs to the EA associated with meeting the requirements of rBWD Article 12 *information to the public* were provided by the EA.

The rBWD states that BW information is provided to the public. The rBWD aim is to give the public sufficient information to enable them to make informed choices about when and where to bathe and notices identifying any emergency circumstances. Most of the public information requirements relate to the information that must be provided on signs at BWs; these costs will be borne by beach operators (see Section 2.1.7). A specific public information requirement relates to the information that must be provided on a website; these costs will be borne by the EA.

The cost of developing and updating an appropriate series of web pages on the national EA Internet was estimated by the EA to be a one-off transitional cost of £0.02M and an annual cost (based on 60 person-days) of £0.04M.

2.1.7 Beach operators

Within England & Wales, the responsibility to disseminate information relating to each BW on beach signage will rest with the beach operator (i.e. whoever is actively involved in promoting the site for bathing), which will tend to be for the most part the Local Authority. The cost of signage (see Section 2.1.6.2) varies and is largely based on signage being provided for standard safety signage, Blue Flag and the ENCAMS (Keep Britain Tidy) Quality Coast Award. On average a beach with numerous access points applying the full recommended Royal National Lifeboat Institution (RNLI) signage scheme of primary, secondary and tertiary signs will cost in the region of £5,000 but this probably would not include BW or tourism information. Recent UK experiences from five BWs provide the cost basis:

- A north-west England BW installed 125 secondary signs at a total cost of £10,000.
- A north-west England BW installed 23 primary signs at a total cost of £4,700.
- A north-west England BW installed safety signage at the RNLI recommended frequency at a total cost of £6,000.
- A southern England BW has indicated that to replace existing safety signage with the new national standard will cost £30,000.
- A BW in Northern Ireland installed a primary sign at the main beach entrance (including the Blue Flag element that is a requirement of the award), two secondary signs at boardwalks and three reminder signs at other unofficial access points at a total cost of £2,000.

The rBWD requires specific information to be displayed at certain times, including during emergency circumstances. However, many beach operators already provide beach-side signage on various aspects of their BWs. The Government considers that the rBWD's new requirements should integrate with the normal cycle of sign replacement and phased in for the start of the 2012 bathing season. This would result in minimal additional cost to implement the rBWD. There may be a limited number of bathing waters which do not currently have beach signage and in these instances the beach operator would need to purchase new signs. The costs of signs can vary as shown above, however, the Government estimates that the cost of placing a sign at each main access point, in these instances, will be approximately £2,000 per BW.

The Government used the public consultation to seek the views of stakeholders on this matter. The majority of respondents felt that most beach operators should be able to update their beach signage during routine sign replacement at minimal cost, however, one respondent suggested that some beach operators may need Government funding if beach signs are to be updated in all locations. The Government will explore this issue further to ensure that any additional costs are identified and that there are no unfunded new burdens imposed on local authorities resulting from the implementation of the rBWD.

2.1.8 Summary

Best estimate costs for Scenario 1A have been summarised and adjusted to annualised costs as follows:

		Asset life (years)	England			Wales			Total Annualised costs		Net present value
			Capital cost	Operating cost	Annualised cost	Capital cost	Operating cost	Annualised cost	by activity	by sector	by sector
Water Companies	Modelling studies	5	£28M	£0	£6.3M	£2.2M	£0	£0.48M	£6.73M	£10.2M	£111M
	WwTW improvements	10	£10.1M	£0.14M	£1.35M	£0	£0	£0	£1.35M		
	CSO improvements	80	£44.3M	£0.29M	£1.95M	£3.69M	£0.02M	£0.16M	£2.11M		
	1st time sewerage	25	£6.0M	£0	£0.66M	£0	£0	£0	£0.66M		
Agriculture		n/a	n/a	n/a	£5.04M	n/a	n/a	£0.46M	£5.50M		£91M
Business, Industry and Institutions	Private WwTW improvements	25	£0.4M	£0.22M	£0.24M	£0	£0	£0	£0.24M	£0.25M	£3.8M
	Caravan park improvements	80	£0.22M	£0	£0.01M	£0	£0	£0	£0.01M		
Local Authorities	Isolating contaminated surface sewers	80	£0.95M	£0	£0.04M	£0.05M	£0	£0.01M	£0.04M	£0.06M	£1.5M
	Urban run-off improvements	80	£0.55M	£0	£0.02M	£0	£0	£0	£0.02M		
Total cost (excluding transitional costs)										£16.0M	£207M
Transitional costs to the Environment Agency	Bathing water profiles	25	£0.58M	£0.08M	£0.12M	£0.11M	£0.01M	£0.02M	£0.13M	£0.21M	n/a
	Public information	25	£0.52M	£0.04M	£0.07M	£0.04M	£0	£0.01M	£0.08M		

Capital, operating and annualised costs listed separately for England and Wales by PoMs activity. Total annualised costs provided by PoMs activity and by sector. The total annualised cost (excluding transitional costs) has been taken forward to the Summary Sheet as the "Average Annual Cost".

Transitional costs considered to apply to the Environment Agency only. The total annualised cost to the Environment Agency has been taken forward to the Summary Sheet as the "one off (Transition)" cost. The period for transition to be effected is prior to 2015, 7 years from transposition of legislation in 2008.

2.2 Other key non-monetised costs by 'main affected groups'

In addition to the monetised costs in Section 2.1, the rBWD could place additional work on Government to meet public participation requirements for annual updating or amending of the list of BWs.

3 Annual benefits

3.1 Description and scale of key monetised benefits by 'main affected groups'

The main benefits, which stem from achieving the tighter water quality standards and other measures associated with Scenario 1A, include the following:

- Potential improvements in public health protection as a result of reductions in the risk of illness from ingestion of sewage contaminated BWs during recreational bathing activities
- Potential improvements in public health protection as a result of better public information
- Safeguard and/ or potentially increase the demand for beach based recreation/ amenity and tourism
- Other potential benefits related to marine and wildlife ecology, aesthetics, and non-use improvements.

Two steps were used in the benefits assessment exercise:

- Physical impact assessment – investigating the physical changes associated with the tighter water quality standards and better public information
- Economic impact assessment – investigating the human welfare significance of the physical impacts in monetary terms.

Supporting information for the benefits assessment is included in Annex D.

3.1.1 Physical Impact Assessment

Although there may be a number of physical impacts associated with the changes considered under Scenario 1A as discussed above, the principal impacts relate to health protection (mainly concerning the risk of gastrointestinal (GI) illness) for those engaged in recreational bathing activities (see later for non-monetised benefits).

The improvement in health protection associated with improvement in faecal indicator water quality at *poor* and high risk *sufficient* BWs under Scenario 1A was estimated on the basis of the following thresholds of risk of illness associated with the rBWD water quality classes (and associated threshold parameter values)[15]:

Water Quality Class	IE (cfu/100 ml)	*E.coli* (cfu/100 ml)	Risk of GI illness
Poor	>185	>500	>8%
Sufficient	185	500	5-8%
Good	200	500	3-5%
Excellent	100	250	<3%

[15] EU (2003), Explanatory Memorandum, Proposal for a Directive of the European Parliament and of the Council concerning the quality of bathing water, (2003/C 45 E/15) *COM(2002) 581 final- 2002/0254 (COD).*

Under Scenario 1A, there is, therefore, a reduction in the risk of GI of at least 0-3% (from >8% to 5-8%) at between 34 and 56 BWs from the improvement in water quality.

Under Scenario 1A, BW quality would improve from *poor* (and high risk *sufficient*) to *sufficient* at between 34 and 56 BWs, giving rise to a change in risk of GI illness from >8% to 5-8%. Since these are threshold ranges, the exact change in GI illness cannot be precisely identified. All that can be said is that water quality falls within the particular range being considered. Nevertheless, for the purposes of the benefits assessment, it is necessary to assess the change between specific (exact) points. Given the ranges associated with each water quality class, it is assumed that the improvement under Scenario 1A lies between 3% (i.e. the difference in the 8% - 5% interval) and 1.5% (i.e. the difference in the 8% - 6.5% interval [where 6.5% = the mid point of the 'sufficient' WQ class risk range]).

In addition, to the water quality improvement, beach signage will be upgraded at all 493 BWs in England & Wales, enabling the public to make a more informed choice on whether to bathe.

3.1.1.1 Better Public Information

The rBWD aims to protect human health not only through improvements in water quality, but also through its new requirements to provide the public with better information. The better provision of information will enable the public to make an informed decision on whether to bathe on a particular day and therefore reduce the risk of illness from bathing. Article 12 of the rBWD sets out most of the information which Member States will be required to disseminate to the public (see below) on beach signage during the bathing season in the near vicinity of the bathing water from the start of the 2012 bathing season.

Within England & Wales, the responsibility to disseminate information relating to each BW on beach signage will rest with the beach operator, which will tend to be for the most part the Local Authority, but there are also a relatively small number of private controllers. As many Local Authorities (and private controllers) already provide beachside signage on various aspects of their bathing waters, the rBWD's new requirements are intended to integrate with this wherever possible and be phased into the normal cycle of sign replacement and updating for the start of the 2012 bathing season (see 2.1.7 above).

Much (if not all) of the information to be displayed on beach signage will be available from the EA and will be based on the information included in its bathing water profiles. This will mean for the vast majority of BWs: a general, non-technical description of the site on the beach sign; its current classification under the rBWD; and any advice currently applicable against bathing. If the option to predict and warn the public of short-term pollution (previously referred to as an Advisory Note System (ANS)) is used at a bathing water (see Scenario 1B), information relating to this scheme must also be provided. When a decision is made to de-designate/ de-list a BW (for example, after 5 consecutive 'poor' classifications) a Local Authority or private controller will be required to provide permanent advice against bathing and the reasons for de-listing the BW.

The Government expects that the general description will provide some indication at all BWs of the water quality to be expected during the bathing season. For example, it is

possible that some *good* or even *excellent* BWs may temporarily have *poor* water quality after heavy rain in which case the public would be advised of this on the beach sign. Although this will not provide the same level of 'real time' water quality information as will be available where the option to predict and warn of short term pollution has been adopted, it would go someway towards a prediction system (ANS) and would attract a proportion of the benefits that would be gained from the use of such a system (see 3.1.2 below). It is also worth noting the results of a study undertaken for the RNLI, titled "Signage Semiotics", which found that only 1/3 of beach visitors read beach signage, the results of which, have been taken into account in the benefit calculations below.

3.1.2 Economic Impact Assessment

Given the physical impact changes identified above, the unit values for willingness to pay (WTP) estimated in EFTEC (2002[16]) were applied to assess the benefits of the changes under Scenario 1A as follows:

- WTP per household per annum per % reduction in risk of GI per BW = £0.0025 (£2007 prices) – since WTP per household per annum for a 1% reduction in risk of GI at all BWs in the UK = £1.25 (£2007 prices). Assume a proportionate relationship between WTP for 1% reduction in risk of GI at all BWs and the number of BWs (493), hence WTP per household per annum per % reduction in risk of GI per BW = 1.25/493=£0.0025 (£2007 prices).
- WTP per household per annum for upgraded beach signage (UBS) at all BWs in England & Wales = £6.37 - £15.59 (range, £2007 prices); factoring an assumption that 1/3 of beach users read the available signage[17].

A number of critical assumptions and caveats are associated with the use of these benefit estimates and the subsequent transfer of values to the various scenarios considered in this impact assessment. These are detailed at the end of Annex D.

Given these assumptions and caveats, the value of benefits for the range of impacts under Scenario 1A is as follows:

Benefits included	No of BWs included	Mean WTP per household per year (£2007Prices)	Cumulative Mean WTP per household per year (£2007Prices)	National Aggregate WTP per year[A] (£2007Million)	Total Net Present Value of Benefits[B] (£2007Million)
1.5% reduction in GI; UBS @ £6.37 @ £15.59	34 493 (@1/3)	0.13 2.12 5.20	0.13 2.25 5.33	2.99 51.8 123	51 854 2,019
1.5% reduction in GI; UBS @ £6.37 @ £15.59	56 493 (@1/3)	0.21 2.12 5.20	0.21 2.34 5.41	4.90 53.7 124	84 886 2,051
2.25% reduction in GI; UBS @ £10.98	45 493 (@1/3)	0.26 3.66	0.26 3.92	5.98 90.2	102 1,486
3% reduction in GI;	34	0.26	0.26	5.98	102

[16] EFTEC (2002), Valuation of Benefits to England and Wales of a Revised Bathing Water Quality Directive and Other Beach Characteristics Using the Choice Experiment Methodology, Final Report submitted to Defra, EFTEC Ltd, London.

[17] RNLI (date unknown) Signage Semiotics

UBS @ £6.37	493	2.12	2.38	54.8	903
@ £15.59	(@1/3)	5.20	5.46	126	2,068

[A] Aggregate WTP for England & Wales is found by multiplying the cumulative mean WTP figures by the number of English & Welsh households = 23 million.

[B] Calculated using 25 year time horizon and discount rate of 3.5%

The annual benefits under Scenario 1A is therefore between £51.8M and £126M, depending on the number of BWs included in the analysis, the reduction in GI illness considered, and the value of the upgraded beach signage. The mid-point estimate (2.25% reduction in GI at 45 BWs; UBS value= £10.98; factoring an assumption that 1/3 of beach users read the available signage) is around £90.2M.

Annual benefits for Scenario 1A in England are estimated (mid-point) as around £76M; in Wales, around £14M.

3.2 Other key non-monetised benefits by 'main affected groups'

There may be additional benefits associated with other relevant illness risk reductions (e.g. respiratory illness, eye infections, etc). It is unclear to what extent the EFTEC values may capture some element of these risks). Secondly, there may be additional benefits from an increase in demand for beach recreation, i.e. new visitors who visit the beach following the improvements in water quality. Although there is some evidence of a small increase in visitation amongst existing beach users (e.g. Hanley et al, 2001)[18], this did not consider current non-users. Thirdly, there may be additional values from improvements in marine and wildlife ecology. Limited evidence exists on this which suggest that these may be significant. The problem with all of these additional possible values is that it is unclear to what extent they are additive to the risk reduction values from the EFTEC study as a result of the possibility of double counting. This depends on the extent to which people incorporate other benefit value motivations in their assessment of the risk reduction improvements considered in the EFTEC study. If for example they consider the fact that they will visit the beach more when giving a value for the health risk reduction associated with water quality improvements, then it is not legitimate to add these two separate sources of value (since that would involve double counting). It is unclear to what extent the EFTEC values capture these other benefits. There is evidence from the study that other motivations are certainly included in the values that people gave.

In addition, in terms of tourism impact, tourism expenditures by beach visitors (e.g. food, accommodation, shopping and so on) and employment increases from any increase in tourism are sometimes perceived as benefits since they are important for the development of regional coastal economies. However from a national perspective they are likely to be transfer payments, i.e. activities that would have taken place elsewhere in England and Wales. Thus, there would be no net increase in spending across the country. Although they can legitimately be added to an economic impact analysis, they should not be included in a cost-benefit analysis. However, if we think that improvements to bathing water quality could attract new visitors to the affected areas (foreign tourists or residents choosing to stay in England & Wales rather than go abroad), these expenditures can be included in cost-benefit analysis.

[18] Hanley N, Bell D and Alvarez-Farizo B. (2003) Valuing the benefits of coastal water quality improvements using contingent and real behaviour, *Environmental and Resource Economics,* 24(3): 273-285.

4 Key Assumption/Sensitivities/Risks

4.1 Selection of BWs

The assessment of Scenario 1A is sensitive to the number and location of BWs included. Although the number of BWs is indicative and for exploratory purposes only, uncertainty is associated with: the use of historic EA sampling data as indicative of future water quality; and the selection criteria used to identify *poor BWs* and high risk *sufficient* BWs.

4.2 Programme of Measures

4.2.1 Identifying Measures

Identifying the available measures is subject to discrepancy in approach between EA regions undertaking the source apportionment and the BW-specific level of detail available, in part dependent on any modelling or investigative studies undertaken to date. The historic EA monitoring data was again used to profile the pollution pattern at each BW and in the selection of appropriate measures at individual BWs. In the absence of modelling studies, the suitable measures for inclusion in the PoMs were based on best judgement and may result in either selection for too many measures or too few measures, or alternatively an ineffective range of measures.

There is considerable uncertainty associated with the effectiveness of agricultural improvement measures intended prior to 2012 through Common Agricultural Policy reform and to address the Nitrates Directive (see Annex C). Delivery of these measures could improve BW quality at many Scenario 1A BWs currently subject to intermittent faecal water quality problems. Where effective, these measures could remove or reduce the need for additional measures to address intermittent sources, such as further CSO improvements and urban diffuse pollution controls. The Scenario 1A PoMs may include too many measures targeted at intermittent faecal pollution sources. This can only be identified through BW-specific modelling studies to identify the potential faecal water quality improvements from ongoing diffuse agricultural pollution control measures and quantification of the remaining risk. Scientific understanding and model capability in these areas is developing.

4.2.2 Interaction with other EU Directives

It is probable that the quality of some BWs will improve as a result of measures taken under the Water Framework Directive (WFD)[19] or other EU Directives to meet other environmental objectives - for example, to reduce diffuse urban, diffuse agricultural and nitrate pollution. The implementation of the rBWD and the WFD are linked because BWs are “protected areas” under the WFD. Consequently, actions under the WFD to improve water quality will include measures to achieve the new BW quality standards.

[19] Council of the European Communities 2000 Directive 2000/60/EC (OJ No. L 327 22.12.2000) (establishing a framework for Community action in the field of water policy)

It is currently difficult to interpret the geographical extent of overlap between any potential WFD and other EU Directive measures (other than under the Shellfish Waters Directive see 4.2.2.1) and the rBWD Scenario 1A PoMs. So for the time being the costs, in particular to reduce diffuse agricultural pollution, represent a worst case scenario which takes no account of the synergies between measures to meet different objectives and therefore overestimates the costs. However, the extent of the overlap will become clear as the Agency draws up PoMs in 2008. When the synergies of the various measures have been properly assessed it may be possible to adjust the costs estimates downwards.

At BWs where, for example, agricultural measures under other EU Directives will not deliver improvements prior to 2012, there remains the risk of failing the objectives of Scenario 1A. The use of four years of sampling data to determine the BW quality means that agricultural improvement measures implemented for the 2015 bathing season will not improve water quality in preceding years and affect BW quality determination until after 2018 (when 2014 and previous data are no longer included in the analysis dataset). However, as these agricultural improvement measures will be implemented, albeit with a minor time lag compared with the rBWD, it was not considered appropriate to include the same or alternative measures into the costed PoMs for Scenario 1A. An interim approach acknowledging the risk to BW quality at specific BWs in this timeframe, is described in Scenario 1B.

4.2.2.1 Shellfish Waters Directive

England and Wales are endeavouring to meet the faecal coliform guideline standard in the SWD by 2013 when the SWD is then repealed and replaced by the WFD. EA (2007)[20] source apportionment work identified potentially suitable measures at each Shellfish Water (SW) reported with failure of the flesh faecal coliform guideline standard in the SWD or classified as prohibited. Although the geographical coverage of the 41 SWs is widespread, the spatial overlap with Scenario 1A BWs is limited. There is also limited identification of common sources between the two drivers. However, a number of SW measures, typically associated with intermittent inputs from water company discharges (CSOs) or agricultural pollution are considered to improve microbial water quality at Scenario 1A BWs. Where these overlapping measures could provide compliance with the SWD the costs associated with their implementation could be considered to rest outside the rBWD. Using this approach, the CSO improvement costs associated with 9 BWs were removed from Scenario 1A although this may be an under- or over-estimate.

4.2.3 Costing Measures

The unit costs developed across the PoMs were sourced from a range of studies, each with their own uncertainty. It is emphasised that the PoMs for Scenario 1A were for the demonstration of the range of total costs and their distribution between sectors in the IA, rather than reflecting the precise measures that would be undertaken at named

[20] Environment Agency (2007) Semi-quantitative assessment of pollution source inputs to Shellfish Waters reported with failure of the flesh faecal coliform guideline standard in the Shellfish Waters Directive or classified as prohibited.

BWs. The PoMs and its cost basis should be considered as indicative only, and it is recognised that a BW-specific investigative study, typically involving modelling of sources and BW hydro-geomorphic characteristics, should be undertaken prior to implementing any improvement measures for the rBWD.

4.3 Benefits

The limitations of the willingness to pay studies are noted in Annex D.

5 Economic basis

5.1 Price base

The price base year was established as 2007. It is likely that most regulatory proposals will impose costs and have benefits that accrue over a number of years. In order to compare options with costs and benefits occurring at different times a discounting approach has been used. A discount rate of 3.5% has been used, as recommended in Annex 6 of the HM Treasury Green Book: appraisal and evaluation in central Government.

5.2 Time period

For the calculation of present value (PV) Scenario 1A was assessed and discounted over a 25 year period. This period is consistent with Water Company asset planning discount periods and the long-term aspirations of the rBWD.

6 Other considerations

6.1 What is the geographic coverage of the policy/option?

The IA is specific to England and Wales. The EA risk categorisation identified 52 BWs in England and 4 in Wales for inclusion in Scenario 1A. All BWs in Scenario 1A are coastal. The geographic coverage can be sub-divided into WFD River Basin Districts, as follows:

	River Basin District										
	Anglian	Dee	Humber	North West	Northumbria	Severn	Solway Tweed	South East	South West	Thames	Western Wales
No. Scenario 1A Bathing Waters	4	0	4	17	4	2	1	5	15	0	4

6.2 On what date will the policy be implemented?

Scenario 1A addresses the minimum requirement of the rBWD for Member States to ensure that, by the end of the 2015 bathing season, all BW are at least *sufficient*.

Article 5(2) of the rBWD states that “the first classification according to the requirements of this Directive shall be completed by the end of the 2015 bathing

season". Therefore, whilst this is the latest the UK can make its first classification under the rBWD there is the possibility of making an earlier classification. The Government believes that it would be best to wait until 2015 to make the first formal bathing water classifications as this would:

- ensure the best fit with the WFD planning cycle, especially the PoMs
- help to achieve the rBWD's more stringent standards by allowing the maximum time for the effect of improvement measures to show through in the monitoring results
- give the maximum time before England & Wales need to take the Article 5(4) measures (i.e. requirement to advise the public against bathing) for poor bathing waters and the start of the period for counting the 5 consecutive years of poor classification permitted by Article 5 (4)(b).

6.3 Which organisation(s) will enforce the policy?

In English and Welsh legislation transposing the rBWD, the EA will be named as the competent authority in England and Wales.

6.4 What is the total annual cost of enforcement for these organisations?

6.4.1 Monitoring compliance with Scenario 1A through microbial sampling and analysis

The costs to the EA associated with meeting the requirements of rBWD Article 3 *monitoring* in terms of amendments to the current BWD microbial sampling and analysis programme were discussed with the EA.

The rBWD allows Member States to carry out fewer field visits for the collection of samples. For some BWs (those likely to be classified as *good* or *excellent*), the number of sample occasions could be reduced from the current 20 per bathing season to as few as four per bathing season (although the length of the bathing season in England and Wales would dictate a minimum of 5 samples per bathing season). The EA advise that a reduction in sampling frequency could increase the risk to maintaining the classification, with for example, some *excellent* BWs reducing to *good*. An increase in the perception of public health risk and reduction in amenity value would be associated with this risk. As modelling tools develop it may be practicable for the EA to identify those BWs which are not at risk of reduction in standard from a reduction in monitoring frequency.

