

Title: Future Water Resource Management IA No: Defra1365 Lead department or agency: Defra Other departments or agencies: Environment Agency/Ofwat	Impact Assessment (IA)				
	Date: 15/08/2011				
	Stage: Final				
	Source of intervention: Domestic				
	Type of measure: Other				
	Contact for enquiries: Henry Leveson-Gower Tel: 020 7238 5393				
Summary: Intervention and Options					
Cost of Preferred (or more likely) Option					

Total Net Present Value	Business Net Present Value	Net cost to business per year (EANCB on 2009 prices)	In scope of One-In, One-Out?	Measure qualifies as
£65.7m	~£0m	~£0m	Yes	Zero Net Cost

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

We are faced with increasing water scarcity due to climate change and increasing demand mainly driven by population growth which without action could affect our ability to meet our need for water and protect water ecosystems. There are already risks to water ecosystems due to abstracting water from rivers, lakes and aquifers. Government already intervenes in this area through regulating water abstraction and public water resource management. We believe that the current regulatory systems are not responsive or dynamic enough to address these challenges efficiently, potentially leading to excessive costs to water bill payers and abstractors, increased insecurity of supply and deterioration of water ecosystems

What are the policy objectives and the intended effects?

- to provide clearer signals to abstractors to make the necessary investments to meet water needs and protect ecosystem functioning.
- to make more water accessible to higher value users in order to drive economic growth.
- to ensure that the costs of reducing unsustainable abstraction are minimised.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

(1)Do nothing; (2)Complete reform of the water abstraction system to make it fit for purpose for a world of climate change and increasing demand; (3)A package of no regrets, low risk measures to restore sustainable abstraction more efficiently through the EA using revenue from abstraction charges to fund hydromorphological measures and to increase the economic value from water mainly by facilitating trading of abstraction licences through provision of information. Our preferred option is 3 as although it doesn't adequately address the problems identified, it allows immediate low regrets actions to ameliorate the current problems, while allowing adequate time to develop the evidence base further to take forward option 2, which should address the problems identified. To implement option 2 at this point would create significant risks, due to the inadequacy of the evidence base, of designing a significantly sub-optimal solution which would have negative impacts on abstractors, water bill payers and other stakeholders.

Will the policy be reviewed? It will be reviewed. If applicable, set review date: 04/2014					
Does implementation go beyond minimum EU requirements?				N/A	
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.		Micro No	< 20 Yes	Small Yes	Medium Yes
What is the CO2 equivalent change in greenhouse gas emissions? (Million tonnes CO2 equivalent)				Traded: N/A	Non-traded: N/A

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 SELECT SIGNATORY: _____ Date: _____

Summary: Analysis & Evidence

Policy Option 1

Description: Do Nothing

FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years N/A	Net Benefit (Present Value (PV)) (£m)		
			Low: N/A	High: N/A	Best Estimate: N/A

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	N/A	N/A	N/A
High	N/A	N/A	N/A
Best Estimate	N/A	N/A	N/A

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

It was not possible to monetise the costs due to inadequate evidence.

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

Main affected groups are water and sewerage companies, non-water company abstractors (including farmers and industry), potential abstractors and consumers of water. Baseline costs would rise over time from regulation, reduced availability of water and impacts on the environment. There would be no new costs as the option is to do nothing and keep the existing system.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/A	N/A	N/A
High	N/A	N/A	N/A
Best Estimate	N/A	N/A	N/A

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

There would be no new benefits as the option is to do nothing. The possibility of significant potential benefits from reforming the system is foregone – however any potential costs are also avoided, e.g. there would be no administrative impact for the Environment Agency or Ofwat.

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

N/A

Key assumptions/sensitivities/risks

Discount rate (%) 3.5

Risks:(i) Worsening of environmental damage caused by over abstraction, (ii) Excessively costly and/or inadequate investment to meet water needs and (iii) Inefficient investment from not having resources used by highest value users. Assumptions: Climate change will cause a reduction in overall resource availability which will be significant by the 2030s and population growth will be in line with Office for National Statistics (ONS) forecasts .

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: N/A	Benefits: N/A	Net: N/A	No	NA

Summary: Analysis & Evidence

Policy Option 2

Description: Complete reform of the water abstraction system to make it fit for purpose for a world of climate change and increasing demand.

FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: N/A	High: N/A	Best Estimate: N/A

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	N/A	N/A	N/A
High	N/A	N/A	N/A
Best Estimate	N/A	N/A	N/A

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

Impossible to monetise at this stage (see below).

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

Main affected groups are water and sewerage companies, non-water company abstractors (including farmers and industry), potential abstractors and consumers. Non-monetised costs for all groups would include the cost of reforming the system and adapting to those reforms. It is not possible to estimate these costs at this time due to a lack of development of reform options and evidence on their costs which are complex due to the range of different sectors potentially affected.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/A	N/A	N/A
High	N/A	N/A	N/A
Best Estimate	N/A	N/A	N/A

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

No monetised estimates.

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

The key non-monetised benefit would be reduced costs of meeting water needs and protecting ecosystem services compared to business as usual. Evidence is not currently available to monetise these.

Key assumptions/sensitivities/risks

Discount rate (%) 3.5

Risks:

Excessive costs to abstractors and others from choosing a significantly sub-optimal reform option due to a lack of adequate evidence and engagement with stakeholders..

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: N/A	Benefits: N/A	Net: N/A	Yes/No	NA

Summary: Analysis & Evidence

Policy Option 3

Description: A package of no regrets, low risk measures to restore sustainable abstraction more efficiently through the EA using revenue from abstraction charges to fund hydromorphological measures and to increase the economic value from water mainly by facilitating trading of abstraction licences through provision of information.

FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: 40.72	High: 122.21	Best Estimate: 65.17

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0.03	0.09	0.81
High	0.03	0.27	2.38
Best Estimate	0.03	0.15	1.28

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

Transition costs consist of estimated £12,000 administrative cost for Environment Agency (EA) to produce trading rules guidance, and estimated £20,000 administrative cost for Environment Agency to update its electronic public register tool to enable publication of licence details. Annual costs represent the cost of using hydromorphological measures to achieve sustainable abstraction, which abstractors would pay for via the Environment Improvement Unit Charge (EIUC) levied by the EA.

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

A portion of the baseline costs would still be incurred (although would not be additional) as this option does not affectively address all the problems identified with business as usual. Whilst potential benefits are being foregone from not implementing option 2, costs associated with the risk of potentially significant sub-optimal reforms are also avoided.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	N/A	4.83	41.53
High	N/A	14.48	124.59
Best Estimate	N/A	7.72	66.45

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

The main affected groups are non-water company abstractors, who receive this benefit in the form of reduced EIUC payments (as these would now support cheaper hydromorphological measures as well as more expensive licence variations), and potential abstractors. The main monetised benefit is the cost avoided through using hydromorphological measures rather than licence variations.

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

The benefits from increased trading, expected to result from the publication of trading rules guidance and trade prices, have not been monetised owing to a lack of robust evidence on which to base such estimates. Under the best estimate scenario, breakeven analysis suggests that just two additional trades would deliver benefits to offset the £32,000 cost of this element of Option 2.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5
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Benefits may be overstated, but these are enabling measures and action will not happen unless benefits outweigh costs for each hydromorphological measure and each trade. They are no regret measures as transition costs are very low and at least qualitative learning benefits reasonably certain.

Assumptions: The case studies used to estimate benefits of hydromorphological measures are reasonably representative of the population.

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: ~0	Benefits: 0	Net: ~0	Yes	IN

Evidence Base (for summary sheets)

References

	Legislation or publication
1	Water resources strategy for England and Wales, Environment Agency, 2009: http://www.environment-agency.gov.uk/research/library/publications/40731.aspx
2	Defra, <i>Assessment of regulatory barriers and constraints to effective interconnectivity of water supplies</i> , 2010: http://archive.defra.gov.uk/environment/quality/water/resources/documents/wt0921-technical-report.pdf
3	Understanding Latent Demand for Water Abstraction Licences: Final Report on Task 1: Estimation of Latent Demand, RPA, February 2011 (awaiting publication)
4	<i>Exploring views on the potential for more active water rights trading</i> Synovate UK, 2008: http://www.ofwat.gov.uk/aboutofwat/submissionsresponsesevidence/pap_rsh_syndovatedec08.pdf
5	<i>Review of trading</i> , Environment Agency, 2009: http://www.environment-agency.gov.uk/business/topics/water/32024.aspx
6	Independent Review of Competition and Innovation in Water Market, Cave, 2009: http://archive.defra.gov.uk/environment/quality/water/industry/cavereview/final-report.htm
7	Consultation on time-limiting of abstraction licences: http://www.defra.gov.uk/environment/quality/water/resources/abstraction/
8	Water Resources Act 1991: http://www.legislation.gov.uk/ukpga/1991/57/contents
9	Environment Agency publication on future demand scenarios: http://publications.environment-agency.gov.uk/PDF/GEHO1208BPBY-E-E.pdf
10	Environment Agency/Ofwat Case for Change to be published with the Water White Paper
11	Water Framework Directive: http://ec.europa.eu/environment/water/water-framework/index_en.html

Evidence Base

	Y ₀	Y ₁	Y ₂	Y ₃	Y ₄	Y ₅	Y ₆	Y ₇	Y ₈	Y ₉
Transition costs	0.03	0	0	0	0	0	0	0	0	0
Annual recurring cost	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Total annual costs	0.18	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Transition benefits	0	0	0	0	0	0	0	0	0	0
Annual recurring benefits	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72
Total annual benefits	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72

Evidence Base (for summary sheets)

The problem overview

Water in rivers and aquifers is a common property resource and therefore needs a system of management to avoid the problem of the “tragedy of the commons” which would lead to inequity and environmental damage:

- If excessive water is abstracted from rivers upstream, this could affect the ability of those downstream to abstract water, potentially derogating their rights i.e. stopping their ability to access water in line with their licences; and
- Abstraction can significantly affect water flow regimes impacting on the quality and type of habitat in the river; the amount and type of sediment that is carried in the water and where it is deposited; and water quality (temperature, dissolved oxygen, dilution of pollutants, residence time of chemicals).
- Abstraction from aquifers can affect the availability of water for other abstracters and reduce water availability for wetlands and rivers, damaging the environment.

