WATER TRADING INSTRUMENTS IN AUSTRALIA
Some thoughts on future development of Australian water markets

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Abstract

Despite commendable progress in the evolution of water trading markets in Australia, there remains a range of regulatory and institutional impediments to potentially valuable further evolution. Even with the removal of these constraints, it will take time for a mature market to emerge. This paper focuses on a number of these constraints and discusses a range of instruments that are likely to find increasing use in the future. A key emphasis is on the potential role of derivative markets in providing more flexibility to deal with the high water supply volatility in Australia, and to encourage better integration of demand and supply side instruments in deriving maximum value from these markets. Other suggestions include selective separation and trading in delivery capacity rights and a measured transition to the use of tagging as opposed to exchange rate mechanisms in respect of inter-jurisdictional trading.

Purpose

This paper draws heavily on a 2003 study I undertook, with Michael Woolston, for the Water Reform Working Group (ACIL Tasman, 2003) – essentially covering current trading instruments and possible gaps and limitations in these instruments, and looking forward to the types of instruments that might reasonably emerge in coming years. That report extended to thoughts on the role, if any, for government in encouraging these instruments and associated trades or, perhaps more pertinently, for lowering existing barriers to their emergence.

This paper involves some updating, to reflect evolution in my thinking and in the markets and policy arrangements and plans for the arrangements) themselves, and the presentation to a wider audience than the target of the earlier report. Nonetheless, much of the content is common with the earlier report – and that report includes greater detail on a number of matters.

It retains the discussion paper character of the earlier paper. A range of ideas and ways of looking at possibilities are raised, but it is not prescriptive, beyond some emphasis on removing unnecessary barriers to the emergence, testing and, where valuable, retention and growth of some of these instruments. The thinking here has been tested on a range of water users and regulators, in the course of developing the original paper and since – but is still very much put forward as a contribution to the on-going policy debate and market evolution, to be used selectively as and where appropriate.

Background

Many of us have observed the progressive development of water markets in this country over the past two decades. To a large extent, the initial thinking, amongst economists and farmers, was concerned with the redirection of the resource to more valuable *extractive uses*.

This objective does, of course, remain, but in more recent years has been expanded. It came to include a desire to find least cost ways of meeting a wider range of demands, including non-extractive uses, on a resource that has been increasingly recognised by the community for its value and finiteness. The right to trade, and hence extract greater value from extractive use, has in effect become (at least in some jurisdictions) part of the basis for compensation for some attenuation of effective rights to extract – allowing greater returns to environmental flows or achievement of wider quality outcomes than might otherwise have been affordable or politically acceptable.

Even more recently, the idea of active market trading as a direct means of acquiring more water for environmental flows, or for better balancing extractive/non-extractive uses to deliver greater value – in addition to the more traditional balancing within extractive uses – has been receiving greater attention, including in the most recent COAG position, which is summarized below.

Trading to date has generally been somewhat cautious, from the perspectives of regulators, holders of water rights and potential buyers and lenders:

- Regulators have reflected concerns for limiting transfers of extractive water rights to uses that, while possibly involving improved commercial performance, may involve 'unacceptable' environmental or (to a lesser extent) social consequences;
  - regulators have understandably seen temporary (within season) transfers as less of a concern and this has been reflected in approvals arrangements.
- Holders of rights have tended to see *temporary trading* as an effective way to manage their variable demand for irrigation water, rather than reassessing the best structure of their farm enterprises and the level of their water holdings, given the relaxation of a previous constraint on approved uses of the water rights.
  - In effect, trading (especially within irrigation) has been seen in terms of managing short-run variation in marginal demand and supply, rather than in managing *enterprises* and *water usage patterns* to maximise the long-run value of *discretionary water*.
- Both groups have tended to express nervousness at allowing ownership in rights to pass, through trading, to intermediaries or to fundamentally different uses, including in some cases out of irrigation areas.
- Flowing from this last point, water businesses have tended to play a regulatory role in limiting trading of water out of area and in protecting the value of local infrastructure.
- Potential buyers of rights, and lenders, have had concerns with the security of the rights being traded on a permanent basis.

