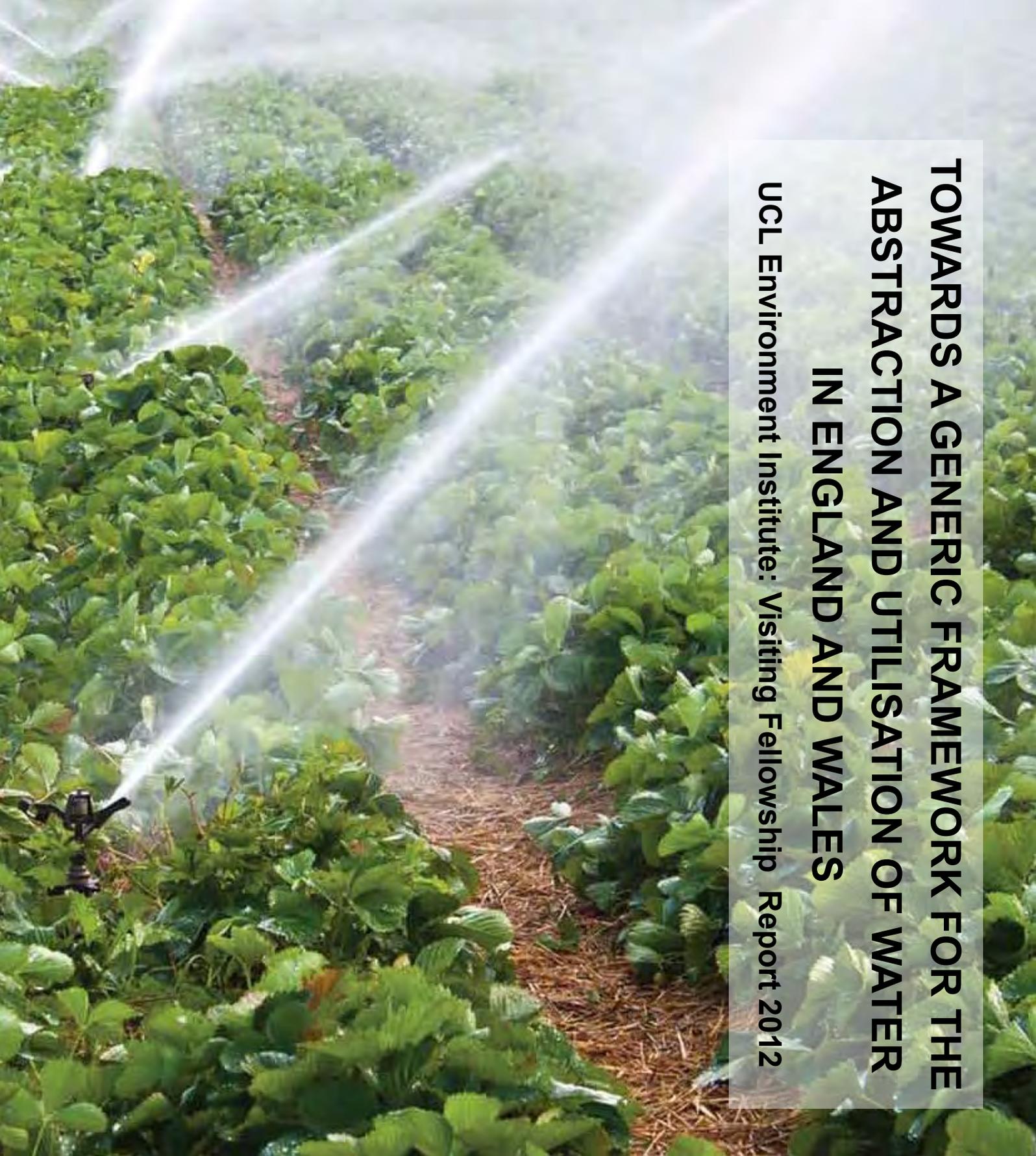




UCL

**TOWARDS A GENERIC FRAMEWORK FOR THE
ABSTRACTION AND UTILISATION OF WATER
IN ENGLAND AND WALES**

UCL Environment Institute: Visiting Fellowship Report 2012





TOWARDS A GENERIC FRAMEWORK FOR THE ABSTRACTION AND UTILISATION OF WATER IN ENGLAND AND WALES

Author

Prof. Mike Young



Research Chair,
Water and Environmental Policy,
Faculty of Professions,
The University of Adelaide



Honorary Professor,
UCL Environment Institute,
University College London

Contents

	FOREWORD	
	EXECUTIVE SUMMARY	i
	DEFINITIONS	1
1.	INTRODUCTION	3
2.	REPORT STRUCTURE	3
3.	GOALS AND OBJECTIVES	3
	Global experience with abstraction reform.....	4
4.	DESIGN PRINCIPLES AND CONCEPTS	5
	Regime sophistication.....	6
	Unbundling.....	6
	Entitlement register and allocation accounts.....	9
	Regulation.....	10
5.	A GENERIC FRAMEWORK	10
	Principles and guidelines for the UK.....	12
	Basin and catchment plans.....	13
	Entitlement registers and allocation accounts.....	15
	Trading, charging and pricing.....	16
	Trading.....	16
	Charging and pricing.....	16
	Entitlement definition.....	17
	Illustrative examples.....	17
	Application to a river reach.....	18
	Allocation arrangements.....	18
	Inter-reach trading.....	21
	Application to a groundwater system.....	21
6.	IMPLEMENTATION	22
7.	CONCLUDING COMMENTS	22
8.	RECOMMENDED READING	23

Due care and diligence have been taken to ensure the highest accuracy and quality for the production of this report, however the author declines any responsibility for decisions taken based on the findings of this report.

The view and opinions expressed in this report are those of the author and do not necessarily represent the views of the University College London and of the reviewers.

FOREWORD

This Visiting Fellowship report draws upon global experience in the development of abstraction licensing regimes in Australia, Canada and New Zealand. The Fellowship was made possible by a DEFRA decision to help fund a ten week Fellowship in partnership with University College London and the University of Adelaide.

The aim of the fellowship was to identify elements of a framework that could be used to manage the abstraction and utilisation of water in England and Wales. The Framework is indicative of the nature of the abstraction licence reforms that experience in Australia and elsewhere suggests is worthy of serious consideration.

Written during the early stages of the development and exploration of options for reform based on the visions set out in the Government's "Water for Life" White Paper, this report aims to catalyse interest in a search for the characteristics of an best abstraction regime designed to ensure that water is always put to its best use. "Best use" is interpreted widely to include environmental and social benefits.

During the development of this report and the concepts that underpin it, I have benefited from the opportunity to work closely with a large number of people. In particular, I would like to acknowledge the opportunity to work closely with the "Abstraction Reform Team" involving people from DEFRA, the Environment Agency and OFWAT working with a group of consultants interested in improving the way water is managed in England and Wales.

A special thank you is due to Henry Leveson-Gower from DEFRA, Jonathon Dennis and Clare Dinnis from the Environment Agency and Julien Harou from University College London for the opportunity to spend many hours developing and testing the ideas presented in this report. Yvonne Rydin, Marianne Knight and Nina Crane at University College London's Environment Institute played important roles in setting up the Fellowship and making it possible. I would also like to take this opportunity to thank Sharon Wilson at the University of Adelaide for managing my Adelaide office while I worked in London.

Finally, I would like to thank the many people who took the time to comment on earlier drafts of this report – Alison Thompson; Andy Gill; Bruce Lankford; Chris Binnie; Chris Lambert; Christine Esau; Colin Fenn; David Zetland; John F. Raffensperger; Helen Chapman; Mark Owen; Michael Thompson; Michelle Russ; Niall Jones; Neil Edwards; Paul Hope; Phil Haygarth; Rob Cunningham; Ronan Palmer; Rose Timlett; Stuart Kirk and Susie Young.

Prof. Mike Young

Professor of Water and Environmental Policy, The University of Adelaide, Adelaide, Australia 5005

Honorary Professor, UCL Environment Institute, University College London

5th November 2012

EXECUTIVE SUMMARY

The case for change in the way that water is allocated in England and Wales is strong.

The recent "Water for Life" white paper for England and the written paper on Water Policy in Wales identify a need to enable growing populations to cope with unsatisfied and changing demands for access to water and changing economic circumstances.

There is also a need to put in place arrangements that encourage autonomous adjustment to the potentially adverse effects of climate change on water supplies and the need to improve the ecological status of some water ways.

In an attempt to help prepare England and Wales for these needs, this report proposes a new, more robust way to define, allocate and manage water use. The resultant framework builds upon the strengths of the existing abstraction licence and discharge permitting regime used to manage water.

The vision

Preparation of a National Water Policy Statement is suggested as a way to shape a new vision and chart a water reform pathway. The principles established in this Statement need to recognise the benefits of simultaneously keeping use within sustainable limits, increasing investment, removing impediments to change, rewarding innovation and maintaining good ecological status.

The Statement will need to recognise that, in any region, the amount of water that can be sustainably abstracted and consumed may need to change. Every water user, without exception, needs to be encouraged to think about ways of using less water. The need for clear top-down restrictions on use needs to be matched with changes that enable more bottom-up innovation.

Concepts

Three concepts underpin the thrust of the recommended changes to water entitlement and allocation arrangements.

The first concept recognises the importance of transitioning to a robust abstraction licensing regime. Under the current regime, a considerable proportion of abstracted water, following use and treatment, is returned back to the system for use by others. A robust allocation licensing regime begins by specifying return flow obligations so so-called improvements in water use efficiency do not have the perverse effect of reducing the amount of water available to downstream water users. The definition of licences as an entitlement only to the "net" amount of water used coupled with a well defined accounting system is necessary to achieve this outcome.

The second concept identifies the benefit of allowing individual water users to solve scarcity and pollution problems by trading entitlements and allocations with one another. Unbundling, coupled with the verification of registers, will enable water trading to be used as one of the vehicles to manage both long and short-term scarcity in a timely manner.

The third concept recognises the potential of separating management of system-wide allocation and environmental considerations from the arrangements used to specify how access to water is to be shared among users. Much more efficient management can be achieved if basin and catchment planning processes are used to define the net amount of water that can be abstracted and licences specified as an entitlement to a share of the water allocated in this manner.

Implementation

As the degree of stress and number of water users varies from region to region, it is not necessary to implement the reforms everywhere. It is possible to identify a sub-set of basins and catchments where the case for reform is greatest and use this sub-set to gain experience and deepen capacity before proceeding to implement the reforms throughout England and Wales.

Five improvements to regime used to allocate and manage water in England and Wales are suggested.