Water is abstracted by a range of industries and individuals – see Figure 1. It is a crucial resource for businesses and households. Beyond sustaining life, supporting hygiene and growing food, it is also a crucial input to many industries, providing process cooling to heavy industries, particularly the power sector but also metals and chemical sectors, and being incorporated into products in food and drink and paper industries. Much of the water abstracted is returned but there remain substantial losses in evaporation, leakage and incorporation into products, while abstraction and discharge can be substantial distances apart leaving depleted stretches of surface and groundwater¹.

Figure 1 Abstraction licences, licensed abstraction and actual abstraction by abstracter type for 2008/9²

	Licences in force		Licensed abstraction		Actual abstraction	
	No	%	MI/day	%	MI/day	%
Public water supply	1,672	8%	26,580	21%	16,241	30%
Spray irrigation	10,529	49%	934	0.7%	156	0.3%
Agriculture (excl. spray irrigation)	3,035	14%	240	0.2%	38	0.1%
Electricity supply industry	398	2%	81,875	63%	30,588	56%
Other industry	4,041	19%	14,000	11%	4,954	9%
Fish farming, cress growing, amenity ponds	706	3%	5,291	4%	2,850	5%
Private water supply	1,048	5%	104	0.1%	24	0.04%
Other	201	1%	442	0.3%	74	0.1%
Total	21,630	100%	129,466	100%	54,925	100%

¹ Systematic information on actual losses is not currently available and will be investigated as part of developing the evidence base to underpin more radical reform.

² Source Defra statistics - <http://archive.defra.gov.uk/evidence/statistics/environment/inlwater/iwabstraction.htm#iwtb22>

The current water abstraction management regime (see Box 1) was designed to regulate how much water can be abstracted from rivers and groundwater at any particular time by any particular licence holder. Although it has evolved at times, for the majority of licensees it has not changed significantly. At the time it was designed there was an apparent surplus of water in most areas. This surplus has been eroded over time as understanding has increased of the impact of water abstraction levels on water ecosystems and legislation has been put in place to address it. Currently the Environment Agency is investigating almost 300 schemes where there are significant risks of damage to important conservation sites including Natura 2000 sites and Sites of Special Scientific Interest. Overall 12% of water bodies are unsustainably abstracted with risks of damaging water ecosystems and being instrumental in the failure of water bodies to meet good ecological status under the Water Framework Directive.

Box 1 The abstraction management regime and unsustainable abstraction

The abstraction management regime was originally created in 1963 with licences issued based on previous usage, Acts of Parliament and common law rights. These licences have been grandfathered into new legislation while the issuing of new licences has taken account of environmental legislation as it has come into force such as the Habitats Directive and the Water Framework Directive. These directives have restricted the issuing and affected the nature of new licences and also created a number of areas where abstraction is deemed to be unsustainable as it may be causing environmental damage.

EA is investigating these areas where the potential for damage is identified to establish the extent of environmental damage and whether it contravenes environmental law. If an abstraction is established to be contravening environmental law and the abstractor is not willing to take voluntary action to stop the damage, the Environment Agency is able to compulsorily vary licences to remove damage. However the Environment Agency is then liable to compensate the licence holder, if they appeal against the variation, for any losses due to the variation in the licence unless the licence has been unused or after 2012 the abstraction is causing 'serious damage'. The Environment Agency raises funds to meet these compensation liabilities through a charge on abstractors called the Environmental Improvement Unit Charge (EIUC).

In the future we face substantial new challenges from climate change and increasing water demand.

- There is a significant risk that climate change will significantly increase the variability and decrease the average amount of water available by 10-15 per cent. Natural river flows in the late summer and early autumn could fall by up to 50 per cent, and the driest months in some catchments by up to 80 per cent by 2050, compared with the second half of the 20th century.
- Population growth, changing lifestyle and climate change mean that demand for water may well increase. Under an unrestricted demand scenario this could be by 5 per cent by 2020 and as much as 35 per cent by 2050³.

Inadequate supplies of water can have significant impacts on households, the provision of increased housing and on the promotion of green economic growth:

- Shortages of the public water supply affects households and a wide range of businesses.
- The power sector depends significantly on abstracted water and shortages could affect the availability and affordability of electricity.
- A wide range of other industries rely on abstracted water particularly the chemical, metals, paper and food & drinks industries with the main use being process cooling.

³ <http://www.environment-agency.gov.uk/research/library/publications/40731.aspx>

- Farmers can lose crops, such as potatoes, due to water shortages which can be very costly, particularly for small businesses.

The current water abstraction regime is not fit to deal efficiently with these new challenges because

- The right to abstract does not generally vary automatically as water availability changes but can only be changed through slow and costly regulatory mechanisms, leading to regulatory uncertainty and barriers to investment to respond efficiently to reducing water availability;
- The market for abstraction licences is not dynamic due to barriers to trading (see Box 1) and potentially overly cautious holding of licences, which means that it is unlikely the maximum economic value is being gained from water use or will be as water becomes more scarce; and
- Our knowledge of the value of water in the environment and how it supports water ecosystems is subject to significant uncertainty raising questions as to the efficiency with which we currently manage water.

The water abstraction system is already demonstrating its limitations in the time and cost taken in addressing the legacy of unsustainable abstraction with risks to the environment, and in the limited level of licence trading activity seen to date.

Box 2 Trading in abstraction licences

It is currently possible for holders of abstraction licences to enter into a commercial private transaction to trade their rights to water where licences relate to hydrologically linked water bodies, generally in the same catchment subject to Environment Agency approval. The trade actually happens through the seller applying for a variation in their licence and the buyer applying for a similar level of variation or a new equivalent licence in a different location. The Environment Agency will investigate the potential environmental impacts of any such trade before agreeing it. Since 2003 and up to November 2010 there have been 53 trades⁴ with the main traders being agricultural irrigators in East Anglia.

The Environment Agency and Ofwat commissioned work⁵ to assess if there were any unnecessary barriers to trading in abstraction licences which concluded that there were a number of significant informational barriers such as unclear trading rules and a lack of information on the price of water traded.

As a result of these inadequacies in the abstraction regime, there could be:

- risks of unsustainable and/or inefficient investment in public water supplies affecting water bill payers in both households and businesses;
- increased risk to security of supplies for water users as necessary investments in water infrastructure are not made on a timely basis;
- risk of excessive costs affecting industries highly dependent on water abstraction such as the power, chemicals, metals and food & drink sectors, and irrigators who are often small businesses; and
- risk of deterioration of water ecosystems contrary to the Water Framework Directive.

In short the current system is no longer fit for purpose and may require substantial reform, although we do not currently hold adequate evidence to design that reform at this point. However there are possibilities for no regrets, low risk measures to restore sustainable abstraction more efficiently and increase the economic value from water mainly by facilitating trading of abstraction licences.

⁴ In total there have been 53 trades. However for 2 of these trades we do not hold data on the year of trade.

⁵ *Exploring views on the potential for more active water rights trading* Synovate UK, 2008

Rationale for intervention

As a common property resource, Government is already intervening to protect these natural systems. However as discussed above the current regulatory system for water abstraction is not sufficiently dynamic and responsive to cope with existing unsustainable abstraction and with the challenges of increasing population and climate change. Without additional steps to reform and update the system to make it fit for purpose in the future several negative consequences can be expected:

- The system will become increasingly costly to operate, particularly due to the increased need for site investigations into whether environmental damage is occurring due to abstraction, and will not represent a least cost management regime.
- There may be excessively costly investment in capital intensive water storage, treatment and/or transfer infrastructure to provide alternative sources of water or even disruptions to water supply due to delays in more timely and efficient investment options due to regulatory uncertainty.
- Water will not move from low to high value uses in response to increasing scarcity.

However, it must be recognised that any plan for improved intervention will have to overcome some significant uncertainties and risks. In particular, uncertainties about what the impact of climate change will be, the impact of abstractions on the environment, and costs to abstractors of different reform options. The plan for intervention therefore needs to address these risks and uncertainties and take an adaptive approach. Hence the preferred option is to take low regret, low risk actions that move in the direction of these objectives while evidence is gained to underpin more fundamental reform.

Policy objectives

Given the above, the key policy objectives can be stated as to:

- provide clearer signals to abstractors to make the necessary investments to meet water needs and protect ecosystem functioning.
- make more water accessible to higher value users in order to drive economic growth.
- ensure that the costs of reducing unsustainable abstraction are minimised while meeting reasonable expectations of compensation.

At the same time, there is a need to take into account the current uncertainties and risks which may lead to a poorly designed intervention with a sub-optimal outcome.

Description of options considered

This Impact Assessment looks specifically at abstraction measures. Although demand-reduction measures would also help to achieve some of our objectives, these are being taken forward elsewhere.

Option 1

Option 1 is to do nothing. This would represent continuing with the current water abstraction regime, using whatever tools are currently available to achieve or attempt to achieve the policy objectives. But the policy objectives could not be achieved and there would be:

- inefficient (high cost) restoration of unsustainable abstraction;
- constraints on economic growth through not ensuring water achieves maximum economic value; and
- inefficient or inadequate investment to adaptation to climate change and increasing water demands, and at the same time an increasing deterioration in water ecosystems.

Option 2

Option 2 is to reform the water abstraction system completely to make it fit for purpose in a world of climate change and increasing demand for water. In practice this is likely to involve reform of water abstraction licensing so that rights to water are more clearly linked to levels of water available at any particular time and reform of the pricing of abstracted water. A number of sub-options are likely to be developed involving different combinations of rights and pricing reform which have yet to be developed.