Not surprisingly, temporary trades predominate and have reached substantial levels in a number of systems where water has real scarcity value. Some permanent trading does occur and the cumulative level of permanent trades is now reasonably significant in some systems. There have been other signs of maturing in the markets, including a growing role for intermediaries.

An important issue since we reported to the WRWG has been the growing emphasis on the legal aspects of the title system, and the scope for registering third party interests. These matters have been the subject of other studies, including by ACIL Tasman and Freehills (2004), and are being covered by other contributors to this conference, but I do emphasise the inextricable linkage between a sound basis for clearly understood title – with confidence amongst traders and lenders

underpinned by either indefeasibility or title insurance arrangements – and incentives for the evolution of efficient trading arrangements, especially where these involve various forms of forward trading that I discuss further below.

National Water Initiative & COAG

The June 2004 Council of Australian Governments (COAG) meeting confirmed a National Water Initiative agenda that can be expected to flow through into a range of changes to the trading environment. Realistically, trends implied by the evolution of these arrangements should be viewed as part of the forward environment in which trading plans, the valuation of water rights and the development of new instruments should be judged. COAG has, most recently, committed to (COAG Communiqué, 25 June 2004):

- "expansion of permanent trade in water bringing about more profitable use of water and more cost effective and flexible recovery of water to achieve environmental outcomes;
- "more confidence for those investing in the water industry due to more secure water access entitlements, better and more compatible registry arrangements, better monitoring, reporting and accounting of water use, and improved public access to information;
- "more sophisticated, transparent and comprehensive water planning that deals with key issues such as the major interception of water, the interaction between surface and groundwater systems, and the provision of water to meet specific environmental outcomes….

"Key elements of the NWI include:

- "water access entitlements to generally be defined as open-ended or perpetual access to a share of the water resource that is available for consumption as specified in a water plan (recognising that there are some cases where other forms of entitlement are more appropriate);…
- "overallocated water systems to be returned to sustainable levels of use in order to meet environmental outcomes, with substantial progress by 2010;
- "a framework that assigns the risk of future reductions in water availability as follows: -
  - "reductions arising from natural events such as climate change, drought or bushfire to be borne by water users,
  - "reductions arising from bona fide improvements in knowledge about water systems' capacity to sustain particular extraction levels to be borne by water users up to 2014. After 2014, water users to bear this risk for the first three per cent reduction in water allocation, State/Territory and the Australian Government would share (one-third and two-third shares respectively) the risk of reductions of between three per cent and six per cent; State/Territory and the Australian Government would share equally the risk of reductions above six per cent,
  - "reductions arising from changes in government policy not previously provided for would be borne by governments, and
  - "where there is voluntary agreement between relevant State or Territory Governments and key stakeholders, a different risk assignment model to the above may be implemented;
- "more efficient administrative arrangements to facilitate water trade in connected systems;

- "removal of institutional barriers to trade in water, including a phased removal of barriers to permanent trade out of water irrigation areas in the southern Murray-Darling Basin;…
- "national standards for water accounting, reporting and metering; and
- "actions to better manage the demand for water in urban areas, including a review of temporary water restrictions, minimum water efficiency standards and mandatory labelling of household appliances, and national guidelines for water sensitive urban design.

" In relation to the Murray-Darling Basin (MDB), COAG noted that the MDB Water Agreement signed by the Prime Minister, the Premiers of New South Wales, Victoria and South Australia and the Chief Minister of the Australian Capital Territory, sets out the arrangements for investing $500 million over five years commencing in 2004-05, to reduce the level of water overallocation and to achieve specific environmental outcomes in the MDB."

Apologies for the long quote, that most of you will have seen already, but this does seem a rather important part of the landscape looking forward at the evolution of the markets and associated instruments. Each of the items included above involves commitment to changes that should encourage more active, and in many cases more sophisticated, trading – including the development of more versatile instruments. Of particular importance here are measures likely to:

- Deliver firmer property rights, with greater long-term certainty, supporting greater access to debt and equity markets and a greater willingness to commit longer term trading positions.
  - Clearly including any implications for the confidence a buyer may have of compensation in the event that the effective rights are later clawed back for any reason – at least providing a sounder basis for market valuation of any residual risks.
- Any changes that further limit effective volumes of water available for extraction, or that seek to better protect environmental access to water when water is scarcest.
- The likelihood that the planned expenditures in the Murray-Darling Basin will include water-saving infrastructure, with implications for both effective volumes and for the mix of fixed/sunk and variable costs.
- Indications that restrictions on permanent trading out of irrigation areas are to be relaxed.