1. *The current licensing regime lacks hydrological integrity. In particular, licences do not specify the proportion of abstractions which, following use, must be returned back to a river or an aquifer.*

In England and Wales, a significant proportion of water, following use, is returned to a river or aquifer and then either used to maintain flow or re-allocated to a downstream user. In order to protect the interests of these downstream users and maintain environmental outcomes, transition from a gross entitlement to a net entitlement regime is recommended.

In a net entitlement regime, the proportion of any entitlement that must be returned to an aquifer or river is fully specified. Actions that decrease the proportion of water returned and must be offset by a compensating increase elsewhere. That is, no user is allowed to increase the volume of water they consume by decreasing the amount of water they return to a river or aquifer. Requirements to transfer water from one system to another are equally well specified.

2. *Current abstraction licence arrangements neither reward people who search for ways to use water more efficiently nor protect valid financial interests in a manner that makes low cost trading possible.*

In fully-allocated water resource pools, the requirement to use water or risk losing access to it needs to be replaced with arrangements that encourage people to invest in water and treat it as the valuable resource to be managed with care. Entitlements need to be specified as an entitlement to on-going share of any water allocated to the pool. Priority needs to be given to innovation. Those who find a way to use water more efficiently and thereby make savings should be given the opportunity to sell the “saved” water to someone else.

One of the biggest impediments to innovation and improved efficiency is a failure to include the names of all those who have a direct financial interest on a licence. In particular, licence registers have not been constructed in a manner that makes it clear which people need to agree to the transfer of part of a water licence from one person to another.

In a significant number of cases, licences have been issued to a tenant rather than the owner of the land owner where water has been used. A verification process needs to be run to determine who has sufficient legal standing to request that a water entitlement be transferred from one location to another and, during a transfer, which financial and other registered interests need to be protected. Resolution of this issue is necessary before low-cost trading arrangements can be put in place.

A verified, digital water entitlement register is needed for each catchment. In the new regime, it should be possible to record a mortgage, caveat or any other financial interest on a water entitlement. The accuracy of this register should be guaranteed by government and make it clear to all parties that whenever a transfer occurs unrecorded interests in a licence will have no standing in law.

3. *The current abstraction licence regime fails to link licence to system-wide planning and allocation arrangements. In particular, a significant number of licences make no reference to a catchment plan and are written in a manner that enables changes in a plan to be ignored by a licensee.*

To encourage all water users to plan for changes in climatic, supply and economic conditions, basin and catchment plans need to be statutory instruments and become the prime instrument for managing system-wide issues and dealing with third party interests. Legislation needs to ensure that the processes

used to amend a plan are transparent and equitable. All stakeholders need to be given the opportunity to engage in the plan development and review processes.

When the water resource system is large and inter-connected, it will be more efficient to use a Basin Plan to specify the over-all limits on use and manage transfers from one part of the system to another. When this is the case, catchment plans will need to be written in a manner that is consistent with the basin plan and focus on detail.

Catchment plans need to begin by identifying the number of water resource pools needed for efficient management of the inter-connected water bodies that collectively form a catchment.

An environmentally sustainable take or limit on use then needs to be placed on the amount of water that can be abstracted sustainably from each pool at any point in time. In some pools, it will be sufficient to define the limit on an annual basis. In other pools, the amount that can be taken will need to be specified by reference to the flow at a specific point.

With these basin and catchment arrangements in place, each water abstraction licence needs to be defined as an entitlement to a share or proportion of any water allocated to a pool. Trading rules, exchange rates, etc need to be defined in either in plans or in documents to which these plans refer.

In some catchments, a single sharing regime will be appropriate. In many systems, however, pools will need to be defined on a reach-by-reach basis or zone-by-zone basis. In some catchments, it may be necessary to establish high, general and low security pools so that, in times of drought, it is clear whose interests will take priority.

During the process of setting up these sharing arrangements, care needs to be taken to differentiate between a licence holder’s long-term interest – their “entitlement” – and the opportunity to abstract at a point in time – their “allocation”.

Entitlements and any allocations made to a pool should be tradeable according to pre-specified rules and, because of the transparent processes used during plan development, not subject to third party appeal.

4. *The last step in the recommended suite of improvements to the existing licensing and planning arrangements is implementation of a process known as “unbundling.”*

Unbundling involves the separation of the main components of a licence into their separate parts. This allows the more efficient management of each component. Unbundling begins with the definition of each component of a licence with sufficient hydrological integrity that decisions can be made about that component without consideration of consequences for other parts of the regime.

Unbundling can be partial or full. Partial unbundling involves the separation of use permitting arrangements from arrangements that determine how much water can be used at any point in time.

In partially unbundled systems licences, allocation decisions are made typically on an annual basis and, as a consequence, within season allocation trading is difficult.

In a fully unbundled regime, entitlements are recorded on an entitlement register and a separate set of allocation accounts established. Low cost, short-term allocation trading can then be implemented by transferring an allocation from one person to another. Rapid trading of allocations on a daily, weekly or fortnightly basis becomes possible.

Typically, a fully unbundled water allocation and management regime would involve:

- The use of basin and catchment plans to manage system-wide issues;
- The use of entitlement registers to define each individual’s long term interest;
- The use of allocation accounts to track the volume of water that has been taken and still may be taken by a person;

- The use of permits to define location-specific abstraction conditions and arrangements associated with the discharge of water;
- The use of separate policy documents to define trading protocols, delivery charges, etc.
- In systems where there is congestion, delivery shares can be used to manage congestion in systems with limited flow capacity.

In an unbundled regime, it is possible to obtain and hold a permit to abstract, use and discharge water on the understanding that this water will be purchased as and when it is needed. The reverse arrangement should also apply. In order to encourage investment and innovation, it should be possible to hold an entitlement without entering into a commitment to use the water allocated to it.

5. *In times of water stress, adverse impacts on the environment and the economy will be much less if water users can trade allocations quickly from one location to another. This is sometimes known as temporary trading. In basins and catchments where there are a significant number of licences, on-line allocation accounts need to be established and structured so that water users can trade allocations with each other at pre-determined exchange rates. Charges are used to recover the full costs of administering trades from licence holders.*

In the most advanced water accounting regimes, the same suite of arrangements are used to give credits for groundwater recharge and, also, for the return of “surplus” water to a river.

If the above changes are implemented, the value of the contribution that water makes to the economy and the services it provides can be expected to increase – especially in catchments that are either fully or over allocated.

Finally, it needs to be stressed that during the process of developing the system-wide planning and other proposed water reforms careful consideration needs to be given to governance arrangements.

With a clear statement of National Principles in place, it is possible, for example, to decide that each plan should be prepared by a board and, following an appropriate consultation process, ultimately approved by a Minister and tabled in Parliament. In some cases, it may be appropriate, make an independent authority responsible for the preparation of a basin plan and then managing the catchments covered by that plan.

DEFINITIONS

Water Resource system

- A set of connected water bodies typically defined by a set of interacting rivers, aquifers, storages, weirs and other related infrastructure.

Administrative regime

- A suite of institutional arrangements used to define, manage, guide investment in and influence use of a water resource system. This includes the full suite of economic, persuasive, regulatory and governance arrangements.

Water resource pool

- A water resource that can be managed as a single entity. Within a pool, all allocation arrangements are defined in a similar manner.
- Many water resource pools form a river and/or an aquifer “system.” In some cases, the pool is described as a management zone.

Environmentally sustainable take

- After accounting for the amount of water that is returned following use, the maximum amount or proportion of a water resource pool that can be taken from a water resource pool over a defined period of time without compromising in-pool environmental objectives and downstream supply obligations.

Entitlement

- A specified long-term interest or right to a share of any water allocated to a water resource pool. Allocations are usually made in proportion to the number of entitlement shares held.

Allocation

- A definable opportunity to take water that may be taken within a defined period and defined location. A classic example of an allocation would be a once-off authorisation to take not more than one ML of water on the 10th of August from a defined water resource pool if the flow rate is above 20 ML per day. In a groundwater system, an allocation might be defined as a once-off authorisation to take not more than one ML of water between 1st April and 30th September.

Abstraction, use and discharge permit

- A set of rules used to govern and manage taking, accounting for, using and discharging water to one or more defined water resource pools.

1. INTRODUCTION

The current abstraction regime has served England and Wales well but new pressures and demands are emerging. Released in December 2011, a major aspect of the UK Government's "Water for Life" White Paper challenges those interested in water to think about better ways to allocate and manage water use¹. The Welsh Government's recent Written Statement on Water Policy makes a similar set of observations².

The case for change is strong.

- ✓ Climate change modelling suggests a need to plan for more variable weather conditions and, in some regions, drier conditions;
- ✓ Population projections suggest that the demand for water, in some areas, will increase to levels which cannot be sustained without an increase in efficiency and/or the re-allocation of water to different users and uses;
- ✓ As significant number of water bodies are not in good ecological and chemical status and as under the Water Framework Directive, the UK is required to restore these bodies back to health unless the costs of doing so are disproportionate, less water will be available for consumptive use in some regions³;
- ✓ The contribution that water use is making to the economy is less than would be the case if a way could be found to re-allocate it to more efficient uses.

Collectively, these observations suggest that water scarcity is set to become a major issue.

Water quality improvement is a parallel challenge⁴.

2. REPORT STRUCTURE

This report is written in two parts. The first part explains concepts new to England and Wales and provides some background information. The second part provides an indicative framework for the improvement of water abstraction arrangements. Options for implementation are then discussed.

3. GOALS AND OBJECTIVES

The White Paper sets out a series of policy goals, objectives and policy constraints. A careful read of this paper suggests that the UK Government, in essence, is seeking ways to ensure that water management arrangements

1. Drive economic growth
2. Protect rivers and aquifers
3. Facilitate adaptation to ever changing water supply, technological, economic and social conditions

¹ See <http://www.official-documents.gov.uk/document/cm82/8230/8230.asp>

² See <http://wales.gov.uk/about/cabinet/cabinetstatements/2011/12decemberwaterpolicy/?lang=en>

³ For more information, see http://ec.europa.eu/environment/water/water-framework/objectives/status_en.htm

⁴ In a significant number of regions, the benefits from abstraction reform may be greater if the reforms put in place seek reward improvement in water quality, as well as, water quantity outcomes. Experience in both the United States, New Zealand and Australia is revealing that market-based approaches to the reduction of water pollution problems can be particularly effective.

Salinity trading arrangements, for example, are being used successfully in Australia's River Murray and its Hunter River to keep the water quality dimension of water use within sustainable limits. In the United States, the introduction of pollution trading arrangements has led to improvements in water quality. New Zealand is giving serious consideration to the introduction of non-point nutrient trading arrangements as a means to improve water quality.