If we were to specify and implement this option now, a new regime would be introduced as soon as practicable with limited attention paid to the uncertainties which are present. As a result the new regime would either entail a high risk of not meeting its objectives or being higher cost than is necessary. We do consider that comprehensive longer-term reform is ultimately necessary, and as such have signalled our intention to reform in the Natural Environment White Paper. However there is still much design, testing and options appraisal to be carried out to avoid implementing a sub-optimal option. We intend to commission a range of research over the next year with key areas being targeted:

- examination of how different designs for reform would impact on the public water supply and costs to water bill payers compared to Option 1;
- examination of how different designs for reform would impact on the ability of non public water supply abstractors to minimise their costs of managing their risks of water scarcity particularly due to climate change (e.g. through trading water) compared to Option 1;
- potential to improve the evidence base which underpins the establishment of environmental standards to reflect environmental benefits and meet regulatory requirements, particularly under the Water Framework, Habitat and Birds directives; and
- mechanisms to better recognise the value of discharges of abstracted water back into rivers and ground water which many industries perform.

As well as improving our evidence base, we would also need to seek further input from stakeholders on the approach before pursuing substantial reform, which will take time. Ministers have agreed this approach to long-term reform. The current plan is to consult on variations of Option 2 in 2013, providing a draft impact assessment at that time based on the above evidence and engagement processes.

Option 3

Option 3 responds to the problems identified with implementing Option 2 at this time by focusing on low risk and low and no cost measures initially which contribute towards the objectives identified and are consistent with likely long-term directions of reform while evidence is developed to underpin Option 2. This would entail:

- the Environment Agency using EIUC to fund its use of existing hydromorphological powers⁶ to achieve sustainable abstraction at a much reduced cost.
- a package of measures designed to facilitate access to water within current abstraction licensing regime regulations. This will include publishing clear and simple trading rules, and making information about trades publicly available, including prices in a manner that does not cause commercial damage.

The Environment Agency changing their charging scheme so that abstraction charging income is used to fund the exercise of hydromorphological measures removes a barrier to using more cost beneficial measures to achieve sustainable abstraction. It is also more equitable as such measures will reduce the amounts abstractors will need to pay towards funding reductions in

⁶ Hydromorphology is a term used to describe the hydrological and geomorphological (structural) processes and attributes of rivers, estuaries and coastal waters. The Environment Agency powers allow changes to be made to hydromorphology to achieve Water Framework Directive objectives of achieving good ecological status. Hydromorphological measures might, for instance, involve deepening river channels, installing sluices in the bank of a river or activating existing dam structures.

unsustainable abstraction. The main current means of reducing unsustainable abstraction is to reduce licensed volumes of abstractors and use funds to pay compensation for losses that arise. These same funds with this option would then be available to fund hydromorphological measures where they are most cost beneficial than variations to licences and hence reduce the need to collect funds from abstractors.

We consider that facilitating access to water through trading would have a positive impact on competition as removing many artificial barriers to trading (e.g. through providing better information on trades) will enable water to be accessed where it is most needed, thus increasing the economic value from the water used. The trading measures would also contribute to the reduction in risks and uncertainties surrounding promoting trading by helping the Environment Agency to develop its knowledge and experience to aid the design of future systems. However, it is important to acknowledge that this option is still constrained by the current nature of the abstraction management regime so is unlikely to achieve the level of trading possible under Option 2. Option 3 would provide a first “no-regrets” step on the road to future reform.

Consultation

Over the last year, Defra has instituted an informal consultation process with stakeholder affected by these options. We have met individually with affected sectors (water industry, power sector, other industrial heavy users of abstracted water, irrigators and environmental NGOs) and held a major workshop with representatives of all stakeholders. In general stakeholders have been positive about option 3 except for stakeholder concerns, particularly representatives of farmers, about the use of EIUC to fund hydromorphological measures. They have indicated that there are risks of resulting damage to land holders. We have indicated that such measures would only be used where benefits outweighed costs and directly affected landholder potentially affected by a proposed hydromorphological measure would be consulted as part of assessing whether such a measure was appropriate. The Environment Agency will also consult on the use of EIUC to fund hydromorphological measures as part of its consultation on changes to its charging regimes.

Conclusion

In order to bring immediate benefits to the economy, society and the environment, taking account of the current uncertainties, we consider **Option 3** to be the best option to pursue straight away as it provides benefits with low risks and costs, while we develop the evidence base to underpin more fundamental reform.

Costs and benefits of each option

Costs and benefits summary table for preferred option

Option	Costs		Benefits		In/out
	Description	£m (NPV)	Description	£m (NPV)	
3a – hydromorphological change	Cost of implementing hydromorphological measures, ultimately paid for by abstractors through the Environmental Improvement Unit Charge (EIUC).	1.25	Reduced costs of meeting sustainable abstraction, ultimately benefiting abstractors who currently fund this through the Environmental Improvement Unit Charge (EIUC).	66.45 ⁷	Out of scope
3b, c, d - measures to encourage trading	Administrative cost to Environment Agency of producing trading principles guidance.	0.01	Availability of better information may have the effect of encouraging increased trading.	Benefits from increased trades are expected to equal or exceed associated costs, however without a robust estimate for the increase in trades expected, these benefits remain non-monetised.: >£0.032m	In (but negligible: ~£0m)
	Administrative cost to the Environment Agency of adding licence detail fields to its electronic public register tool.	0.02			
	Negligible cost to business of additional box to complete on existing form	~~0			
Total		1.28m		66.45	

⁷ These benefits are a best estimate based on available evidence, but are uncertain due to lack of knowledge of the representativeness of the sample underlying the evidence. However in actual fact the measures would not be implemented without a specific detailed cost benefit assessment ensuring they would only be used where benefits clearly exceeded costs.

Option 1 – Do nothing

Costs

This option carries no upfront implementation costs as it is a continuance of the existing system. However, over time costs would be incurred based on the problems of the current system set out previously.

- Unsustainable abstraction would not be tackled as efficiently as possible;
- maximum economic value will not be gained from water use; and
- investment will not be planned efficiently for adaptation to climate change due to lack of clear signals from the abstraction management regime which could lead to overly costly solutions to water supply (e.g. desalination plants), disruptions to water supply and/or environmental damage.

It is not possible to estimate these costs. Instead we will estimate the costs and benefits of Option 3 compared with the do nothing baseline. However in terms of context it is worth noting that the recently completed National Ecosystem Assessment⁸ identified the costs of 'do nothing' as in the region of £1.4 billion to £2.1 billion per annum. These costs provide an order of magnitude of the costs associated with inefficiently addressing the challenges of climate change and the potential from saving through more efficient approaches. However it should be clear that a proportion of these costs are likely to be incurred anyway in responding to climate change as it is unlikely that the whole challenge can be addressed through demand management alone.

Box 3 UK National Ecosystems Assessment 2011

In the long term, the economic value of freshwater provisioning will reflect the costs of achieving an appropriate balance of the demand for and supply of water. On the demand side, the Environment Agency reports⁹ that measures such as compulsory metering to reduce household water consumption by a target of 15% (from 150 to 130 litres/day) could cost between £1.40 and £1.6/m³. By comparison, options to enhance freshwater supply appear more expensive, namely surface and ground water development (£1-£5/m³), reservoirs (£3-£10/m³) and desalinisation (£4-£8/m³). A detailed review of water supply options in 1998¹⁰ however, estimated incremental average costs ranging between £0.21/m³ and £1.36/m³ in 2010 prices for water delivered from large scale reservoir development (excluding treatment) assuming on average that 50% of available reservoir capacity is used each year.

Increased investments may be required in future in order to avoid pressures on freshwater ecosystems associated with changes in climate and/or demographics. A moderate climate change scenario could reduce water available for immediate abstraction by 10% by 2060, equivalent to about 1.4 billion m³/year for the UK at current levels of abstraction. Assuming water storage and transfer costs of between £1 and £1.5/ m³ for large scale provision, securing this amount of water would cost about £1.4 to £2.1 billion per year for the whole UK population assuming similar abstraction rates across the nation (equivalent to about £23 to £35/year/capita of population affected). These investment costs could be higher if the climate change impact is greater and the growth in water demand is unconstrained. While these figures do not estimate the value of water services provided by freshwater ecosystems, they indicate the equivalent cost of securing water supplies for use while maintaining the non-market ecosystem services of rivers, lakes and aquifers. In some cases, investments in supply enhancement and regulation may also achieve environmental enhancements.

⁸ Morris, J. and Camino, M (2011) Economic Assessment of Freshwater, Wetland and Floodplain (FWF) Ecosystem Services

⁹ Environment Agency. 2009. Water for people and the environment: Water Resources Strategy for England and Wales < Environment Agency, Bristol <http://publications.environment-agency.gov.uk/pdf/GEHO0309BPKXE-E.pdf>

¹⁰ Mott MacDonald. 1998. Review of Costs to Balance Water Supply and Demand. Report no 48550/WSD/02B, August 1998. Ofwat, Birmingham

Benefits

There are no real benefits from continuing with the existing system, other than the certainty it offers as it is a known system, particularly when given the uncertainties around options 2 and 3. The evidence shows that change is required to ensure we meet water needs efficiently and protect water ecosystem services.

Option 2 - Long term reform

Option 2 is complete reform of the water abstraction system to make it fit for purpose in a new world of climate change and increasing demand. As set out above, we believe that this is necessary in the longer-term but that it is not currently possible to assess the detailed reform requirements due to a lack of robust evidence to assess the costs and benefits. As a result, we have not developed in detail what the options for long-term reform are, or the costs to business.

Option 3 a - Restoring sustainable abstraction

Option 3 represents a package of no and low cost reforms which represent a first, “no-regrets” step towards the longer term reform options.

3a - Hydromorphological powers¹¹

Costs

There are no significant changes in cost associated with this option.

Cost = 0

Benefits

We believe the use of abstraction charging income for hydromorphological works to relieve water or habitat stresses offers the benefit that:

- the cost of undertaking the works would be cheaper overall compared with the costs of varying/revoking licences to achieve the same objective. This will reduce the overall costs of meeting sustainable abstraction objectives, benefiting abstractors who ultimately fund this through the Environmental Improvement Unit Charge (EIUC).