The commitment to greater permanent trading is likely also to address impediments to longer term temporary and conditional trading – leasing over several years and forward sales and options – to the extent that these have been impeded by demands for greater environmental checking for non-temporary trades to take place. I see this point as important. From the point of view of efficient resource use, I am relaxed about the level of permanent trading that takes place. What has concerned me has been the extent of constraints on a range of forms of longer-term contracting – each constraint having an understandable history but with a cumulative impact that is likely to be quite costly.

In a number of contexts I have also observed that, given the intensity of government and community concerns with some aspects of current water usage, an 'onus of proof' requirement that falls on those wanting to move water may be counterproductive. In ACIL Tasman (2003) we observed:

- "In many cases, restrictions on trading designed to guard against accidentally increasing damage may be having the effect of preventing trades that would reduce existing rates of damage;

- "This is likely as a result of any measures that slow or prevent trades that are subsequently deemed appropriate;
- "Past a certain point, impediments to trading based on well-intentioned precaution in respect of damage minimisation could prove counterproductive.
- "A similar effect could also occur as a result of new site usage approval processes that focus on damage at the new site without also taking into account the effects of water usage leaving the old site – looking at *gross* as opposed to *net damage*;
- "These comments in no way argue against sensible precaution in the context of sustainable resource management and development strategy."

Current trends in favour of block approvals for transfers and the related elements in the COAG Communiqué are all positive – but it would be a mistake to think in terms of the choices being between within-season temporary transfers and permanent transfers. There is a range of possibilities in between that are likely to be better suited to dealing with the particular characteristics of Australia's water supplies and demands.

Managing supply & demand volatility

I will not be the first to observe that water supplies in much of Australia are highly prone to chance variation, over and above normal seasonal variation. The recent drought conditions have intensified wider community appreciation of this feature, while recent prices attached to water trades have highlighted the scope for the scarcity value of water to vary dramatically as result of these conditions. Regulated supplies can, to an extent, be designed to compensate for this natural volatility – it usually implies high capacity in dams relative to average annual inflows, and has tended to encourage regulated water products with different levels of supply reliability attached.

In effect, increasing supply reliability attached to an entitlement implies either an *effective allocation* of a larger share of capacity in storage (even where the form ownership of water in storage is not the basis for the property right), or the creation of greater storage. The same logic means, of course, that the formal regulation of water products with different levels of reliability may not be necessary, even where the evolution of these products in a non-trading world is understandable.

There is substantial scope for markets to manage supply reliability through trade in volume of nominal allocation. Those needing high reliability supplies could either acquire nominal volumes that are surplus to normal needs – and could seek to trade to others the surpluses in normal or wet years – or can seek to enter the markets as buyers of temporary transfers as and when supply reliability becomes a concern. Alternatively, they might seek to forward contract access to water under specified trigger conditions.

The flexibility of such markets to deliver efficient outcomes is, however, constrained if there is little scope for husbanding the resource – in the sense of individual decisions to under-utilise entitlement now being reflected in individual rights to increased access to water in the future. Forward sales can be heavily constrained if it is not possible to obtain approval for conditional transfers at a future time – and this is still widely the case. I understand that some contracts for forward sales and options are written, but there is necessarily some uncertainty where the approvals can only be obtained at the time of formal transfer.

Setting aside for the moment those sorts of constraints, it would be fair to say that the natural hydrology of much of Australia, the experience with climatic variation and the diversity of water uses that offer quite different and changing marginal values of water as scarcity values rise all contribute to a fairly strong conclusion that best use of our water supplies is likely to entail:

- On-going demands to redirect water between uses, in response to chance variations in supply;
  - Trading efficiencies are not just about once and for all redirecting water to more efficient use, but rather about on-going management of tradable assets with high volatility in their relative values in different uses at different points in time.
- A mix of spot market transactions, but also involving much more active use of various forms of derivatives, including forward sales and options.
  - While, in theory, it should be possible to access water when needed by entering the spot market, this entails substantial price risks that these instruments should allow to be allocate more effectively to those best placed to accept these risks.
  - The outcome is likely to be opportunities for reduced uncertainty for both prospective buyers and prospective sellers in respect of the price environment during periods of high scarcity, feeding through to longer term investment strategy.