If these goals are to be achieved then there is a need to for an abstraction regime that:

1. **Promotes dynamically efficient resource use which will be achieved if the administrative regime used to govern water abstraction encourages:**
 - **Productive efficiency** because water can be deployed to the place where, at any point in time, it makes its greatest contribution to the economy, society and the environment given current prices, investment in infrastructure, technology, etc;
 - **Allocative efficiency** because investors are encouraged to make long term plans, pursue new investments, trial new technologies, anticipate changes in supply and demand, etc;
 - **Administrative efficiency** because transaction costs are low and recovered from users.
2. **Incentivises innovation so that the England and Wales can continue to prosper from the astute use, development and management of water resources.**
3. **Maintains and where necessary improves the environmental status of all water resources.**

The White Paper also makes it clear that the abstraction regime should not allow “environmental deterioration” and, where possible, encourages “environmental improvement” when the cost of improvement is not disproportionate.

One would expect that European Community Water Framework Directive requirements and other related European Community directives to be respected.

The White Paper also contains a commitment to equity in process. That is, any proposed changes must be made in full consultation with stakeholders and their views are to be taken into account.

Global experience with abstraction reform

The White Paper makes it clear that any abstraction licence reform will not be used to solve existing over-allocation problems and, as is normally the case, that changes will be made in a way that takes into account existing entitlements and regulatory arrangements. Academics call this approach grandfathering. International experience, particularly in Australia, suggests that virtually all successful water policy reforms involve a large amount of grandfathering but that this does not mean that the underlying structure of the regime cannot be improved.

Australian experience suggests that water reform takes time and is best seen as an iterative process. One of the most common mistakes made is to assume that each policy change can be seen and treated in isolation. Experience suggests that successful reforms focus as much on policy instrument interaction as on the design of each instrument used. Attention to the mix of policies is as important as the development of individual policy options.

Attention to reform sequencing is critical. If, for example, a decision is made to make rapid water trading possible then it is first necessary to validate licence registers so that mortgages, caveats and other financial interests in a licence are recorded in a manner that prevents a decision to trade from undermining the value of these interests.

Experience also draws attention to the need for careful attention to the state of the art in the detail associated with apparently simple instruments. If, for example, a decision is made to define entitlements as shares then it is important that these shares are defined using a unit share structure rather than a proportional share structure so that boundary and other changes can be made at minimal cost⁵.

⁵ When a unit share structure is used, shares can be added or removed by dealing only with those shares. When ownership is defined as a percentage of the whole, every change to the number of shares in a system requires the expensive redefinition of every share in the system. The arrangement is similar to that used in the corporate world where, the size of one’s interest in a limited liability company is defined by the number of shares held not the proportion of one’s interest in the company. The legislation used to establish a sharing regime needs to ensure that this mechanism cannot be used to erode the interests of existing shareholders.

Often in the midst of a policy debate instruments are set up as competing alternatives when they should be seen as complementary to one another. Debate about the merits of trading versus pricing approaches in water resource management provides an example. In practice, both approaches have a role to play. Pricing plays an important role in signalling the costs of providing water to users, maintaining infrastructure, etc. Trading plays an important role in revealing opportunity costs, driving innovation and facilitating adjustment.

4. DESIGN PRINCIPLES AND CONCEPTS

There is a growing but still limited amount of literature on the design of abstraction licensing regimes. This literature suggests that, when a country faces the suite of challenges faced by England and Wales, the abstraction regime used should be consistent with the following principles and concepts.

The Tinbergen Principle	Dynamic efficiency is much more likely to be achieved if a separate instrument is used to pursue each policy objective so that changes in the purpose of one instrument do not have to be compromised because of the impacts of one objective on another.
Mundell's Assignment Principle	Once assigned to an objective, instruments should not be used for any other purpose.
The Coase Theorem	When property rights are fully specified and can be re-assigned at zero cost, participants in a market can find an efficient and equitable way to way to re-allocate rights without the need for government intervention. In practice, transaction costs will always be significant. The challenge is to find ways to keep transaction costs low as possible and specify licences in a robust manner so that the interest of any third parties likely to be affected by a trade are protected.
The 80-20 Rule	Given various names, this rule observes that around 80% of most problems are caused by around 20% of users. In practice, this means that it can be more cost-effective to use low-cost rules of thumb that are “approximately” right and avoid the use of complicated models that need to be re-run every time a decision needs to be made.
Full Risk Assignment	Assign full responsibility for managing risk to users so that they plan for it and do not assume that governments will bail them out whenever, for example, there is a drought.
Full-cost pricing and charging	Resource use and investment will be most efficient if the costs of providing a service are fully reflected in the charging structures used and if the provider of these services has an incentive to keep these costs as low as possible.
Hydrological integrity	The entitlement regime used should account for connections between ground and surface water bodies and, in particular, ensure that any reduction in the amount of water that is returned to a system is accounted for.

Regime sophistication

The relationship between the degree of regime sophistication and the cost of maintaining the regime used to allocate and manage a water resource requires careful consideration. When there are many license holders and water is scarce, there is a strong case for the development of a highly sophisticated regime. However, when there are only a few licence holders, the cost of developing complex trading rules, allocation accounting systems etc may not be justified. As a general rule and if the environment is not to be compromised, the more robust and elegant a licensing regime

- The greater the mean volume of water that can be abstracted sustainably through time relative to the total water available;
- But the more variable the rate of and volume abstraction must be and the greater administrative costs tend to be.

With attention to robustness and elegance in design, costs can be kept to a minimum but they do need to be considered. Often, design elegance is characterised by simplicity. Reliance upon a simple look-up table that is adapted with experience, for example, can be much more cost-effective than an arrangement that requires the use of a complex computer model to set an exchange rate. Similarly, specification of return flow obligations in an entitlement changes to one licence can be made without having to consider the impact of the proposed change on other parts of the system.

Unbundling

One of the key recommendations arising from consideration of the above principles and concepts is the notion of unbundling of licensing regime into its component parts.

Unbundling lowers transaction costs and reduces administrative complexity by requiring the development of licensing arrangements that can be dealt with in isolation from one another.

A typical abstraction licence can be described as a “bundle” of entitlements and obligations. “Unbundling,” as the process is now called, is the break-up of these licences into their main components. In an unbundled regime, entitlements, allocations, permits are defined so that they can be administered and dealt with separately from one another. Amongst other things this requires the definition of system-wide allocation arrangements in basin and catchment plans and the use of licences to determine how these allocations are to be shared among aspiring users. Typically, unbundled water allocation and management regimes involve:

- The use of basin and catchment plans to manage system-wide issues;
- The use of entitlement registers to define each individual’s long term interest;
- The use of allocation accounts to track the volume of water that has been taken and still may be taken by a person and, also, to facilitate low cost allocation trading⁶;
- The use of permits to define location specific abstraction conditions and arrangements associated with the discharge of water;
- The use of separate policy documents to define trading protocols, delivery charges, etc.;
- In systems where there is congestion, delivery shares can be used to manage congestion in systems with limited flow capacity.

Figure 1 illustrates the difference between a bundled and an unbundled allocation regime. In a bundled regime, whenever a change in one component is contemplated consideration must be given to the implication of the changes for all other components. In an unbundled regime, changes in one component can be made without the need to change other components. This is achieved by defining allocation arrangements in a manner that has hydrological integrity and using basin and catchment plans to limit the total amount of water that users may take.

⁶ Well designed allocation accounts look like a conventional bank account. Each water user is issued with an account. Allocations, as they are made, are then credited to the account and debited from the account as they are used. Allocations trade are executed by debiting the seller’s account then crediting the buyer’s account with adjustment for transmission losses. Allocation accounts, and the meters that make it possible to monitor use, play an important function in ensuring compliance with any system that is put in place.

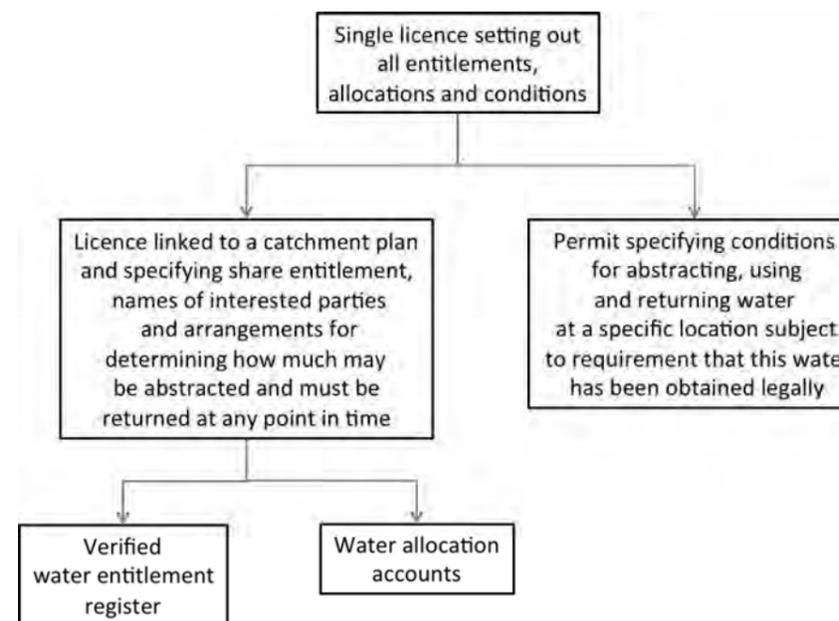


Figure 1

In large complex inter-connected systems, a basin plan would be used to define the limit that would apply in each catchment and define how much water must be transferred from one catchment to another. Catchment plans would then be used to manage within system detail.

In the example given presented in Figure 1, the amount that may be transferred temporarily to another water user is defined as the amount that a person may take less the amount that has been discharged so that the net effect of the transfer on river flow is zero. A permit is used to specify the abstraction, use and discharge conditions of water that is held in an allocation account.