We have considered the potential cost savings from the use of the Environment Agency’s hydromorphological measures being funded from charging income. Currently such measures could be funded from Grant-in-aid but the resources are not available given other commitments and given that the benefits of such measures accrue to abstractors, we believe that it is fair that they should meet the costs.

The Environment Agency has identified seven sites for non-water companies¹² where using hydromorphological measures to restore sustainable abstraction could be more effective than the current option of varying a licence. There may be more examples that come forward as the RSA investigations progress but these will not be considered in the assessment of benefits.

We have calculated the net present value of reduced costs from adopting this approach.

The estimated average cost of restoring a site via varying the abstraction licence and requiring the licence holder to find alternative options to meet their demand is between £9 million and £42 million (with some much more minor ongoing costs). This is based on the engineering cost estimates for restoring four specific sites identified by the Environment Agency (*Annex 4*). This can be compared to the average cost of restoring a site via hydromorphological change

¹¹ The Environment Agency has hydromorphological powers under the Water Resources Act s161ZB which enable it to carry out works, such as deepening river channels, installing sluices in the bank of a river or activating existing dam structures, in order to achieve WFD objectives.

¹² Water companies have been excluded from this sub-option as there is a separate Ofwat policy proposal that would remove water companies from the scope of the EIUC. EIUC would no longer be used to fund water company licence variations to achieve sustainable abstraction. Water companies would be expected to put forward proposals for schemes to address unsustainable abstraction for consideration by the economic regulator at the next price review in 2014.

(calculated using the average cost for the same four sites) which ranges from £3,000 to £600,000 in the cost of works with some minor ongoing costs. Calculated over ten years the net present value (NPV) of the saving of the hydromorphological measure over changing the abstraction licence is around £80 million (NPV) for non-public water supply sites. To account for potential outliers in the data, the central estimate was revised down to £65m. Annex 4 provides more detailed discussion of how these estimates have been arrived at.

This estimate is based on the best available evidence of benefits but has a level of uncertainty associated with it due to lack of knowledge of representativeness of the sample of example sites. However:

- it is a conservative estimate as there may be more than seven sites where hydromorphological measure may deliver such benefits; and
- the use of hydromorphological measures for each site will be subject to a detailed and rigorous cost benefit assessment in each case before they are used.

Benefits = £65 million NPV.

Option 3 b, c and d: green economic growth and access to water

As this is a package of measures to encourage licence trading, we have set out the collective benefits of encouraging trading. Costs are outlined separately as they differ for each measure. It should be noted that trading licences is currently possible under the current abstraction regime, but it occurs rarely due to a number of mainly informational barriers¹³. The package of measures is designed to remove these barriers as far as that is possible within the current regime.

¹³ *Exploring views on the potential for more active water rights trading* Synovate UK, 2008:
http://www.ofwat.gov.uk/aboutofwat/submissionsresponsesevidence/pap_rsh_syndovatedec08.pdf

Option 3b – Licence trading

Costs

Through discussion with the Environment Agency we have estimated that they would incur additional administrative costs of £12,000 to produce guidance on current trading rules¹⁴.

Cost = £12,000

Option 3c – publication of abstraction licence details on the public register

Costs

The estimated administrative cost of including the necessary fields on the Environment Agency's current electronic public register tool (ePR) in order to be able to publish licence details is a maximum of £20,000.

Cost = £20,000

Option 3d – publishing trade prices

As this would be in the form of a simple spreadsheet made available on an internet page, this would be included within the costs for Option 3c.

Overall benefits of encouraging trading

Both qualitative and quantitative evidence on the benefits of trading have been considered during the preparation of this Impact Assessment. Any voluntary trade of water rights would be expected to create a benefit to those involved in the trade and thereby benefit society by improving the allocation of water from lower to higher value uses.

- Trading will give access to water for those who value it more, increasing overall welfare.
- Trading leads to a more efficient use of limited resource by maximising the productivity of water.
- By giving access to existing under-used or under-valued water supplies, abstractors could reduce or defer investments in new water resources that are less cost-effective. Trading may add to the mix of options available for maintaining supply/demand balance; for water companies' customers, this could help minimise water bills.

However, the promotion of additional trading also comes at a cost. While longer-term reform of abstraction management (as in Option 2) would be expected to lead to a significant increase in trading activity (or a significant move towards an increased level of trading), it is less clear how much additional trading would be expected to follow on from the short term interventions considered in this option.

Publicly available information about trades and prices would benefit potential participants in the market, who currently have limited information about the going 'market price' of licences. By learning the value of water, as represented by trade prices, they will be able to make better informed decisions about their own participation in the market. It should be noted that trading prices would be published in a manner that does not cause commercial damage. This requirement will limit the detail at which trade price information can be published and hence its value.

Aside from the benefits of the additional trades created, there are also significant 'learning benefits'. These may be described as the development of knowledge and experience so that the Environment Agency can better design future systems, where trading may be an integral element. For example, a better understanding of the value of water, the principles of trading, what works and what doesn't. Hence this option would contribute to the reduction in risks and uncertainties which constrain the effectiveness and practicability of Option 2.

¹⁴ Based on 80 days effort of Environment Agency staff time and a one day workshop

The measures would:

- help to reveal value of water in stressed catchments (moving from cost recovery to value of scarce resource) also reducing transaction costs involved in discovering prices.
- test emerging processes so that any weak points and barriers can be revealed and addressed; better understanding of incentives to sell and buy.
- provide a better understanding of how the scarcity of resource influences its value.
- provide an early understanding of any potential inequalities trading may create (i.e., value of produce vs. demand for water, and who can afford it).

Although it might be possible to ascribe a quantitative number to these benefits (e.g. by assessing the likely increase in efficiency of a future trading scenario because of the learning undertaken in the short term) it is considered that this would be spurious at this stage owing to the lack of available evidence on which to base such an estimate.

Instead we have reviewed the evidence on the benefits of trading to determine whether it would be possible to produce a monetary estimate of the benefit of encouraging additional trades as part of the short term reforms to be announced in the Water White Paper. A monetary estimate is possible but is not considered to be robust (see Annex 5 for full review of evidence). This lack of robustness leads to a wide range in the answer such that it is possible to say: Any intervention that cost more than £32K per annum and was not able to stimulate two additional trades would be unlikely to be cost-beneficial. Depending on the situation it may require 18 more trades or just one.

Until there is a significant improvement in the evidence (probably requiring a meta-analysis of existing evidence or a survey to collect new values) it is unlikely a more robust estimate can be produced. As such an investment is likely to cost more than the intervention (c £32K) it is not considered proportionate to do so at this stage. However the evidence base will be improved in the medium to long term (partly as a result of these interventions).

- Traders and would be traders have better access to information to be able to determine where possibilities are.
- Potential environmental improvements as traders look to alternative lower value resources.
- Potential economic benefits as a result of increased water availability.
- May help to reveal the value of water.

Whilst these benefits cannot be quantified, it is expected that the additional costs of stimulating trading are at least balanced by benefits of a similar amount. If this is considered to be a conservative assumption and ignores the wider significant qualitative benefits from learning and better design of a future trading system are included in the qualitative assessment then the benefits are expected to exceed the costs. Without robust evidence on which to base any assumption for the increase in trading as a result of the measures, a prudent approach has been taken and thus the expected benefits have not been monetised.

Benefits = Non-monetised, but expected to outweigh the costs of the intervention: >£32,000

Risks and assumptions

Option 1

Risks

The key risk from implementing the do nothing option is the worsening of environmental damage caused by over abstraction and the inability to meet future pressures such as climate

change and population growth. In addition to this, if we do nothing now, we may not have time to take action before it's too late so we would have to pursue a more expensive option (e.g. desalination).

Assumptions

- Climate change will cause a reduction in overall resource availability which will be significant by the 2030s.
- Population growth will be in line with ONS forecasts.

These assumptions are common to all options.

Option 2

Risks

The key risk from implementing Option 2 straight away is that we take the wrong approach due to a lack of adequate evidence. These risks are discussed in detail under the rationale for not implementing Option 2 at this point.

Option 3

Risks

The key risk arising from implementing the preferred option (3) is that it will not go far enough to ensure the abstraction management regime is fit to withstand the pressure of climate change and population growth. This is why we are investigating more substantial reform (Option 2) over a longer timeframe.

There is also a risk that the measures will have very limited impact as these largely enabling measures will not actually deliver benefits as in actual fact there are limited opportunities for cost beneficial hydromorphological measures and very few extra abstraction licence trades eventuate. However the transition costs at ~£32,000 are very low and even if these benefits don't eventuate there will be important learning in terms of the effectiveness of hydromorphological measures and the potential for increased trading, which can be incorporated into design of future more radical reform option consideration. Hence these measures have close to zero downsides and can be considered as no regrets measures.

Assumptions

- Trading will be promoted to a reasonable extent by improving available market information; and
- The case studies for estimating the benefits of hydromorphological measures are reasonably representative of the population of potential schemes.

One-in, one-out

The preferred option and regulations do not in themselves impose a significant additional burden on business. In fact they are aimed at simplifying the existing regime, in particular making it easier for water companies to plan ahead more effectively, in line with the PR/WRMP processes.

The only burden is the collection of trading price information from only those abstractors that are involved in trades which is negligible as it would only involve completing one extra box on an existing form giving information about trades. The preferred option does not generate any direct benefits for business. The benefits that accrue to businesses from the measures to encourage trading will be indirect.

Consequently, whilst the preferred option is within scope of OIOO and does impose an additional burden on business, this burden is considered ~£0. Hence the option is considered to be a 'zero In'.