Of related importance here is the scope for water users to modify their usage systems so as to lower their demand for water – either generally, or at times when the opportunity cost of using the water is highest. This can include mainstream demand management instruments – from low flow shower heads through to trickle irrigation – but can extend to choices in respect of on-farm water storage (with the possibility of accessing supplies when they are cheapest for use of higher cost times), choices in respect of permanent and annual crops and wider aspects of drought tolerance, tillage systems, forward sales or options to sell livestock etc. Any of these could be expected to influence the incentives and willingness to trade water. 'Optimal' response to the new trading opportunities should involve review of the mix of all these.

A key theme developed in the earlier paper was the concept of landowners in particular looking to trading of water as a core part of their overall enterprises, and optimising product mix across traditional production and trading market opportunities. This is rather different from the view that water trading is about selling the unneeded surplus, or topping up limited supplies – an input management focus rather than a whole of enterprise profitability and risk management focus. Choice of farming systems and marketing strategy do have the ability to offer cost effective ways of providing access to discretionary and tradable water supplies at times when water is most valuable; and also offers scope for limiting exposure.

Overview of major possibilities

The following is effectively an edited and annotated extract from ACIL Tasman (2003), covering the discussion of the types of developments in market instruments and transactions that might seem reasonable and noting any regulatory impediments to their emergence.

Many of the ideas floated here are already being used to a limited extent. The scope for using them, and the commercial incentives, can vary substantially across jurisdictions, catchments and uses. In many cases, it is likely to take time for the more sophisticated instruments to develop to

an efficient level, even where there are no regulatory barriers – in other cases the regulatory impediments are substantial.

The interrelated possibilities can be loosely categorised as:

- those involving the "unbundling" or re-definition of the primary product or entitlement;
  - permitting and/or facilitating an expanded range of transactions; and
- facilitative measures to enhance beneficial water trading opportunities.

While some of the possibilities are presented below, the very nature of market processes suggests that products and transactions may emerge that were never previously thought of.

Greater unbundling/re-defining of primary entitlements

A key insight is that water access entitlements themselves comprise various bundles of (conditional) rights to access water such as:

- The right to take or receive water;
- The right to a defined quality of water;
- The right to have the volume and timing of water delivered;
- The right to use the water;
- The right to build, operate or have an interest in works to take and control the water;
- The right to return the water.

Each of these components may have value, and that value may vary between users and uses. For example, hydro-electric generators and irrigators may place different value on the timing of releases from dams at different times. This implies that there may be merit in "unbundling" the various constituent elements so that they can be traded separately. Limited unbundling has occurred; there is a question as to what extent remaining bundling may be reducing the incentives to discover and/or use transactions based around less bundled product opportunities. This prospect needs to be weighed against what is likely to be the higher administrative or policing costs that might flow from further unbundling.

"Full" separation of water from land

In some jurisdictions, vestiges remain of the bundling of land and water, while the water rights themselves commonly involve a bundle of services that cannot be readily traded separately.

The requirement of some jurisdictions, that holders of irrigation water rights must also hold land, has an understandable history but may well impede the emergence of intermediaries in the market – as is common in may other areas – who can play a valuable role in acquiring, packing and making available composite services in ways that add value.

At the same time, it is recognised that there are significant sensitivities in respect of these matters. Some of the benefits of this unbundling could be achieved through the use of derivatives and lease instruments, without the need for fundamental ownership of entitlement to move away from the land base. The remaining restrictions may not be very severe – but they would

constitute restrictions and could probably be expected to impede the rate of emergence of secondary markets.