The EA are currently undertaking a study to develop an understanding of the nature and magnitude of potential savings from a rationalisation of the monitoring programme in England and Wales. The majority of cost savings to the EA would be associated with a reduction in sampling effort rather than laboratory analyses and reporting. However, because of the dynamic nature of EA sampling programmes and regional differences in approach, it has not been possible to derive a suitable cost for this reduction in effort. Whilst the risk to classification of a reduction in sampling at around 215 *good* or *excellent* waters may be low, the retention of the existing 20 samples per season

monitoring minimises the fluctuations between classifications and ensures that classifications are representative of the true water quality at each bathing water.

The rBWD includes the removal of all the field analysis requirements within the cBWD. This range of non-microbial parameters includes colour, mineral oils and transparency. The EA advise that the cost of field analysis for non-microbial parameters is not significant and limited cost savings would be made.

The rBWD includes a reduction in the laboratory microbial analyses, requiring only two faecal indicators (intestinal enterococci and *Escherichia coli* (*E.coli*)) compared with a typical three in the current BWD (total coliforms, faecal coliforms and faecal streptococci). The analytical method is identical for numerating intestinal enterococci (IE)/ faecal streptococci (FS) and also for *E.coli* / faecal coliforms (FC): the cost to the EA of analysing these faecal indicators remains unchanged. The EA advises that the cost of analysis for total coliforms is approximately £11 per sample, and a removal of this analysis from 20 annual samples at each BW would reduce annual costs by approximately £0.1M. Any reduction in sampling frequency would further reduce costs to the EA.

6.4.2 Reporting requirements for Scenario 1A

Costs to the EA are associated with meeting the requirements of rBWD Article 4 *Bathing water quality assessment*.

The statistical analysis techniques and annual reporting requirements of the rBWD are not significantly different in terms of EA execution time from the cBWD. EA BW monitoring teams would be required to periodically check BW signage. Costs to the EA are considered to be cost-neutral with continuation of current expenditure profiles the same as those for the cBWD.

6.4.3 Achieving the standards of Scenario 1A

For discharges to controlled waters the EA will use its discharge consent powers etc to achieve standards. There will be an associated increase in cost to consenting teams from investigative studies, education programmes and legal action which the EA cannot quantify.

For urban diffuse pollution the EA will use information, education and their extant powers through pollution control legislation to achieve standards. There will be an associated increase in cost from pollution tracing investigations and actions which the EA cannot quantify.

The EA has existing powers to establish Water Protection Zones (Section 93 of the Water Resources Act 1991) through which agricultural diffuse pollution could be controlled (see Section 2.1.2). Costs associated with designation and enforcement of these zones would be borne by the EA, associated with the WFD and not with the rBWD.

6.5 Does enforcement comply with Hampton principles?

Yes. As stated in Section 6.3 above, the EA will be named as the competent authority in English and Welsh transposing legislation. Whilst the Government must adhere to the requirements set out in the rBWD, the rBWD does allow the EA to take a risk based approach, for example to monitoring BW quality (i.e. where a BW consistently meets the 'excellent' classification it may be possible to reduce the number of water samples collected from the current twenty (one sample per week) to five).

6.6 Will implementation go beyond minimum EU requirements?

No, Scenario 1A addresses the minimum requirement of the rBWD for Member States to ensure that, by the end of the 2015 bathing season, all BW are at least *sufficient*.

6.7 What is the value of the proposed offsetting measure per year?

The Government has decided as part of the rBWD transposition process to replace the existing legislation with one statutory instrument (SI). Industry will in due course no longer need to refer to the original 1991 Bathing Water Regulations, the 2003 amending SI and the directions and notices issued by the Secretary of State in England or Welsh Assembly Government in Wales, but rather one set of Regulations in England and one in Wales.

The rBWD updates and improves the cBWD which has allowed the Government to make further compensatory simplification measures. The Regulations, consistent with the rBWD, will require the EA to monitor fewer faecal indicators when assessing BW quality, an annual saving of £0.1M (see Section 6.4.1). The Regulations will also provide the EA with the option to reduce the number of sampling visits undertaken at each BW, where appropriate. These Regulations may enable the EA to make some costs savings in the future.

6.8 What is the value of changes in greenhouse gas emissions?

Greenhouse gas emissions are associated with the PoMs for Scenario 1A, particularly the increase in energy requirements to operate the additional tertiary (disinfection) plant at WwTW (see Section 2.1.1.1). Energy expenditure in wastewater disinfection is dependent on the tertiary treatment method used, noting that the increasingly common membrane bio-reactor systems at small WwTW have a significantly lower energy expenditure than ultraviolet (UV) irradiation. An experience-based indicative carbon footprint for UV irradiation at 16 small WwTW (less than 20,000pe) has been provided by Dwr Cymru Welsh Water. Assuming an average 12kW installed UV capacity and continuous operation, a UV system at a small WwTW has an average carbon footprint of 23 tonnes CO_2/year. Based on a worst case of UV irradiation at each of the 10 WwTW identified in Annex B for the Scenario 1A PoMs, the annual increase in greenhouse gas emissions for Scenario 1A is estimated as 230 tonnes CO_2/year.

Guidance is not currently available from which to calculate the embodied energy of construction works included in the PoMs. Greenhouse gas emissions associated with any change to the number of journeys to visit BWs from the improvement in amenity value of Scenario 1A were not calculated.

6.9 Will the proposal have a significant impact on competition?

A competition assessment has been carried out according to Office of Fair Trading (2007)[21] guidance. The guidance includes a filter test of four questions, answered below.

Competition test questions	Answer Yes/No
Q1: In any affected market, would the proposal directly limit the number or range of suppliers?	No
Q2: In any affected market, would the proposal indirectly limit the number or range of suppliers?	Yes
Q3: In any affected market, would the proposal limit the ability of suppliers to compete?	No
Q4: In any affected market, would the proposal reduce suppliers' incentives to compete vigorously?	No

Section 2 of this IA demonstrates that the costs of the PoMs do not impact uniformly across all Water Companies or across all sectors of agriculture, the two sectors most impacted.

Although not specifically identified in the IA, only a small number of Water Companies would require asset improvements as part of a Scenario 1A PoMs: the costs to their customers and the increased risk of failure of compliance would impact on these companies in proportion to their discharges.

Work undertaken elsewhere, as part of the consultation on agricultural improvements for a revised NVZ Action Programme, identified that the dairy sector is likely to be at a competitive disadvantage as a consequence of agricultural diffuse pollution improvement measures. An NVZ Action Programme is likely to indirectly limit the supplier's freedoms to organise their own production processes by setting constraints on the way they handle slurries, manures and organic matter. It may also limit the range of dairy suppliers in two ways: firstly, the NVZ Action Programme would raise costs of production to dairy farmers; secondly, there may be a deterrent effect on new entrants.

6.10 Annual cost per organisation

The costs associated with actions under the Scenario 1A PoMs were identified by impacted sector in the table in Section 2.1.8. An indicative breakdown into organisation size assumed:

- Water companies as large businesses (more than 250 employees)
- Agriculture as small businesses (fewer than 50 employees), with 50% as micro businesses (a sub-set of small businesses with fewer than 10 employees)
- Private individuals as micro businesses (a sub-set of small businesses with fewer than 10 employees)
- Local Authorities as large businesses (more than 250 employees).

Therefore, the total annualised cost of the PoMs to organisations by size category was estimated as: micro £2.98M; small (excluding micro) £2.75M; medium £zero; large £2.77M. It is difficult to separate these costs per organisation affected, as the number of organisations involved is not known with any level of confidence. However, from the geographic coverage presented in Section 6.1, it is estimated that 60% of asset

[21] Office of Fair Trading (2007) Completing competition assessments in Impact Assessments. Guideline for policy makers. August 2007. OFT876

improvements would be borne by two Water Companies. The best estimate total annualised cost to Water Companies of £2.71M equates to an average annualised cost of £1.36M per Water Company.

A small firms impact test was undertaken for the agricultural sector. Costs per average farm were estimated from Defra (2007)[6]. In the 43 modelled river catchments there were an estimated average of 83 dairy farms, 119 beef farms, 159 sheep farms, 9 pig farms and 2 poultry farms – 372 farms per catchment. If all farms within a river catchment were to be included in Water Protection Zones (for additional agricultural improvement measures) and making the assumption that costs would be evenly distributed across agricultural sectors, the mid-point annualised cost of £0.46M per BW equates to an average annualised cost of £1,200 per average farm.

The above costs are averages, and are likely to vary depending on location and farm size as well as by farm type. Although it is not possible to estimate the likely full spread of costs, a fuller picture is provided by estimating the costs by farm size, following the approach of the catchment sensitive farming IA[22].

Farm size	Average annual farm level costs
Part-time	£492
Small	£733
Medium	£1,090
Large	£2,320
Very large	£3,705

Note however that costs would also vary by catchment depending on the level of pollution reduction required; this aspect of variability is not captured in these averages.

6.11 Are any of these organisations exempt?

No. The Government has not proposed that any organisations should be exempt.

6.12 Impact on administrative burdens baseline

The rBWD will not directly introduce a statutory requirement to undertake additional administrative duties or maintain additional records to any organisations beyond those identified to the EA for enforcement, described in Section 6.4.

BW quality records are not currently (cBWD) required to be kept by beach operators (typically Local Authorities) and are not required under the rBWD. However, several activities under the PoMs may result in additional administrative burdens: water companies for operational best practice and consent compliance for new assets; agriculture for demonstrating compliance with Action Programmes. It has not been possible to identify the extent of overlap with other agricultural programmes and the extent of the administrative burden attributable exclusively to rBWD activities.

[22] Defra (2007) Partial Regulatory Impact Assessment on proposals relating to tackling diffuse pollution from agriculture, August 2007

SCENARIO 1B ALL BATHING WATERS AT LEAST 'SUFFICIENT' BY THE END OF THE 2015 BATHING SEASON INCLUDING THE PREDICTION APPROACH TO DISCOUNTING POOR WATER QUALITY SAMPLES

1 Scenario description

Scenario 1B provided an alternative to Scenario 1A by proposing the use of a prediction and system at a limited number of bathing waters to meet the minimum requirement of the rBWD to ensure that by the end of the 2015 bathing season all BWs are at least *sufficient*.

The purpose of the rBWD is to protect public health from pollution at bathing waters. Primarily this is done in the rBWD by setting new more stringent water quality standards, which require Member States to put measures in place to reduce the amount of faecal pollution entering our bathing waters. However, even after putting new measures in place in a BW catchment, a BW could still be subject to episodes of short-term pollution following heavy rainfall, for example. To help address this problem, the rBWD gives Member States the option to identify BW where short term pollution may be a problem, to establish procedures to predict the BW quality and to advise the public against bathing during short-term pollution events. This system is therefore intended to provide bathers with an additional level of protection, beyond any action to prevent pollution.

The rBWD gives Member States the option to disregard or "discount" up to 15% of samples taken at a BW during short-term pollution events, as long as the public has been warned in advance that the water quality may be unsuitable for bathing. It is also worth noting that the use of discounting is only permissible if measures are actively being taken to prevent, eliminate or reduce the causes of pollution in the BW's catchment area. Discounting should, therefore, not be seen as a way of avoiding taking measures to improve bathing water quality. Instead it provides an option to improve the water quality from say *poor* to *sufficient*, where measures have been and continue to be taken - but would be disproportionately expensive or technically unfeasible to take further measures.

Several methods of pollution prediction were trialled or considered by Defra and the EA early in 2006, including in particular, the system already run by the Scottish Environment Protection Agency (SEPA) at a number of sites in Scotland. Following completion of this work, it was concluded that discounting does have potential at certain sites in England and Wales.

The work has shown that the model can predict microbiological water quality at a number of BWs. The Agency found that of the 56 poor and at risk *sufficient* bathing waters included in Scenario 1A that approximately 45 BWs could be suitable for a prediction system. However, it is estimated that even if a prediction system was in operation at all 45 BWs, less than 10 would see a class change (i.e. improve from *poor* to *sufficient*) each year and it is currently not possible to predict in advance which BWs it would be. It should be noted that the EA model is still being developed and as it is refined and further assessments of BWs are carried out, it should be possible to

determine at which sites discounting would be most effectively applied to in the future, hence making the model more viable.

The PoMs specific to improving the classification of *poor* and high risk *sufficient* BWs in Scenario 1A were included in Scenario 1B (refer to Scenario 1A for these measures and the breakdown of costs and benefits). To demonstrate the scale of costs and benefits associated with operating a discounting system, Scenario 1B was developed and includes five BWs for application of the discounting option. These BWs were drawn from those in Scenario 1A.

2 Annual costs

2.1 Description and scale of key monetised costs by 'main affected groups'

The costs associated with Scenario 1B are as those presented in Scenario 1A, with the exception of the following:

- Modification of the PoMs to reduce disproportionately expensive water quality improvement measures at five selected BWs
- Increase in the public information requirements at five selected BWs to take account of rBWD requirements when using a discounting approach.

The highest unit costs for measures in Scenario 1A were associated with high contributions from agricultural pollution. For the purposes of Scenario 1B, the most cost-effective application of a discounting methodology would be to limit additional agricultural improvement measures (see Scenario 1A, Section 2.1.2) at five BWs.

2.1.1 Agriculture

Cost savings for Scenario 1B are associated with the 5 BWs where it is possible to remove additional measures to address agricultural contribution. The cost of these measures (total at the 5 BWs) then potentially reduces the annualised cost range by £2.51-3.05M and annualised cost best estimate by £2.78M.

2.1.2 Beach operators

In addition to Scenario 1A costs, the rBWD requires specific information to be displayed at certain times when short-term pollution is predicted as part of a discounting approach in Scenario 1B at the 5 BWs.

There may be costs to the beach operators whose BWs are included in the prediction and discounting system. The beach operators would be required to advise the public against bathing when poor water quality is predicted. The beach operators may choose to adapt existing beach signage (manual or electronic) resulting in minimal additional costs.

Where additional manually updateable signs are used at the main access point and smaller reminder signs at any un-official access points, transitional costs would be similar to those presented in Scenario 1A (Section 2.1.7), £2,000 per BW.

SEPA currently provide daily information on predicted water quality at 10 designated BWs in Scotland, displayed on electronic message signs. The electronic message signs allow SEPA to advise beach users with a daily forecast of predicted water quality.

Typical costs provided by SEPA, for electronic beach signs at each of the 5 BWs would be approximately £0.028, a total one-off transitional cost of £0.14M to beach operators. Annual recurring costs are estimated at £1,260 per sign. For an asset life of 5 years, the total annualised cost of 5 electronic signs is £0.037M.

2.1.3 Environment Agency

In addition to Scenario 1A costs, the transitional costs of establishing and operating a prediction system would be borne by the EA. The EA estimated these as:

- a one-off cost of £50,000 associated with the costs of purchasing rain gauges at the 5 BWs (i.e. £10,000 per BW) selected for a prediction system
- an annual cost of £50,000 for a central EA co-ordinator to run the prediction system
- an annual cost of £125,000 for local EA staff time (with local BW knowledge) to help run the prediction system at the 5 BWs (i.e. £25,000 per BW)
- a one-off cost of £100,000 and an annual cost (based on 75 person-days) of £50,000 for developing and updating an appropriate series of web pages on the national EA Internet.

Assuming an asset life of 10 years for the rain gauges and website, the total annualised transitional cost to the EA was estimated as £0.24M.

2.1.4 Summary

Best estimate costs for Scenario 1B were summarised and adjusted to annualised costs as follows:

		Asset life (years)	England			Wales			Total Annualised costs		Net present value
			Capital cost	Operating cost	Annualised cost	Capital cost	Operating cost	Annualised cost	by activity	by sector	by sector
Water Companies	Modelling studies	5	£28M	£0	£6.3M	£2.2M	£0	£0.48M	£6.73M	£10.2M	£111M
	WwTW improvements	10	£10.1M	£0.14M	£1.35M	£0	£0	£0	£1.35M		
	CSO improvements	80	£44.3M	£0.29M	£1.95M	£3.69M	£0.02M	£0.16M	£2.11M		
	1st time sewerage	25	£6.0M	£0	£0.66M	£0	£0	£0	£0.66M		
Agriculture		n/a	n/a	n/a	£2.26M	n/a	n/a	£0.46M	£2.72		£45M
Business, Industry and Institutions	Private WwTW improvements	25	£0.4M	£0.22M	£0.24M	£0	£0	£0	£0.24M	£0.25M	£3.8M
	Caravan park improvements	80	£0.22M	£0	£0.01M	£0	£0	£0	£0.01M		
Local Authorities	Isolating contaminated surface sewers	80	£0.95M	£0	£0.04M	£0.05M	£0	£0.01M	£0.04M	£0.06M	£1.5M
	Urban run-off improvements	80	£0.55M	£0	£0.02M	£0	£0	£0	£0.02M		
Total cost (excluding transitional costs)										£13.2M	£155M
Transitional costs to Beach	Beach signage costs	5	£0.14	£0.01	£0.04	£0	£0	£0	£0.04	£0.49M	n/a

Operators											
Transitional costs to the Environment Agency	Bathing water profiles	25	£0.58M	£0.08M	£0.12M	£0.11M	£0.01M	£0.02M	£0.13M		
	Public information	25	£0.73M	£0.27M	£0.31M	£0.04M	£0	£0.01M	£0.32M		

Capital, operating and annualised costs listed separately for England and Wales by PoMs activity. Total annualised costs provided by PoMs activity and by sector. The total annualised cost (excluding transitional costs) has been taken forward to the Summary Sheet as the "Average Annual Cost".

Transitional costs considered to apply to the Environment Agency and Beach Operators only. The total annualised cost to the Environment Agency and Beach Operators has been taken forward to the Summary Sheet as the "one off (Transition)" cost. The period for transition to be effected is prior to 2015, 7 years from transposition of legislation in 2008.

2.2 Other key non-monetised costs by 'main affected groups'

As Scenario 1A.

3 Annual benefits

3.1 Description and scale of key monetised benefits by 'main affected groups'

The benefits assessment exercise for Scenario 1B used the same approach and evidence base as that under Scenario 1A and Annex D.

3.1.1 Physical Impact Assessment

Once again the principal impacts associated with Scenario 1B related to health protection for those engaged in recreational bathing activities. The health protection benefits arise from the water quality improvements at *poor* and high *sufficient* BWs, and from the introduction of a prediction and warning system (PWS) advising against swimming on days when water quality is worse than *sufficient*.

The improvement in health protection associated with improvement in faecal indicator water quality at *poor* and high risk *sufficient* BWs under Scenario 1B were again estimated on the basis of the thresholds of risk of illness associated with the rBWD water quality classes (and associated threshold parameter values) shown under Scenario 1A.

3.1.1.1 Better Public Information

In addition to the water quality improvement and introduction of the prediction and warning system (PWS) at 5 bathing waters, there is UBS at 493 additional BWs in England & Wales enabling the public to make a more informed choice on whether to bathe (see Scenario 1A).

3.1.2 Economic Impact Assessment

Once again, the unit values for willingness to pay (WTP) shown in Scenario 1A could be applied to assess the benefits of the changes under Scenario 1B.

It could be considered that at the 5 BWs with predictive signage the full value of the WTP for ANS/UBS is appropriate. The WTP per % reduction in risk of GI per BW remains as Scenario 1A. Given the assumptions and caveats detailed at the end of Annex D, the value of benefits for the range of impacts under Scenario 1B are therefore as follows:

Benefits included	No of BWs included	Mean WTP per household per year (£2007Prices)	Cumulative Mean WTP per household per year (£2007Prices)	National Aggregate WTP per year[A] (£2007Million)	Total Net Present Value of Benefits[B] (£2007Million)
1.5% reduction in GI; UBS @ £6.37 @ £15.59	34 (488 @1/3 5 @ full UBS)	0.13 2.16 5.31	0.13 2.29 5.44	2.99 52.7 125	51 869 2,060
1.5% reduction in GI; UBS @ £6.37 @ £15.59	56 (488 @1/3 5 @ full UBS)	0.21 2.16 5.31	0.21 2.37 5.52	4.90 54.6 127	84 900 2,091
2.25% reduction in GI; UBS @ £10.98	45 (488 @1/3 5 @ full UBS)	0.26 3.73	0.26 3.99	5.98 91.8	102 1,514
3% reduction in GI; UBS @ £6.37 @ £15.59	34 (488 @1/3 5 @ full UBS)	0.26 2.16 5.31	0.26 2.42 5.57	5.98 55.7 128	102 918 2,110

[A] Aggregate WTP for England and Wales is found by multiplying the cumulative mean WTP figures by the number of English and Welsh households = 23 million.
[B] Calculated using 25 year time horizon and discount rate of 3.5%

The annual benefits under Scenario 1B are therefore marginally increased on Scenario 1A, between £52.7M and £128M, depending on the number of BWs included in the analysis, the reduction in GI illness considered, and the value of the upgraded beach signage. The mid-point estimate (2.25% reduction in GI at 45 BWs; UBS value= £10.98) is around £91.8M.

Annual benefits for Scenario 1B in England are estimated (mid-point) as around £78M; in Wales, around £14M.

3.2 Other key non-monetised benefits by 'main affected groups'

The recreational opportunities and amenity dis-benefit to visitors and local users of any temporary advice against bathing at the 5 BWs included in the discounting approach could not be costed. Although WTP studies are available for seasonal beach closures, there are a range of factors (e.g. temporary duration of closure, provision of advance information, proximity of nearest open BW (visitors use), magnitude of local population (local use) which prevent the transfer of costs. Other non-monetised benefits are as discussed under Scenario 1A.

4 Key Assumption/Sensitivities/Risks

The key assumptions, sensitivities and risks of Scenario 1B are similar to Scenario 1A. In addition, the range, number and scale of measures excluded from the PoMs as part of the discounting approach at the five selected BWs are indicative only; intended to explore the type of measures that could be set aside as disproportionate and the associated cost savings.

Where possible, it would be prudent to select the 5 BWs for application of the discounting methodology from those where there is no other driver for agricultural diffuse pollution improvements, particularly large contributing catchment areas. Adopting this approach would realise the full benefits of the off-set measures and minimise additional expenditure requirements under the rBWD in catchments where

there are no other diffuse pollution benefits (e.g. nutrient contributions and eutrophication) from adopting agricultural improvement measures.

5 Economic basis

As Scenario 1A.

6 Other considerations

6.1 What is the geographic coverage of the policy/option?

The IA is specific to England & Wales. Suitable BWs for application of the discounting option in Scenario 1B would be drawn from Scenario 1A.

6.2 On what date will the policy be implemented?

The timescale of implementation of Scenario 1B is the end of the 2015 bathing season, which influences the criteria for selection of suitable BW. The implications of discounting will be examined as a separate exercise at a later stage when the potential for discounting at individual BWs is better understood following model development and investigative studies.

6.3 Which organisation(s) will enforce the policy?

As Scenario 1A.