Summary (and preferred option, with description of implementation plan)

In summary, our preferred option is Option 3. This will allow for short to medium-term improvements to be made at least cost. Longer-term reform, although necessary, will require further analysis, evidence and engagement with stakeholders

The key implementation steps for the preferred option would be:

Action	Date implemented by	Responsible owner
Publish guidance on trading principles.	Summer 2011	Environment Agency
Electronically publish details of abstraction licences on the public register.	2012/13	Environment Agency
Legislate to give the Environment Agency new powers to require trade price information.	2014	Defra
Legislate to allow the Environment Agency to use abstraction charges to fund hydromorphological measures,	2014	Defra
Incorporate funding for water company sustainability changes into PR14 (and accompanying guidance)	<p>October 2012 – January 2013: consultation on the approach.</p> <p>August 2013 - companies submit and publish summaries of draft business plans, informed by cost-benefit assessments and including a 25-year forward look.</p> <p>April 2014 - companies submit and publish summaries of final business plans.</p> <p>November 2014: Ofwat publishes its final determinations.</p> <p>[indicative timetable based on approach to PR09]</p>	Ofwat

Annex 1 - Specific Impact Tests

Statutory equalities duties

There are no limitations on meeting the requirements of the options on the grounds of race, disability or gender. The options do not impose any restriction or involve any requirement that a person of a particular racial background, disability or gender would find difficult to comply with. Conditions apply equally to all individuals and businesses involved in the activities. The main affected groups are water and sewerage companies, non-water company abstractors (including farmers and industry), and potential abstractors.

Competition assessment

The proposal does not limit the number or range of suppliers, nor does it reduce their ability or incentives to compete. Instead the preferred option has a positive impact on competition through removing artificial barriers to trading which enables water to be accessed where it is most needed, thus stimulating the economy. As none of the four Office of Fair Trading filter questions apply to any of the options, a full competition assessment is not required.

Small firms impact test

The proposal does not place small firms at any unreasonable disadvantage compared to normal market conditions.

We have considered the moratorium on micro businesses and start ups and these will be exempt from any regulation during the growth period. As this is a first stage Impact Assessment we do not anticipate regulations coming into force until 2013 so micro businesses and start ups will be exempt until April 2014. We do not consider that the exemption should be permanent because the proposals will bring net economic benefits and exempting micro businesses permanently will mean we are not achieving the full benefits of the proposals. The reduction in benefits will be minimal due to the time for exemption.

Greenhouse gas

We do not consider there to be a significant impact on greenhouse gas emissions.

Wider environmental issues

Of the seven potential impacts listed in Defra's guidance for assessing wider environmental impacts, only one applies.

<u>Will the policy option be vulnerable to the predicted effects of climate change?</u>	Yes. That is why we also propose longer-term work to look at how to develop a new regime to meet the challenge of climate change.
<u>Will the policy option lead to a change in the financial costs or the environmental and health impacts of waste management?</u>	No
<u>Will the policy option impact significantly on air quality?</u>	No
<u>Will the policy option involve any material change to the appearance of the landscape or townscape?</u>	No
<u>Will the proposal change 1) the degree of water pollution, 2) levels of abstraction of water or 3) exposure to flood risk?</u>	The proposal will change the levels of abstraction of water but there will be no adverse environmental impact.
<u>Will the policy option change 1) the amount or variety of living species, 2) the amount, variety or quality of ecosystems?</u>	No

<u>Will the policy option affect the number of people exposed to noise or the levels to which they're exposed?</u>	No
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Sustainable development

Although the proposal has wider environmental impacts, as outlined in the wider environmental specific impact test, the questions in the sustainable development SIT proforma do not apply. For example, there is no significant impact on the key legal and regulatory standards (in this case the Water Framework Directive) and no inter-generational impacts identified for the preferred option. In a broader sense, the policy could have a beneficial impact on sustainable development through, for example, making local access to water easier. In the longer-term, work on developing a new abstraction management regime (Option 2) will have a greater impact on future generations and we will revisit this as part of developing that work.

Health and well-being

The proposal does not have an impact on health and well being.

Human rights

This proposal does not have any human rights impacts and is consistent with the Human Rights Act 1998.

Justice

The proposal does not have any judicial impact.

Rural proofing

We have considered the rural proofing toolkit and do not consider that the policy has an adverse impact on rural areas.

Annex 2 – Further Details on the Nature of the Problem

Long-term challenges of climate change and increases in water demand

There is a significant risk of increasingly variable and reduced water availability due to climate change

The effect of predicted changes in rainfall and evaporation will mean that natural river flows during the summer and autumn are likely on average to be significantly lower by the 2050s, with potentially a drop in annual average river flows by up to 15 per cent. River flows are also likely to be increasingly variable.

- Natural river flows in the late summer and early autumn could fall by up to 50 per cent, and the driest months in some catchments by up to 80 per cent, compared the second half of the 20th century.
- In winter, as a result of the higher projected rainfall, average natural river flows may increase by 10 to 15 per cent.¹⁵

Ground water availability may also reduce to some extent as more intense winter rainfall may be less effective at recharging groundwater as it will tend to runoff to a greater extent. Furthermore the recharge period during the winter is likely to start later.

The risk of droughts is likely to increase based on Met Office modelling, with a best case of very limited change to very worst case modelling suggesting a ten times increase in likelihood of significant droughts to once every ten years by 2100 – this would involve droughts like those experienced in 1975/6 occurring every ten years.

There is likely to be increasing demand for water, particularly due to population growth

Population growth, changing lifestyle and climate change mean that demand for water may well increase. Under an unrestricted demand scenario this could be by 5 per cent by 2020 and as much as 35 per cent by 2050¹⁶.

- Domestic demand alone could increase by around 1,300 Ml/day (or around 10 per cent of current public water supply abstraction) by 2030 and is likely to be skewed towards the South East where the population growth is likely to be highest. This increase already assumes a much lower per capita consumption of 130 litres per head per day than we have today for a 10 million population rise predicted for 2030 by ONS and would be 1,480 Ml/d if today's average consumption continued instead.
- Demand for water will also increase due to climate change. Some types of abstraction will need more water either due to increased output (for example, the expansion of the soft drinks industry) or increased water use (for example, increased irrigation, as there will be less rain in summer on average). The scale of change will vary in different in parts of England.

These two effects create the risk of a significant gap between water supply and demand to arise without significant investment. There are a range of options available to fill this gap between supply and demand.

The main options for water companies are likely to be expanding reservoirs, aquifer recharge, inter basin transfers/water trading, re-use of discharged water and smarter demand management. Other abstractors, for instance farmers, could also invest in reservoirs while industry using water for cooling, could invest in air cooling systems.

¹⁵ These were the best available estimates based on CIP02 scenarios, which are currently being updated based on CP09 scenarios. The Environment Agency have determined that the new estimates will not be significantly different from previous ones.

¹⁶ <http://www.environment-agency.gov.uk/research/library/publications/40731.aspx>

However the current abstraction management system does not provide clear signals of the real availability of water to steer the required investment due to the fact that existing abstractors have licences in perpetuity.

The current abstraction management regulations provide the majority of abstractors with licences that do not respond to actual water availability. Their rights are constant even if the actual water reduces substantially as is likely to happen with climate change. The regime signals to abstractors that they have significant available water, providing them with an expectation of being able to meet increasing demand from increasing utilisation of their licences.

Currently there are significant amounts of licensed volumes that are not abstracted. Over the period 2003 to 2007, only 44 per cent of licensed volume was actually abstracted in England from non-tidal sources. Public water supply licensees abstracted 55 per cent of their licensed volume and for all other uses the average utilisation was just 35 per cent. It is important to note that some of this licensed but unused water is legitimate headroom, for contingency planning purposes.

The key issue with the current abstraction management system is the historic problem of over-licensing. If all abstractors were to make full use of their licensed volumes, this could lead to environmental damage.

The current abstraction system only responds slowly after unsustainable abstraction is identified

Catchments will become increasingly unsustainably abstracted, as abstractors use their licensed volumes to meet demand and climate change reduces the availability of water. Some abstractors may not even be able to use all their licensed volumes as the physical water may not be available as rivers dry out.

Under the current system, all licences in water bodies that become unsustainably abstracted will need to be investigated under the Water Framework Directive, any required changes to licences will need to be assessed and funds raised from abstraction charges to compensate licensees for any losses that might arise from changes to licences. This will be a time consuming and costly process, likely to create a substantial back log of damaging abstractions where decisions are pending on whether variations to licences are required.

The slowness of response of the current system will create a level of uncertainty for abstractors

This back log will cause uncertainty for abstractors as their access to water will be under question as investigations are undertaken and funds are raised to meet any compensation requirements. It will also make it difficult for them to make decisions on supply and demand management options. Abstractors have already cited the uncertainty created by the current regulatory system as a major barrier to investment, in the particular case of establishing interconnections between water companies¹⁷.

This lack of responsiveness of the abstraction system may also lead to environmental damage.

The backlog of investigations will mean that any environmental damage is ongoing until abstraction licences are varied or revoked. Water flows affect the quality and type of habitat in the river; the amount and type of sediment that is carried in the water and where it is deposited; and the water quality e.g. through diluting pollutants.

Although it is difficult to generalise the relationship between flow and the ecology and there is a level of scientific uncertainty in this relationship, the severity, duration and frequency of flow stress, i.e. flows significantly lower than natural flow regimes, are all critical factors in determining whether environmental damage has occurred and whether the ecological status of water bodies has deteriorated contrary to the WFD.

¹⁷ Defra, 2010, Assessment of regulatory barriers and constraints to effective interconnectivity of water supplies

The Legacy of Unsustainable Abstraction

Historically, fixed volume licences were given to those deemed to hold water property rights already by their previous usage and legal rights without knowledge of the resulting environmental damage. Subsequently it has become clear that levels of abstraction in some water bodies may be causing environmental damage.

- There are almost 300 sites in England where the Environment Agency is investigating low water flows due to unsustainable abstraction which is potentially damaging valuable conservation areas.
- The Environment Agency believes there may be as many as 12% of water bodies that are currently unsustainably abstracted, meaning low water flows may be implicated in damaging natural water systems and preventing the achievement of good ecological status under the WFD. These are also being investigated to establish whether unsustainable abstraction is affecting the achievement of good ecological status under the WFD. The Environment Agency will not have an accurate estimate of the licensed volume that will need to be recovered to help achieve good ecological status until the investigations are complete (December 2012).