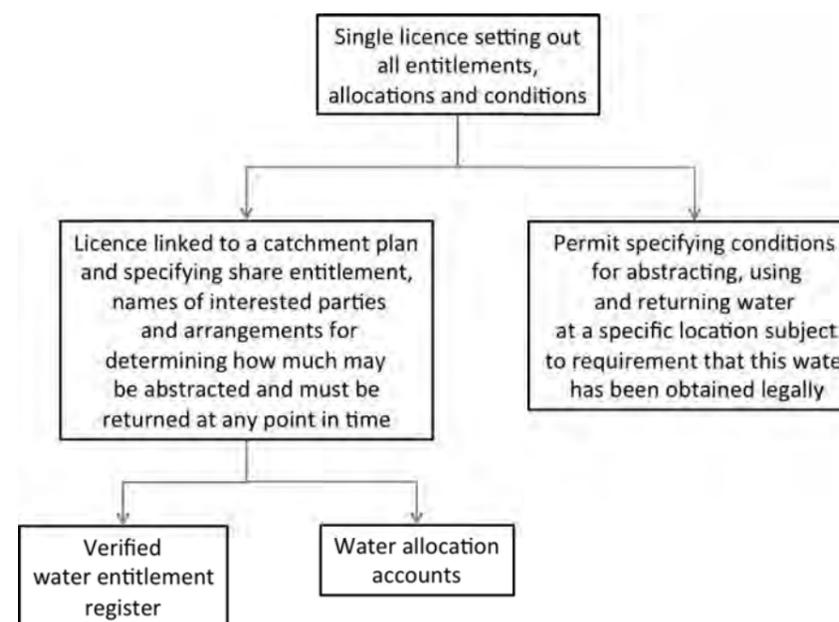


Figure 1 Steps in the process of unbundling water abstraction licences and discharge permits. In an unbundled regime, each component is defined in a manner that enables decisions about one component to be made without consideration of implications for other components because each component is defined in a hydrologically and legally robust manner

In an unbundled regime, the licensee's long-term interest is defined as an entitlement and, the amount that can be taken at any point in time defined using a set of water allocation accounts. Users are then given the choice of trading their entitlement and/or their allocation. In unbundled regimes, Australian experience suggests that administrative processes tend to be simpler and changes more easily accommodated⁷. In particular, there is an upfront investment in the development of rules that allow for speedy allocation trading – often called temporary trades – to occur because they are specified in a manner that ensures that the trade can proceed at exchange rates that ensure that the result will neither harm the environment nor any third party interests⁸.

From a licence holder perspective, when a significant number of water users are able to trade and more efficient ways to use water are known, the economic case for unbundling is strong. When unbundling was introduced in Australia's Southern Connected River Murray system, the value of entitlements increased by over 15% per annum for ten years due to the potential released for trading (see Figure 1).

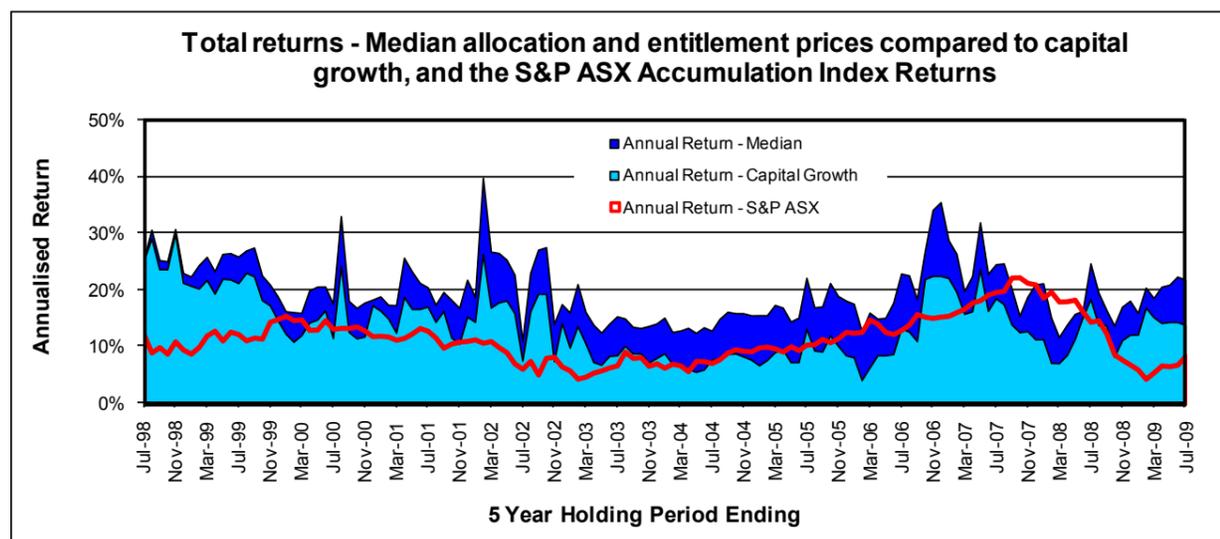


Figure 2 Annualised return from holding a water licence in the Southern Connected River Murray System compared with the return from holding a portfolio of Australian shares. The light blue shows the return gained from increases in the value of entitlements and the dark blue from selling allocations

Source: Updated from Bjornlund and Rossini 2007⁹.

In England and Wales, the main elements of an unbundled a regime would include:

1. A **tradeable entitlement** issued in perpetuity¹⁰ and used to define the holder's long term share or interest in a defined water resource;
2. A **tradeable short-term allocation** that authorises a person to take a specified volume of water within a defined period or transfer this opportunity to someone else. Allocations are always made in proportion to the number of entitlement shares held and in unregulated river system may be taken only when the flow is greater than a nominated rate.

⁷ See for example, the South Australian Government document on the benefits of unbundling at <http://www.waterforgood.sa.gov.au/rivers-reservoirs-aquifers/river-murray/unbundling-water-rights/> and the Victorian Government document at http://www.water.vic.gov.au/allocation/entitlements/irrigation_water_entitlements/

⁸ In some systems, there may be little trading for many years and then suddenly a large amount of trading because of a rapid change in demand, climatic circumstances, technology or prices.

⁹ Bjornlund, H. and Rossini, P. (2007) "An Analysis of the Returns from an Investment in Water Entitlements in Australia."

¹⁰ Perpetuity rather than a time-limited arrangement promotes investment because it guarantees those who can find a more efficient way to manage "their" water the right to sell the resultant savings to someone else. In some systems, it is necessary to include un-meterable uses of water in the allocation regime. In some Australian catchments, for example, look-up tables are used to estimate the impact of timber plantations on water availability. In locations where the impact is significant and as it is impossible to meter use, a deeming system is used to determine how much allocations per hectare have to be set aside before permission to plant trees can be obtained.

3. A **non-tradeable abstraction, use and discharge permit** that specifies the conditions associated with the abstraction, use and return of water at defined locations. As a general rule, one would expect almost all abstractions to be metered¹¹.

In the most sophisticated regimes, unbundled pollution management regimes operate alongside unbundled abstraction regimes. In these regimes, participants are encouraged to trade pollution entitlements and pollution permits¹².

A clear distinction needs to be made between fully and partially unbundled regimes.

- In a **partially unbundled regime**, entitlements are separated from the permits used to manage use. Normally, each entitlement has a default maximum allocation and this amount is not expected to change.
- In a **fully unbundled regime**, entitlements are issued and allocations issued in proportion to each the number of entitlement shares held. Allocations announcements are made on a regular basis and, when they are made, immediately credited to an allocation account. Entitlement holders understand and expect the size of the allocation per share to change from time to time. Typically, the allocation period is short. In the most sophisticated regimes with access to storage, allocations are made on a fortnightly basis as water becomes available. In unregulated systems¹³, typically, allocations are specified as a maximum annual volume and a maximum amount per hour that may be diverted when river flow is above a nominated rate.

The decision as to whether to partially or fully unbundle a regime depends upon the number of license holders involved, the value of the water resource and enforcement costs¹⁴. An illustrative example of a fully unbundled regime is provided later in this report.

In fully unbundled regimes, allocations are made in proportion to the number of entitlements held and credited to each entitlement holder's allocation account. The account holder is then free to choose whether to take or sell these allocations. In systems with access to storage, the allocation is specified simply as a volume. In systems where the flow rate is variable, however, the allocation may be conditional. The allocation may, for example, be specified as an opportunity to take not more than 1 ML per day when river flow is greater than 100 ML per day.

As a general rule, it is only possible to unbundle a regime if, environmental interests are protected by defining return-flow obligations and setting exchange rates that account for transmission losses within, for example, a river reach.

In the most sophisticated trading regime, rules for trading between river reaches and even between ground and surface water resources are included in a basin or catchment plan.

Entitlement register and allocation accounts

In an unbundled regime, the owners of each entitlement are recorded on a central register. Once a register has been established and its content verified, *entitlement trades* are executed by amending the names recorded on the register. This approach allows mortgages and other financial interests, such as a caveat, to be recorded at low cost and, if the integrity of the register is guaranteed by government, significantly increases the value of an entitlement.

Allocation trades are made by debiting one account and, at the appropriate exchange rate, crediting someone else's account. To keep transaction costs low, the registration of financial and other interests is restricted to

¹¹ In some systems, it is necessary to include un-meterable uses of water in the allocation regime. In some Australian catchments, for example, look-up tables are used to estimate the impact of timber plantations on water availability. In locations where the impact is significant and as it is impossible to meter use, a deeming system is used to determine how much allocations per hectare have to be set aside before permission to plant trees can be obtained.

¹² In river systems where the amount of water abstracted by one person can affect delivery capacity, delivery capacity entitlements may need to be issued to ensure that the impacts of increased abstraction by one person do not have inequitable effects on other entitlement holder or a water resource. This is particularly likely to be the case where the capacity to deliver water at one location is limited because, for example, the width of a stream or the nature of an aquifer is constrained. In Australia, where there has been considerable public investment in dam construction, dam storage rights are being issued and are tradeable.

¹³ The flow in a regulated river system can be controlled by varying the rate at which water is released from storage. In unregulated rivers and streams, the flow rate is much more variable and difficult to manipulate.

¹⁴ It needs to be noted that the cost of installing and operating continuous metering and monitoring systems is falling. For more information on these systems and, in particular, the development of total channel control systems see <http://www.rubicon.com.au/EN/index.html>

entitlement registers and no-one is allowed to register an interest in a water allocation. Whenever a buyer and seller agree to a trade, the allocation trade is made according to a pre-specified exchange rate published in a catchment plan or at a place or site identified in a plan. If a third party objects to an allocation trade, the only option open to them is request that the exchange rate and / or the rules that allow trade be amended. That is, there is no opportunity for a third party to stop a trade from occurring¹⁵. This means that it is possible to complete an allocation trade in one or two days.

As with an allocation entitlement trades typically occur at a nominated exchange rate but can only be completed when all registered interest agree to the trade. The difference between the two is akin to the difference between the sale of a house from one person to another and the transfer of money from one person to another.