6.4 What is the total annual cost of enforcement for these organisations?

Monitoring compliance with Scenario 1B through microbial sampling and analysis

The costs to the EA would be similar to Scenario 1A, noting that there will be a minor increase in the number of sampling occasions and subsequent laboratory analyses to substitute for the *discounted* samples in the overall compliance dataset. Costs were considered, by the EA to be cost-neutral with continuation of current expenditure for the current BWD.

Reporting requirements for Scenario 1B and achieving the standards of Scenario 1B are as Scenario 1A.

6.5 Does enforcement comply with Hampton principles?

As Scenario 1A.

6.6 Will implementation go beyond minimum EU requirements?

No, Scenario 1B addresses the minimum requirement of the rBWD for Member States to ensure that, by the end of the 2015 bathing season, all BW are at least *sufficient*.

6.7 What is the value of the proposed offsetting measure per year?

As Scenario 1A.

6.8 What is the value of changes in greenhouse gas emissions?

As Scenario 1A.

6.9 Will the proposal have a significant impact on competition?

As Scenario 1A.

6.10 Annual cost per organisation

Following the approach in Scenario 1A, the total annualised cost of the PoMs to organisations by size category were estimated as: micro £1.59M; small (excluding micro) £1.36M; medium £zero; large £2.81M.

Costs per Water Company are as presented for Scenario 1A, an average annualised cost of £0.92M per Water Company, noting the uncertainties in the estimate.

Costs per farm are assumed to be as presented for Scenario 1A, an average annualised cost of £1,200 per farm, noting the uncertainties in the estimate.

6.11 Are any of these organisations exempt?

As Scenario 1A.

6.12 Impact on administrative burdens baseline

As Scenario 1A.

SCENARIO 2 INCREASE THE NUMBER OF BATHING WATERS CLASSIFIED AS *EXCELLENT*

1 Scenario description

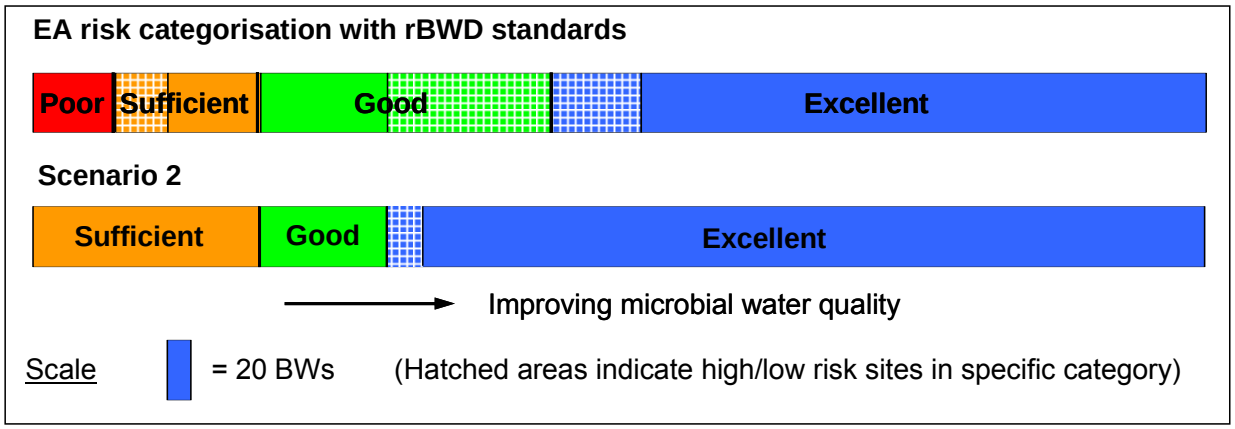
Scenario 2 provided a further alternative for the implementation of the rBWD by endeavouring to explore the costs and benefits of going beyond the minimum rBWD requirements. Article 5(3) of the rBWD places an obligation on Member States to increase the number of bathing waters classified as *excellent* or *good*, but as the Government is not expecting to make the first formal BW classifications until 2015 this objective cannot strictly speaking begin in England and Wales until the 2016 bathing season. The Government believes that in the meantime there was potentially a third scenario, which incorporated the BWs identified in Scenario 1A (or 1B), and at the same time explored the costs and benefits of going a little further. Stakeholders were given the opportunity to comment on Scenario 2, noting that it will ultimately be up to Ministers to decide whether these are options England and Wales should pursue.

It is expected that BWs will need to achieve an *excellent* classification to qualify for the Blue Flag award in future years. Scenario 2 therefore focuses on the PoMs which will need to be taken to maximise the potential for Blue Flag beaches in England & Wales. The cost of improving/ maintaining these BWs has been considered along with the costs of "doing nothing" i.e. beaches losing their Blue Flag awards and a possible reduction in tourism, for example.

The EA has identified, through their prediction work, 110 BWs in England and 11 BWs in Wales which are predicted as being classified as *good* under the rBWD. Of these BWs 68 (60 in England, 8 in Wales) have been assessed as having a less than 10% chance of failing their current classification, with 7 having less than or equal to 1% probability of failing the *good* standard and are termed low risk *good* BWs. These BW have been considered by the EA for improvement to the *excellent* classification by 2015 and are included in Scenario 2. Of the 11 BW in Wales predicted to be classified as *good*, only 3 are not within this low risk *good* category. It may lead to an anomalous approach to exclude such a small number of BW. Therefore, the Welsh Assembly Government (WAG) has included these 3 BW in Scenario 2 for improvement to *excellent* by 2015.

The EA identified, through their prediction work, 271 BWs (213 in England, 58 in Wales) which are predicted as being classified as *excellent* under the rBWD. Of these BWs 37 (34 in England, 3 in Wales) have been assessed as having a greater than 25% probability of failing to achieve the *excellent* classification (i.e. could deteriorate to the *good* classification). A PoMs may need to be put in place at each of these BW prior to 2015 to ensure that these high risk *excellent* BWs maintain their classification in 2015. However, current Blue Flag beaches warrant priority since they are potentially associated with the greatest benefit. EA analysis identified 8 Blue Flag beaches (6 in England, 2 in Wales) in this category. These BW would be maintained in the *excellent* classification in 2015 and are included in Scenario 2. In Wales, of the 3 high risk *excellent* BW, only one is not currently a Blue Flag beach. Again, to avoid the possibility of an anomalous approach within the classification, this BW is also included in Scenario 2.

Using the EA risk categorisation with rBWD standards, the diagram below shows the assessed current categorisation (upper bar) and anticipated improvements from the PoMs in Scenario 2 (lower bar). Scenario 2 includes the PoMs to improve BWs in Scenario 1A, indicated by the improvement of *poor* (red) BWs to *sufficient* (orange) and reduction of the risk to high risk *sufficient* (hatched orange) BWs, bringing these to *sufficient* (orange). Scenario 2 also shows the reduction of the risk to low risk *good* (hatched green) BWs, bringing these to *excellent* (blue) and the reduction of the risk to high risk *excellent* (hatched blue) BWs, bringing these to *excellent* (blue).



The PoMs specific to improving the classification of *poor* and high risk *sufficient* BWs in Scenario 1A is included in Scenario 2 (refer to Scenario 1A for these measures and the breakdown of costs and benefits). Annex A details the additional 80 BWs included in Scenario 2 and Annex B identifies the main microbial pollution pressures affecting these additional BWs. The EA has not yet undertaken a semi-quantitative analysis of these additional BW. Until such data are available, BW-specific qualitative assessments of pressures undertaken for the previous pRIA (Cascade Consulting, 2002) have been used, updated through review of investments made in AMP4. As these BW are of improved quality, it is more difficult to identify the most effective options within a PoMs to achieve the objectives of Scenario 2.

2 Annual costs

2.1 Description and scale of key monetised costs by 'main affected groups'

EA (2006) source apportionment work did not identify potential measures at low risk *good* BWs and high risk *excellent* BWs in Scenario 2. Previous source apportionment work (Cascade Consulting, 2002)[23] qualitatively identified potential measures at the majority of these BWs and has been revised using data provided by Ofwat on improvements to water company assets funded through PR04. A contribution scale (high/medium) has been overlaid from workings of the Cascade Consulting (2002) report to provide consistency with EA (2006) source apportionment work. The nature and magnitude of improvement required at each Scenario 2 BW has been identified from 2003-2006 EA BW monitoring data (see Annex A). Each BW's risk profile has

[23] Cascade Consulting (2002) Costing of the Revision to the Bathing Water Directive: Phase 3 Studies Final Report June 2002 prepared for Department for the Environment, Food and Rural Affairs

been used to tailor the selection of suitable improvement measures from the EA list of BW-specific options within the indicative Scenario 2 PoMs (see Annex B).

2.1.1 Water Companies

Costs to Water Companies and consequently their customers are associated with options within a PoMs to improve microbial water quality at Scenario 2 BWs, see Annex B.

Modelling studies (see Scenario 1A) required at each of the additional 80 Scenario 2 BWs would have an approximate total capital cost of £35M to water companies for BWs in England and £8.1M for BWs in Wales.

Scenario 2 includes the programme of measures to improve BWs in Scenario 1A. The capital cost to water companies of Scenario 1A was in the range of £56-102M and best estimate of £88M; annual recurring costs in the range of £0.2-0.7M and best estimate of £0.5M.

2.1.1.1 WwTW improvements

Two medium-large WwTW have been identified in the Scenario 2 PoMs (see Annex B). Both WwTW (in England) currently have secondary (biological) treatment and are included for upgrade to tertiary (disinfection), costed on the basis of installation of UV disinfection. From Ofwat data, and incorporating an optimism bias correction[5], a capital cost of £8.5M; annual recurring costs of £0.5M have been estimated for these improvements. It is acknowledged (in light of responses received to the consultation) that the number of WwTW considered for improvement could be low and once detailed investigative studies and modelling have been undertaken, additional WwTW may be identified as requiring treatment upgrade. Annex B Table B3 lists a further 23 WwTW where WwTW are considered to be potential significant sources of faecal contamination. An upper band cost could consider 50% of these WwTW as requiring treatment upgrade; assuming the costs of a medium-sized WwTW from Scenario 1A, an additional capital cost of £49M; annual recurring costs of £2.9M could be added for these improvements.

2.1.1.2 CSO improvements

The cost basis of CSO improvements is presented in Scenario 1A (Section 2.1.1.2). An additional 52 BWs in England and 8 in Wales with CSO improvements have been identified in the PoMs for Scenario 2. Section 4 identifies that several of these improvements may take place to achieve the requirements of the SWD prior to 2015. Using this approach, the CSO improvement costs associated with 4 BWs in the North West and South West RBDs and 1 in Western Wales RBD have been removed.

In England the capital cost range for additional CSO improvements has been derived as £18-77M and best estimate of £59M; annual recurring costs in the range of £0.1-0.7M and best estimate of £0.3M. In Wales the capital cost range has been developed as £2.6-11.2M and best estimate of £8.6M; annual recurring costs in the range £0.02-0.10M and best estimate of £0.06M. Investigative works are estimated at a further £0.27M per scheme.

2.1.1.3 Removing sewerage cross-connections

Sewerage cross-connections have been identified at 9 BWs in England and 1 in Wales. Consistent with Scenario 1A, no additional costs have been identified for removing sewerage cross-connections.

2.1.2 Agriculture

The cost basis of agricultural pollution reduction measures are presented in Scenario 1A (Section 2.1.2). Agricultural measures in addition to those intended to be implemented prior to 2012 (Business as Usual) have been identified at an additional 3 BWs in England and 3 in Wales. In England the annualised cost range has been derived as £1.3M-1.5M for the 3 bathing waters (£0.42 to £0.51m per bathing water) and best estimate of £1.4M (£0.46m per bathing water); similar costs in Wales.

The EA (2006) has identified potential contributions to risk from diffuse agricultural pollution at a further 25 BWs in England and 2 in Wales. It is expected that measures under the Business as Usual scenario will substantially reduce the risk at these BWs from these sources and additional improvements have been omitted from the PoMs.

2.1.3 Business, Industry and Institutions

Scenario 2 includes the PoMs to improve BWs in Scenario 1A. The capital cost to business from private sewerage improvements is identical to Scenario 1A, in the range of £0.07-0.37M and best estimate (mid-point) of £0.22M.

2.1.3.1 Caravan park improvements

The cost basis of connecting caravan parks to the main sewerage system is presented in Scenario 1A (Section 2.1.3.2). An additional 1 BW in England and zero in Wales with potential for pollution risk has been identified in the PoMs for Scenario 2; a cost range of £0.01-0.1 and best estimate of £0.06M. Contributions to risk from caravan parks have been identified at a further 2 BWs in England and 1 in Wales; additional costs in the range of £0.03-0.3M and best estimate of an additional £0.16M (not included in the costed PoMs).

2.1.4 Private individuals

Scenario 2 includes the PoMs to improve BWs in Scenario 1A. There are no additional costs to private individuals from Scenario 2.

2.1.5 Local Authorities

Scenario 2 includes the PoMs to improve BWs in Scenario 1A. The capital cost to Local Authorities of Scenario 1A was highly speculative and a best estimate of £1.55M derived.

2.1.5.1 Isolating contaminated surface sewers

The cost basis of isolating contaminated surface sewers is presented in Scenario 1A (Section 2.1.5.1). An additional 1 BW in England and zero in Wales with potential for isolating contaminated surface sewers has been identified in the PoMs for Scenario 2; a cost range of £0.001-0.1M and best estimate of £0.05M.

2.1.5.2 Animal/ bird actions

Several BWs are known to have a problem with bird populations that contribute to diffuse faecal pollution. Animal and bird sources of faecal pollution have been identified as a high contributor at 6 Scenario 2 BWs. It may be appropriate in these circumstances where consistent compliance with the *excellent* standard cannot be guaranteed, to review the inclusion of the BW in Scenario 2.

Consistent with Scenario 1A, no costing has been allocated, as it has not been deemed possible to develop such costs.

2.1.5.3 Urban run-off improvements

The cost basis of urban run-off improvements is presented in Scenario 1A (Section 2.1.5.3). An additional 12 BWs in England and zero in Wales with potential for reducing urban run-off pollution has been identified in the PoMs for Scenario 2; the capital costs were estimated as £0.6M.

2.1.6 Environment Agency

Modelling studies (see Scenario 1A) required at each of the additional 80 Scenario 2 BWs (15 in Wales) would be to the approximate total one-off transitional cost of £0.8M to the EA.

2.1.6.1 Bathing water profiles

The one-off transitional costs to the EA are identical to Scenario 1A, estimated as a one-off cost of £0.58M in England; £0.11M in Wales.

Profiles are to be reviewed on fixed timescales: every two years (*poor*), every three years (*sufficient*), every four years (*good*), only on change in status (*excellent*). Using the EA rBWD risk categorisation, Scenario 2 (incorporating Scenario 1A) includes 94 *sufficient* BWs (85 in England; 9 in Wales) and 53 *good* BWs (50 in England; 3 in Wales). The annual average recurring cost to the EA is, therefore, estimated to be £0.05M in England and £0.01M. in Wales.

2.1.6.2 Public information

The costs to the EA are identical to Scenario 1A, estimated as a one-off transitional cost of £0.02M and an annual cost of £0.04M.

2.1.7 Beach operators

The basis of costs to beach operators is identical to Scenario 1A, considered by the Government to be a minimal additional cost.

2.1.8 Summary

Best estimate costs for Scenario 2 (includes Scenario 1A) have been summarised and adjusted to annualised costs as follows:

		Asset life (years)	England			Wales			Total Annualised costs		Net present value
			Capital cost	Operating cost	Annualised cost	Capital cost	Operating cost	Annualised cost	by activity	by sector	by sector
Water Companies	Modelling studies	5	£39M	£0	£8.6M	£4.6M	£0	£1.0M	£9.6M	£17.8M	£206M
	WwTW improvements	10	£18.6M	£0.64M	£2.59M	£0	£0	£0	£2.59M		
	CSO improvements	80	£103	£0.69M	£4.54M	£12.3M	£0.08M	£0.54M	£5.08M		
	1st time sewerage	25	£6.0M	£0	£0.66M	£0	£0	£0	£0.66M		
Agriculture		n/a	n/a	n/a	£6.44M	n/a	n/a	£1.86M	£8.30M		£137M
Business, Industry and Institutions	Private WwTW improvements	n/a	£0M	£0.22M	£0.22M	£0	£0	£0	£0.22M	£0.23M	£3.9M
	Caravan park improvements	80	£0.28M	£0	£0.01M	£0	£0	£0	£0.01M		
Local Authorities	Isolating contaminated surface sewers	80	£0.95M	£0	£0.04M	£0.05M	£0	£0.01M	£0.04M	£0.08M	£2.1M
	Urban run-off improvements	80	£1.15M	£0	£0.04M	£0	£0	£0	£0.04M		
Total cost (excluding transitional costs)										£26.4M	£349M
Transitional costs to the Environment Agency	Bathing water profiles	25	£0.58M	£0.05M	£0.09M	£0.11M	£0.01M	£0.02M	£0.11M	£0.20M	n/a
	Public information	25	£0.74M	£0.04M	£0.08M	£0.08M	£0	£0.01	£0.09M		

Capital, operating and annualised costs listed separately for England and Wales by PoMs activity. Total annualised costs provided by PoMs activity and by sector. The total annualised cost (excluding transitional costs) has been taken forward to the Summary Sheet as the "Average Annual Cost".
Transitional costs considered to apply to the Environment Agency only. The total annualised cost to the Environment Agency has been taken forward to the Summary Sheet as the "one off (Transition)" cost. The period for transition to be effected is prior to 2015, 7 years from transposition of legislation in 2008.

2.2 Other key non-monetised costs by 'main affected groups'

As Scenario 1A.

3 Annual benefits

3.1 Description and scale of key monetised benefits by 'main affected groups'

The approach and evidence base for assessing the benefits of Scenario 2 are as presented in Scenario 1A and Annex D.

3.1.1 Physical Impact Assessment

Once again the principal impacts associated with Scenario 2 relate to health protection for those engaged in recreational bathing activities. The health protection benefits arise from the water quality improvements at BWs considered in Scenario 1A, plus the further improvements in faecal pathogen water quality at low risk *good* and high risk *excellent* BWs

The improvement in health protection associated with improvement in faecal indicator water quality under Scenario 2 is again estimated on the basis of the thresholds of risk

of illness associated with the rBWD water quality classes (and associated threshold parameter values) shown under Scenario 1A.

Under Scenario 2, there is the reduction in risk of GI illness as for Scenario 1A, plus a further reduction associated with the improvement in BW quality from *good* (and high risk *excellent*) to *excellent* at between 71 and 80 additional identified BWs. This further improvement at the 71 – 80 BW's gives rise to a change in risk of GI illness at these BW's from 3-5% to <3%. Since these are again threshold values (as for scenario 1A), for the purposes of the benefits assessment it is assumed that the improvement lies between 2% (i.e. the difference in the 5% - 3% interval) and 3.5% (i.e. the difference in the 5% - 1.5% interval [where 1.5% = the mid point of the *excellent* WQ class risk range]).

In addition, to the water quality improvement, beach signage will be upgraded at all 493 BWs in England & Wales, enabling the public to make a more informed choice on whether to bathe.

3.1.1.1 Better Public Information

In addition to the water quality improvement, there is UBS at all 493 BWs in England & Wales, enabling the public to make a more informed choice on whether to bathe (see Scenario 1A).

3.1.2 Economic Impact Assessment

Once again, the unit values for willingness to pay (WTP) shown in Scenario 1A can be applied to assess the benefits of the changes under Scenario 2. Given the assumptions and caveats detailed at the end of Annex D, the value of benefits for the range of impacts under Scenario 2 is therefore as follows:

Benefits included	No of BWs included	Mean WTP per household per year (£2007Prices)	Cumulative Mean WTP per household per year (£2007Prices)	National Aggregate WTP per year[A] (£2007Million)	Total Net Present Value of Benefits[B] (£2007Million)
1.5 & 2% reduction in GI;	34 & 71	0.49	0.49	11.3	192
UBS @ £6.37	493	2.12	2.61	60.0	989
@ £15.59	(@1/3)	5.20	5.69	131	2,157
1.5 & 2% reduction in GI;	56 & 80	0.62	0.62	14.3	243
UBS @ £6.37	493	2.12	2.74	63.0	1,039
@ £15.59	(@1/3)	5.20	5.82	134	2,206
2.25 & 2.75% reduction in GI;	45 & 76	0.79	0.79	18.2	310
UBS @ £10.98	493	3.66	4.45	102	1,687
	(@1/3)				
3 & 3.5% reduction in GI;	34 & 71	0.89	0.89	20.5	349
UBS @ £6.37	493	2.12	3.01	69.2	1,141
@ £15.59	(@1/3)	5.20	6.09	140	2,309

[A] Aggregate WTP for England and Wales is found by multiplying the cumulative mean WTP figures by the number of English and Welsh households = 23 million.
[B] Calculated using 25 year time horizon and discount rate of 3.5%

The annual benefits under Scenario 2 are therefore between £60.0M and £140M, depending on the number of BWs included in the analysis, the reduction in GI illness considered, and the value of the upgraded beach signage. The mid-point estimate

(2.25% reduction in GI at 45 bathing waters and 2.75% reduction in GI at 76 additional bathing waters; UBS value= £10.98; factoring an assumption that 1/3 of beach users read the available signage) is around £102M.

Annual benefits for Scenario in England are estimated (mid-point) as around £85M; in Wales, around £16M.

3.2 Other key non-monetised benefits by 'main affected groups'

ENCAMS have identified the following benefits to local communities from attaining the international Blue Flag status and likewise these benefits would be lost if Blue Flag status is withdrawn:

- Blue Flags are known to increase local pride, providing excellent public relations opportunities to raise the profile of a BW and the surrounding area
- Blue Flag beaches have the competitive edge over other non-awarded beaches in the area and help to boost tourism
- over £5 million worth of media coverage is generated in the UK for Blue Flag beaches each year
- Blue Flag beaches are featured on both the national and international Blue Flag websites which attract around 440,000 visitors every year
- Blue Flag can open up various financial opportunities, including European funding streams
- Blue Flag criteria, such as access for disabled people, promote social inclusion which in turn can increase visitor numbers to the area
- Blue Flag can be used as a practical management tool to address key local environmental quality and anti-social behaviour issues.

However, as noted above, unless there is an overall increase in the number of visitors to BWs in England & Wales, the benefits are displaced from other areas, without any overall increase. Where opportunities arise for EC funding for regional development from achieving Blue Flag status, there may be a real-terms financial benefit, although this is not quantified here.

Other non-monetised benefits are as discussed under Scenario 1A.

4 Key Assumption/Sensitivities/Risks

The key assumptions, sensitivities and risks of Scenario 2 are similar to Scenario 1A. In addition, there are a range of assumptions around the selection of additional BWs and the associated PoMs.

The assessment of Scenario 2 is sensitive to the number and location of BWs included. Although the number of BWs is indicative and for exploratory purposes only, uncertainty is associated with: the use of historic EA sampling data as indicative of future water quality; and the selection criteria used to identify high risk *excellent BWs* with Blue Flags and low risk *good* BWs. The number of BWs with Blue Flags in 2015 has been assumed as consistent with present. However, this is a significant

assumption, considering the need to update the selection criteria for Blue Flags to reflect implementation of the rBWD and any other socio-environmental changes prior to 2015.