Current situation

The Environment Agency has the RSA programme which is aimed at reducing abstraction levels where damage is occurring, particularly to conservation areas.

This programme investigates areas where damage may be occurring, particularly to Natura 2000 sites, Sites of Special Scientific Interest and priority sites under the Biodiversity Action Plan. These investigations determine whether damage is occurring and then identify and assess options to address the damage. Such options may range from fitting screens to abstraction pipes to stop fish being killed to reducing amounts of water than can be abstracted to increase water flow.

Current law requires that abstractors are compensated for any losses arising from changes to their abstraction licences.

The Environment Agency collects a tax, the EIUC, as part of its abstraction charges which is then spent on compensating licence holders for any such losses. By the end of 2010/11, the Environment Agency had collected £25m of funds through the EIUC. Ofwat's Periodic Review (PR) process also funds water company schemes to protect Natura 2000 sites (£184m was allocated for this purpose to water companies in PR09 to be spent between 2010 and 2015).

Limitations of current approach

Hydromorphological measures¹⁸

The Environment Agency has hydromorphological powers under the Water Resources Act s161ZB which enable it to carry out works, such as deepening river channels, installing sluices in the bank of a river or activating existing dam structures, in order to achieve WFD objectives. These measures often present relatively cheap means of achieving RSA objectives. Undertaking hydromorphological works is currently classed as an environmental protection activity under the Environment Act 1995. Any changes made using these powers are funded through Grant-in-Aid. Abstraction charges cannot currently be used to fund hydromorphological measures, creating a substantial barrier to their use and being inequitable as abstractors would directly benefit from reduced EIUC charges as a result of using hydromorphological measures.

Promoting green economic growth

Abstracted water is an important input to many areas of the economy to drive economic growth.

¹⁸ Hydromorphology is a term used to describe the hydrological and geomorphological (structural) processes and attributes of rivers, estuaries and coastal waters.

- About 40% is used for process cooling, mainly in the power, chemical and metals sectors.
- Other important users are the food and drink and paper sectors that incorporate significant amounts of water into their products.
- Irrigation is an important use, particularly for East Anglian farming such as potato growing and leisure industries such as golf courses.

In some sectors there is unmet demand for water, which may increase in the future. There are though limitations on access to water rights which may be a constraint on economic growth.

A report¹⁹ by Risk & Policy Analysts Ltd (RPA) shows that, based on information from its expert survey, a small number of sectors currently face problems with unmet demand and expect the problem to worsen in the future due to expansion of production.

- They are primarily those using irrigation for agriculture, golf course watering and horticulture, plus process water for food and drink production; all key water users.
- There is only limited information on how this varies geographically, but the east and south of England appear most affected.

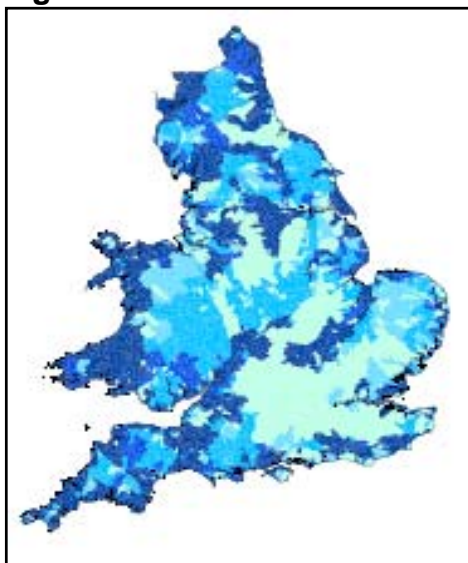
In the longer term, unmet demand could become significant for electricity generation. Ageing conventional power plants could be replaced by bigger plants or new technologies, both of which could require more water. Other sectors expressed concern that future reductions in the availability of water could increase costs or pose technical challenges, especially where they have already invested in a range of measures to reduce demand.

The overall extent of unmet demand cannot be determined on the information available, but there is a possibility that it may be wider than is apparent from the evidence gathered for the study.

Access to new and currently very-reliable (at least 95% of the time) water rights is limited, especially in South East England.

- On average, fewer than half the water bodies in England and Wales can provide new and reliable water for consumptive use (see fig.1).
- The distribution of availability is not even. Broadly speaking, England has more water bodies with water scarcity than Wales does (see fig.1).

Figure 1 Current new resource availability in England and Wales (source: Environment Agency)



New resource availability	Number of water bodies	% of total
at least 95% of time	4,701	46
at least 70%	810	8
at least 50%	1,667	17
at least 30%	745	7
less than 30%	2,206	22

¹⁹ Understanding Latent Demand for Water Abstraction Licences: Final Report on Task 1: Estimation of Latent Demand, RPA, February 2011

The Water Act 2003 made significant changes to the Water Resources Act 1991 to modernise the regulation of water resources

The following changes were brought in as part of the Water Act 2003. These measures were subject to a full Impact Assessment when the legislation was passed and are due to come into force in 2012.

- An end to most of the exemptions from abstraction licensing control that currently exist. These include for example trickle irrigation, dewatering (of mines and quarries), and abstraction of surface water into the canal network and other navigation systems. This will ensure that the Environment Agency can take action to manage the impact of damaging abstraction that, whilst outside of licensing control, may continue unabated and without regard to the environment or other abstractors.
- The Environment Agency will be able to amend or take away someone's permanent licence without compensation if they are causing serious damage to the environment.
- If a licence is not used for four years (previously seven years) the Environment Agency can revoke it and not pay compensation.

There are barriers to purchasing of water rights from others due to lack of information to facilitate the market²⁰.

Very few existing water rights appear to have been traded in England and Wales since trading became possible through the Water Act 2003.

- Only 53 licence trades have been identified since 2003 up to November 2010, although some trades may not have been recorded and this is a best estimate.
- There may have been significant sales of land including water rights but these have not been recorded.
- The majority of trades that have occurred have been between farmers in East Anglia, who use water for irrigation.

Work carried out by the Environment Agency and Ofwat²¹ suggests that there are currently two main barriers to water rights trading in England and Wales which may be restricting trade.

- A lack of market information (including information on buyers and sellers, prices, volumes, locations and other constraints) makes it difficult for potential buyers and sellers to be connected or for trades to take place.
- Rules governing trading of licences are not transparent and are perceived to be restrictive and complex, requiring long investigations by the Environment Agency before trades can be authorised.
- The Environment Agency currently receives information on the quantity and location of water licenses traded as part of its regulatory role of varying and issuing new licences in the context of a trade in an abstraction licence (see figure 2). However it does not currently receive any information on the price paid between the traders to effect this transaction.

²⁰ Synovate UK, 2008, 'Exploring views on the potential for more active water rights trading'

²¹ <http://www.environment-agency.gov.uk/business/topics/water/32024.aspx>

Figure 2 – Number of trades by region by year as of November 2010 (source: Environment Agency)

	2003	2004	2005	2006	2007	2008	2009	2010
Anglian		2	1	10	7	9	2	2
Thames		1	1	1	1		1	
Southern	1		1		1			1
Midlands				1		1		2
North East				1	1			
South West			2					
Wales							1	
Total	1	3	5	13	10	10	4	5

- **NB:** Although 53 trades have taken place, full information is not available for two of the trades therefore only 51 are recorded in the table.

Generally price information is seen as a key factor in promoting market transactions.

Synovate UK²² stated in its 2008 report for the Environment Agency and Ofwat:

- The true value of water ... is .. a key piece of information that people would like to know before getting involved in trades, and indeed, [the lack of it] is a barrier for people entering the market.
- It suggests 'publishing details of how much licences had been traded for' but notes that 'given that some people might view this information as being commercially sensitive, it may be that this would need to be anonymised in some cases'.

However there is a need to respect information identified as commercially confidential, unless the public interest outweighs the private interest.

²² Synovate UK, 2008, 'Exploring views on the potential for more active water rights trading'

Annex 3 - Additional detail on hydromorphological schemes

The following four examples are details of sites where sustainable abstraction is achieved at less cost via hydromorphological measures than via the compensation route.

Example 1

A SSSI in unfavourable condition due to reduced water levels. These are caused by land drainage and exacerbated by abstractions. Investigations have shown that the most cost-effective approach to improving the environment is to raise the water level in the site by increasing the retention level of an existing dam and construction of a new dam nearby. Alteration in the operation of the surrounding ditch network to limit the area of farmland compromised by the water level rise is also needed. Land use change from arable to grassland would be required and this may involve land purchase. The cost estimate for this scheme is approximately £600,000.

Costs could be reduced if landowners do not need to sell but become partners in the scheme. Revenue costs are estimated to be about £28,000 per year but there would be a contribution of about £21,000 from the high level stewardship scheme.

An indicative cost of ceasing four abstractions can be calculated by examining the cost of alternative sources. This indicates costs of between £25 million and £59 million.

Example 2

An SSSI in which abstraction from public water supply boreholes and an Environment Agency support scheme are known to lower groundwater levels under the wetland site. The Environment Agency support scheme provides water to the adjacent stream in mitigation but it is not totally effective in raising groundwater levels on the site. Investigation and Options Appraisal was undertaken as part of AMP4 (Ofwat's 2004 Periodic Review for the water industry) by the water company.

The Environment Agency could continue to use the present support scheme and dam structures in the adjacent stream to hold up water levels to prevent the drainage of the site. This would make better use of the support water. The dam structures were installed in the 1990s but have never been used. There would be operating costs of approximately £3,000 per year if this approach were to be taken. To revoke the licence and require the water company to find an alternative option to balance demand and supply could cost £9 million and there would be an additional £10,000 per year increase in operating costs for the water company.

Example 3

This is an SSSI impacted by abstraction for public water supply and spray irrigation. These affect groundwater levels under the SSSI and reduces spring flows to the brook which runs through the site. The site is known for wet woodland and it would be sufficient if the brook is kept flowing. The Environment Agency operates a support scheme using a borehole to pump water to the site in mitigation for the abstraction impact. However, it has been shown that the discharge water does not enter the site in the correct location to protect the wet woodland. To revoke the licence could cost £9 million and there could be an additional £10,000 per year in operating costs for the water company.