Regulation

In all unbundled regimes there is the full separation of permits and other instruments used to regulate us from the instruments used to define entitlements. Usually, a single instrument – a permit – is used to describe all user-specific conditions associated with abstraction, use and discharge. Location-specific conditions are negotiated on a case-by-case basis, all other conditions are set out in a periodically-revised catchment plan and the permit holder required to comply with these conditions.

From the user perspective, unbundled arrangements enable environmental and water use approvals to be obtained before water is sourced. A farmer may, for example, decide to apply for a permit to abstract water, apply it to an area of land and discharge it, then proceed to develop that land and, once that has been done, make arrangements to buy or lease the water needed. The result enables the much more efficient use of capital¹⁶.

5. A GENERIC FRAMEWORK

The above considerations, including the case for change, suggest the need for the development of a new framework for the management of water in England and Wales. At the UK level it would be desirable if the principles set out in the framework applied to all water resources including those where water is still abundant. If this approach is taken then the framework could be as applicable to Scotland as it is to England and Wales.

This report, and as set out in Figure 3, identifies a need for:

1. A clear “UK” statement of principles and guidelines.
2. A suite of basin and catchment plans to define the form of the licensing regime to be used in each catchment and place robust limits on the amount of water that may be abstracted at any point in time.
3. A new abstraction license register designed to promote investment, drive innovation and facilitate adjustment.

Many of the building blocks for the development of such framework are already in place. Formalisation of the above arrangements could do much to reduce the administrative overlap and duplication in function that the current regime necessitates. The main reforms recommended in this report are:

- The use of statutory catchment (and/or basin) plans¹⁷ to determine the amount of water that is to be shared among licence holders and how allocations should be made as conditions change;

¹⁵ Trading rules normally include a provision that allows the suspension of trading until an amendment is made. As with share trading, all trades made before the “suspension of trading” must be honoured.

¹⁶ In Australia, irrigators often transfer ownership of their water to a self managed pension fund and then lease this water to their farm business because this enables the more efficient use of capital.

¹⁷ There are two main differences between this proposed approach and that currently in place. First, in order to protect the interests of all, it is recommended that plans be statutory and, thereby, amendable only through a carefully prescribed, transparent administrative process. Second, it is recommended that without exception all licences be redefined so that they entitle each holder to a share of water allocated through the planning process. If the amount allocated through the plan is increased then the relevant shareholders become entitled to a larger allocation per share held. Conversely, if the amount allocated is decreased then they automatically become entitled to a smaller allocation per share held.

National Framework	Over-arching statement of binding principles for water allocation and management Legislation establishing catchment planning framework, licensing regime, entitlement registers, etc.
Basin and Catchment Plans	Statutory definition of water resource pools and system-wide administrative arrangements Definition of environmentally sustainable take from each pool and transfer obligations among pools Administrative detail needed to make allocations to and control use of each pool
Licensing Regime	Verified Entitlement Registers Entitlement Trading Protocols Allocation Accounting Regime Allocation Trading Protocols

Figure 3 Elements of a framework for the UK

- The conversion of existing abstraction licences into licences entitling their holder to a share of any water allocated to a defined water resource pool;
- In all catchments, at least, the partial unbundling of existing licences into an arrangement that defines each person's entitlement share separately from arrangements used to specify abstraction, use and discharge conditions;
- In regions where there is a strong case for temporary trading, the further unbundling of licences so that allocations can be managed separately from entitlement shares.

The result is a suite of arrangements that assign risk, reward innovation, promote efficient long term investment, encourage efficient use in the short term, facilitate adjustment and improve opportunities to manage environmental impacts. One of the most important changes is the proposed transition from the existing regime to one where all licences are converted into shares of the environmentally sustainable level of take set for a pool. That is, the catchment plan is used to determine the level of take and following due process, any change at that level has automatic consequences for all people who take water from that pool. If adopted, this arrangement would significantly strengthen the effectiveness of the existing Catchment Abstraction Management System (CAMS).

If this proposed reform is implemented, then careful consideration will need to be given to the governance arrangements necessary to enable efficient and effective stakeholder involvement in the development of catchment plans. One of the most important issues to resolve is the question who should be involved in the preparation of a draft catchment plan and what processes should be used to move from a draft plan to one that is recognised in law as a statutory instrument. Australian experience suggests a strong case for considerable stakeholder representation on the boards and committees used during the development and implementation of plans.

Principles and guidelines for the UK

The purpose of a National statement of water management principles is to establish a vision and robust framework for the allocation and use of water. This statement would need to recognise the varying nature of water use and supply conditions throughout the country and the degree of development that has occurred in different parts of the country. In the first instance, the statement could recognise the need to differentiate among catchments that

- Are fully or over allocated; and
- Those that still have the capacity for the more licences to be issued.

In order to encourage efficient investment, drive innovation and ensure that abstraction reform does not result in the emergence of environmental problems, each catchment plan would begin by identifying the number of water resource pools that exist and establish requirements for the transfer of water from pool to pool another so that changes in the way water is abstracted from one pool neither undermines the value of any other pool nor the environmental status of those pools.

Within each pool, environmental flow requirements then need to be identified and the environmentally sustainable level of take specified. In some pools, such as a groundwater pool, the environmentally sustainable level of take may be defined as a net volume of water that may be taken within a season. In many surface water resources, however, it may be more appropriate to define the sustainable level of take by volume and the flow rate at the top of the pool (ie Q95, Q70, etc.)¹⁸.

As a general rule, all water resource pools should be “closed” well before they are fully allocated. Pragmatically, closure could occur when licences to something like two thirds of a pool’s “environmentally sustainable take” has been issued. At the time of closure, the final number of shares in the pool is declared and the remaining shares registered in the name of a body such as the Environment Agency or the Natural Resources Body in Wales¹⁹. The Environment Agency would then need to determine how and when to issue these unallocated shares. The result is an institutional arrangement that signals the need for all water users to plan for a transition from a regime that encourages more water use to one designed to prevent over-allocation problems from emerging²⁰.

Until closure, a regime similar to the current licensing regime would be used. In an unclosed water resource, time-limited entitlements would be issued to genuine users on a first-come, first-served basis on the understanding that full use of the licence is required within an agreed period. Consistent with current practice, failure to make sufficient use of the water within an agreed time would result either in amendment of the licence and/or its cancellation. From the outset, abstraction, use and discharge permits would be issued separately from the entitlement.

To prevent speculation in the lead up to closure, the holders of all existing licence would be required to “show cause” as to why any unused proportion of their licence should not be cancelled²¹. On closure, the legislation would require that all entitlements be re-issued as a unit share entitlement to a proportion of any water allocated to a defined water resource pool.

The proposed UK Water Policy Framework would also establish clear governance arrangements for the development of catchment plans. As the plans would play an important role in defining the value of a licence, they would be statutory plans and capable of being changed only via a legally defined process.

¹⁸ It may also be necessary to limit the rate at which abstraction may occur so that no-one user can access all the resource at one point in time.

¹⁹ As these organisations would be interested only in holding but not using these shares, no abstraction, use and discharge permit would be allocated to them. Procedures for the sale or transfer of these entitlements to aspiring users would need to be developed.

²⁰ Over-allocation occurs when the total amount of water that people have been licensed to take is greater than the amount that can be taken sustainably. In Australia’s Murray Darling Basin, over-allocation was caused by the practice of some governments to assume that a proportion but not all of the water allocated to each licence would be taken and, as a result, issue more licences than that which could be sustained if all the water allocated to each licence was used. In the short term, this created no problem. With the introduction of markets, however, licence holders began to seek more efficient ways to use all the water allocated to them. So called, sleeping, water was either activated or sold to someone who would use it. As a result, over-allocation became a serious problem.

²¹ Show cause mechanisms can be used to reduce the extent of over-allocation problems.

In areas where a pool has or is in the process of being closed and, in order to reward efficient use and innovation, **entitlements** would be:

- Defined as a transferable, perpetual or on-going share to a water resource so that it is clear that any savings resulting from the more efficient use of water or otherwise may be sold and may not be confiscated²²;
- Mortgageable so that there is an incentive to put water to its most valuable use;
- Defined as a “net” entitlement to take water from a system so that the incentives for the more efficient use of water neither erode the interests of downstream users or the environment;
- Defined so that abstracting, use and discharge conditions are subject to separate permitting arrangements.

In order to facilitate efficient **low-cost transfer** (trading) of water entitlements and allocations to the entity that can make the best use of this water:

- The registration of interests in a water licence be recorded on water entitlement register whose accuracy and integrity is guaranteed by government;
- Where there are sufficient entitlement holders to justify “temporary” allocation trading, allocation accounts would be established.

Basin and catchment plans

The European Community Water Framework directive identifies the Basin as the most appropriate unit to manage a water resource. Within England and Wales, 11 Basins have been identified and plans prepared for each (see Figure 4 on page 14).

The purpose of a catchment plan is to facilitate the efficient management of system-wide issues separately from processes associated with the adjustment of the arrangements used to protect the interests of individual licence holders.

To encourage all water users to plan for changing climatic, supply and economic conditions, Basin and catchment plans need to be statutory instruments and become the prime instrument for managing system-wide relationships and trade-offs.

Legislation needs to ensure that the processes used to amend a plan are transparent, equitable and protected by statute so that changes to things like the environmentally sustainable level of take can only be made following due process.