Selecting and costing the PoMs is subject to the same range of limitations as Scenario 1A. However, as the available measures at the additional BWs were identified historically for the partial RIA (Cascade Consulting (2002), updated through data received from Ofwat), they do not necessarily accurately represent the current balance of faecal pollution source apportionment at these BWs. Additional EA source apportionment work is required to verify the available measures, their relative contribution and the confidence of the prediction. It is again emphasised that the PoMs for Scenario 2 is for the demonstration of the range of total costs and their distribution between sectors in the IA, rather than reflecting the precise measures that would be undertaken at named BWs. It is recognised that a BW-specific investigative study, typically involving modelling of sources and BW hydro-geomorphic characteristics, should be undertaking prior to implementing any improvement measures for the rBWD.

It is possible that the quality of some additional Scenario 2 BWs may improve as a result of SWD measures. Using the same approach as Scenario 1A, the CSO improvement costs associated with 5 BWs have been removed from Scenario 2 although this may be an under- or over-estimate.

5 Economic basis

As Scenario 1A.

6 Other considerations

6.1 What is the geographic coverage of the policy/option?

The IA is specific to England and Wales. The EA risk categorisation and WAG identified 66 BWs in England and 14 in Wales for inclusion in Scenario 2. With the exception of 1 inland BW in north London, all BWs in Scenario 2 are coastal. The geographic coverage can be sub-divided into WFD River Basin Districts, as follows:

	River Basin District										
	Anglian	Dee	Humber	North West	Northumbria	Severn	Solway Tweed	South East	South West	Thames	Western Wales
No. Scenario 2 Bathing Waters	8	0	7	4	8	1	0	12	24	2	14

Scenario 2 includes the programme of measures to improve BWs in Scenario 1A. Improvements to BWs in Scenario 1A have been included as per Scenario 1A and have not been repeated here.

6.2 On what date will the policy be implemented?

The timescale of implementation of Scenario 2 is after the end of the 2015 bathing season.

6.3 Which organisation(s) will enforce the policy?

As Scenario 1A.

6.4 What is the total annual cost of enforcement for these organisations?

Monitoring compliance with Scenario 2 through microbial sampling and analysis

The costs to the EA are identical to Scenario 1A.

At a subsequent stage, the EA may consider further statistical analysis of the compliance dataset to identify additional *excellent* BWs with extremely low risk of a change in status associated with a reduction in the sampling frequency. This risk may be reduced at selected BWs by a programme of measures in Scenario 2. For such BWs, a reduction in compliance monitoring cost, to the EA, could be effected. This cost has not been calculated.

Reporting requirements for Scenario 2

As Scenario 1A.

Achieving the standards of Scenario 2

The costs to the EA are similar to Scenario 1A, noting that the cost has not been calculated.

6.5 Does enforcement comply with Hampton principles?

As Scenario 1A.

6.6 Will implementation go beyond minimum EU requirements?

Scenario 2, as described in Section 1, goes beyond the minimum requirements of the rBWD.

6.7 What is the value of the proposed offsetting measure per year?

As Scenario 1A.

6.8 What is the value of changes in greenhouse gas emissions?

The basis of estimating greenhouse gas emission is presented in Scenario 1A (Section 6.8). An additional 2 medium-sized (20,000-200,000pe) WwTW with tertiary treatment (assumed as UV irradiation) have been identified in the PoMs for Scenario 2. An experience-based indicative carbon footprint for UV irradiation at 13 medium-sized WwTW (greater than 20,000pe) has been provided by Dwr Cymru Welsh Water. Assuming an average 100kW installed UV capacity and continuous operation, a UV system at a medium-sized WwTW has an average carbon footprint of 300 tonnes CO_2/year. Based on a worst case of UV irradiation at both of the WwTW identified in Annex B for the Scenario 2 PoMs, the annual increase in greenhouse gas emissions for Scenario 2 is estimated as 600 tonnes CO_2/year.

6.9 Will the proposal have a significant impact on competition?

As Scenario 1A.

6.10 Annual cost per organisation

Following the approach in Scenario 1A, the total annualised cost of the PoMs to organisations by size category is estimated as: micro £4.38M; small (excluding micro) £4.15M; medium £zero; large £6.54M. Within the bands of uncertainty of this IA it is difficult to separate these costs per organisation affected, as the number of organisations involved is not known with any level of confidence.

From the geographic coverage presented in Section 6.1, it is estimated that asset improvements would be borne evenly by seven Water Companies. The best estimate total annualised cost to Water Companies of £6.45M equates to an average annualised cost of £0.92M per Water Company.

Costs per farm are assumed to be as presented for Scenario 1A, an average annualised cost of £1,200 per farm, noting the uncertainties in the estimate.

6.11 Are any of these organisations exempt?

As Scenario 1A.

6.12 Impact on administrative burdens baseline

As Scenario 1A.

Specific Impact Tests

Below is a list of the other specific impact tests considered in this IA.

Type of testing undertaken	Results in Evidence Base?	Results annexed?
Competition Assessment	Yes [1]	No
Small Firms Impact Test	Yes [2]	No
Legal Aid	No	Yes [3]
Sustainable Development	No	Yes [3]
Carbon Assessment	Yes [4]	No
Other Environment	No	Yes [3]
Health Impact Assessment	Yes [5]	No
Race Equality	No	Yes [3]
Disability Equality	No	Yes [3]
Gender Equality	No	Yes [3]
Human Rights	No	Yes [3]
Rural Proofing	No	Yes [3]

Footnotes:

1. Competition assessment included in Section 6.9 of the Evidence Base for each of Scenarios 1A, 1B and 2.
2. Small firms impact test included in Section 6.10 of the Evidence Base for each of Scenarios 1A, 1B and 2.
3. This test does not impact on the cost-benefit analysis. Further discussion has been included in Annex E.
4. Carbon assessment included in Section 6.8 of the Evidence Base for each of Scenarios 1A, 1B and 2.
5. Health impact assessment included in Section 3.1 of the Evidence Base for each of Scenarios 1A, 1B and 2. The primary objective of the rBWD is a reduction in the risk to public health associated with bathing.

Annex
of supporting investigations

Annex A: Microbial Water Quality Risk

Available data were interpreted (in Annex A) to identify the nature and scale of faecal pollution risk at each BW. Different water quality improvement measures are available, depending on the nature of the faecal pollution risk, to deliver improvements in BW quality. It is, therefore, important to distinguish between risk to BW quality from intermittent pollution sources (characterised in the microbial water quality monitoring data by occasional peaks of reduced BW quality) and from continuous pollution sources (characterised in the microbial water quality monitoring data by a constant high baseload of reduced BW quality). These data were also interpreted to identify the scale of the faecal pollution risk at each BW.

The range of faecal pollution risk reduction measures available at each BW were identified (see Annex B). From these, the BW-specific range of measures appropriate to each Scenario were selected:

- Scenario 1A was intended to improve BW quality at *poor* and high risk *sufficient* BWs. From the understanding of the nature and scale of faecal pollution at each Scenario 1A BW, an appropriate BW-specific range of measures were selected for the costed PoMs. At each BW the selection was specific to achieve the BW quality improvements required to meet the objectives of Scenario 1A. More (appropriate) measures were included in the PoMs where a more significant faecal pollution problem had been identified at a BW.
- Scenario 2 was intended to improve BW quality at low risk *good* and selected high risk *excellent* BWs in addition to the BWs targeted in Scenario 1A. From the understanding of the nature and scale of faecal pollution at each Scenario 2 BW, an appropriate BW-specific range of measures were selected for the costed PoMs. At each BW the selection was specific to achieve the BW quality improvements required to meet the objectives of Scenario 2. Again, more (appropriate) measures were included in the PoMs where a more significant faecal pollution problem had been identified at a BW.

EA Risk Categorisation

The EA had undertaken predictive work through re-interpretation of microbial water quality data collected for the cBWD for the 2003–2006 bathing seasons. This predictive work ranked all BWs in England & Wales according to their risk of failing to meet each of the rBWD standards (*excellent*, *good* and *sufficient*). The analysis was undertaken separately for FC and FS, with the categorisation based on the poorer of the two indicators.

This risk-based statistical approach includes a number of limitations which the reader should be aware:

- Monitoring data for the 2003-2006 bathing seasons is representative of microbial water quality under the range of meteorological conditions local to each BW during 2003-

2006. In particular, the frequency and duration of storm events during 2003-2006, and the pattern of storm derived faecal pollution, are not necessarily representative of the long-term record and therefore the full range of meteorological-derived risks at each BW.

- Monitoring data for the 2003-2006 bathing seasons is representative of microbial water quality under the range of faecal pollution sources present during those years. No allowance was made for the investment in faecal pollution reduction during the 2003-2006 period which potentially influences the BW quality in future years and may reduce the validity of the indicative dataset for 2015. Deterioration in assets, and new pollution sources (e.g. additional cross-connections) may also reduce the validity of the indicative dataset for 2015.

Those BWs assessed as having a greater than 25% probability of failing to achieve the *sufficient* classification were identified for Scenario 1A. Of these, 33 BWs in England and 1 BW in Wales were predicted to be classified as *poor* under the rBWD. A further 19 BWs in England and 3 BWs in Wales were predicted to be classified as *sufficient* under the rBWD, and are termed high risk *sufficient*. These BWs are listed in Table A1, ranked by decreasing BW quality, and an indicative PoMs from which to develop costs and benefits has been included in Annex B for each of these BWs.

Those BWs assessed as having a less than 10% chance of failing to achieve the *good* standard, that is to say are consistently achieving the *good* standard, are termed low risk *good* BWs. There are 60 low risk *good* BWs in England and 8 in Wales. A further 3 BWs in Wales with a greater than 10% chance of failing to achieve the *good* standard were included in Scenario 2 by WAG. In addition, those BWs categorised as *excellent* but assessed as having a greater than 25% probability of failing to achieve the *excellent* classification were identified as high risk *excellent* BWs. There are 6 high risk *excellent* BWs in England and 2 in Wales which currently hold Blue Flag status, and these have been identified for Scenario 2, together with 1 additional BW in Wales identified by WAG. These BWs are listed in Table A2, ranked by decreasing BW quality, and an indicative PoMs from which to develop costs and benefits has been included in Annex B for each of these BWs.

Microbial Water Quality Data Interpretation

The microbial water quality data collected for the cBWD for the 2003–2006 bathing seasons was re-interpreted to develop an understanding of the nature and magnitude of improvement measures appropriate to Scenario 1A (1B) and Scenario 2 BWs. This re-interpretation specifically addressed the faecal water quality problems at each BW with compliance against the rBWD targets:

- The nature and magnitude of improvement measures in Table A1 are specific to improvements to meet the requirements of Scenario 1A, the minimum BW quality improvements under the rBWD.
- The nature and magnitude of improvement measures in Table A3 are specific to improvements to meet the requirements of Scenario 2, which addressed the minimum BW quality improvements under the rBWD and improvements in low risk *good* and selected high risk *excellent* BWs.

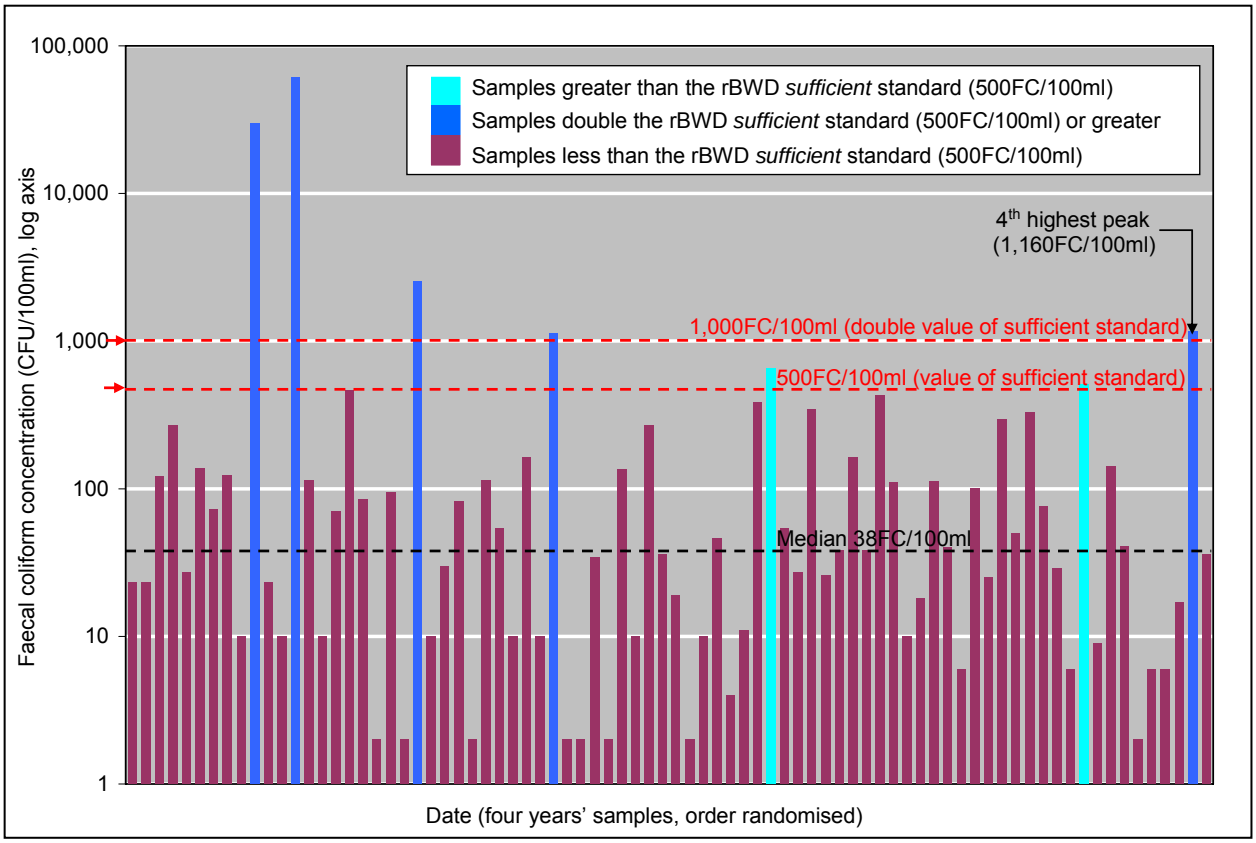
This work focused on identifying the number, frequency and magnitude of peaks in faecal pollution and the typical baseload or background level. The interpretation was restricted to the use of faecal indicator sampling data and did not include time series analysis to match, for example, tidal condition, meteorological influence, WwTW discharge quality, CSO spills; or BW-specific factors, for example, nearshore circulation pattern, riverine influence, urban extent or local topography. Investigation of these factors would be required through detailed modelling exercises to develop an understanding of the controls on faecal pollution at specific BWs and the benefit associated with specific reduction measures.

Analysis of the number, frequency and magnitude of peaks in faecal pollution at a BW provided an understanding of the influence of intermittent sources. Following a review of suitable measures, the following summary values were calculated for the analysis:

- Proportion of samples greater than the rBWD standard - each contributing to statistical compliance with the rBWD standard
- Proportion of samples double the rBWD standard or greater - an indication of the number and frequency of large pollution incidents
- 4^{th} highest peak - equivalent to the largest peak on an annual average basis

Each of these values is presented for Scenario 1A BWs in Table A1 using the FC/ *E.coli sufficient* standard of 500 CFU/100ml and the FS/IE *sufficient* standard of 185 CFU/100ml for coastal BWs. For illustrative purposes, 2003-2006 data for Haverigg have been annotated in Figure A1. For additional Scenario 2 BWs (see Table A2) values are presented using the FC/ *E.coli excellent* standard of 250 CFU/100ml and the FS/IE *excellent* standard of 100 CFU/100ml for coastal BWs (inland standards used where appropriate). For additional Scenario 2 BWs microbial water quality is better and the measure of large pollution incidents was selected as the proportion of samples 50% or more greater than the rBWD standard.

Figure A1 **Illustration of faecal coliform data interpretation 2003-2006 for Haverigg, categorised as *poor* using the rBWD standards**



Analysis of the typical baseload or background level of faecal contamination provided an indication of the influence of continuous sources. Following a review of suitable measures, the median was calculated for the analysis (see Tables A1 and A2).

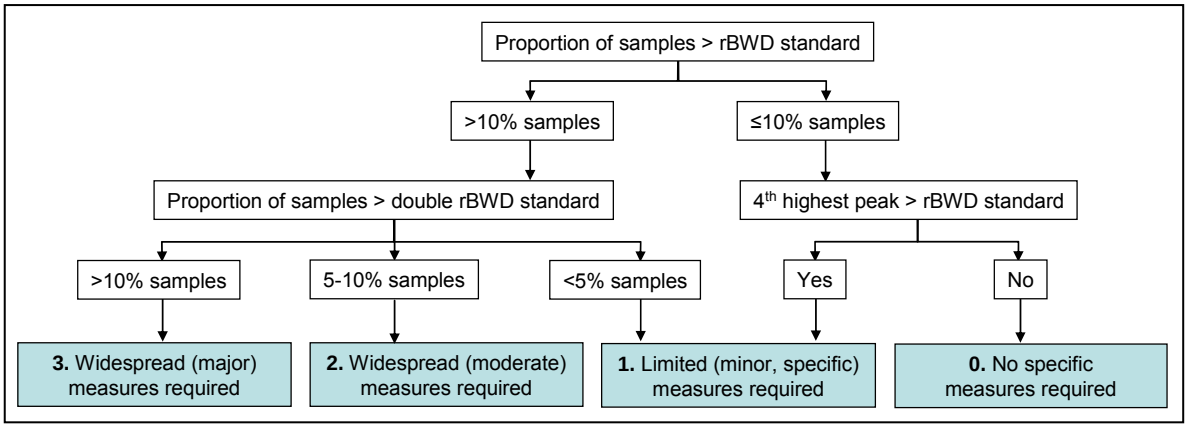
Faecal Pollution Source Categorisation

The microbial water quality data interpretation described above was used to define a microbial pollution source categorisation. The categorisation separates risk associated with continuous pollution sources from risk associated with intermittent pollution sources. FC and FS were categorised separately and then combined to an overall source categorisation, used to develop the PoMs in Annex B.

For continuous pollution sources, the categorisation was based on the median as a proportion of the rBWD standard, as outlined below:

Source categorisation	**Scenario 1A (using the *sufficient* rBWD standard for coastal BWs)**		**Scenario 2 (using the *excellent* rBWD standard for coastal BWs)**	
	FC	**FS**	**FC**	**FS**
rBWD Standard	500 CFU/100ml	185 CFU/100ml	250 CFU/100ml	100 CFU/100ml
3 Widespread (major) measures required	Median >250 CFU/100ml	Median >92 CFU/100ml	Median >125 CFU/100ml	Median >50 CFU/100ml
2 Limited (moderate) measures required	Median 125-250 CFU/100ml	Median 46-92 CFU/100ml	Median 62-125 CFU/100ml	Median 25-50 CFU/100ml
0 No specific measures required	Median <125 CFU/100ml	Median <46 CFU/100ml	Median <62 CFU/100ml	Median >25 CFU/100ml

For intermittent pollution sources, the categorisation followed a stepwise methodology, as outlined below:



For the Haverigg example illustrated above, the FC source categorisation was 0 (no specific measures) for continuous pollution sources, with a median of 38FC/100ml lower than 25% of the coastal BW *sufficient* standard. For intermittent pollution sources the FC categorisation was 1 (limited measures required): 9% samples (7 samples out of 80) greater than the coastal BW *sufficient* standard and a 4th highest peak of 1,160FC/100ml, above the standard. For FS (see Table A1) the continuous sources were again categorised as 0 and the intermittent source categorised as 1. Therefore, for Haverigg the overall source categorisation was 0 (no specific measures) for continuous pollution sources and 1 (limited measures required) for intermittent pollution sources.

At several BWs there was discrepancy between the FC and FS source categorisation. In these cases the higher categorisation was listed as the overall categorisation. For clarity, where there was two or more classes difference (e.g. 1 for FC and 3 for FS) the overall categorisation was qualified through use of a question mark (e.g. 3?).

Table A1 EA risk categorisation, data interpretation and source categorisation for Scenario 1A BWs

Bathing Water	WFD River Basin District	EA rBWD risk assessment			Faecal coliform						Faecal streptococci						Overall	
					Data interpretation				Source categorisation		Data interpretation				Source categorisation		Source categorisation	
		Percentage probability of failing the sufficient standard	Determinand most at risk	EA risk categorisation	Percentage of samples greater than the *sufficient* standard	Percentage of samples double the *sufficient* standard or greater	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Percentage of samples greater than the *sufficient* standard	Percentage of samples double the *sufficient* standard or greater	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Continuous	Intermittent
East Looe	South West	26	FS	High risk sufficient	5	4	1.6	2.9	0	1	6	4	1.2	2.4	0	1	0	1
Fleetwood	North West	26	FS	High risk sufficient	10	1	1.7	2.9	0	1	8	5	1.4	2.6	0	1	0	1
Redcar Coatham	Northumbria	28	FS	High risk sufficient	3	0	1.0	2.3	0	0	10	6	1.0	2.8	0	1	0	1?
Llangrannog	Western Wales	28	FS	High risk sufficient	5	5	1.5	3.3	0	1	8	5	1.2	2.9	0	1	0	1
Jacksons Bay Barry	Western Wales	29	FS	High risk sufficient	4	3	1.5	2.6	0	0	9	5	1.3	2.6	0	1	0	1?
Blackpool South	North West	34	FC	High risk sufficient	8	5	1.8	3.0	0	1	4	1	1.3	2.3	0	1	0	1
Morecambe North	North West	35	FC	High risk sufficient	10	5	1.7	3.2	0	1	8	3	1.3	2.4	0	1	0	1
Ladram Bay	South West	36	FS	High risk sufficient	5	1	1.7	2.7	0	1	8	5	1.5	2.6	0	1	0	1
Hunstanton Main Beach	Anglian	38	FS	High risk sufficient	5	1	1.6	2.8	0	1	9	3	1.4	2.5	0	1	0	1
St Anne's North	North West	38	FC	High risk sufficient	10	3	1.7	2.9	0	1	5	5	1.2	2.6	0	1	0	1
Aberdyfi	Western Wales	40	FC	High risk sufficient	13	5	1.4	3.0	0	1	8	4	0.9	2.4	0	1	0	1
Littlestone	South East	40	FS	High risk sufficient	8	1	1.6	2.9	0	1	10	5	1.0	2.8	0	1	0	1
Southport	North West	40	FC	High risk sufficient	9	4	1.7	3.0	0	1	4	1	1.0	2.1	0	0	0	1?
Aldingham	North West	41	FS	High risk sufficient	8	1	1.6	2.9	0	1	8	6	1.2	2.8	0	1	0	1
Torre Abbey	South West	46	FS	High risk sufficient	10	6	1.2	3.2	0	1	10	9	1.3	2.7	0	1	0	1
Blackpool North	North West	46	FC	High risk sufficient	9	4	1.9	2.9	0	1	9	3	1.5	2.4	0	1	0	1
Silloth	Solway Tweed	46	FC	High risk sufficient	11	8	1.7	3.1	0	2	3	1	1.0	2.2	0	1	0	2?
Instow	South West	47	FS	High risk sufficient	14	8	1.5	3.3	0	2	13	8	1.3	2.9	0	2	0	2
Wilsthorpe	Humber	47	FS	High risk sufficient	3	1	1.5	2.2	0	0	8	4	1.5	2.5	0	1	0	1?
Allonby South	North West	48	FS	High risk sufficient	3	3	1.7	2.6	0	0	10	5	1.2	2.7	0	1	0	1?
Hunstanton Beach	Anglian	48	FS	High risk sufficient	3	3	1.6	2.6	0	0	13	7	1.4	2.7	0	2	0	2?
Goodrington	South West	49	FS	High risk sufficient	4	3	1.4	2.7	0	0	11	4	1.3	2.4	0	1	0	1?
Ilfracombe Hele	South West	51	FS	Poor	5	5	1.7	3.2	0	1	9	5	1.3	2.7	0	1	0	1
Bembridge	South East	60	FS	Poor	8	6	1.0	3.1	0	1	10	9	1.0	3.2	0	1	0	1
Spittal	Northumbria	61	FC	Poor	10	8	1.5	3.1	0	1	6	6	1.0	2.9	0	1	0	1
Seascale	North West	65	FS	Poor	5	3	1.7	2.7	0	1	9	6	1.3	2.8	0	1	0	1
Paignton Preston Sands	South West	71	FS	Poor	5	3	1.4	2.8	0	1	9	4	1.4	2.6	0	1	0	1
Bognor Regis	South East	73	FS	Poor	5	1	1.4	2.7	0	1	15	8	1.2	2.8	0	2	0	2?
Clacton (Groyne 41)	Anglian	73	FS	Poor	8	3	2.0	2.9	0	1	10	5	1.7	2.7	0	1	0	1
Haverigg	North West	73	FC	Poor	9	6	1.6	3.1	0	1	10	6	1.0	2.9	0	1	0	1
Lyme Regis Church Beach	South West	74	FS	Poor	11	5	1.8	3.0	0	1	10	6	1.4	2.8	0	1	0	1
Roan Head	North West	76	FC	Poor	15	8	1.8	3.2	0	2	3	3	1.1	2.2	0	1	0	2?
Hollicombe	South West	77	FS	Poor	4	1	1.2	2.7	0	0	18	8	1.3	2.7	0	2	0	2?
Allonby	North West	81	FS	Poor	6	3	1.8	2.9	0	1	11	8	1.5	2.9	0	2	0	2?
Hastings	South East	82	FS	Poor	6	4	1.7	3.0	0	1	14	8	1.4	3.0	0	2	0	2?