The alternative would be a small engineering project to relocate the discharge in the site with permission from the landowner and Natural England. The estimate of costs for these works is between £5,000 and £10,000.

Example 4

This is an SSSI affected by groundwater abstraction. The Environment Agency installed sluices in the flood banks of the river at the upstream end of the site in at a cost of £600,000 so that

flood plan could be inundated at high flows. Flooding occurred in January 2011. It is hoped that by allowing the flood plain to flood, the effects of the lowered groundwater levels will be mitigated. If this is successful then no licence changes will be necessary, to protect the water dependent features. The current compensation estimate for this scheme is £15m.

Calculating the benefits of the EA using abstraction charging income to implement hydromorphological measures

The average cost saving of the examples set out above was calculated, for each of the ten years in the appraisal period.

Environment Agency investigations have suggested that between 15 and 30 sites could be amenable to hydromorphological measures such as those in the examples above. Of these, 7 are non-water company and are in the delivery programme. As a prudent central estimate it has been assumed that 7 sites undertake such measures. To generate a range of estimates, a low assumption of 4 sites and a high assumption of 13 were chosen (based on a range for the total number of sites of 10-30 with 16 as the central estimate).

Measures were assumed to be implemented at a constant rate across the ten-year appraisal period (i.e. for the central scenario a rate of 1.6 sites per year), creating a profile of benefits. This was then discounted (using the standard 3.5% discount rate from HM Treasury's Green Book appraisal guidance) to give the NPV of the benefits. The results are set out below, based on all examples.

Estimated average cost of hydromorphology options (present value):	£0.4m
Estimated average cost of abstraction options (present value):	£18.8m
Estimated average net saving from hydromorphology (present value):	£18.4m

	LOW	CENTRAL	HIGH
Number of sites	4	7	13
Average rate over 10 years	0.4	0.7	1.3
Benefits of hydromorphological measures (NPV) £m	69.4	111.1	208.3

The assumptions and evidence used represent the best available information at this time. The central estimate is felt to be prudent, being based upon the number of sites currently in the programme of delivery – meaning we can be relatively confident of their implementation. The limitations of the information are recognised, however, as the representativeness of these examples are unclear due to lack of detailed information on the rest of the sample. However it should be noted that the costs and benefits of hydromorphological measures will be investigated in detail for each scheme before being implemented.

With only four examples of sites where hydromorphical measures reduce the cost of achieving sustainable abstraction available at this time, it is noted that a single outlier could have a significant effect on the averages used for the estimates in the table above. To test the impact of this, the estimates were also produced based only on Examples 2-4 – excluding Example 1, where the costs (particularly on the compensation side) are considerably greater than for the other examples. The resulting central estimate of £65m (NPV) was just outside the lower bound of the original range.

Given this sensitivity to the inclusion of the costs from one example, it was decided to omit it from the analysis to test its impact on the estimates.

Excluding Example 1:

Estimated average cost of hydromorphology options (present value): £0.2m

Estimated average cost of abstraction options (present value): £11.1m

Estimated average net saving from hydromorphology (present value): £10.8m

Adjusted: examples 2 – 4 only	LOW	CENTRAL	HIGH
Number of sites	4	7	13
Average rate over 10 years	0.4	0.7	1.3
Benefit of hydromorphological measures (npv) £m	40.7	65.2	122.2

Annex 4 – Estimation of the value of additional trading

This annex sets out the available evidence on licence trades which have taken place in England and Wales and evaluates the available evidence of the values of water that might be held by different users. The robustness of this evidence is limited, but the available estimates can still enable an assessment of the value²³ that might be realised if further licence trades could be encouraged. One question of particular interest is how many additional trades attributable to this option would be required to cover the cost of those interventions.

Number of trades concluded

The EA provided a spreadsheet of trades which it has recorded as having taken place since 2003. This information is summarised in the following table:

Table A4.1: Volume of water traded, 2003-2010, m³

	Agriculture	Industry	Private non-industrial	Unknown	Total
2003		22,000			22,000
2004	106,491				106,491
2005	100,376			1,000	101,376
2006	338,587	132,500		24,665	495,752
2007	184,500	400,496		73,000	657,996
2008	195,961	35,400			231,361
2009	30,300	30,380			60,680
2010	134,499		8,900		143,399
Total	1,090,714	620,776	8,900	98,665	1,819,055

Since 2003 a total of 1819MI (or 1.8 million m³) have been traded. The majority of these trades have taken place in the agricultural sector although significant trades have also taken place in the industry sector. These figures are only for recorded trades. More are likely to have taken place, for instance where land sales have included water rights. The volume of unrecorded trades is not considered likely to differ markedly from volumes of recorded trades in the table above.

Table A4.2, below, summarises details of the 51 trades for which data is available, split by the buyer (column) and seller (row) sectors. Almost half of the trades are between the same uses (spray irrigation direct). Taking all types of spray irrigation as one makes this almost 70%. The average volume of the trades is 37 MI per annum. Trades are mainly temporary but some are permanent.

Past trades may not necessarily represent an accurate guide to future trades. If the short (or longer term) changes to the water resource management scheme increase the number of trades they may also change the average volume of traded water as well as which sectors tend to trade most.

²³ Value here is defined as overall societal value – i.e. the present value of social benefits net of any social costs. These benefits and costs are defined in their widest context and include the productive value of the water in use as well as its value in the environment. This is distinct from (subjective) value of water to particular parties – i.e. private costs and benefits.

Table A4.2: Classification of trades by sector (buyer = column; seller = row)

	General farming	Industrial process of compost manufacture	Make-up or top-up water	Mineral washing	Private water undertaker	Process water	Spray irrigation	Spray irrigation direct	Spray irrigation storage	Vegetable washing	Water bottling	Potable water supply	Unknown	Total
Evaporative cooling							1							1
General farming	2													2
Mineral washing				1				2						3
Private water supply												1		1
Manufacturing													1	1
Process water												1		1
Spray irrigation							3							3
Spray irrigation direct	1			1		1	1	23	6	1				34
Spray irrigation storage			1					1						2
Water bottling											1			1
Unknown		1			1									2
Total	3	1	1	2	1	1	5	26	6	1	1	2		51

(Note that information is incomplete for 2 trades, so data presented here is for 51 trades as opposed to 53.)

Available evidence of the differences in the (private) value of water to sectors

There is very poor information available on the value of water to different sectors²⁴. Defra is undertaking a study at present into the value of water into production but it has yet to provide any meaningful sector valuations of water which could be used to estimate the value of future potential trades. Readily available information suffers a number of limitations:

- Out of date. While some of the studies were recently concluded others relate to information gathered in the 1990s. In all cases the information has been updated to 2010 values and expressed as £/m³
- Location. Some of the studies were undertaken in different countries (Canada, China) and even the studies undertaken in the UK have limited geographic coverage – East Anglia and Scotland for example are covered well.
- Sectors. Information is available on a limited range of sectors although numbers are available for public water supply, agriculture (various types but mainly potatoes) and industry (again various types) and aquaculture.

²⁴ Here we are talking the subjective or private valuations of water to specific users.

- Average values. In many cases the numbers appear to be average values rather than the marginal values which should be used to assess marginal changes achieved from additional trades. In the case of public water supply incremental values are available.

Table A4.4 provides the available information on values of water. This information comes from the following sources.

Ofwat (2010) A Study on the Potential Benefits of Upstream Markets in England and Wales. This gives Average Incremental Social Costs (taken from the Water Company Water Resource Management Plans). The AISC measures the incremental cost of each option to restore the balance between supply and demand in a water resource zone. It is expressed in p/m³ and includes the whole life economic cost (capital and operating) and social and environmental cost (typically limited to carbon emissions). Figures range from £0.2 to over £1 per m³. Note that AISCs are not computed for areas where there is a surplus or where no further abstraction is possible.

Moran & Dann (2008) The Economic value of water use: implications of implementing the Water Framework Directive in Scotland. This uses a previous study by Dubourg & Bate (1997) employing a net back analysis to estimate the maximum amount farmers would be willing to pay (after all other costs have been accounted for) to produce an output given how much they can sell it for. The values range from £0.24 to £1.43 per m³.

Renzetti & Dupont (2003) The value of water in manufacturing. This used a cost minimisation model to determine the shadow price of water in the production process of 13 industry types in Canada. In 2010 prices the values range from less than £0.01/m³ to about £0.20/m³.

Wang & Lall (2002) Valuing Water for Chinese Industries: A marginal productivity assessment. This study uses a more flexible model (compared to Renzetti & Dupont) to estimate the marginal value of water to Chinese industries. The values are typically an order of magnitude higher ranging from 1p to £3.22 per m³.

Morris et al (2003) The sustainability of irrigation in England and the impact of water pricing. This gives a range of values which contrast a potato vegetable system (£2.05/m³) and a potato sugar beet system (1.33/m³).

Knox et al (2000) Mapping the financial benefits of sprinkler irrigation and the financial impact of restrictions on abstraction. This gives some low and high values for sprinkler irrigation which are £1.33 to £2.65 per m³.

Morris et al (1997). This study gives average irrigation benefits for a range of crop types. These give some of the highest values ranging from over £4/m³ for early potatoes to £0.04/m³ for cereals.

Advice was also sought from an industry expert who provided the following information on market values of sales:

Potatoes, sugar beet etc

- Perpetual licence: £0.50-£1/m³ annual licensed volume;
- Temporary licence: £0.30/m³ annual licensed volume.

Soft fruit e.g. Strawberry crop

- Perpetual licence: £2/m³ annual licensed volume;
- Temporary licence: £1/m³ annual licensed volume.

It is not clear why a perpetual licence is only worth 2-3 times a temporary one. It may be because the value of a perpetual licence is discounted by the possibility that natural rainfall will

be sufficient in most years, and that temporary licences are based on an annual assessment of water needs, or because farmers may change crops from water-intensive to less so.