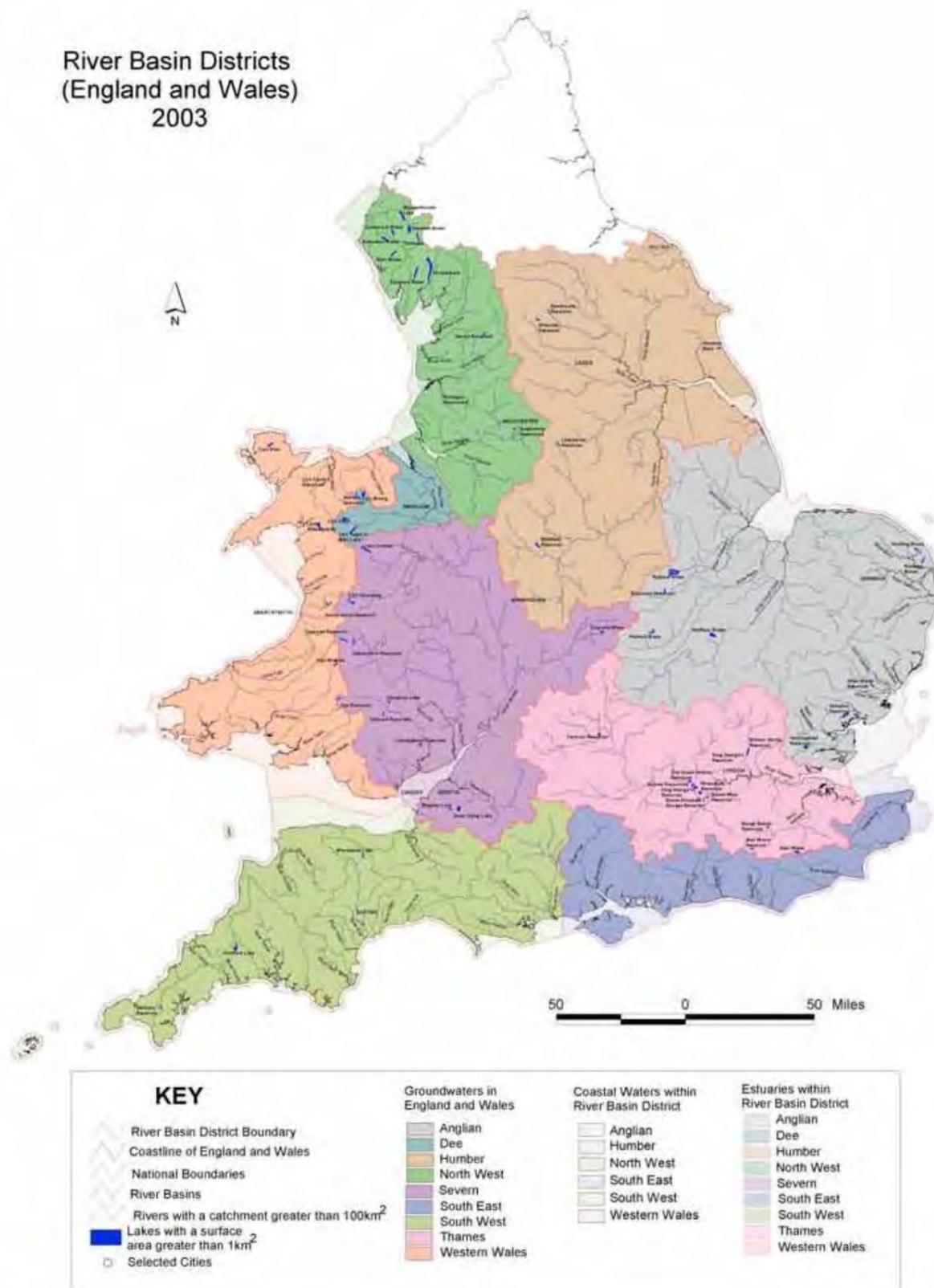
When the water resource system is large and inter-connected, it may be more efficient to use a basin plan to specify the over-all limits on use and manage transfers from one part of the system to another. When this is the case, catchment plans will need to be written in a manner that is consistent with the Basin Plan that governs them.

As a general rule, catchment plans should be used to specify the detail needed to establish the entitlement and allocation system to be used in each part of a basin. Catchment plans need to begin by identifying the number of water resource pools needed for efficient management of the inter-connected water bodies that form a catchment.

Catchment plans would begin by identifying the number of water resource pools that collectively define the catchment. This would be followed by a definition of the environmental objectives for each water resource pool in a manner that is consistent with basin-wide objectives.

²² Prior to closure, all entitlements would be time limited and contain arrangements that allow any unused portion of a licence to be taken back from the licensee. Experience shows that this arrangement coupled with a requirement to pay an annual fee that is set in proportion to the size of the entitlement is sufficient to prevent speculation problems from emerging as a significant issue.

River Basin Districts
(England and Wales)
2003



This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Environment Agency, 100026380, (2003). © Environment Agency

Figure 4 River Basin Districts in England and Wales
Source: <http://maps.environment-agency.gov.uk/>

In systems where there is a case for an arrangement that gives, for example, allocation priority to urban users during times of scarcity, there may be a case for two or three priority pools within a river reach²³.

An environmentally sustainable abstraction limit would then be defined for each pool and, in order to protect downstream users and environmental interests, obligations to transfer water from one water resource pool to another defined.

Catchment plans would then go on to specify the entitlement regime to be used in each pool, the degree of unbundling to occur, how allocations to the pool will be made and distributed amongst each pool's shareholders.

During the process of setting up these sharing arrangements, care needs to be taken to differentiate between a licence holder's long-term interest – their "entitlement" – and the opportunity to abstract at a point in time – their "allocation".

In some catchments, a single sharing regime will be appropriate. In many systems, however, pools will need to be defined on a reach-by-reach basis or zone-by-zone basis. In some catchments, it may be necessary to establish high, general and low security pools so that, in times of drought, it is clear whose interests will take priority.

Entitlements and any allocations made to a pool should be tradeable according to pre-specified rules and exchange rates.

Amongst other things, each catchment plan would include start up rules for the equitable conversion of existing licences into shares. Each plan would also establish abstraction, use and discharge permitting arrangements and play an integral role in the delivery of environmental objectives in the catchment.

Entitlement registers and allocation accounts

The purpose of each entitlement register is to define the nature of each licence holder's interest in a water resource pool. In addition, registers would be used to record the nature of any financial interest in an entitlement such as a mortgage or caveat. Entitlement trades would be executed by amending the names recorded on the register. Any financial or other interest not recorded on the register would have no standing and could not be used to prevent a trade.

In England and Wales, there is an immediate need to verify of licence registers. Moreover and as part of this process, there is a need to decide who is the most appropriate person to hold each licence. In an environment where trading is allowed, the people whose names are listed on a licence should be allowed to decide to transfer it to someone else without having to consult anyone whose name is not registered on the licence.

It is current practice in England and Wales to issue licences to tenants as they are the abstractor of the water. In a trading environment, many landlords would be furious if the water that had been used on their land for many years was sold to someone else without their agreement. Thus, during any unbundling process and as trading is introduced, it is necessary to run a process to determine which person, people or legal entity has the right to decide to transfer an entitlements or allocation to someone else and, where appropriate, re-issue the licence in their name. The usual default position is to begin by allocating entitlements to the owners of the land where water is used and then recording any other interests in an appropriate manner.

Careful consideration also needs to be given to the influence that the introduction of trading can have for mortgages that have been attached to a land title where the water has been used. In particular, banks need to be given the opportunity to negotiate a mortgage over an entitlement that has been separated from the land title with which it was previously associated.

In parallel with this process, consideration needs to be given to the case for continuing to issue abstraction, use and discharge permits to a tenant or involve the landlord in the enforcement process.

Early consultation with the banking industry and others who hold a financial or other interest in irrigated farmland is advised. Once established and verified the accuracy of the content of each register should be guaranteed by government²⁴.

²³ Where ever more than one priority pool is established, the catchment plan could specify that the holders of high security pool entitlements receive their full allocation before any water is allocated to the general security pool.

²⁴ The accuracy the processes used and integrity of the register should be such that title insurance should not be necessary.

Trading, charging and pricing

The White Paper identifies the valuable opportunity that trading and improved pricing and charging arrangements offer. Well-designed trading and charging arrangements reveal the value of marginal opportunity costs, reward those who innovate and reveal the full costs of delivering water to users.

Trading

Whenever a well-designed entitlement and allocation system is introduced, interest in trading emerges naturally. Australian experience has revealed that trading drives innovation and efficient investment – especially when underpinned by arrangements that assign 100% of climatic risk to entitlement holders and forces the allocation system to be kept within sustainable limits.

Trading of allocations, sometimes called temporary trading, allows the efficient use of water within a season. Experience in Australia has revealed that allocation trading is particularly valuable during a drought and other periods of water shortage. Trades need to be completed within days not months.

One of the more recent innovations in the development of trading arrangements in Australia is the development of what is known as “tagged trading.” Tagged trading involves the approval of a change in entitlement ownership on the condition that the nature of the entitlement is not redefined. Instead, a commitment is made to automatically trade any allocations made to a new location at the going exchange rate. This means that most of the exchange rate risk is left with the buyer. Importantly, the arrangement allows the consequences of moving water from one location to be tested and revised. In the first year, for example, the exchange rate used to account for transmission losses may be set at 0.7 and then, in the second year, increased to 0.75. The approach is particularly useful when the models being used to calculate exchange rates are still under development.

Charging and pricing

Government charging can be used to reveal the full costs of managing the entitlement, allocation and permitting regime and thereby help to ensure efficient investment in businesses that use water. The provision of water regulation services to users at subsidised rates has the opposite effect and discourages efficient investment and use.

In well-designed systems, charges are collected in proportion both to the size of the entitlement and the amount of water taken so that all entitlement holders have an incentive to either use the water allocated to them or transfer it to someone else²⁵. Typically, the entitlement charge is used to reflect the fixed cost of administering the regime plus the cost of maintaining infrastructure. Allocation charges are used to reveal costs marginal costs of delivering each unit of water to the user.

In parallel with these arrangements, often there is interest in the use of pricing as a means to reflect scarcity values. Scarcity pricing, however, is notoriously ineffective at keeping resource use within sustainable limits as it requires the administrator to put up the price at the very time that an industry is under financial pressure. In contrast, water markets in Australia are proving to be very effective in revealing scarcity prices to users and encouraging people to think about selling allocations to others.

Where there is interest in sending a scarcity price signal and trading is not well established, a scarcity price signal can be sent by establishing what is sometimes known as an “All-in-Auction”²⁶.

In an All-in-Auction²⁷, every licence holder is required to contribute a proportion of their entitlement to a pool and then indicate at what price they would be prepared to sell this entitlement. If someone offers to pay more than that price then the entitlement is sold and the existing licence holder receives a cheque. That said, any entitlement holder can set a very high price and thereby ensure that all their “contribution” is returned to them. In practice, however, most can be expected to set a realistic reserve price. In an All-in-Auction, multiple bids are allowed and every participant is allowed to bid to secure as much water as they like.

²⁵ A charge levied in proportion to the size of the entitlement held has the additional advantage of discouraging people from holding an entitlement for speculative purposes and/or to prevent someone else from using it.

²⁶ In other literature, this arrangement is called a zero-revenue auction because all the revenue collected is returned to licence holders and none to the government.

²⁷ See Zetland, David, All-in-Auctions for Water (July 25, 2012) PERC Research Paper No. 12/15. Available at SSRN: <http://ssrn.com/abstract=1658193> or <http://dx.doi.org/10.2139/ssrn.1658193>.

The proportion contributed need not be large. In many cases, a contribution of 1% to 2% per annum is sufficient to establish a viable market, reveal scarcity prices and encourage all users to consider the merits of selling some or all of their water entitlement.