Bathing Water	WFD River Basin District	EA rBWD risk assessment			Faecal coliform						Faecal streptococci						Overall	
					Data interpretation				Source categorisation		Data interpretation				Source categorisation		Source categorisation	
		Percentage probability of failing the sufficient standard	Determinand most at risk	EA risk categorisation	Percentage of samples greater than the *sufficient* standard	Percentage of samples double the *sufficient* standard or greater	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Percentage of samples greater than the *sufficient* standard	Percentage of samples double the *sufficient* standard or greater	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Continuous	Intermittent
Bridlington South Beach	Humber	83	FS	Poor	4	1	1.6	2.7	0	0	10	6	1.6	2.9	0	1	0	1?
Worthing	South East	84	FS	Poor	6	1	1.5	2.9	0	1	15	10	1.3	2.9	0	2	0	2?
Askam-in-Furness	North West	85	FC	Poor	18	9	1.7	3.1	0	2	11	8	1.0	2.9	0	2	0	2
Rhyl	Western Wales	88	FC	Poor	13	10	1.9	3.3	0	2	11	8	1.3	2.9	0	2	0	2
Weston Main	Severn	90	FS	Poor	5	4	1.8	2.9	0	1	9	6	1.6	2.8	0	1	0	1
Newbiggin	North West	91	FS	Poor	14	6	1.8	3.1	0	2	13	11	1.4	2.8	0	3	0	3
Blue Anchor West	South West	93	FS	Poor	5	3	1.6	2.7	0	1	14	8	1.4	3.0	0	2	0	2?
Teignmouth Town	South West	94	FS	Poor	3	0	1.2	2.4	0	0	14	10	1.6	2.7	0	2	0	2?
Heacham	Anglian	99	FS	Poor	9	3	1.7	2.9	0	1	14	9	1.4	2.8	0	2	0	2?
Burnham Jetty	South West	99	FS	Poor	9	1	2.1	2.9	0	1	16	10	1.8	2.8	2	2	2?	2?
Paignton Paignton Sands	South West	99	FS	Poor	6	1	1.7	2.8	0	1	9	6	1.9	2.9	2	1	2?	1
Flamborough North Landing	Humber	100	FC	Poor	16	8	2.1	3.3	2	2	9	5	1.6	2.6	0	1	2?	2?
Scarborough South Bay	Humber	100	FS	Poor	5	1	1.6	2.7	0	1	14	9	1.7	2.9	2	2	2?	2?
Combe Martin	South West	100	FS	Poor	10	8	1.7	3.4	0	1	13	11	1.6	2.9	0	3	0	3?
Weston-s-Mare Uphill Slipway	Severn	100	FS	Poor	8	4	2.0	3.0	0	1	22	9	1.8	2.7	2	2	2?	2?
Ilfracombe Capstone (Wildersmouth)	South West	100	FS	Poor	13	6	1.9	3.2	0	2	20	8	1.7	2.8	2	2	2?	2
Newbiggin North	Northumbria	100	FS	Poor	14	8	1.8	3.4	0	2	30	23	1.9	3.5	2	3	2?	3
Staithes	Northumbria	100	FC	Poor	40	25	2.5	4.0	3	3	51	39	2.3	3.8	3	3	3	3
Heysham Half Moon Bay	North West	100	FS	Poor	16	11	2.1	3.4	0	3	19	18	1.5	3.4	0	3	0	3
Morecambe South	North West	100	FS	Poor	23	11	2.0	3.5	0	3	29	21	1.6	3.7	0	3	0	3
Bardsea	North West	100	FS	Poor	20	11	2.0	3.1	0	3	29	19	1.7	3.1	2	3	2	3

Highlighting data interpretation contributing to a major (3) - moderate (2) source categorisation

Highlighting data interpretation contributing to a minor (1) - moderate (2) source categorisation

FC: Faecal coliforms

FS: Faecal streptococci

Table A2 EA risk categorisation, data interpretation and source categorisation for additional Scenario 2 BWs

Bathing Water	WFD River Basin District	EA rBWD risk assessment			Faecal coliform						Faecal streptococci						Overall	
					Data interpretation				Source categorisation		Data interpretation				Source categorisation		Source categorisation	
		Percentage probability of failing the good standard	Determinand most at risk	EA risk categorisation	Percentage of samples greater than the *excellent* standard	Percentage of samples 50% or more greater than the *excellent* standard	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Percentage of samples greater than the *excellent* standard	Percentage of samples 50% or more greater than the *excellent* standard	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Continuous	Intermittent
St Mary's Bay	South East	25	FS	High risk excellent	6	5	1.3	2.6	0	1	3	3	1.0	2.0	0	0	0	1?
Mundesley	Anglian	28	FS	High risk excellent	1	0	1.3	2.1	0	0	4	4	1.0	1.9	0	0	0	0
Whitby	Humber	30	FS	High risk excellent	4	4	0.9	2.0	0	0	6	6	0.8	2.1	0	1	0	1?
Westgate Bay	South East	31	FC	High risk excellent	4	3	1.3	2.3	0	0	5	5	0.9	2.1	0	1	0	1?
Whitley Bay	Northumbria	34	FS	High risk excellent	6	6	1.0	2.7	0	1	5	5	1.0	2.1	0	1	0	1
Traeth Lligwy (not Blue Flag)	Western Wales	38	FS	High risk excellent	4	3	0.9	2.4	0	0	6	6	0.6	2.4	0	1	0	1?
Tywyn	Western Wales	39	FC	High risk excellent	6	4	1.0	2.5	0	1	4	4	0.6	1.9	0	0	0	1?
Criccieth	Western Wales	42	FC	High risk excellent	6	4	1.0	2.5	0	1	4	4	0.3	2.0	0	0	0	1?
Bournemouth Fisherman's Walk	South West	42	FS	High risk excellent	1	1	1.0	2.0	0	0	6	6	1.0	2.0	0	1	0	1?
Scarborough North Bay	Humber	50	FS	High risk excellent	4	4	1.0	2.3	0	0	6	6	1.0	2.2	0	1	0	1?
Tunstall	Humber	1	FS	Low risk good	3	3	1.0	2.2	0	0	8	8	1.0	2.2	0	1	0	1?
Kingsand	South West	1	FS	Low risk good	5	5	1.0	2.6	0	1	5	5	1.0	2.1	0	1	0	1
Porthminster	South West	1	FS	Low risk good	0	0	1.0	1.9	0	0	3	3	1.0	1.9	0	0	0	0
Skegness	Anglian	1	FS	Low risk good	1	1	1.2	2.2	0	0	8	8	1.2	2.1	0	1	0	1?
Beer	South West	1	FS	Low risk good	5	3	1.2	2.5	0	1	8	8	1.0	2.2	0	1	0	1
Carbis Bay Station Beach	South West	1	FS	Low risk good	4	3	0.9	2.4	0	0	8	8	1.0	2.3	0	1	0	1?
Caister Point	Anglian	1	FS	Low risk good	3	3	0.9	2.1	0	0	8	8	0.9	2.4	0	1	0	1?
Walney West Shore	North West	1	FC	Low risk good	3	3	1.2	2.3	0	0	1	1	0.9	1.8	0	0	0	0
Pendine	Western Wales	1	FC	Low risk good	5	3	1.4	2.5	0	1	8	8	0.8	2.0	0	1	0	1
Maen Porth	South West	1	FS	Low risk good	3	0	1.1	2.3	0	0	5	5	1.0	2.1	0	1	0	1?
Lynmouth	South West	1	FS	Low risk good	5	1	1.5	2.4	0	1	5	5	1.0	2.1	0	1	0	1
Eastbourne	South East	1	FS	Low risk good	5	4	1.6	2.4	0	1	6	6	1.2	2.1	0	1	0	1
Sandgate	South East	2	FS	Low risk good	5	5	1.0	2.6	0	1	9	9	0.9	2.4	0	1	0	1
Crantock	South West	2	FS	Low risk good	6	4	1.0	2.5	0	1	9	9	0.8	2.6	0	1	0	1
Marsden	Northumbria	2	FS	Low risk good	5	3	1.0	2.4	0	1	5	5	1.0	2.2	0	1	0	1
Hornsea	Humber	2	FS	Low risk good	3	1	1.1	2.3	0	0	5	5	1.0	2.1	0	1	0	1?
Reighton	Humber	2	FS	Low risk good	6	6	0.9	2.8	0	1	5	5	0.7	2.2	0	1	0	1
Seaham Hall Beach (Remand Home)	Northumbria	2	FS	Low risk good	6	4	0.7	2.6	0	1	8	8	0.6	2.8	0	1	0	1
West Beach	South East	2	FS	Low risk good	3	0	1.0	2.2	0	0	6	6	0.8	2.1	0	1	0	1?
Robin Hoods Bay	Humber	2	FS	Low risk good	4	3	1.0	2.1	0	0	11	11	1.0	2.2	0	2	0	2?
The Towans (Godrevy)	South West	2	FS	Low risk good	3	1	0.9	2.2	0	0	5	5	0.8	2.0	0	1	0	1?
Seaton Sluice	Northumbria	2	FS	Low risk good	3	3	0.8	2.3	0	0	8	8	0.9	2.3	0	1	0	1?
Pagham	South East	3	FS	Low risk good	4	4	1.0	2.3	0	0	8	8	1.0	2.1	0	1	0	1?
Gurnard	South East	3	FS	Low risk good	4	3	0.8	2.3	0	0	8	8	0.8	2.3	0	1	0	1?

Bathing Water	WFD River Basin District	EA rBWD risk assessment			Faecal coliform						Faecal streptococci						Overall	
					Data interpretation				Source categorisation		Data interpretation				Source categorisation		Source categorisation	
		Percentage probability of failing the good standard	Determinand most at risk	EA risk categorisation	Percentage of samples greater than the *excellent* standard	Percentage of samples 50% or more greater than the *excellent* standard	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Percentage of samples greater than the *excellent* standard	Percentage of samples 50% or more greater than the *excellent* standard	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Continuous	Intermittent
Harlyn Bay	South West	3	FS	Low risk good	4	4	0.8	2.2	0	0	11	11	0.9	2.3	0	2	0	2?
West Angle	Western Wales	3	FS	Low risk good	4	4	1.0	2.3	0	0	9	9	0.9	2.1	0	1	0	1?
Leysdown	Thames	3	FS	Low risk good	4	3	1.0	2.3	0	0	9	9	1.0	2.3	0	1	0	1?
Poole Harbour Rockley Sands	South West	3	FS	Low risk good	6	1	1.6	2.5	0	1	9	9	1.1	2.2	0	1	0	1
Hampstead Heath (Mens Pond)	Thames	3	FS	Low risk good	1	1	1.6	2.3	0	0	8	8	1.2	2.8	0	1	0	1?
Camber	South East	3	FC	Low risk good	6	4	1.2	2.6	0	1	9	9	1.0	2.2	0	1	0	1
Herne Bay	South East	3	FS	Low risk good	5	4	1.1	2.5	0	1	6	6	1.0	2.1	0	1	0	1
Dunster North West	South West	3	FS	Low risk good	9	5	1.8	2.7	2	1	9	9	1.6	2.1	2	1	2	1
Felpham	South East	4	FS	Low risk good	10	8	1.0	2.7	0	1	8	8	1.0	2.3	0	1	0	1
Wells	Anglian	4	FS	Low risk good	6	3	1.2	2.5	0	1	9	9	1.0	2.2	0	1	0	1
Hope Cove	South West	4	FC	Low risk good	8	5	1.2	2.6	0	1	6	6	1.0	2.1	0	1	0	1
Westbrook Bay	South East	4	FC	Low risk good	9	5	1.2	2.6	0	1	6	6	0.9	2.2	0	1	0	1
Sidmouth Town	South West	4	FS	Low risk good	5	5	1.2	2.8	0	1	8	8	1.0	2.4	0	1	0	1
Moreton	North West	4	FS	Low risk good	3	1	1.3	2.3	0	0	9	9	1.0	2.1	0	1	0	1?
Aberystwyth South	Western Wales	4	FC	Low risk good	6	5	1.2	2.7	0	1	4	4	0.8	1.8	0	0	0	1?
Trevaunance Cove	South West	4	FS	Low risk good	5	5	1.0	2.8	0	1	6	6	0.9	2.5	0	1	0	1
Prestatyn	Western Wales	4	FC	Low risk good	6	3	1.6	2.4	0	1	4	4	1.0	2.0	0	0	0	1?
Christchurch Avon Beach	South West	4	FC	Low risk good	6	6	1.1	2.7	0	1	6	6	0.8	2.3	0	1	0	1
Bowleaze Cove	South West	4	FS	Low risk good	4	4	1.0	2.4	0	0	8	8	1.0	2.5	0	1	0	1?
Aberporth	Western Wales	4	FS	Low risk good	6	4	1.0	2.5	0	1	9	9	0.3	2.1	0	1	0	1
Mawgan Porth	South West	5	FS	Low risk good	6	5	1.0	2.7	0	1	5	5	1.0	2.3	0	1	0	1
Southwold The Denes	Anglian	5	FC	Low risk good	5	5	1.4	2.7	0	1	6	6	1.0	2.1	0	1	0	1
Druridge Bay	Northumbria	5	FS	Low risk good	5	4	0.8	2.4	0	1	9	9	0.9	2.3	0	1	0	1
Portland Harbour Castle Cove	South West	5	FS	Low risk good	6	1	1.0	2.5	0	1	11	11	0.9	2.2	0	2	0	2?
Holland	Anglian	5	FS	Low risk good	5	5	1.0	2.7	0	1	6	6	1.0	2.5	0	1	0	1
Berrow North of Unity Farm	Severn	5	FS	Low risk good	1	1	1.4	2.2	0	0	10	10	1.2	2.2	0	1	0	1?
Ramsgate Main Sands	South East	5	FS	Low risk good	3	1	1.2	2.2	0	0	9	9	1.0	2.3	0	1	0	1?
Lulworth Cove	South West	6	FS	Low risk good	6	3	1.0	2.4	0	1	8	8	1.0	2.4	0	1	0	1
Watcombe	South West	6	FS	Low risk good	8	8	1.0	2.7	0	1	10	10	0.9	2.6	0	1	0	1
Aberafan	Western Wales	6	FC	Low risk good	8	8	1.1	2.9	0	1	6	6	0.8	2.2	0	1	0	1
Tynemouth Long Sands North	Northumbria	6	FS	Low risk good	0	0	1.0	2.2	0	0	8	8	1.1	2.1	0	1	0	1?
Silecroft	North West	6	FC	Low risk good	8	6	1.1	3.1	0	1	10	10	1.0	2.2	0	1	0	1
Mounts Bay Heliport	South West	6	FS	Low risk good	8	5	0.9	2.7	0	1	8	8	1.0	2.6	0	1	0	1
Penmaenmawr	Western Wales	7	FS	Low risk good	8	8	1.0	2.9	0	1	9	9	0.8	2.2	0	1	0	1
Redcar Stray	Northumbria	7	FS	Low risk good	5	4	1.0	2.5	0	1	9	9	1.0	2.4	0	1	0	1
Formby	North West	8	FC	Low risk good	8	4	1.5	2.5	0	1	5	5	1.0	2.0	0	1	0	1

Bathing Water	WFD River Basin District	EA rBWD risk assessment			Faecal coliform						Faecal streptococci						Overall	
					Data interpretation				Source categorisation		Data interpretation				Source categorisation		Source categorisation	
		Percentage probability of failing the good standard	Determinand most at risk	EA risk categorisation	Percentage of samples greater than the *excellent* standard	Percentage of samples 50% or more greater than the *excellent* standard	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Percentage of samples greater than the *excellent* standard	Percentage of samples 50% or more greater than the *excellent* standard	Median (log10)	4th highest peak (log10)	Continuous	Intermittent	Continuous	Intermittent
Whitmore Bay Barry	Western Wales	8	FS	Low risk good	8	3	1.4	2.5	0	1	9	9	1.0	2.3	0	1	0	1
Great Yarmouth Pier	Anglian	8	FS	Low risk good	6	3	1.0	2.5	0	1	10	10	1.0	2.6	0	1	0	1
Southend Westcliff Bay	Anglian	8	FS	Low risk good	8	3	1.3	2.5	0	1	6	6	1.0	2.3	0	1	0	1
Towan	South West	9	FS	Low risk good	3	1	1.1	2.3	0	0	10	10	1.0	2.2	0	1	0	1?
Barmston	Humber	9	FS	Low risk good	4	1	1.2	2.3	0	0	9	9	1.0	2.2	0	1	0	1?
Shaldon	South West	9	FS	Low risk good	1	1	1.3	2.3	0	0	9	9	1.3	2.1	0	1	0	1?
South Shields	Northumbria	10	FS	Low risk good	5	4	1.0	2.4	0	1	9	9	1.0	2.2	0	1	0	1
Llandanwg	Western Wales	11	FC	Good (medium risk)	8	5	1.2	2.7	0	1	5	5	0.3	2.1	0	1	0	1
Kinmel Bay (Sandy Cove)	Western Wales	19	FC	Good (medium risk)	9	5	1.3	2.7	0	1	6	6	0.9	2.4	0	1	0	1
Llandudno West Shore	Western Wales	32	FC	Good (medium risk)	9	6	1.2	2.7	0	1	9	9	1.0	2.1	0	1	0	1

For grey coloured BW the probability is failing the excellent standard
Hampstead Heath (Mens Pond) is an inland BW

Highlighting data interpretation contributing to a major (3) - moderate (2) source categorisation
Highlighting data interpretation contributing to a minor (1) - moderate (2) source categorisation

FC: Faecal coliforms
FS: Faecal streptococci

Annex B: Programme of Measures to Reduce Faecal Pollution

For Scenario 1A and 1B EA (2006)[24] source apportionment work identified potentially suitable measures, at each BW, which may reduce the risk to microbial water quality from contributing sources, with differentiation between:

- Water Company Discharges:
  - WwTW (continuous/ baseload)
  - CSO (intermittent/ peaks)
- Other Point Source Discharges (continuous/ baseload):
  - Private WwTWs
  - Septic Tanks
  - Caravan Parks
- Urban Sources:
  - Mis and cross connections (continuous/ baseload)
  - Run-off (intermittent/ peaks)
  - Contaminated surface water sewers (continuous/ baseload; intermittent/ peaks)
- Agriculture (intermittent/ peaks):
  - Dairy
  - Pigs
  - Livestock general
  - Arable
  - Rough grazing
- Undefined (continuous/ baseload; intermittent/ peaks)
- Animal / bird source (continuous/ baseload; intermittent/ peaks).

A qualitative contribution scale (high/medium/low) and the confidence in the assessment (high/medium/low) was also provided by the EA. These potential measures, specific to each BW, are presented as the entries in Table B1. Supplementary notes are included in Table B2. Measures included in AMP4, to continue to comply with the requirements of the current BWD, have been highlighted in green in Table B1 and the costs were not included in the PoMs.

The faecal pollution source categorisation presented in Annex A was used to select appropriate measures from the potentially suitable measures, depending on the nature (continuous/ baseload; intermittent/ peaks) and scale (0-3) of the risk. This selective approach ensured that the number and scale of measures fitted the scale of the improvement needed to reduce the risk of failure of the *sufficient* categorisation, with more measures selected for *poor* category BWs. The cost of implementing a measure and the uncertainty of delivery of the benefit was also used in this qualified judgement. Selected component measures of the Scenario 1A PoMs are highlighted in blue in Table B1. Potentially suitable measures not selected for the PoMs are without highlighting.

For example, Hunstanton Main Beach (a high risk sufficient BW) was identified (see Table A1) as having a negligible contribution from continuous sources (0) and minor contribution from intermittent sources (1) (ie only minor measures would be required to improve to the

[24] Environment Agency (2006) Semi-quantitative assessment of pollution source inputs to Bathing Waters predicted to be classified as poor and sufficient

standard required of Scenario 1A). The EA identified a range of sources of faecal pollution at this BW:

- medium contribution from WwTW (but this has been included in AMP4 already) and CSOs
- high contribution from other point source discharges (but these are considered as continuous sources (which Table A1 identifies as not priority) so omitted from the Scenario 1A PoMs)
- low contribution from mis-and cross connections and contaminated surface water sewers
- medium contribution from animal/ bird sources.

Noting the relative contribution, cost and effectiveness of the identified measures to reduce the intermittent sources of pollution, together with the extent of improvement required, only CSO improvements were selected for the PoMs.