For consistency with the other values and to be more meaningful in terms of the policy scenario the focus should be on the temporary licence values. Hence this evidence presents a range of £0.30-£1 per m³.

Evidence from the Australian experience of trading is less useful in the UK context. Reports by the Australian authorities give the value of trading in supporting regional GDP during droughts. Some very high values are found but this is a different context to the situation faced here. It does however highlight the potential benefits trading would provide during droughts.

This might be useful as an additional qualitative argument provided it is felt that it is reasonable that trading would be an additional mechanism to help companies manage droughts.

Taken together this information provides a very limited basis for assessing the value of additional trades should these arise as a result of the options.

Qualitative evidence for benefits from trading

Although there may be a range of qualitative arguments perhaps the most compelling is the learning effect of increased trades. As abstractors go through the process of trading they will learn about the process and the value of water to different industries of trade (as might occur through the gathering and analysis of price information). Trading will then be more on their 'radar' allowing them to better take advantage of future potential trades.

A second qualitative argument (referred to above) relates to the potential benefits of trading in a drought situation. As noted above this is the main source of benefits in more arid examples like Australia. The mechanism through which these benefits would arise would simply be through the fact that abstractors with relatively high valuations of water were able to find an additional source during droughts.

Using the available evidence to produce a monetary estimate of the benefits of additional trades

In theory the welfare gain from an additional trade can be measured using the change in the price (the price the buyer pays less the prices of the alternative supply or volume he is using) and the volume of water traded. A simplifying assumption is to use the "rule of half" to calculate the value of the welfare change to society. This assumes a linear demand curve. The change in welfare can then be calculated as:

$$\text{Change in welfare as a result of trade} = 0.5 * (P1 - P2) * (Qt)$$

Trades only take place where a price can be struck which is between P1 and P2. Exactly where the agreed price is struck in this range determines the split of benefits between buyer and seller. This doesn't matter in terms of the societal value of the trade. What matters is that someone who valued water at P1 is now able to obtain the water through trade at a price lower than P1 (and someone who valued water at P2 is able to sell that water at a higher price).

The opportunity for trade depends largely on differences in the value of water between different abstractors (i.e. P1-P2). There is a great deal of variation and hence (on the face of it) potential for trade²⁵.

²⁵ However the potential for trade also depends on certain technical characteristics about time and location of demand and the nature of the existing licence conditions.

To evaluate the potential benefits of additional trading, the average difference in values across the studies has been calculated. This represents the (P1 – P2) in the equation above, and was calculated to be £1.03 (all estimates were first rebased to a common year and currency).

The change in welfare resulting from a single additional trade ($Q_t = 1$) is $0.5 * £1.03 = £0.515$, rounded to £0.5.

This estimate could be biased in either direction – for instance, due to the use of average rather than marginal bias (possible downward bias) or from combining values from different studies. Sensitivity analysis has therefore been conducted.

A lower bound of £0.05 (10% of the estimated value) and an upper bound of £1.0 (double the estimated value) were selected to produce a wide range to capture the uncertainties of the analysis. Using these it is possible to estimate the number of trades that the intervention would need to generate in order to produce a £32k welfare gain – the switching value at which the intervention becomes cost-beneficial (as set out on page 12 (check reference). costs are estimated to total £32,000). It is assumed that each additional trade is 37Ml or $37,000m^3$ (the average volume of previous trades). If the value of an additional trade was £0.05, 18 additional trades would be needed. With a value of £1, this falls to 1 additional trade. Using the central value of £0.5, an additional 2 trades would be needed for a £32,000 welfare gain. Any intervention that cost more than £32k and did not generate 2 additional trades would be unlikely to be cost-beneficial. It could require 18 more trades or as few as 1 to be cost-beneficial.

These estimates have used the fact that studies show variation between abstractors as illustrating the potential value of additional trades. However this variation could also be an indication of limitations to the estimates. Of particular concern is that the variation between studies is greater than the variation within studies:

Overall range taken across all studies = $£4.04/m^3$

Range within studies ($£/m^3$):

Ofwat (2010) = 0.8
 Moran & Dann (2008) = 1.19
 Renzetti & Dupont (2003) = 0.19
 Wang & Lall (2002) = 3.21
 Morris (2003) = 0.75
 Knox (2000) = 1.33
 Morris 1977 = 4.00

The differences between studies could be more important in defining the range than the differences in the sectors. There is a major difference between the cross-sectoral studies undertaken by Renzetti & Dupont (2003) and Wang & Lall (2002), which are orders of magnitude different for a number of sectors:

Table A4.3: Difference in values, Wang & Lall vs. Renzetti & Dupont

Sector	Wang & Lall (2002)	Renzetti & Dupont (2003)
Petroleum	0.65-0.73	0.19
Metal/smelting	0.007-0.11	0.26-0.46
Chemicals	0.12	0.05
Beverages/Food	0.31	0.01-0.03
Paper	0.1	0.02
Transport	3.22	0.02
Textiles	1.38	0.00

It is difficult to explain these differences with certainty. They may arise from perfectly logical differences, such as differences arising from the geography of China and Canada. The north-east of China (where most manufacturing takes place) is notoriously dry so limited supply conditions could drive up the water valuations. It may be however that these differences are due to the different methodologies taken. In the absence of a proper meta-analysis of this and other studies it is not possible to conclude how these very large differences across similar industries arise.

Table A4.4: Available Information on the Value of Water to Different Abstractors

<i>Ofwat 2010, A study of the potential benefits of upstream markets in the water sector in England and Wales</i>			
Public Water Supply			
	AISC for WRZ £/m3 (2010 prices)		
Lowest AISC in E&W	0.20		
Highest AISC in E&W	1.00		
2010 prices			
Moran and Dann (2008) The economic value of water use: implications for implementing the WFD in Scotland.			
Column1	£/m3 (2008 prices)	£/m3 (2010 prices)	
Potato Farmers Max WTP low	0.23	0.24	
Potato Farmers Max WTP high	1.38	1.43	
Aquaculture	0.126	0.13	
Renzetti and Dupont (2003) The value of water in manufacturing			
Column1	2004 prices £/m3	£/m3 (2010 prices)	
Refined petroleum and coke	0.157	0.19	
Primary metal	0.058	0.07	
Chemicals and chemical products	0.039	0.05	
Fabricated metal products	0.026	0.03	
Beverage	0.021	0.03	
Plastic products	0.017	0.02	
Paper and allied products	0.017	0.02	
Transport equipment	0.014	0.02	
Non-metallic mineral products	0.013	0.02	
Wood	0.011	0.01	
Food	0.009	0.01	
Rubber products	0.003	0.00	
Textile products	0.003	0.00	
2004 prices			
Wang and Lall (2002) Valuing Water for Chinese Industries: A marginal Productivity Assessment			
Column1	Yuan/m3	£/m3 (2002 prices)	£/m3 (2010 prices)
Transportation equipment	26.83	2.54	3.22
Electronic equipment	24.11	2.29	2.89
Leather goods	17.46	1.66	2.09
Textiles	11.50	1.09	1.38
Industrial equipment and machinery	8.90	0.84	1.07
Petroleum extraction	6.07	0.58	0.73
Construction	5.50	0.52	0.66
Petroleum	5.43	0.51	0.65
Smelting	3.82	0.36	0.46
Medical products	3.26	0.31	0.39
Food and beverage manufacturing	2.57	0.24	0.31
Coal mining	1.16	0.11	0.14
Chemicals	0.98	0.09	0.12
Metal mining and preparation	0.90	0.09	0.11
Paper and pulp products	0.84	0.08	0.10
Power generation	0.05	0.00	0.01
Industry average	2.45	0.23	0.29
Morris et al (2003) The sustainability of Irrigation in England and the Impact of Water Pricing			
Column1	£/m3 (2001 prices)	£/m3 2010 prices	
Potato vegetable system	1.58	2.05	
Potato sugar beet system	1	1.29	
Knox et al (2000) Mapping the financial benefits of sprinkler irrigation and potential financial impact of restrictions on abstraction			
Column1	£/m3 2000 prices	£/m3 2010 prices	
knox irrigation High	2	2.65	
Knox irrigation Low	1	1.33	
Average	1.4	1.86	

Conclusion and next steps

Using the available estimates of the value of trades allows us to conclude that any intervention that cost more than £32K per annum and was not able to achieve 2 additional trades would be unlikely to be cost-beneficial. Depending on the situation it may require 18 more trades or just 1. The limitations of the evidence used for these estimates have been discussed. However these studies are considered to be the best available evidence at this time.

The value of additional trades represents the benefit of the measures being proposed to encourage trading. The analysis set out here provides an indication of how many additional trades might be required for the policy to be cost-beneficial. The measures proposed in this IA seek to reduce the transaction costs of trading – such as finding trading partners, and searching for information about what the ‘going’ market price might be. Reduced transaction costs should result in more market participants. Without evidence about the number of additional trades that might be expected it is necessary to take a cautious approach to estimating these benefits. Under the central scenario, 2 additional trades are needed for the proposed intervention to be cost-beneficial. This represents a 4% increase in trades when compared to the number that

have taken place so far²⁶. This is a relatively low implied increase in trades required for the intervention to be cost-beneficial, and so it is expected that the benefits would be at least equal the costs. However without robust evidence to inform any assumed increase in trading, the expected benefits have not been monetised. Consequently the argument that benefits are expected to at least equal the costs remains a qualitative one. Considering the wider benefits from promoting trading, (such as learning effects for both participants and the EA) strengthens this qualitative case that the intervention would deliver a net benefit overall. In recognition of the lack of evidence on which to base a benefits estimate, it is assumed here that sufficient additional trades occur to make the intervention cost-beneficial. This is considered reasonable since an increase in trading of just 4% is required under the central scenario. The benefits are thus assumed to be £32,000 (NPV).

²⁶ 51 trades have occurred in the past seven years. To match the ten-year appraisal period the average annual number of trades (51/7) was applied to a ten-year period to give 73 trades. 6 additional trades represents an 8% increase on this.