All-in-Auction processes have a number of distinct advantages. Whilst yet to be used in the water sector, first and foremost, they force all entitlement holders to think about the marginal value of their water entitlement and reveal the value of this entitlement to others. Second, they force the establishment of a market in a manner that makes it possible for new entrants to cost-effectively acquire water. All-in-Auctions are likely to be particularly effective when the benefits of trade are significant but the number of licence holders is small and users are fearful that if they sell a water entitlement they may not be able to buy it back in the future²⁸.

Entitlement definition

In an unbundled regime, entitlements are used to define the licence holder’s long-term interest in a water resource pool. The most appropriate way to define entitlements can be expected to vary by type of water body.

Experience with the management of water in Australia and, international experience in the allocation of fishing licences, suggests that responsibility for risk management is most efficiently assigned and managed using sharing systems similar to those used to allocate shares in a limited liability company²⁹. The main feature of all of these sharing systems is an arrangement that sets up a simple rule designed to prevent over-allocation problems from emerging. The simple rule is that if anyone wants permanent access to a larger share of a resource, the only way they can do this is to persuade someone to sell or transfer some of “their” shares to them. Market rather than administrative processes are then used to determine who gets access to water³⁰.

In groundwater systems, the entitlement is normally a share of the sustainable amount of water that can be taken. Groundwater allocations are usually made on a quarterly or annual basis so that the use of each groundwater body’s storage capacity is optimised. Up to a volumetric limit, carry-forward of a proportion of any unused water from one period to the next is allowed.

In surface water systems where there is considerable storage and capacity to control the flow rate, typically, the entitlement is to a share of any volume of water available for consumptive use. In the most sophisticated of these sharing regimes, shares in delivery capacity and storage are issued and marketing arrangements developed so that those who aspire, for example, to store large amounts of water can arrange to do so by either renting storage space from those who hold an entitlement to it or paying them to store water on their behalf.

In unregulated free flowing surface water systems, a mixture of hands-off flow and sharing arrangements can be used. In these unregulated systems, access is allowed only when the flow rate is greater than a defined minimum. Whenever a hands-off flow arrangement is included in a sharing regime, base flow is protected from abstraction and first priority is given to the river. Differing from current practice in England and Wales and in systems where flow varies, however, the amount of water that can be taken above that limit is defined as a proportion of the flow above that minimum rate that can be taken. In the most sophisticated regimes, flow above the minimum is divided into a number of priority bands and access to each band shared. Rules are also put in place to ensure adequate flow variability.

Illustrative examples

In order to clarify some of the concepts described in the previous sections the following sections provide some examples of the way that the above described unbundling arrangement could be implemented in surface and groundwater systems. The examples given are for fully allocated water resource systems which, if the

²⁸ The mechanism can also be used to recover a resource rent by retaining a proportion of the money received.

²⁹ Even though the entitlement is to a proportion of all allocations made, shares are defined as unit shares so that more shares can be issued without having to change each individual share. This arrangement facilitates low-cost adjustment to boundaries and the transfer of entitlements from one water pool without compromising the integrity of the sharing system. Shares in one pool can be surrendered and shares in a new pool issued simply by dealing with the shares in question. The result is an increase in the number of shares in one pool and a decrease in the number of shares in the other pool. All other shares remain on the register and need no amendment. If they were issued as rights to a percentage of all allocations made, every time entitlements were transferred from one pool to another every share certificate (what are these?) would have to be amended.

³⁰ In Australia, where this approach is now used in the Murray Darling Basin, the allocation arrangements include special provisions that come into play when there is insufficient water to ensure conveyance to places where water is needed for essential human needs and/or when there is insufficient water in the system to supply those needs.

recommendations proposed in this report are adopted, have been closed. That is, all the shares in at least one priority pool have been assigned to a user³¹.

For simplicity of explanation, the number of abstractors in these systems is much less than would normally be the case. The purpose of the next section is to be illustrative and informative not comprehensive.

Application to a river reach

Imagine a river reach with a hands-off flow-rate of 1,000 ML per day and five abstraction licences along it. Whenever the flow is greater than the hands-off flow-rate, it has been determined that up to 20% of this flow may be abstracted without detriment to river health or down-stream water users. Two security pools have been identified - a high security pool and a general security pool. Moreover, it has been decided to never allocate entitlements to abstract any flood water as the administrative costs of allowing access to this water are greater than the benefits access would generate. High security users can start accessing their water only when the flow rate at the top of the reach is greater than 1,000 ML per day. General security users, however, can start accessing their water when the flow rate is greater than 2,000 ML per day (see Figure 4 on page 14).

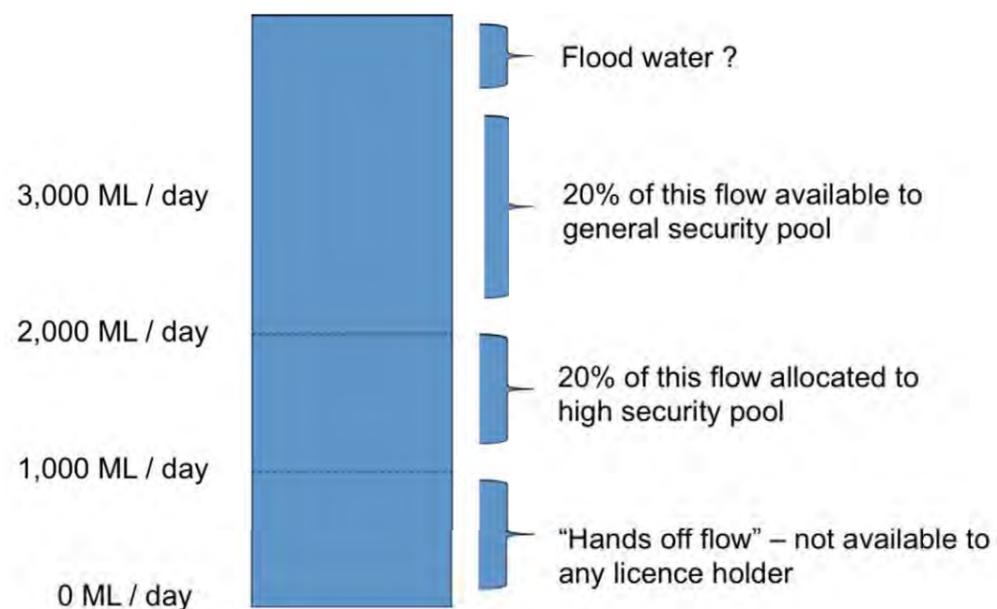


Figure 5 A flow regime for an imaginary river reach

Source: <http://maps.environment-agency.gov.uk/>

During the transition to the proposed regime there is a commitment to issue entitlements in a manner that reflects each licensee's equitable interest in the existing regime. Under the existing regime, if all abstractors took their maximum entitlement and after accounting for return flows, they would take a maximum of 200 ML per day. That is, without harm to the environment, all could take their full entitlement when the flow rate is 2,000 ML per day. Pragmatically, this flow rate is used to define the upper limit to the high security pool within this reach of the river.

In summary and as illustrated in the figure above and to the right.

For simplicity, assume that no licences have been issued for the general security pool. The high security pool, however, has been closed so that the interests of shareholders in this pool are fully specified and their proportional share protected. In a closed pool, if someone wants acquire an entitlement to abstract water from this pool, the only way they can do this is to convince someone to transfer it to them.

³¹ In some parts of England, there is still opportunity for people to access very high flow events. The question of whether or not licences for this water should be issued. One of the first tests is to decide whether or not the administrative costs of allowing access to this water is greater than the benefits that would be generated if access is granted. This needs to be solved on a catchment by catchment basis.

Hands off flow necessary to protect river health and meet downstream abstraction requirements	1,000 ML/day
“High” security” pool	1,000 to 2,000ML/day
Environmentally sustainable take from high security pool	20% of flow in the pool
Maximum “net” amount that may be abstracted from high security pool on any day	20% of (2,000 – 1,000) = 200 ML/day

As shown in Table 1, it is possible to analyse existing discharge permit arrangements to estimate a daily discharge rate and from this estimate the number of high security shares that each licence holder should be issued. Shares are issued in proportion to the net amount of water each licence holder implicitly is allowed to use. Each ML is worth 10 shares³². In total, 2,000 shares would be issued (see Table 1). The accuracy of the entitlement register would be guaranteed. Any unregistered interest in these shares would have no right to prevent the transfer of these shares to a third person. Each share would guarantee an entitlement to 1/2000th of any allocations made to the high security pool.

Abstractor	Maximum daily take ML/day	Assumed daily discharge in permit ML/day	Implied net use ML/day	Entitlement expressed as a share
A	402	0	20	200 shares
B	603	0	30	300 shares
C	1202	0	100	1,000 shares
D	603	0	30	300 shares
E	402	0	20	200 shares

Table 1 Conversion from current abstraction licence to shares

Allocation arrangements

Assume that the catchment plan also specifies the default proportion of the high security pool that could be abstracted on a monthly basis and empower the river manager, acting on the advice of an appropriate body³³, to vary this percentage (see Table 2)³⁴. The resultant accounting regime, while fully unbundled, only requires use to be accounted for on a monthly basis³⁵.

³² In some systems, equity considerations may require adjustment for conveyance losses along the reach.

³³ One option would be to establish a catchment management board to advice on issues like this.

³⁴ It is stressed that a seasonal allocation arrangement may not be necessary or appropriate. In some systems, however, it may be possible to allocate more water to users in some seasons than in other seasons.

³⁵ Entitlement holders could, as the benefits of trading are realised, opt to move to a continuous accounting system which, while it may cost more to operate, would enable environmentally sustainable take to be increased.

Month	Default abstraction percentage when the flow rate is above 1000 ML/day
January to March	120%
April to June	120%
July to September	80%
October to December	80%

Table 2 Default seasonal abstraction percentage

The result is an abstraction regime that allows for more water to be taken in winter than in summer³⁶.

To bring all this together into a coherent system, the Environment Agency³⁷:

- Sets up an allocation accounting system that records the amount of water that each licence holder is allowed to take at any point in time and how much is taken and return;
- Establishes an entitlement register for each the catchment and verifies its integrity;
- Issues a new set of abstraction, use and discharge permits that bring together all use conditions into a single instrument.

Under such a regime, Abstractor C's abstraction, use and discharge permit might require that:

- All abstractions be metered and only be taken from location X;
- All returns be metered and only returned at location Y;
- At least, $(20/120 \times 100) = 17\%$ of all abstracted water be returned to the system;
- To remove the need to monitor take on a continuous basis, the pump at Location X contain a restrictor preventing abstraction at a rate greater than 120% of the maximum daily entitlement.