Table B1 Scenario 1A: Programme of measures

Bathing Water	Water Company Discharges				Other Point Source Discharges					Urban Sources					Agriculture							Undefined		Animal / Bird source	
	WwTW	CSO	Contribution	Confidence	Private WwTWs	Septic Tanks	Caravan Parks	Contribution	Confidence	Mis and cross connections	Run-off	Cont'd surface water sewers	Contribution	Confidence	Dairy	Pigs	Livestock general	Arable	Rough grazing	Contribution	Confidence	Contribution	Confidence	Contribution	Confidence
East Looe	x	✓	H	H						✓	✓	✓	M	L			✓			M	L				
Fleetwood		✓	H	H	?	?	?	L	H	?	?	?	M	L					✓	L	L			M	L
Redcar Coatham																						H	M		
Llangrannog	x		L	H	✓	✓		H	H								✓			M	H				
Jacksons Bay Barry		✓	H	H				L					L				✓			M	L			M	
Blackpool South	✓	✓	H	H						?	?	?	L	M					✓	M	M			H	H
Morecambe North	✓	✓	M	H						?	?	?	H	M					✓	L	L			H	L
Ladram Bay	x	✓	L	M							✓		L/M	H			✓			L/M	H			H	H
Hunstanton Main Beach	x	✓	M	L	?	?	?	H	H	✓		✓	L	M										M	M
St Anne's North	✓	✓	H	H						?	?	?	M	M					✓	M	M			M	L
Aberdyfi		✓	M	H			✓	L	M		✓		M	L					✓	H	H	L	L	M	L
Littlestone	✓		M	H	✓			M	L										·			M	L		
Southport	✓	✓	H	H						?	?	?	M	M					✓	M	M			M	L
Aldingham	✓	✓	L	H	✓	✓		M	M										✓	L	M			M	L
Torre Abbey		✓	L/M	M						✓	✓	✓	M/H	M											
Blackpool North	✓	✓	H	H						?	?	?	L	M										H	H
Silloth		✓	L	H						?	?	?	M	L					✓	M	L			M	L
Instow		✓	L/M	H							✓	✓	L	L			✓			M/H	H				
Wilsthorpe	✓	✓	M	M																		M	M		
Allonby South		✓	H	H			✓	L	H										✓	M	L			L	L
Hunstanton Beach	x	✓	M	L	?	?	?	H	H	✓		✓	L	M										M	M
Goodrington		✓	L/M	M						✓	✓	✓	H	M											
Ilfracombe Hele		✓	L/M	H													✓			H	H				
Bembridge		✓	M	L																		H	L		
Spittal	✓	✓	M	M						✓	✓	✓	M	L	✓	✓	✓	✓	✓	M	L				
Seascale	✓	✓	M	L	✓			L	H	?	?	?	L	L			✓			M	L			L	L
Paignton Preston Sands		✓	L/M	M						✓	✓	✓	M/H	M											
Bognor Regis		✓	L	M								✓	H	H											
Clacton (Groyne 41)	✓	✓	M	L	?	?	?	M	L			✓	L	L											
Haverigg	✓	✓	H	M	✓	✓		L	M	?	?	?	L	L			✓			M	L			M	L
Lyme Regis Church Beach	x	✓	M	H						x	✓	x	H	H			✓			L	M				
Roan Head	✓	✓	H	M	✓	✓		L	M								✓			M	L			M	L
Hollicombe		✓	L/M	M						✓	✓	✓	M/H	M											
Allonby		✓	H	H			✓	L	H								✓			M	L			L	L
Hastings		✓	M	M								✓	M	L								L	L		
Bridlington South Beach	x	✓	H	M																					
Worthing											✓	✓	H	H											
Askam-in-Furness	✓	✓	H	M	✓	✓		L	M	?	?	?	L	L			✓			M	L			M	L
Rhyl	x	✓	M	L				L		✓		✓	M	M	✓					M	H				
Weston Main	x	✓	M	M						✓	✓	✓	M/H	H			✓			L/M	M				
Newbiggin	✓	✓	H	M	✓	✓		L	M	?	?	?	L	L			✓			M	L			M	L
Blue Anchor West		✓	M	M												✓	✓			M/H	H				
Teignmouth Town		✓	L	M						✓	✓		L	L								?	?	M	L
Heacham	x	✓	M	L	?	?	?	H	H	✓		✓	L	M										M	M
Burnham Jetty	x	✓	M	M							✓	✓	M	M			✓			M	M				
Paignton Paignton Sands		✓	L/M	M						✓	✓	✓	H	M											
Flamborough North Landing		·													✓	✓	✓	✓	✓	L	L			L	L
Scarborough South Bay		✓	L	L	✓	✓	✓	L	L	✓	✓	✓	L	L								H	H	L	L
Combe Martin	x	✓	M	H						✓	✓	✓	H	H			✓			H	H				
Weston-s-Mare Uphill Slipway	x	✓	M	M						✓	✓	✓	M/H	H			✓			L/M	M				
Ilfracombe Capstone (Wildersmouth)	x	✓	L	H						✓	✓	✓	H	H			✓			M	H				
Newbiggin North		✓	H	M																					
Staithes		✓	M	M						✓		✓	L	L			✓			H	H	M	M		
Heysham Half Moon Bay	✓	✓	H	H	?	?	?	L	M	?	?	?	H	L			✓			L	L			M	L
Morecambe South	✓	✓	H	H	?	?	?	L	M	?	?	?	H	L			✓			L	L			M	L
Bardsea	✓	✓	M	H	?	?	?	H	M	?	?	?	M	L			✓			M	L			H	L

✓ Identified by EA				
? Suggested by EA				
	x	Identified by EA but already funded through AMP4 or considered to be effected through CAP reform	H	High
	✓ ?	Included in programme of measures	M	Medium
	✓ ?	Not included in programme of measures	L	Low

Table B2 Scenario 1A: Supplementary notes

Bathing Water	Comments (main sources identified)
East Looe	• CSOs (in Looe, saline infiltration of sewers) • Diffuse urban (into East Looe River and Looe estuary) • Diffuse agricultural inputs (into East Looe River ~4,800ha). West Looe River ~4,500ha.
Fleetwood	• 3WwTWs: (Fleetwood) pe 250,265, currently to secondary treatment; (Garstang) 13,019, currently to secondary treatment; (Morecambe) pe 33,126, currently to tertiary treatment but required reductions not being made (Morecambe WwTW also under Morecambe Bay North & South) • 34 CSOs (4 designed to 3spbs) • Subject to studies being undertaken
Redcar Coatham	• Requires further investigation • Discharges to the Tidal River Tees (enters the sea just North of the Bathing Water not been quantified)
Llangrannog	• High Confidence in table entries (MSc projects (2005)) • Other point sources (unsatisfactory drainage from private systems serving numerous rural properties)
Jacksons Bay Barry	• High Confidence in table entries (Investigations / improvements underway in Barry East Catchment progressed under AMP process). R. Cadoxton ~3,870ha.
Blackpool South	• 7 WwTWs : (Croston) pe 21,061, currently secondary treatment; (Longton) pe 13,842, currently secondary treatment; (Walton le Dale) pe 48,957, currently secondary treatment; (Blackburn) pe 120,592 currently secondary treatment; (Chorley) pe 47,243, currently secondary treatment; (Leyland) pe 42,112, currently secondary treatment; (Mere Brow) pe 3928, currently secondary treatment (also under Southport and St Annes North). • 68 CSOs (45 designed to 3spbs (AMP3 or AMP4) • Birds (starlings on pier significant) • Beach activities (Donkeys) • Uncertainty (sanitary arrangements). R. Wyre ~32,000ha. R. Ribble ~115,400ha.
Morecambe North	• WwTW (Morecambe) pe 33,126, currently to tertiary treatment but required reductions not being made • 13 CSOs (4 designed to 3spbs (4 (2 designed to 3 spbs) also under Heysham Half Moon Bay) • Subject to studies being undertaken • Beach activities (Dogs on shore)
Ladram Bay	• Birds (roosting on the cliffs and stacks in the Bay) • Caravan park • Diffuse agriculture (grazing on pasture fields surrounding Bay). R. Sid ~3900ha.
Hunstanton Main Beach	• Subject to studies being undertaken
St Anne's North	• 7 WwTWs : (Croston) pe 21,061, currently secondary treatment; (Longton) pe 13,842, currently secondary treatment; (Walton le Dale) pe 48,957, currently secondary treatment; (Blackburn) pe 120,592 currently secondary treatment; (Chorley) pe 47,243, currently secondary treatment; (Leyland) pe 42,112, currently secondary treatment; (Mere Brow) pe 3928, currently secondary treatment (also under Blackpool South and Southport). • 64 CSOs (45 designed to 3spbs (AMP3 or AMP4) (also under Blackpool South and Southport) • Diffuse agricultural (grazing on saltmarsh (high spring tides only)). R. Ribble ~115,400ha. R. Wyre ~317,90ha
Aberdyfi	• High Confidence in table entries (due to evidence of pumping station failure) • Pumping station failure
Littlestone	• 1 WwTw (with UV, but in close proximity, via drainage ditch directly to beach) • Septic Tanks (via drainage ditch) • Diffuse urban inputs (via ditch) • High turbilty (low die-off rates)
Southport	• 7 WwTWs : (Croston) pe 21,061, currently secondary treatment; (Longton) pe 13,842, currently secondary treatment; (Walton le Dale) pe 48,957, currently secondary treatment; (Blackburn) pe 120,592 currently secondary treatment; (Chorley) pe 47,243, currently secondary treatment; (Leyland) pe 42,112, currently secondary treatment; (Mere Brow) pe 3,928, currently secondary treatment (also under Blackpool South and St Annes North). • 61 CSOs (45 designed to 3spbs (AMP3 or AMP4) (also under Blackpool South and St Annes North) • Diffuse agricultural (Grazing on saltmarsh (high spring tides only)). R. Ribble ~115,400ha.
Aldingham	• 1 WwTW (Greenodd), pe 325, currently equivalent to primary (also under Bardsea and Newbiggin) • 6 CSOs (3 designed to 3spbs) (5 (also under Bardsea and Aldinham) • Subject to studies being undertaken (Autumn 2006) • Major industrial source at Ulverston (pharmaceutical)
Torre Abbey	• Diffuse urban (into Torre Abbey Stream)
Blackpool North	• 6 CSOs (also under Blackpool South) • Birds (starlings on pier significant)
Silloth	• Uncertainty. R. Duddon diffuse agricultural input ~8,800ha.
Instow	• 1 CSO (local source) • Diffuse agricultural (into Rivers Torridge and Taw)
Wilsthorpe	• 1 CSO (Brid LSO)
Allonby South	• 4 CSOs (1 designed to 3spbs (Maryport) (also under Allonby) • Diffuse agricultural (immediate area low lying grazing, dairy/beef cattle • Requires further investigation (agricultural contributions)
Hunstanton Beach	• Subject to studies being undertaken
Goodrington	• Diffuse urban (into Goodrington Stream)
Ilfracombe Hele	• Diffuse agricultural (into Hele stream ~540ha)

Bathing Water	Comments (main sources identified)
Bembridge	• Requires further investigation • 1 CSO and emergency outfall (has not discharged when high results have been recorded) • Other CSO's (within a few kms north of the bathing water, results of monitoring not conclusive of effect) • Surface water discharges (also potential sources)
Spittal	• Subject to studies being undertaken • 1 WwTW (BerwicKAS plant) pe 19,977, currently to secondary treatment • Large no. CSO's in Tweed estuary. • Subject to AMP4 investigation into causes of poor quality
Seascale	• WwTW (Braystones) pe 10,260, currently to secondary treatment • 17 CSOs (3 designed to 3spbs) • Significant impact from river discharges (Ehen, Calder and Keekle above tidal limits) • Requires further investigation (% contribution from agriculture and others sources e.g. CSOs) • Diffuse agricultural (Immediate area low lying grazing, dairy/beef cattle)
Paignton Preston Sands	• Diffuse urban (into Victoria Park Stream)
Bognor Regis	• 2 CSOs (1km (infrequent) and 2.5km (frequent) offshore) • Numerous surface water outfalls in the proximity known to have significant faecal contamination) • Diffuse urban (Aldingbourne Rife stream enters the sea via a short pumped outfall at the HW mark approx 2.5km away from the site, this has the usual contamination problems but given it's distance from the sampling site may not be hugely influential on the water quality)
Clacton (Groyne 41)	• Future studies planned • 2 WwTWs, Clacton pe 45,600 and Jaywick pe 21,400, currently to secondary treatment (AS).
Haverigg	• 3 WwTWs (Broughton) pe 824, currently to secondary treatment; (Skellow Craggs) pe 20, currently to secondary treatment; (Waingate) pe 22, currently to primary treatment (also under Roan Head and Askam-in-Furness) • 9 CSOs (4 designed to 3spbs) (also under Roan Head and Askam-in-Furness) • Subject to studies being undertaken (Autumn 2006)
Lyme Regis Church Beach	• Diffuse urban (into River Lim) • Leaking sewers
Roan Head	• 3 WwTWs (Broughton) pe 824, currently to secondary treatment; (Skellow Craggs) pe 20, currently to secondary treatment; (Waingate) pe 22, currently to primary treatment (also under Haverigg and Askam-in-Furness) • 9 CSOs (4 designed to 3spbs) (also under Haverigg and Askam-in-Furness) • Uncertainty. R. Duddon ~8,800ha. • Subject to studies being undertaken (Autumn 2006)
Hollicombe	• Diffuse urban (into Hollicombe Stream)
Allonby	• 4 CSOs (1 designed to 3spbs (Maryport) (also under Allonby south) • Diffuse agricultural (immediate area low lying grazing, dairy/beef cattle) • Requires further investigation (agricultural contributions)
Hastings	• 1 CSO (discharges in proximity, discharged 6 times in the 2005 season). • Diffuse urban (culverted stream, Alexandra Park Stream, includes surface water drainages in proximity)
Bridlington South Beach	• Subject to studies being undertaken
Worthing	• Urban diffuse (surface water discharges to top of beach (sediments/ gravels may act as a reservoir for bacteriological contamination so that impacts on bathing water quality can be prolonged. During heavy rainfall the faecal coliform concentrations in surface water are substantial) • Future studies planned (to assess benefits of highway drain gulley-pot and surface water drain cleaning. • Discounting (during wet weather will probably not enable sufficient control due to the prolonged wet weather impacts due to beach sediment/ gravels reservoir affects)
Askam-in-Furness	• 3 WwTWs (Broughton) pe 824, currently to secondary treatment; (Skellow Craggs) pe 20, currently to secondary treatment; (Waingate) pe 22, currently to primary treatment (also under Haverigg and Roan Head) • 9 CSOs (4 designed to 3spbs) (also under Haverigg and Roan Head) • Subject to studies being undertaken (Autumn 2006)
Rhyl	• WwTWs (into River Clwyd) • CSOs (into River Clwyd) • Diffuse agricultural (into River Clwyd)
Weston Main	• Diffuse urban (into Uphill Great Rhyne and the River Axe). R. Axe ~207,00ha. R. Severn ~999,700ha. • Diffuse agricultural (into Uphill Great Rhyne and the River Axe) • CSOs
Newbiggin	• 1 WwTW (Greenodd), pe 325, currently equivalent to primary (also under Bardsea and Aldinham) • 6 CSOs (3 designed to 3spbs) (5 also under Bardsea and Aldinham) • Subject to studies being undertaken (Autumn 2006)
Blue Anchor West	• Diffuse agricultural (into Pill River)
Teignmouth Town	• 1 CSO • Birds (Roosting on Pier)
Heacham	• Subject to studies (some evidence of minor discharges, incidents of poor practice and surface water sewers flowing to ditch connect to river Heacham)
Burnham Jetty	• Diffuse urban (into various streams and rivers entering the Parrett Estuary ~147,600ha). • Diffuse agricultural (into various streams and rivers entering the Parrett Estuary) • CSOs
Paignton Paignton Sands	• Diffuse urban (into Kirkham Stream)

Bathing Water	Comments (main sources identified)
Flamborough North Landing	• Subject to studies being undertaken. Stream ~350ha.
Scarborough South Bay	• Subject to studies being undertaken
Combe Martin	• Diffuse urban (into River Umber and Furze Park Stream) • Diffuse agricultural (into River Umber and Furze Park Stream) • CSOs
Weston-s-Mare Uphill Slipway	• Diffuse urban (into Uphill Great Rhyne and the River Axe). R. Axe ~207,00ha. R. Severn ~999,700ha. • Diffuse agricultural (into Uphill Great Rhyne and the River Axe) • CSOs
Ilfracombe Capstone (Wildersmouth)	• Diffuse urban (into East and West Wilder Brooks) • Diffuse agricultural (into East and West Wilder Brooks)
Newbiggin North	• Subject to studies being undertaken
Staithes	• Subject to studies being undertaken
Heysham Half Moon Bay	• 3 WwTWs: (Halton West) pe 1920, currently to secondary treatment; (Middleton/Overton) pe 1554, currently to secondary treatment;(Morecambe) pe 33,126, currently to tertiary treatment but required reductions not being made • 30 CSOs (13 designed to 3spbs) • Subject to studies being undertaken (Autumn 2006) • Dog walkers on shore
Morecambe South	• WwTW (Morecambe pe 33,126, currently to tertiary treatment but required reductions not being made (also under Morecambe Bay North) • 33 CSOs (13 designed to 3spbs) (30 also under Heysham Half Moon Bay) • Subject to studies being undertaken (Autumn 2006) • Beach activities (Dog walkers on shore)
Bardsea	• 5 WwTWs (Arrad Foot) pe 35, assume equal to primary; (Haverthwaite) pe 921 currently to secondary treatment; (Cark) pe 517, assume equal to primary; (Ravenstown) pe 1729, currently to secondary treatment; WwTW (Greenodd), pe 325, currently equivalent to primary (Greenodd also under Aldinham and Newbiggin) • 11 CSOs (4 designed to 3spbs) (5 (3 designed to 3spbs) also under Aldinham and Newbiggin) • Subject to studies being undertaken (Autumn 2006) • Major industrial source at Ulverston (pharmaceutical) • Beach activities (Dog walkers/Horses on shore)

EA (2006) source apportionment work did not identify potential measures at low risk *good* BWs and high risk *excellent* BWs in Scenario 2. Until such data are available, BW-specific qualitative assessments of pressures undertaken for the previous pRIA (Cascade Consulting, 2002) have been used, but updated through review of investments made in AMP4. As these BW are of improved quality, it was more difficult to identify the most effective options within a PoMs to achieve the objectives of Scenario 2.

The indicative Scenario 2 PoMs is presented in Table B3. Supplementary notes are included in Table B4. This report was revised using data provided by Ofwat on improvements to water company assets funded through PR04, highlighted in green in Table B3 and the costs were not included in the PoMs. A contribution scale (high/medium) was overlaid from workings of the Cascade Consulting (2002) report to provide consistency with EA (2006) source apportionment work.

As with Scenario A1 above, the faecal pollution source categorisation presented in Annex A was used to select appropriate measures from the potentially suitable measures, depending on the nature (continuous or intermittent) and scale (0-3) of the risk. Selected component measures of the Scenario 2 PoMs are highlighted in blue in Table B3, with moderate agricultural improvements highlighted orange. Potentially suitable measures not selected for the PoMs are without highlighting.

Table B3 Scenario 2: Programme of Measures

Bathing Water	Water Company Discharges		Other Point Source Discharges			Urban Sources			Agriculture					Undefined Contribution	Animal / Bird source Contribution
	WwTW	CSO	Private WwTWs	Septic Tanks	Caravan Parks	Mis and cross connections	Run-off	Cont'd surface water sewers	Dairy	Pigs	Livestock general	Arable	Rough grazing		
St Mary's Bay		M									H				
Mundesley	H										M				
Whitby		H					H				H				
Westgate Bay															
Whitley Bay		H					H								
Traeth Lligwy															
Tywyn											H				
Criccieth		H				H									
Bournemouth Fisherman's Walk		H													
Scarborough North Bay	M	H					H								
Tunstall		H			H						H				
Kingsand		H					H								
Porthminster	M	H					M								
Skegness	M	M				H									
Beer		M									H				
Carbis Bay Station Beach	M	M					M				·				
Caister Point	M														
Walney West Shore		M									H				H
Pendine					H						H				
Maen Porth		H									H				
Lynmouth		H													
Eastbourne	H	M									H				
Sandgate	M	H				H									
Crantock	M	M				H					H				
Marsden		H					H								H
Hornsea		H													H
Reighton		H													
Seaham Hall Beach (Remand Home)		M					M				M				
West Beach		M													
Robin Hoods Bay		H													
The Towans (Godrevy)	M	M					M								
Seaton Sluice	M	M									H				
Pagham	M	H													
Gurnard		H									H				
Harlyn Bay											M				
West Angle		M													
Leysdown		H				H									
Poole Harbour Rockley Sands		M									H				
Hampstead Heath (Mens Pond)															
Camber	M	H									H				
Herne Bay		M													
Dunster North West		M													H
Felpham	M	M				H									
Wells		M													H
Hope Cove		H									H				
Westbrook Bay		H													
Sidmouth Town		H				M					M				
Moreton	M	M									H				
Aberystwyth South											H				
Trevaunance Cove	H	M				M									
Prestatyn		H													
Christchurch Avon Beach		M									M				

Bathing Water	Water Company Discharges		Other Point Source Discharges			Urban Sources			Agriculture					Undefined Contribution	Animal / Bird source Contribution
	WwTW	CSO	Private WwTWs	Septic Tanks	Caravan Parks	Mis and cross connections	Run-off	Cont'd surface water sewers	Dairy	Pigs	Livestock general	Arable	Rough grazing		
Bowleaze Cove					H				H						
Aberporth															
Mawgan Porth									H						
Southwold The Denes															
Druridge Bay	M	M							H						
Portland Harbour Castle Cove		H				H									
Holland	H	H							H						
Berrow North of Unity Farm											H				
Ramsgate Main Sands	M	M				H									
Lulworth Cove	H	M	H	H		H		H							H
Watcombe															
Aberafan	H	M													
Tynemouth Long Sands North		H					H								
Silecroft		M							H						
Mounts Bay Heliport															
Penmaenmawr	H	H													
Redcar Stray		H					H								
Formby	M	M							M						
Whitmore Bay Barry															
Great Yarmouth Pier	M	M							M						
Southend Westcliff Bay		H													
Towan							H								
Barmston					H	H			H					H	
Shaldon	M	H							M						
South Shields		M					H								
Llandanwg		H													
Kinmel Bay (Sandy Cove)	x	M							M						
Llandudno West Shore		M							M						

x		Identified but already funded through AMP4 or considered to be effected through CAP reform	H High
H	M	Included in programme of measures	M Medium
H	M	Not included in programme of measures	