Perhaps the final step in completely separating land and water would be to remove the link between 'basic' water rights (eg stock and domestic riparian rights) and the land to which it attaches. In principle, allowing even these entitlements to be traded may offer an opportunity to generate value (eg where a landholder has unused basic entitlements in areas where there is keen competition for water).

In practice, 'normal' usage of these rights is probably already factored into most assessment of sustainable levels of tradeable rights, so some caution is needed, but there may still be some scope for individuals extracting value from their ability and willingness to alter effect demands for this class of water. Serious progress towards greater innovation in this area would probably require some translation, or rights to translate, riparian rights to a volume/reliability basis – to bring it into the exchange rate (or other form of tracking transferred water) net.

Delivery capacity entitlements

The combination of natural hydrology of river systems and variations in flows brought about by system regulation mean that there can at times be points in a river or channel system that 'fill' – preventing further flows passing through that point.

Not surprisingly, one response to such a constraint has been to limit or prevent trading of entitlement from above to below the constraint – presumably to limit the effective attenuation of the reliability of rights below the constraint. In principle, if the limit of flow below the constraint has been reached, any attempts for an individual to access more water will need to be at the expense of someone else below – or the environmental flows below – so the trade opportunity should, in principle, lie amongst entitlement holders below the constraint.

However, if the market is encouraged to seek creative ways of trading in the timing of releases, and is seeking options trading opportunities designed to better allocate risk across the system, and recognises the scope for demand patterns to be adjusted to the new opportunities afforded by a changed market structure, then this logic starts to unravel.

It may well be more efficient to match above-constraint to below-constraint sources of demand and supply of entitlement for the purposes of forward trading – and to address separately the delivery capacity issue through some instrument relating directly to the capacity constraint. The combination of such instruments might well allow for the identification of multilateral trade that delivers a better result for all, and that respects the system constraint. It could be expected also to post explicit information on the economic cost of the constraint in a way that might allow more efficient evolution of system infrastructure investment, including channel capacity – and including investments that could effectively relax the constraint.

Congestion pricing might go some way towards meeting these objectives – though active trade in 'slots' in river or channel capacity could in principle have significant advantages – and would deliver its own market-based congestion prices. Not the least of these advantages would be the scope for the initial allocation of capacity rights to be used to address equity issues concerned with the rights of existing holders of downstream entitlements.

Attaching a financial obligation to the delivery capacity entitlement (whether it is used or not) is another mechanism for addressing the concern about "stranded assets" if water is traded out of an area. I would be the last to seek to restrict trades out of area if the economics add up – but the fact that system delivery infrastructure access and charges are still commonly bundled with in-district usage rights does mean that some out of region trades, while attractive to individuals, could be inefficient.

This issue is discussed in more detail in ACIL Tasman (2003). However, the following highlights the type of market distortion that may arise. Consider two irrigation districts, identical in all respects except that, in the first, delivery rights are bundled with usage rights and in the second they are held separately. It is assumed that the delivery infrastructure is owned by the water business that is in turn owned by the water users. In the first scheme, the costs of maintaining the delivery infrastructure, and repaying the financing costs, are covered by annual charges that are proportional to water usage rights – and that shares in the business are in turn proportional to water usage rights; in the latter the charge is proportional to delivery rights, with ownership being proportional to delivery rights held – but effectively involves the same cost to users with sufficient delivery right to cover their usage demands.

An entitlement holder in each district has an interested downstream buyer, willing to pay the same price for the usage rights. The seller in the first region calculates loss of earnings from sale of water rights, but sets against this the sale price and the fact that he or she will no longer need to contribute to the infrastructure maintenance in the region – and concludes that the sale makes sense. The seller in the second region does the same sums, but realizes that he will be left with financial responsibilities for the delivery infrastructure, in which case the sale is uneconomic. The actual delivery system costs are unaffected – in the first case, levies on remaining water users will need to be increased to cover the shortfall, while in the latter they will not. The holder of the delivery rights will be keen to sell, but any buyer would look carefully at the deal, given that there is less water needing delivery.