Among other things and consistent with National guidelines, this abstraction, use and discharge permit would enable people to be fined for taking water without an allocation, failing to pay user charges, delivery fees, etc.

To support this regime and keep catchment-wide issues separate from individual use arrangements, the catchment plan would contain a default set of entitlement and allocation trading rules. One of the main purposes of these rules would be to define the exchange rates that would be used when an entitlement or allocation is traded from one location to another³⁸.

In such a regime, Abstractor C might decide to use less water in July and sell these savings to Abstractor D.

With the trade to Abstractor D completed, Abstractor C's water allocation account for the month of July would resemble the arrangement set out in Table 3.

July Allocation Account Abstractor C Holding = 1000 shares	Debit in ML	Credit in ML	Balance in ML
Allocation at rate of 80% of 0.2 ML per share for 1000 shares for 31 days in July		4,960	4,960
Total volume returned in July at location Y		700	5,660
Total volume returned in July at location X	4,340		1,320
Allocation transferred to Abstractor D for month of July	500		820
Unused allocation surrendered on 31st July	820		0

Table 3 Illustration of Abstractor C's water allocation account for the month of July

Inter-reach trading

Under the current regime, the amount of water that may be abstracted from a river in England and Wales is defined sometimes by the amount of water that flows past the place where abstraction occurs. When this approach, rather than the more usual approach of defining allocation arrangements by reference to an "assessment" point at the top of a river reach, a "shepherding" problem emerges.

Shepherding problems emerge because a decision to trade water downstream increases the downstream flow rate and thereby increases the opportunity for downstream users to take water – even though they were not involved in the trade. Within a reach, the solution to this shepherding problem is to define each entitlement by reference to the flow rate at the top of a reach and then make arrangements to adjust the reference flow rate when water is traded from one reach to another³⁹. Under this arrangement, one person's opportunity to abstract water does not increase when water is traded within the same reach if they are not doing the trading. Within a reach, licence holders can then trade entitlement and allocations within a reach on the understanding that water left in a river can be accessed only by the person who buys it from the person who sold it.

Application to a groundwater system

For a groundwater system and, as a flow rate and hands-off access regime does not make sense, a different allocation mechanism is needed. If the regime recommended in this report is adopted then a catchment plan would be used to:

- Define a maximum environmentally sustainable abstraction limit and establish a regime to enable licence holders to trade entitlement shares and allocations;
- Establish rules for allocating this water as the state of the resource varied.

³⁶ In many systems, it may not be appropriate to allow more water to be abstracted in different parts of the year.

³⁷ Or, if the catchment was in Wales, the Natural Resources Body.

³⁸ Exchange rates for entitlement trading may be more conservative than those used for allocations. For example, the Plan might stipulate that the default entitlement exchange rate is 80% of the abstraction regime. The plan could also provide for tagged entitlement trades that would leave the maximum entitlement tied to an existing location but guarantee that all water allocated to that account will be immediately transferred to another abstraction account at the nominated abstraction rate. Under this risk all the abstraction exchange rate risk remains with the purchaser. When a permanent trade is made, the exchange rate errors impact permanently on other entitlement holders and/or the environment.

³⁹ For more information see Young, M.D. and McColl, J.C. (2009) Shepherding water: Unregulated water allocation and management. Droplet 15. Available at www.myoung.net.au

In the simplest groundwater systems, allocation rules could be based on depth to groundwater and used to determine how allocations per share would change as the groundwater table rises and falls. In more developed groundwater systems, models are used to estimate net annual recharge and then work out how much water can be allocated to each share at any point in time given, for example, that it may be necessary to ensure that certain groundwater dependent wetlands are watered at least once every few years.

When the flow of water through an aquifer is slow and continuous, a proportion of any unused allocations can be carried forward from one allocation period to another⁴⁰. In these systems, arrangements that allow credit for groundwater recharge in excess of required returns can be used to encourage the development of more efficient groundwater use.

6. IMPLEMENTATION

In practice, unbundling can be rolled out on a catchment by catchment basis and, with attention to the sequencing implications⁴¹, trialled in one or more basins as administrative capacity is developed.

Australian experience suggests that the most appropriate sequence to begin with is one that starts with preparation of a catchment plan and verification of licence registers.

In large complex interconnected systems, the preparation of catchment plans needs to be aligned with the preparation of a basin plan. Amongst other things, it is critical that all arrangements for the distribution of water among catchments are set-out in a basin plan.

Construction and verification of licence registers can proceed in parallel with the development of basin and catchment plans. During this process, existing licences can be unbundled and arrangements put in place to allow the introduction of low-cost trading. The arrangements necessary to allow people to record a mortgage or any other legitimate financial interests on an entitlement can be put in place at this stage.

With verified licence registers in place, attention needs to move to transition arrangements that would enable the closure of water resource pools and the development of catchment plans that enable the development of trading protocols, allocation accounting arrangements that allow groups of people interested in trading to identify each other.

As noted earlier, the cost of developing administrative regimes that enable day to day trading are significant. As a result, it is recommended that the benefits of transitioning to such a system be demonstrated in one or more pilot catchments.

7. CONCLUDING COMMENTS

Written from the perspective of someone interested in global best practice in water licensing arrangements, this report identifies a suite of significant opportunities that can be expected to improve the management and use of water throughout England and Wales. While not developed to the same degree of detail, the opportunities identified include improvements in the way that discharges to the rivers and aquifers are managed.

An indicative framework for the licensing, allocation and management of use is offered and an opportunity to make five improvements to the existing regime identified. These involve:

1. The full specification of return flow obligations in licences.

⁴⁰ For a discussion of the development of continuous accounting systems see Young, M.D. and McColl, J.C. (2007) *Irrigation Water: Use it or trade it because you can't save it!* Droplet 6. Available at www.myyoung.net.au

⁴¹ In some systems, for example, it will be necessary to determine whether or not the entitlement is best issued to the land owner or the tenant. In other systems, allocation trading may be trialled without the need to resolve this "sequencing" issue.

2. Construction and verification of licence registers so that financial interests in water can be recorded efficiently and as a result the cost of and time taken to implement a trade reduced.
3. The conversion of basin and catchment plans into statutory documents and their use define environmentally sustainable levels of abstraction and the return of water to systems coupled with redefinition of licence entitlements as a right to an equitable share of any water allocations made to a water resource pool.
4. The separation of use and discharge conditions from entitlement specification so that low cost trading becomes possible.
5. In catchments with many licences and clear benefits from short-term trading, the use of allocation accounts to facilitate its introduction.

It is recommended that the implications of moving from the existing regime to the new proposed new regime be discussed with stakeholders and then trialled in, at least, one basin and, preferably, several catchments.

8. RECOMMENDED READING

ACCC (Australian Competition and Consumer Commission) (2006) *A Regime for the Calculation and Implementation of Exit, Access and Termination Fees Charged by Irrigation Water Delivery Businesses in the Southern Murray–Darling Basin*. Canberra, Australia: Australian Competition and Consumer Commission.

ACCC (2008) *Water Market Rules Issues Paper*. April. Canberra, Australia: Australian Competition and Consumer Commission.

Brennan, Donna (2007a) *Managing Water Resource Reliability through Water Storage Markets*. Available at www.myyoung.net.au/water/policies/Brennan_Storage_Markets.pdf (accessed 11 July 2012).

Brennan, Donna (2007b) *Missing Markets for Storage and their Implications for Spatial Water Markets*. Paper presented to AARES Conference, Queenstown, NZ, 14 February. Available at www.myyoung.net.au/water/policies/Brennan_AARES07_storage_&_trade.pdf (accessed 11 July 2012).

CoAG (Council of Australian Governments) (2004) "Intergovernmental Agreement on a National Water Initiative." Agreement between the Commonwealth of Australia and the Governments of New South Wales, Victoria, Queensland, South Australia, the Australian Capital Territory and the Northern Territory (25 June).

Frontier Economics (2007) *The Economic and Social Impacts of Water Trading*. Report prepared in association with Tim Cummins and Associates, Dr Alistair Watson, and Dr Elaine Barclay and Dr Ian Reeve of the Institute for Rural Futures, University of New England for the National Water Commission, Canberra. Available at www.frontier-economics.com/australia/au/publications/221 (accessed 11 July 2012).

Vanderbyl, Tom (2007) *Implementation of Continuous Sharing in Queensland*. Brisbane, Australia: SunWater. Available at www.myyoung.net.au/water/policies/SunWater_Continuous_Sharing.pdf (accessed 11 July 2012).

Young, M.D. (2008) "The Effects of Water Markets, Water Institutions and Prices on the Adoption of Irrigation Technology." Paper presented to a conference on Irrigation Technology to Achieve Water Conservation, World Water Expo, Zaragoza, Spain, May.

Young, M.D. (2010) *Environmental Effectiveness and Economic Efficiency of Water Use in Agriculture, The Experience of and Lessons from the Australian Water Reform Programme*. Background report prepared for OECD study (2010) *Sustainable Management of Water Resources in Agriculture*. Available at www.oecd.org/water (accessed 11 July 2012).

Young, M.D. and McColl, J.C. (2003a) "Robust Separation: A Search for a Generic Framework to Simplify Registration and Trading of Interests in Natural Resources." *Agricultural Science* 15(1): 17–22.

Young, M.D. and McColl, J.C. (2003b) "Robust Reform: The Case for a New Water Entitlement System for Australia." *Australian Economic Review* 36(2): 225–34.

- Young, M.D. and McColl, J.C. (2005) "Defining Tradable Water Entitlements and Allocations: A Robust System." *Canadian Water Resources Journal* 30(1): 65–72.
- Young, M.D. and McColl, J.C. (2007) *Irrigation Water: Use It or Lose It Because You Can't Save It*. Droplet 6. Available at www.myoung.net.au/water/count.php?para=6 (accessed 11 July 2012).
- Young, M.D. and McColl, J.C. (2008) *Grounding Connectivity: Do Rivers have Aquifer Rights?* Droplet 13. Available at www.myoung.net.au/water (accessed 11 July 2012).
- Young, M.D. and McColl, J.C. (2009) "Double Trouble: The Importance of Accounting for and Defining Water Entitlements Consistent with Hydrological Realities." *Australian Journal of Agricultural and Resource Economics* 53(1): 19–35.
- Young, M.D., Shi, T. and McIntyre, W. (2006) *Informing Reform: Scoping the Affects, Effects and Effectiveness of High Level Water Policy Reforms on Irrigation Investment and Practice in Four Irrigation Areas*. Technical Report No. 02/06. Mount Barker, Australia: CRC for Irrigation Futures.