Table B4 Scenario 2: Supplementary notes

Bathing Water	Comments (main sources identified)
St Mary's Bay	• Indirect CSO (Hythe CSO) • Diffuse agricultural (marshland). New Sewer ~3,100ha.
Mundesley	• WwTW (suggested UV (Mundesley/North Walsham WwTW pe 36,500) • Diffuse agricultural (Mun catchment)
Whitby	• CSO (local) • Harbour Runoff • Diffuse agricultural (Esk catchment, ~32,950ha)
Westgate Bay	
Whitley Bay	• CSO (local) • Indirect CSOs (Brierdene CSO, CSOs (a few) in Tyne estuary (also involved in South Shields)) • Urban diffuse (Tyne)
Traeth Lligwy	
Tywyn	• Diffuse agricultural (stream ~1,625ha)
Criccieth	• CSO (local)
Bournemouth Fisherman's Walk	• CSO (local)
Scarborough North Bay	• 4 CSOs (not covered in AMP3) • Indirect WwTW (suggested UV at Wheatcroft WwTW) • Indirect CSO (affecting Scalby Beck) • Diffuse urban Harbour runoff (activities eg fish waste?)
Tunstall	• CSO (also included for Hornsea) • Diffuse agricultural (inputs to Tunstall Drain ~360ha). • Further investigation required (caravan parks suggested new connections, diffuse agriculture)
Kingsand	• CSO (local) • Urban diffuse (runoff in Tamar catchment)
Porthminster	• 1 CSO • Indirect WwTW (suggested UV at Hayle WwTW, pe 55,000 (included under the Towans (Godrevy)) • 1 Indirect CSO • Urban diffuse (runoff, minor)
Skegness	• Indirect WwTW (suggested UV at Ingoldmells WwTW pe 77,000) • 1 Indirect CSO (large)
Beer	• Indirect CSO (Beer CSO) • Diffuse/point agricultural (discharges to Beer Brook, ~360ha, including point source (pig farm))
Carbis Bay Station Beach	• Indirect WwTW (UV at Hayle WwTW, PE 55,000 (also under The Towans (Godrevy)) • Indirect CSO (Porthminster CSO) • Urban diffuse (runoff, minor)
Caister Point	• Indirect WwTW (suggested UV Caister WwTW pe 156,000 (also under 'Great Yarmouth Pier'))
Walney West Shore	• Indirect CSO (Duddon estuary CSO) • Diffuse agricultural (Duddon & Kent catchments (Morecombe Bay)) • Birds (Duddon Estuary) • Further investigation required (Bird control, Duddon Estuary)
Pendine	• Diffuse agricultural (stream ~500ha) • Caravan Park (suggested New Connections)
Maen Porth	• 1 CSO (local) • Diffuse agricultural (into Maenporth stream ~850ha)
Lynmouth	• 1 CSO • 4 indirect CSOs (to R Lyn) • Diffuse agricultural (into R. Lyn (east and west), minor)
Eastbourne	• WwTW (suggested UV at Eastbourne WwTW, pe 164,000) • 2 Indirect CSOs • Diffuse agricultural (stream ~500ha)
Sandgate	• CSO (local) • Indirect WwTW (suggested UV at Dover/Folkstone WwTW, pe 160,000))
Crantock	• Diffuse agricultural (into The Gannel ~5,050ha).
Marsden	• 1 CSO (local) • Indirect CSOs (Brierdene CSO, a few discharging into Tyne estuary (also involved South Shields) • Urban runoff (Tyne catchment control also involved in south shields)
Hornsea	• CSO (decrease spill frequency) • Birds (Hornsea Mere, suggested improvements to diffuse pollution bird control)
Reighton	• 1 CSO (private) • Requires further investigation
Seaham Hall Beach (Remand Home)	• Indirect CSO (into Wear and local streams) • Diffuse urban (Harbour runoff) • Diffuse agricultural (into two streams discharging in vicinity of BW ~1000ha)
West Beach	• 5 Indirect CSOs (also under Leysdown)
Robin Hoods Bay	• CSO (local) • Indirect CSO (into Becks)
The Towans (Godrevy)	• Indirect WwTW (suggested UV at Hayle WwTW, pe 55,000) • Indirect CSO (Gwithian CSO) • Urban diffuse (minor urban runoff)

Bathing Water	Comments (main sources identified)
Seaton Sluice	• Indirect WwTW (suggested UV at Blyth/Cramlington WwTW, pe = 48,000 and Cambois WwTW pe 40,000) • Indirect CSO (CSO storm tank) • Diffuse agricultural (into Seaton Burn ~4,850ha).
Pagham	• 1 CSO • Indirect WwTWW (suggested UV at Littlehampton/ Bognor WwTW) • Indirect CSO (Bognor Regis CSO)
Gurnard	• CSO (local) • Diffuse agricultural (into Gurnard Luck ~750ha). • Possible problem from mainland coast?
Harlyn Bay	• Diffuse agricultural (minor) (into stream ~1,200ha)
West Angle	• Indirect CSO
Leysdown	• 1 CSO • 5 Indirect CSOs
Poole Harbour Rockley Sands	• 2 Indirect CSOs (small + local) • Diffuse agricultural (Poole Harbour, Piddle & Frome catchments) R. Frome ~46,400ha. R. Piddle ~18,750ha.
Hampstead Heath (Mens Pond)	
Camber	• CSO (local) • Indirect WwTW (suggested UV at Rye WwTW, pe ~10,000) • 5 Indirect CSOs (into R. Rother) • Diffuse agricultural (Rother catchment). R. Rother ~51,920ha
Herne Bay	• 5 Indirect CSOs
Dunster North West	• 2 Indirect CSOs • Birds (on upstream lakes)
Felpham	• Indirect WwTW (suggested UV at Littlehampton/ Bognor WwTW) • 3 Indirect CSOs
Wells	• Indirect CSO (local) • Birds (Marsh fowl) • Boats
Hope Cove	• CSO (local) • Indirect CSO (Glampton) • Agricultural diffuse (into stream ~320ha).
Westbrook Bay	• 1 CSO • 1 Indirect CSOs (local)
Sidmouth Town	• 6 CSOs (small, local) • Diffuse Agricultural (Sid catchment). R. Sid ~3,900ha.
Moreton	• Indirect WwTW (suggested UV at Bromborough WwTW, pe 182,000; North Liverpool Docks WwTW, pe 892,000 & Birkenhead WwTW, pe 120,000) • Indirect CSOs (into Mersey) • Diffuse agricultural (Mersey and Dee catchments). R. Mersey ~204,400ha. R. Dee ~180,200ha. • Further studies required (agricultural diffuse)
Aberystwyth South	• Diffuse agricultural (Rheidol & Clarach catchment). Rheidol ~18,420ha, Clarach ~4,800ha.
Trevaunance Cove	• WwTW (suggested replace current CAS/UV system at St Agnes WwTW, pe 2,600) • CSO (local) • Requires further investigation
Prestatyn	• CSO
Christchurch Avon Beach	• 2 Indirect CSOs (Christchurch) • Further studies recommended (diffuse agricultural inputs to local stream). R. Mude ~1,540ha
Bowleaze Cove	• Caravans (suggested New connections) • Diffuse agricultural (R. Jordan ~930ha).
Aberporth	
Mawgan Porth	• Diffuse agricultural (into several streams ~4,470ha)
Southwold The Denes	
Druridge Bay	• Indirect WwTW (suggested UV at Hadston WwTW pe 3,000) • Indirect CSO • Diffuse agricultural (stream ~400ha)
Portland Harbour Castle Cove	• CSO (local) • Suspected that high faecal strep counts are being caused by seaweed?
Holland	• WwTW (suggested UV Clacton (Holland Haven) WwTW, pe 51,000) • 1 CSO (in Holland) • Diffuse agricultural (into Holland Brook ~8,500ha).
Berrow North of Unity Farm	• Diffuse agricultural (into R. Parrett and R. Axe)
Ramsgate Main Sands	• Indirect WwTW (suggested Upgrade Pfizers treatment process, UV?) • 2 Indirect CSOs
Lulworth Cove	• WwTW (suggested UV Lulworth WwTW, pe 1,600) • 1 Indirect CSO (small) • PSEO overflow • Private discharges • Birds (Duck pond)
Watcombe	

Bathing Water	Comments (main sources identified)
Aberafan	• WwTW local (suggested UV at local WwTW pe ~150,000) • Indirect CSOs (Afan & Neath catchments) • Failure occurred in 2006. 34 Dwr Cymru assets scheduled for improvement in the Afon Baglan catchment in AMP4 which are expected to have an impact on the bathing water. 5 have been completed in 06/07.
Tynemouth Long Sands North	• CSO (local) • Indirect CSOs (Brierdene CSO, few CSOs in Tyne estuary) (also included for South shields)
Silecroft	• Indirect CSO (into Duddon estuary). R. Duddon ~8,800ha. • Diffuse agricultural (local area) • Requires further investigation (Detailed study required (probably includes Duddon estuary))
Mounts Bay Heliport	
Penmaenmawr	• WwTW (suggested UV at Penmaenmawr WwTW, pe 4,000) • CSO
Redcar Stray	• CSO (local) • Indirect CSO (into Tees) • Diffuse urban (industry / port runoff into Tees)
Formby	• Indirect WwTW (suggested UV at Mersey Estuary WwTWs (also listed for Moreton) • Indirect CSO (Preston) • Agricultural diffuse (Ribble and Mersey). R. Ribble ~115,400ha. R. Mersey ~204,400ha. • Subject to studies undertaken (agricultural diffuse)
Whitmore Bay Barry	
Great Yarmouth Pier	• Indirect WwTW (suggested UV Caister WwTW pe 156,000) • Indirect CSOs (Great Yarmouth) • Diffuse agricultural (into R Waveney & Yare). R. Waveney ~66,700ha. R. Yare ~47,400ha.
Southend Westcliff Bay	• 5 CSOs (in Southend area)
Towan	
Barmston	• Requires further investigation (diffuse agricultural & caravan parks) • Diffuse agricultural (stream catchment ~500ha)
Shaldon	• CSO (local) • Indirect WwTW (suggested improvement of Teignmouth WwTW to UV not requied) • ~50 Indirect CSOs (discharging into Teign estuary) 3) Diffuse agricultural (Teign estuary) • Diffuse agricultural (Teign catchment). R. Teign ~40,600ha.
South Shields	• Indirect CSOs (Brierdene CSO, few CSOs into Tyne estuary) • Diffuse urban (into Tyne estuary)
Llandanwg	• CSO
Kinmel Bay (Sandy Cove)	• CSO (decrease spill frequency) • Indirect WwTW (suggested UV at Rhyl WwTW, pe 60,000) • Diffuse agricultural (Clywd catchment). R. Clywd ~69,150ha.
Llandudno West Shore	• 1 Indirect CSO • Diffuse agricultural (Conwy catchment). R. Conwy ~38,000ha.

Annex C: Supporting Information on Agricultural Improvements to Reduce Faecal Pollution

A range of agricultural measures were identified in Defra (2007), targeted at reducing the faecal pollution of river catchments contributing to microbial quality at BWs. The list of measures included in the scenarios developed in Defra (2007) were:

M13	Reduce overall stocking rates
M14	Reduce grazing time
M15	Reduce stocking rates when wet
M16	Move feed and water troughs
M25	Increase slurry store capacity
M26	Minimise dirty water
M27	Batch store slurry
M30	Change to solid manure
M31	Site heaps away from water
M32	Store solid manure on concrete
M33	No spreading in high risk areas
M35	No spreading at high risk times
M37	Manure transport (50% manure for 5km)
M39	Fence rivers and streams
M40	Construct bridges for livestock
M43	Establish riparian buffers
M44	Establish constructed wetlands

Scenarios were constructed based on packages of policy measures provided by Defra that took into account the likely take-up of the above listed methods on the different 'model' farm types and the efficiency of the methods in practice for catchments affecting 23 BWs:

- Scenario 1: Business as Usual
- Scenario 2: Business as Usual plus Water Protection Zones
- Scenario 3: Business as Usual plus Water Protection Zones + Scheme
- Scenario 4: Business as Usual plus Water Protection Zones + Scheme + Advice

The Business as Usual component of each scenario includes the anticipated effects of agricultural improvements implemented prior to 2015. These include effects of reform to the Common Agricultural Policy and existing agricultural schemes targeted at Nitrate Vulnerable Zones (NVZs) and through England Catchment Sensitive Farming Delivery Initiative (ECSFDI) and Environment Sensitive Farming scheme (ESF) etc. All scenarios assumed that the geo-climate in all catchments was 'medium-clay loam' and that livestock numbers were reduced by the following amounts (assuming 100% implementation) compared to the numbers in the 2000 Agricultural Census: dairy (30%), beef (20%), sheep (5%), pigs (10%).

For the purposes of this study it was assumed that the Business as Usual component would be fully implemented and effective by 2015, delivering the reported average 25.8% reduction in faecal indicators at BWs under high river flow conditions. The removal of Business as Usual from scenarios 2-4 provides a range of additional measures together

with their costs and effectiveness, which may provide additional reductions in faecal indicator levels at BWs from agricultural pollution.

Scenario 2 included increased implementation of M44 (establish and maintain constructed wetlands), M31 (site manure heaps away from water) and M35 (do not spread slurry at high-risk times). Scenario 2 (without Business as Usual) costs an average £0.42M per BW (annualised cost) and was estimated to provide a 15.0% reduction in faecal indicators at BWs under high river flow conditions.

Scenario 3 had no effect on the implementation and efficiency of most of the mitigation methods beyond Scenario 2 and was not used in the development of the range of costs in this IA.

Scenario 4 proposed alternative methods of implementation and suggested increased efficiency, based on the assumption that advice offered would enable farmers to better apply and operate the methods. The net effect of Scenario 4 was to improve the relative reductions in FIO losses to watercourses and to increase the costs for many methods. Scenario 4 (without Business as Usual) costs an average £0.51M per BW (annualised cost) and is estimated to provide a 16.4% reduction in faecal indicators at BWs under high river flow conditions.

Annex D: Benefits Assessment Supporting Information

Objectives

The objective of the impact assessment benefits work was to refocus and update the benefits assessment contained in the existing pRIA (Defra, 2002), to bring the document in line with Defra's proposed measures to implement the rBWD. The benefits assessment should clearly show the benefits of achieving the tighter water quality standards imposed by the rBWD, split between England and Wales, according to the assessment scenarios.

Benefits Assessment Approach

In order to assess the benefits of the rBWD in monetary terms it was necessary to either undertake a new (primary) valuation study or apply existing (secondary) benefit estimates to the scenarios under investigation through benefits transfer[25]. Given the time and resource constraints associated with the impact assessment, the latter approach was taken. A literature review related to the assessment of the benefits of the rBWD was therefore undertaken prior to the assessment of benefit estimates associated with the scenarios under investigation.

Literature Review of Economic Valuation Studies

There is a considerable body of applied literature developed over the past three decades relevant to the valuation of changes in recreational BW water quality. However, there are only a handful of primary (or original) studies that consider explicitly the benefits of reducing faecal contamination of UK coastal BWs in the context of EU policy. These studies, which are summarised in Table D1 include:

1. Day et al (2001)[26]
2. Georgiou et al (1998)[27]
3. Georgiou et al (2000)[28]
4. Hanley et al (2001)[29]
5. EFTEC (2002)

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[25] In the literature, benefits transfer is commonly defined as the transposition of monetary environmental values estimated at one site (study site) to another site (policy site). The study site refers to the site where the original study took place, while the policy site is a new site where information is needed about the monetary value of similar benefits. The most important reason for using previous research results in new policy contexts is that it saves a lot of time and money. Applying previous research findings to similar decision situations is a very attractive alternative to expensive and time-consuming original research to inform decision-making. The decision of whether to undertake an original study or to use existing value estimates can be considered in terms of the acceptability of errors produced by benefits transfer and the level of precision sought, i.e. the purpose of the study and when transfer errors may be too big for this purpose.

[26] Day B, Hanley N and Bergland O (2001) *Non-parametric and semi-parametric approaches to analysing payment ladder contingent valuation data: bathing water quality improvements in Scotland,* Working paper, Economics Department, University of Glasgow.

[27] Georgiou S, Langford IH, Bateman IJ and Turner RK (1998) Determinants of Individuals' Willingness to Pay for Perceived Reductions in Environmental Health Risks: A Case Study of Bathing Water Quality. *Environment and Planning A*, vol. 30. 577-594.

[28] Georgiou S, Bateman IJ, Langford IH and Day RJ (2000) Coastal Bathing Water Health Risks: Developing Means of Assessing the Adequacy of Proposals to Amend the 1976 EC Directive. *Risk Decision and Policy,* vol 5. 49-68.

[29] Hanley N, Bell D and Alvarez-Farizo B. (2003) Valuing the benefits of coastal water quality improvements using contingent and real behaviour, *Environmental and Resource Economics,* 24(3): 273-285.

Table D1 Primary valuation studies of coastal bathing water quality improvements in the UK

	Study, Year & Method	Location	Sampling	Geographical Scope	Categorical Scope of Benefits	Quantitative Scope Change	Welfare Measure, Elicitation Method, Payment Vehicle	Unit of Value	Monetary Estimates (£ 2007)	Comments
1	Day et al (2001) Contingent Valuation	South-west Scotland 1. Ayr 2. Irvine	Beneficiaries sampled: Visitors and non-visitors; unknown sampling procedure.	All 7 beaches, South West Scotland region	Health protection/beach recreation, but could include other motivations	Various current quality states → Guarantee Pass (Imperative 76/160/EEC). Some beaches currently passed whilst some failed.	WM – Compensating $Surplus_{wtp}$ (discrete change) EM - Payment ladder PV - Local water rates	WTP per household pa.	10.71-14.10 6.15 – 8.85	
2	Georgiou et al (1998) Contingent Valuation	1. Great Yarmouth 2. Lowestoft	Beneficiaries sampled: Visitors to site; non-probability sampling	Single beach (split sample)	Health protection/beach recreation, but could include other motivations	Fail → Pass (Imperative 76/160/EEC) & Pass → Maintain (Imperative 76/160/EEC)	WM - Compensating $Surplus_{wtp}$ (discrete change) & Equivalent $Surplus_{wtp}$ (discrete change) EM - Open ended PV - Local water rates	WTP per household pa.	16.64 18.85	
3	Georgiou et al (2000) Contingent Valuation	1. Great Yarmouth 2. Lowestoft 3. Norwich	Beneficiaries sampled: Visitors and non-visitors (split samples); non-probability sampling	All beaches, East Anglian region	Health protection/beach recreation, but could include other motivations	Pass (Imperative 76/160/EEC) → Pass (unspecified) Revised EU	WM - Compensating $Surplus_{wtp}$ (discrete change) EM - Open ended PV - Local water rates	WTP per household pa.	28.51 28.71 51.50	Revised EU described as non-specific ↓ in risk from current EU
4	Hanley, Bell and Alvarez (2001) Travel Cost	South-west Scotland: 1. Ardrossan 2. Ayr 3. Girvan 4. Irvine 5. Prestwick 6. Troon 7. Turnberry	Beneficiaries sampled: Visitors to site; unknown sampling procedure.	All 7 beaches, South West Scotland region	Health protection/beach recreation, but could include other motivations	Various current quality states → Guarantee Pass (Imperative 76/160/EEC). Some beaches currently passed whilst some failed.	WM – Consumer Surplus (discrete change) EM – none (travel costs) PV – none (travel costs)	Consumer surplus increase per person pa. Consumer surplus increase per visit pa.	9.28 0.57	Increase in visitation rates of visitors only. Non visitors not included CS increase per visit value applied to total # of visits.
5	EFTEC (2002) Choice Experiment	Typical (average) British Beach	Beneficiaries sampled: Visitors and non-visitors; representative probability sampling	Typical (average) British Beach	Health protection/beach recreation, but could include other motivations	GI Illness risk level ↓ by 1/100 swimmers ANS (during poor water quality events)	WM - Compensating $Surplus_{wtp}$ (marginal change) EM - choice experiment PV – water rates	WTP per household pa.	1.25 6.37	Gives change in risk at typical (average) UK beach

A few further reports were of potential relevance to the rBWD impact assessment, including the RPA (2005[30]) report for ICREW and the Benefits Assessment Guidance used by the EA to assess the Asset Management Plans of the UK water industry. These reports both sought to undertake secondary (or non original) valuation of BW improvements using estimates from the primary studies listed above. As such these reports were not considered further.

All of the primary valuation studies were undertaken within the past 10 years. Four of the five studies (1, 2, 3, 5) were based on stated preference valuation methods and one study (4) made use of a combined real and contingent behaviour approach on beach visits. Most of the studies appear to be academically motivated studies designed to test/ investigate various methodological issues and questions. Only study 5 was specifically commissioned for use within a cost-benefit analysis assessment (by Defra for the purposes of a Regulatory Impact Assessment).

Although the WTP estimates were converted into common values at 2007 prices, the range of mean values found is quite wide. This can be partly explained by differences in the valuation methods used as these yield theoretically different estimates, but is also a reflection of the differing scale or 'scope' of water quality changes being considered in differing studies. Furthermore, there may also be differences in the perceived range of benefits considered by respondents across studies. For example, while some studies emphasise health benefits, others also consider ecological, aesthetic and amenity improvements.

Most of these studies capture beach users and take place on-site, and measure a discrete change in water quality (e.g. compliance with standard) rather than marginal changes. The nature of on-site studies means that they are concerned only about a particular beach or group of beaches. However, study 5 did aim to investigate marginal WTP estimates for a typical British beach in England and Wales. While these differences in study remit naturally yield a range of value estimates, some consistent findings emerge including, most clearly, that individuals hold significant and positive values for improvements in water quality. The implication is that poor water quality is undesirable and that the public would be willing to pay positive amounts towards improvements. In most instances, the positive estimated values are driven by the wealthier population, those who swim frequently, are not old, are local residents and hold certain attitudes with respect to health and the importance of the rBWD.

Study 5 also considers the benefits associated with the provision of an advisory notice system (i.e. prediction and warning/discounting system). Such a system would advise against swimming on days when the water quality was worse than average and hence the risk of gastrointestinal illness higher than average.

The WTP values shown in Table D1 can be aggregated to provide net present values of the benefits of bathing water quality improvements in the UK. Strictly

[30] RPA (2005), Re-Identification of Recreational Waters, Cost Benefit and SWOT Analysis, ICREW Pilot Action 5, Final Report prepared for the Mersey basin Campaign and the Environment Agency. RPA, Lodden, UK.

speaking only the EFTEC figures should be used for such a purpose (since they consider national changes using a nationally representative sample). Nevertheless the exercise was undertaken for all the studies for the purposes of illustration. Table D2 shows these sums (adjusted for comparability as before) as calculated across the national population of England and Wales. These values were calculated over a 25 year time period and current UK treasury discount rates used to appraise public sector projects. Nevertheless, the corresponding aggregate values imply substantial aggregate benefits across the national population as a whole. The specific valuation scenarios considered in each of the studies are not constant however (i.e. they are for different geographical and quantitative scope changes), and hence comparisons are difficult. The unit change estimates from the EFTEC study are multiplied up to represent two possible scenario changes that might actually occur for UK bathing water improvements – 2.5% and 5% reductions in the risk of contracting gastrointestinal illness. The benefits associated with the provision of an advisory notice system are found to be roughly equivalent to the benefits from a water quality improvement that reduces gastrointestinal illness risk by 5%.

Table D2 Aggregate net present value of the benefits of bathing water quality improvements in the UK

Study	Mean WTP per household per year (£2007Prices[B])	National Aggregate WTP per year (£2007Million)[C]	Total Net Present Value of Benefits (£2007Million)[D]
Day et al (2001)	£10.7 -£14.1 £6.15 - £8.85	£257M - £338M £147.5M - £212.5M	£4,384M - £5,773 M £2,516 M- £3,625 M
Georgiou et al (1998) [A]	£16.64 £18.85	£399 M £452 M	£6,812 M £7,716 M
Georgiou et al (2000)[A]	£28.51 £28.71 £51.50	£684 M £689 M £1,236 M	£11,672 M £11,756 M £21,084 M
Hanley, Bell and Alvarez (2001)	£9.28[E]	£223 M[F]	£3,797 M
EFTEC (2003)			
- Reduction in gastrointestinal risk level by 1/100 swimmers	£1.25	£30 M	£512.5 M
- Reduction in gastrointestinal risk level by 2.5/100 swimmers	£3.13	£75 M	£1,281 M
- Reduction in gastrointestinal risk level by 5/100 swimmers	£6.25	£150 M	£2,563 M
- Advisory Note System (during poor water quality events)	£6.37	£153 M	£2,609 M

A Estimates based on revised figures reported in Georgiou (2003)

B Figures from year that original WTP derived are adjusted by any relevant exchange rates and GDP deflators (UK Treasury figures) to give 2007prices

C Aggregate WTP for England and Wales was found by multiplying the household WTP figures by the number of English and Welsh households = 24 million.