Prima facie, a deal that only makes sense because of the scope for shifting costs of the delivery system onto others who would not be party to the sale contract, is probably an inefficient outcome relative the second example. Of course, the market in the area that would lose the water might respond by forging and alliance to make a higher offer – justifiable because of the fact that the delivery costs are sunk. However, this involves a larger set of transaction costs and an ability, within the stakeholder group, to focus on the higher marginal value of the water *given* that the delivery costs are sunk. Furthermore, some water users in the area are likely to feel it is 'unfair' that they are needing to buy water to sustain their businesses; whether this is in fact unfair will depend on many aspects of the history of water usage and infrastructure development in the area, but they may well have a point in some cases.

Regardless of the true equity, a simpler solution and one probably seen as more equitable by at least some of those involved has been for some regions and water businesses to limit rights to sell, typically in ways that *do not allow market testing* of whether the trade would be cost effective. The end result of these competing pressures is likely to be a proportion of inefficient sales, or refusal of rights to sell, out of district.

The nominal argument for the restricting sales out of area tends to be stated in terms of prevention of asset stranding – though this does not accurately reflect the underlying economic issue.

The above diagnosis is not presented as an argument against assets being stranded – asset stranding is likely to be part of the normal efficient evolution of these markets – given the inherent uncertainties. It is, however, an argument against asset stranding due to defects, for reasons of historical accident, in contracts that bundle access and delivery rights – when a sound argument that recognised sunk costs, even where there are on-going financing charges, would judge retention of the water in district to be more profitable. I would also argue against the use of blunt regulatory and water business commercial instruments for preventing the discovery of opportunities for cost-effective trades, even where these would result in stranded assets. In reality, these assets will not usually be stranded, though a steady loss of water from an area could ultimately have this effect – the costs of sustaining the assets will, however, be spread over a smaller base of water usage, and this will detract from the effective value of water in that area.

Fundamentally, this is an issue about the efficient definition of property rights, and removal of artificial constraints on unbundling and trading. If the downstream buyer of the water were prepared to assume responsibility for the upstream water usage charges (either explicitly, or via a premium on the price paid for the water) then the deal should proceed – with the issue then being one of equity.

The desirability of establishing tradeable entitlements in delivery capacity is likely to vary across systems. Where capacity constraints in a channel affect only a few entitlement holders, establishing a formal market is unlikely to be cost-effective. In situations where capacity constraints affect a large number of users, or where the capacity constraint in fact has some flexibility for relaxation, timing shift etc, the benefits could be substantial. If the unbundling is not to occur, then it would seem desirable to ensure that other aspects of the trading rights environment, including contractual commitments, do not post trading incentives that are distorted excessively by the bundling.

Timing of release

Hydro-electric generation represents one of the key uses of our water systems. The Snowy Scheme provides approximately 8% of the generation in the National Electricity Market, is a key supplier of options to the market to cover the risks of price spikes or loss of system integrity – and interacts strongly with the hydrology of the Murrumbidgee and Murray River (not to mention the Snowy) systems.

The value of its options lies in the flexibility it has to influence the timing of releases from the dams feeding through its generators. Within the constraints under which it operates, its incentives are to maximise the value it produces through these resource husbanding practices – assessed solely within the context of its electricity business. It faces no effective commercial incentives to maximise value over the combination of generation and all potential downstream demands for changes in the timing of its releases. Non-electricity demand normally only enters the strategy via regulated release requirements and, occasionally, negotiated modifications to strategy, typically on a 'no net cost' basis.

These considerations strongly suggest that there may be value in tradeable entitlements to the resource 'husbanding' activities undertaken in regulated systems, allowing release timing to be varied to minimise net costs across electricity and other downstream demands. Analogous considerations also apply to other resources where there is a 'husbanding' option – including many groundwater sources. Present entitlements tend to involve a 'use it or lose it' approach to resource access, in the sense that water not used this year is unavailable for use next year.

The effect of opening up these incentives could be expected to range quite widely. If owners of downstream delivery entitlements faced strong financial inducements to consider a variation in the timing of their extraction options, it could reveal economic incentives to consider alternative farm water storage investments, or otherwise to explore enterprise structures more suited to access that value. In terms of release, and which river system water travels down, Snowy Hydro has substantial theoretical flexibility – it is more constrained by the flow requirements it faces and the associated variable level of discretionary water. Discretionary water is the key asset on which it can base its engagement in secondary markets, and its role in providing a range of products designed to deliver system integrity to electricity generation – and recover its costs.

In effect, it is possible to envisage a move towards a situation in which downstream holders of water entitlements, including delivery entitlements that could be tradeable with values that vary with timing, engage actively in extracting maximum combined value from their use of water, from their sale of water to other uses and from their willingness to vary delivery times to underpin a more effective whole-of-system outcome. This is unlikely to be based on a raft of bilateral arrangements between individual irrigators and Snowy Hydro – but attractive portfolio products could well emerge that would have this type of effect.

Capacity share entitlements

At present most end-user entitlements are specified to entitle the holder to defined volumes of water at a specified off-take point over a certain timeframe. This makes them dependent on the actions of others (ie storage management decisions made by the storage operator). It also means that, unless carry-over is permitted, an entitlement holder may not reap the full benefits from conserving water.

While an entitlement holder may be able to sell excess water in the temporary market, it may be that the water would have more value (to the entitlement holder or someone else) being held in storage. However, a delivery entitlement provides no incentive to do this, since any entitlement not used or sold is effectively lost.

In theory, a capacity share entitlement (that defines the access entitlement as a share of the available inflows, storage capacity, and off-take capacity) represents a more efficient form of entitlement, but may entail high costs and inefficiencies in coordinating storage management and release decisions.

However, in some situations, there may be merit in exploring the possibility of specifying entitlements in this form. Capacity shares, possibly combined with other derivatives or an explicit swap, offers a theoretically clean approach to dealing with trading in release timing as discussed above.

The approach adopted in the St.George Water Supply Scheme in the Condamine-Balonne Basin in south-west Queensland provides an interesting example of capacity sharing (see Box 1). As a fallback, establishment of water accounting with carry-overs and under-draws represents a step in this direction that may be easier to implement.

Box 1 Capacity Sharing in the St.George Water Supply Scheme

In response to demands by users for more control over allocation decisions, the St George Water Supply Scheme is now operated as a capacity share scheme. Under the arrangements, the four scheme storages (as a whole) are conceptually partitioned into vertical shares. The shares distinguish between Individual Capacity Shares (ICS) and the Bulk Share (BS). Individual users who have chosen to hold individual capacity shares effectively manage these shares independently by issuing instructions to the storage operator. Other users continue to be supplied by SunWater out of the Bulk Share, according to traditional allocation processes based on the scheme operator's assessments of future demands and supply. A system of water accounting keeps track of the volume in each individual user's share, and the Bulk Share in accordance with defined rules for measuring inflows, releases, evaporation, seepage and transmission losses etc. There is also scope to shift between the two capacity share types within defined rules.

The introduction of capacity shares has had significant impact on behaviours, with individual users who are able to do so making much greater use of on-farm storages rather than keeping water in Beardmore Dam and incurring higher evaporation losses. This is almost a reversal of the approach under announced allocations managed by the operator, where water harvesting was used in preference to water in bulk storage. This reflects the incentives for managing the system to maximise overall yields under individual capacity shares. Against this, however, the system involves higher administrative costs in managing the water accounts (one full-time staff position) and compliance costs in reconciling water ordered and used. These costs could be expected to increase for more complex systems (the St.George system supplies around 120 users and there are no tributary inflows between storages).

Source: 'Capacity Sharing – A New Water Management System for the St.George Water Supply Scheme', Ian Ryan, Rob Keogh, Neranjala Fernando and Peter Boettcher (State Water Projects). Paper presented to ANCID 2000 Conference, Interim Resource Operations Licence for St George Water Supply Scheme, Issued to SunWater March 2002, Pers. Comm, Rob Keogh, SunWater.

The same principle applies quite explicitly in the case of groundwater sources where supply is constrained by recharge rate. In effect, the move would parallel the shift from the use of input controls to catch quota as a device for managing a fishery – again engendering incentives to husband the resource by redressing an externality.