D Calculated using 25 year time horizon and discount rate of 3.5%
E Estimate of mean WTP per visit was not included, as in Table 1, since this was calculated from the per person figure using the mean number of visits per person.
F Although the estimate was strictly speaking based on a WTP per person, it was nevertheless applied on a WTP per household basis to estimate aggregate WTP for England and Wales.

Critical Assessment of Existing Benefits Valuation Studies for Use in rBWD Impact Assessment

In order to undertake benefits transfer of the estimates of monetary values from the studies outlined above, it was first necessary to critically assess the studies in relation to a number of policy context characteristics of the rBWD impact assessment scenarios, which are relevant to the assessment of their net present value of monetary benefits. These characteristics include[31] :

A. Categorical scope of benefits (capture of benefits) associated with the proposed action
B. Geographical (spatial) scope of coverage of the proposed action
C. Quantitative scope of environmental change associated with the proposed action
D. Accounting stance (extent of market) associated with the proposed action

A. Categorical scope of benefits (capture of benefits)

The categorical scope of benefits concerns the range of beneficial outcomes that have human welfare significance, which are included in the impact assessment. As outlined earlier the main objective of the rBWD is to preserve, protect and improve the quality of the environment and to protect human health from faecal pollution at BWs.

The improvements in human health protection arise as a result of reductions in the risk of illness, which stem from the water and ecological quality improvements and other measures associated with each of the impact assessment scenarios described above.

The relevant possible outcomes of interest which impact on social well being and hence have an economic value, which stem from the water quality improvements associated with the rBWD are identical for each scenario and include the following:

[31] Desvousges et al (1992) propose several necessary conditions in order to perform effective and efficient transfers of benefit estimates. These conditions which relate to the correspondence between the study site data and policy site conditions can be summarised in terms of the following characteristics.
Desvousges WH, Naughton MC and Parsons GR (1992) Benefits Transfer: Conceptual Problems in Estimating Water Quality Benefits Using Existing Studies. *Water Resources Research*. Vol. 28

- Potential improvements in public health protection as a result of reductions in the risk of illness from ingestion of faecal contaminated waters during recreation bathing activities[32]
- Potential improvements in public health protection as a result of better public information
- Potential increase in demand for BWs based recreation/ amenity and tourism impact[33]
- Other potential benefits related to marine and wildlife ecology, aesthetics, and non-use improvements.

B. Geographical (spatial) scope of coverage

The geographical scope of coverage defines the geographic area of the environmental improvements that are relevant to the benefits assessment exercise. This is not necessarily the same as the accounting stance which looks at the area over which there are human welfare impacts. Nevertheless, the geographical scope of coverage is important since it helps to identify and define the accounting stance. The geographical scope of the health benefits from better public information extends to all BWs in England & Wales for all scenarios.

The geographical scope of the health benefits from reduction in GI illness from improvements in water quality was defined within each of the scenarios considered in the impact assessment.

Scenario 1A: 56 BWs (34 *poor* and 22 high risk *sufficient*) identified for improvement.

Scenario 1B: 56 BWs (34 *poor* and 22 high risk *sufficient*) identified for improvement as per Scenario 1A, but with option to implement a discounting approach at 5 unnamed BWs.

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[32] The human health effects from bathing in faecal contaminated coastal waters primarily consist of minor morbidity impacts. The economic consequences of the adverse health effects from bathing in faecal contaminated coastal waters include: medical and care-giving costs; work loss; other social and economic costs. the medical costs plus work loss constitute the measure of welfare known as Cost of Illness. Since this measure does not include other social and economic costs it will not reflect the total welfare impact of an adverse health effect. The maximum WTP to reduce the risk of the health effect and all associated costs is a comprehensive measure of welfare. It reflects all the reasons an individual might want to avoid an adverse health effect, including financial and non-financial concerns. Furthermore, WTP reflects expectations rather than realised damages. If the benefits assessment is based on an ex-ante decision basis (i.e. on expected reductions of adverse human health effects rather than ex-post realised reductions) then WTP is more appropriate.

[33] Note that in terms of tourism impact, tourism expenditures by BW visitors (e.g. food, accommodation, shopping and so on) and employment increases from any increase in tourism are sometimes perceived as benefits since they are important for the development of regional coastal economies. However, from a national perspective they are likely to be transfer payments, i.e. activities that would have taken place elsewhere in England & Wales. Thus, there would be no net increase in spending across the country. Although they can legitimately be added to an economic impact analysis, they should not be included in a cost-benefit analysis. However, if it is considered that improvements to BW quality could attract new visitors to the affected areas (foreign tourist; or residents choosing to stay in England & Wales rather than going abroad), these expenditures can be included in cost-benefit analysis.

Scenario 2: 56 BWs (34 *poor* and 22 high risk *sufficient*) identified for improvement as per Scenario 1A, plus a further 80 BWs (71 low risk *good* and 9 high risk *excellent*) identified for improvement.

C. Quantitative scope of environmental change

The quantitative scope relates to the magnitude of the environmental change that is being considered. This change is the difference between the current (status quo or baseline) situation and the situation following implementation of the rBWD. The change is again defined by each of the scenarios considered in the impacts assessment as follows:

Scenario 1A: Improve *poor* BWs to at least *sufficient* standard and maintain and high risk *sufficient* BWs at *sufficient* standard.

Scenario 1B: Improve *poor* BWs to at least *sufficient* standard and maintain and high risk *sufficient* BWs at *sufficient* standard, but with option to apply a prediction/ discounting approach at 5 BWs.

Scenario 2: Improve *poor* BWs to at least *sufficient* standard and maintain and high risk *sufficient* BWs at *sufficient* standard and additionally improve low risk *good* BWs to *excellent* standard and maintain high risk *excellent blue flag* BWs at *excellent* standard.

D. Accounting stance

The accounting stance defines the relevant beneficiaries and population for aggregation of benefits. The accounting stance should be such that it captures all 'pareto relevant' impacts. Given the categorical scope of benefits, the relevant beneficiaries include both visitors and non-visitors. Visitors who bathe in the BWs included in the impact assessment scenarios will benefit from improvements in public health protection. In addition, potential increases in demand for beach-based recreation can take place amongst both current visitors and non-visitors.

The relevant population for aggregation can in principle extend to all those who might benefit from the improvement, i.e. it may extend out to the national population. However, if fiscal equivalence is to be maintained with those who might be expected to pay for compliance, then the relevant aggregation population consists of the regional population within administrative boundaries or water company boundaries.

Summary of Applicability of Primary Valuation Studies to Impact Assessment Scenarios

All of the existing valuation studies are concerned with estimating the health protection/ beach recreation and other benefits associated with faecal contamination of BWs. However, as mentioned earlier, most of the studies appear to emphasise health benefits more than the other benefits associated with BW quality improvements. Nevertheless, this does not preclude the fact that respondents do consider some of these other types of benefits when considering BW improvements.

The geographic scope of the existing studies varied from a single BW to multiple BWs. Three of the studies (1, 3, 4) looked at all BWs in a particular water authority region. As such they did not correspond to the geographic scope covered by the impact assessment scenarios. Furthermore, it was unclear to what extent the visitation and other characteristics of these BWs correspond to the BWs relevant in impact assessment scenarios. These studies were thus not suitable for the purposes of estimating the benefits of the impact assessment scenarios. Study 2 looked at single BWs in East Anglia. Whilst the values could be applied to each (separate) BW in the impact assessment scenarios, this did not allow for potential substitution and consequent scope effects. These effects were found to be significant in the economics literature and would lead to biased benefit estimates if they were not taken into account. It was not clear how such effects could be taken into account in applying study 2 to the impact assessment scenarios. Again, this study was not suitable for the purposes of estimating the benefits of the impact assessment scenarios.

Study 5 describes the geographic scope in terms of conditions at a hypothetical typical (or average) BW in the UK. Although it was unclear as to whether this concerns the conditions at one single typical (or average) BW in the UK, or typical (or average) condition of all BWs in the UK, the stated aim of the study was to estimate the value of improvements at all UK BWs, which remains valid for health benefits from better public information. Although the geographic scope (of the GI risk reduction) in study 5 did not correspond with the geographic scope of the impact assessment scenarios (for GI risk reduction) (since these relate to a subset of identified BWs across the UK), if one assumes that there is a proportional relationship between the number of BWs in study 5 (i.e. the total number of BWs in the UK) and the aggregate benefit estimates found in study 5, then this study can be used to estimate the benefits of the impact assessment scenarios (for GI risk reductions). Note that it was necessary to assume that any possible substitution and scope effects were small, and that the geographic scope did actually concern all UK BWs, as was the stated aim of the study, rather than one single BW.

Although all five of the studies estimate values for compliance with EU water policy, none of the studies considered water quality improvements in terms of the rBWD scenarios described above. In the case of studies 1, 2, and 4, the category class change related to the imperative standard of the cBWD. That is, only improvements to ensure compliance (or maintenance of compliance in the presence of risk) with the imperative standard of the cBWD are considered. The imperative standard does not correspond to any of the water quality classes in the rBWD and hence these studies are not suitable for the purposes of estimating the benefits of the impact assessment scenarios.

In the case of study 3, the quantitative scope change related to a ‘revised’ BWD that “would result in further reductions in risks to health at those BWs which satisfy this new standard”. The scope of improvement was thus vaguely defined and hence it was not possible to identify which water quality class change the improvement actually related to. Although, the study contained information on the

current levels of risk of illness and asked respondents for the percentage reduction in risk of illness that they expect from the new standard, this was not part of the formal definition of the scope of improvement and terms of provision, hence it was not possible to define the level of improvement on this basis. This study was thus also not suitable for the purposes of estimating the benefits of the impact assessment scenarios.

In the case of study 5, this was based on quantitative scope changes defined in terms of the risk of illness associated with BW quality. Though difficult in practice, it is in principle, possible to relate a particular risk of illness to the specific water quality classes associated with the impact assessment scenarios (on the basis of established epidemiological relationships between risk of illness and the water quality parameters associated with each of the water quality classes). Given the lack of alternatives, this study was used to estimate the benefits of the impact assessment scenarios.

The studies varied in terms of the relevant beneficiary populations included in the analysis. The sampling procedures used to sample these groups also varied between the studies. In two of the studies (2, 4) only (on-site) visitors were included and hence only partial value estimates were obtained. Values for non-visitors would have to be included in order to avoid bias. The three other studies (1, 3, 5) included both visitors and non-visitors. Studies 1 and 4 have unknown sampling procedures. Study 2 and 3 made use of non-probability sampling, which makes the valuation estimates from these studies problematic for use. Although the value estimates could be adjusted using the bid functions, it remains unclear how representative the values would be. Study 5 had a nationally representative sample and hence was the only study suitable for the purposes of estimating the benefits of the impact assessment scenarios.

Supplementary Commentary on Individual Studies

1. Day et al (2001)

Categorical scope of benefits – Applicable since covers health protection/ beach recreation and possibly other motivations.

Geographical scope of coverage – Difficult to apply since only specific regional coverage (7 BWs in region). Also focus is Scottish BWs.

Quantitative scope – Not applicable since only discrete quality change considered relating to imperative standard of cBWD.

Accounting stance – Potentially applicable since includes both visitors and non-visitors, but unknown sampling procedure and hence unknown population representation.

This is primarily a methodological study to compare statistical estimation methods for analysing the payment ladder elicitation method. The study only considers a discrete quantitative scope change relating to compliance with the Imperative standard of the cBWD hence not applicable to impact assessment scenarios

which concern rBWD. The WTP question and other aspects of the study are not fully reported, hence it is not possible to fully assess the study. Application would require more information on sampling procedure to assess representativeness of values.

2. Georgiou et al (1998):

Categorical scope of benefits – Applicable since covers health protection/ beach recreation and possibly other motivations.

Geographical scope of coverage – Only relates to a single BW. Values could be applied to each (separate) BW, but this difficult due to potential substitution and scope effects.

Quantitative scope – Not applicable since only discrete quality change considered relating to imperative standard of the cBWD.

Accounting stance – Mixed applicability since only includes visitors and non-probability sampling undertaken, hence population representation problems.

This is primarily a pilot methodological study (for study 3) to investigate psychological determinants of WTP rather than to provide robust estimates of WTP values. The study only considered discrete quantitative scope change relating to compliance with the Imperative standard of the cBWD hence is not applicable to impact assessment scenarios which concern rBWD. The non-probability sampling makes the raw valuation estimates from this study problematic for use. Could adjust valuation estimates using bid function to obtain representative sample value for visitors to each site. The study only considered a single site value. The analysis on substitution and scope effects is not possible and renders the study inapplicable to impact assessment scenarios. The study only considered visitor values. The use of values for non-visitors would be required to avoid bias.

3. Georgiou et al (2000)

Categorical scope of benefits – Applicable since covers health protection/ beach recreation and possibly other motivations.

Geographical scope of coverage – Difficult to apply since only specific regional coverage (all BWs in East Anglia)

Quantitative scope – Considers discrete quantitative scope change relating to a 'revised' BWD. The situation following implementation is specified only as an improvement from cBWD, but no specific details given. The study does contain some information on percentage improvement from current illness rates expected by respondents. Too vague to be applicable

Accounting stance – Possibly applicable since includes both visitors and non-visitors, but non-probability sampling procedure used, hence population representation problems.

This is primarily a methodological study investigating psychological and cultural determinants of WTP. Not intended to provide robust estimates of WTP. The

study considers a discrete quantitative scope change relating to a non-specific 'revised' EU BWD, which "would result in further reductions in risks to health at those beaches which satisfy this new standard". The scope of improvement is thus vague and inapplicable to impact assessment scenarios. The non-probability sampling makes the raw valuation estimates from this study problematic for use with impact assessment scenarios. Could adjust valuation estimates using bid function to obtain representative sample value for visitors to each BW.

4. Hanley et al (2001):

Categorical scope of benefits – Applicable since covers health protection/ beach recreation and possibly other motivations.

Geographical scope of coverage – Difficult to apply since only specific regional coverage (7 BWs in region). Also focus is Scottish BWs.

Quantitative scope – Not applicable since only discrete quality change considered relating to imperative standard of the cBWD.

Accounting stance – Partially applicable since only includes visitors, but unknown sampling procedure and hence possible population representation problems.

This is a sister methodological study to study 1, based on a combined stated and revealed preference approach to valuation and thus having potentially more validity than the other studies. This is the only study to provide a per visit valuation (as well as a per person value). The study only considered a discrete quantitative scope change relating to compliance with the Imperative standard of the cBWD hence not applicable to impact assessment scenarios. The WTP question and other aspects of the study are not fully reported, hence it is not possible to fully assess the study. The study only considered visitor values. The use of values for non-visitors would be required to avoid bias. Application would also require more information on sampling procedure to assess representativeness of values. Only those improvements which generate an increase in visitation are considered to be beneficial. This does not account for health protection benefits on existing visits. Data on relevant aggregation population required: for the per visit value (this requires data on the number of visits per annum for each site); for the per person value (this requires total annual visitors to each site - note not visits). Again there are problems of value for non-visitors.

Study 5 EFTEC (2002):

Categorical scope of benefits – Applicable since covers health protection/ beach recreation and possibly other motivations.

Geographical scope of coverage – Potentially applicability since based on hypothetical typical (average) beach in the UK. Unclear whether this scope relates to one single average BW or to the average of all BWs. Stated aim of the study was to estimate the value of improvements at all UK BWs.

Quantitative scope – Potentially applicable since based on scope change defined in terms of risk of gastrointestinal illness at typical (average) BW in the UK. Can in principle relate this to water quality classes associated with the impact scenarios.

Accounting stance – Applicable since includes both visitors and non-visitors, nationally representative sample.

This is the only study which was specifically undertaken to assess values for health risk reductions related to coastal bathing water for use in CBA. The geographical and quantitative scope of improvement is based on a change at a typical (average) BW in the UK. However, the wording in the study is unclear as to whether this concerns the conditions at one single typical (or average) BW in the UK, or typical (or average) condition of all BWs in the UK, the stated aim of the study was to estimate the value of improvements at all UK beaches, it is therefore valid for health benefits from better public information. Although the geographic scope of study 5 does not correspond with the geographic scope of the (GI risk reduction) impact assessment scenarios (since these relate to a subset of identified beaches across the UK), if one assumes that there is a proportional relationship between the number of beaches in study 5 (i.e. the total number of beaches in the UK) and the aggregate benefit estimates found in study 5, then this study can be used to estimate the benefits of the impact assessment scenarios. Note that it is necessary to assume that any possible substitution and scope effects are small, and that the geographic scope does actually concern all UK BWs, as was the stated aim of the study, rather than one single beach. Data on scope change (levels of probability of gastrointestinal illness) requires data on water quality parameter changes to be translated to equivalent illness probability changes.

Critical Assumptions and Caveats Attached to the Benefit Estimates

The following were some of the critical assumptions and caveats associated with producing the benefit estimates given in the impact assessment:

i) Reliance on the fact that the change in risk was based on the change in threshold parameter values of water quality associated with each WQ class. Use of threshold values is a blunt instrument in measuring improvements. It cannot tell us the exact amount of change, but only whether a certain threshold has been met or not (hence two quite different WQ parameter changes can have the same class change). Even so, it was necessary within each IA scenario to assume some specific point change in risk has taken place (i.e. that risk has moved from some identifiable risk value point to another identifiable risk value point). The problem with threshold classes of WQ is that such identifiable risk value point changes are not known. All that is known is whether risk is above or below the required threshold minimum/maximum. The estimates obtained in the IA rely on making assumptions about specific identifiable risk value points. It is unclear how accurate a change in risk these describe in reality.

ii) Assumes that the risk associated with each WQ class has been correctly estimated by the EU. Clearly the values are average threshold values for each class of WQ. It is unclear how much these may differ to values for the specific changes that would arise at the actual designated sites considered in the scenarios. This would require more detailed modelling to be undertaken at the specific sites of interest. Such work has not been undertaken.

iii) In order to apply the EFTEC values, it was assumed that the EFTEC benefit values are divisible by the number of beaches considered. The EFTEC values were estimated for average improvements across all beaches in the UK. It is thus necessary to assume that since the scenarios only consider a proportion of all beaches that the value of improvements at these beaches is in proportion to the total number of beaches considered in the EFTEC study. This is an assumption that is commonly made in benefits assessment work, but there is currently no evidence that this is actually true, i.e. that the value of improvements at 2 BWs is twice the value of improvements at 1 BW, etc. It is likely that there will be substitution and scope effects (due for example to the law of diminishing marginal utility) that cause a non-linear relationship between the number of beaches improved and the value of improvements. Hence the assumption of divisibility (and in a linear or equal unit form) is questionable. It is not possible to say what effect this may have on the IA benefit estimates.

iv) In order to apply the EFTEC values, it was assumed that the EFTEC benefit values hold a linear relationship between the percentage reduction in risk of gastrointestinal illness and the value attached to the reduction. A linear utility model was used in the EFTEC study to derive the benefit estimates. It was not clear that this was the only model that can be applied. In any case, the law of diminishing marginal utility would suggest that a linear relationship does not apply at some level of risk. It was not clear at what level of risk this would apply. The assumption may lead to an overestimation of benefit values.

v) In order to apply the EFTEC values it was assumed that the extent of the market (aggregation population) for the purposes of aggregation is the entire population of England and Wales. Since the EFTEC study considered England and Wales wide improvements, the relevant extent of the market for that study was indeed, the UK population. In the IA scenarios we were only concerned with a subset of beaches across England and Wales for the GI risk reductions. As such, it was not clear that in the case of the GI risk reduction benefits, the relevant extent of the market extends to the entire England and Wales population. The assumption that it did may lead to an overestimation of values. In the case of the information (beach signage) benefits, this was not a problem since these are nationally based (i.e. beach signage is implemented at all beaches nationwide).

vi) In order to apply the EFTEC values it was assumed that the information (beach signage) improvements associated with the IA scenarios correspond with the provision of information (advisory note system)

considered in the EFTEC study. The precise terms of this advisory note system were vaguely defined in the EFTEC study and it is unclear that such correspondence exists. Furthermore, the vague description of the advisory note system in the EFTEC study renders the validity of the values obtained from the study open to question. The assumption may lead to overestimation of benefit values.

Annex E: Specific Impact Tests not affecting the Cost-Benefit Analysis

Legal Aid

There will be no impact on Legal Aid.

Sustainable Development

'Water Availability and Quality' is a high impact policy area under Defra's Water Strategy and links directly to the Departments high level goals of avoiding dangerous climate change and protecting and enhancing the natural asset base. The aim being to improve standards of service and quality, while balancing environmental impacts, water quality, supply and demand, and social and economic effects.

As well as protecting public health, many of the measures needed to achieve compliance with the revised bathing water standards – such as upgrading sewerage infrastructure and controlling agricultural and non-agricultural diffuse pollution – are measures that promote the broader Water Strategy objectives. These include good ecological status of water quality in the environment, increased biodiversity and ecology with more value from sustainable recreation, helping the water sector adapt to climate change and encouraging more sustainable farming.

Other Environment

Each of the range of available measures to reduce faecal pollution has a range of associated direct and indirect environmental and social adverse impacts and benefits. Where measures include constructed solutions, adverse impacts are typically short-term, associated with construction activities (e.g. for WwTW improvements, CSO improvements, removing sewerage cross-connections, private WwTW improvements, caravan park improvements, septic tank improvements, isolating contaminated surface sewers). Planning legislation may require Environmental Impact Assessment of schemes in the PoMs in certain circumstances. Where measures include management activities they may have long-term or recurring adverse impacts (e.g. urban run-off improvements, agricultural improvements, reduction in pollution from animal and bird sources).

Race, Disability, Gender and Other Equality

We do not believe that there will be an impact on the equality strands as the proposals impact on business and regulators, not on individuals. We have, however, looked at each of the equality impact initial tests individually and are confident that there is no impact.

Human Rights

If any regulatory requirements to be imposed under the Regulations engage Article 1 of the First Protocol to the European Convention on Human Rights in relation to private [beach] controllers, the requirements are 'necessary to control the use of property in accordance with the general interest'. The relatively limited requirements imposed are clear, non-discriminatory and proportionate to the

objective of protecting bathers' heath. The draft Regulations are therefore compatible with Convention rights.

Rural Proofing

We have looked at the initial test on rural proofing and are confident that the impact on rural communities will be limited. The proposals may have a negative impact on the agriculture industry in the short to medium term, but the outcome will be improved water quality which will benefit rural areas through increased recreation and tourism. It is possible that the agricultural industry may benefit in the longer term as it moves to more sustainable farming practices.