Drainage rights

The use of water under a water entitlement may have adverse impact on third parties or on the environment (eg adverse salinity or drainage impacts). Indeed, a prime rationale for the current trade approval processes is to prevent such external impacts. The issue then becomes one of ensuring that the regulatory intervention represents the most efficient way of addressing the concern, and that it does so without unanticipated side-effects. Since these adverse external impacts reflect the absence of clearly defined rights (eg to pollute the environment), an alternative solution in some circumstances may be to establish a new product (ie drainage diversion rights) in the market.

Well-based and tradeable drainage rights may well have substantial advantages over attempts at direct externality pricing – provided that the basis for determining the aggregate block of rights is sound. At present, irrigators have implicit rights to return flows and are able to trade without consideration of the downstream impacts (eg salinity) – these impacts are meant to be addressed through the regulatory approval processes and rules. A system of tradeable pollution rights (eg salt credits) represents a market-based mechanism that may enable these external impacts to be addressed at lower economic cost. In theory efficient outcomes requires spatially differentiated property rights that reflect site specific differences between external cost of water use at the source and receiving locations. In practice, a partially differentiated system (eg defining salt credits at irrigation area level rather than individual site level) may represent an effective second best solution[1]. A system of trading in salt credits is being considered for potential application in the Murray-Darling Basin.

Expanded transaction range

Leasing

Leasing is the transfer to another person of some or all of the water that may be taken under a water entitlement for a defined period (typically a number of years), but with the ownership of the entitlement remaining with the original holder. In effect, it involves an extension of temporary transfers, though formally it involves a different instrument. Leasing of entitlements is permitted in some States but not in others. It is difficult to see why legal restrictions on leasing should not be removed in those jurisdictions where they remain. Certainly in circumstances where the permanent transfer of the rights would be approved, and where by default the non-transfer of the rights is approved, it is difficult to see how the temporary leasing of the rights for a number of years would weaken controls over adverse impacts.

Secondary markets

To date, most of the development of water trading has been directed at primary trading – the permanent or temporary transfer entitlement from one user/use to another. This is understandable. However, the processes that have led to the institutional changes that have allowed such trades appear to have been predicated almost entirely on the notion of facilitating these forms of trade.

Some secondary market products have begun to emerge, and more advanced secondary markets have developed overseas. Secondary markets, especially a range of forward price-based options, have features that could, in principle be bring substantially increased flexibility to the market, and that could encourage significant shifts in the patterns of water usage. As has already been discussed, important synergies could be expected to lie between different forms of irrigated agriculture, with different vulnerabilities to drought, and with hydro-generation and other uses.

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[1] See Stephen Beare and Anna Heaney, Australian Bureau of Agricultural and Resource Economics, 'Externalities and water trading in the Murray Darling Basin, Australia', Paper for the Australian Conference of Economists, Adelaide, 30 September – 3 October 2002, ABARE Conference Paper 02.19.

Options could offer alternative (with substantially lower up-front cost) or expanded mechanisms for individuals pursuing supply reliability and manageable price risk; could reduce the need for regulators to manage different classes of supply reliability; and could insert into existing entitlement structures some of the features of entitlement based on volumes in storage, with the associated incentives for resource husbanding across seasons. They could encourage a more coordinated strategy across irrigation regions, involving changes in enterprise mix and an expansion in designing farm systems for their value in backing flexible water trading over time as well as for the value of production.

Such a market would attach greater value to flexibility to substantially reduce demands for water in times of drought. In the case of irrigated agriculture, the opportunity for better matching pastures and annual crops against perennial crops, for example, suggests value opportunities that are likely to be only partially satisfied through different classes of water reliability. In a sense, such market instruments could eliminate the need for and value in multiple classes of water reliability – because these price capping products would allow users to blend entitlement and differently configured caps to meet their own risk profiles.

Secondary markets face substantial hurdles in becoming a more important feature of the market. These markets will probably always be significantly 'thinner' than markets in financial or energy derivatives. In many cases, the entitlements have been designed in a way that effectively prevents the forward sale of a wide range of options – contracted willingness to deliver water at some time in the future under prescribed trigger conditions – despite the fact that, *prima facie*, such transactions could extract significant value from the resource.

Were the role of environmental trader to emerge, then access to an effective market in options could be of very substantial interest to such traders. As new information emerged regarding dynamic requirements of the rivers for flows, and of the implications of variations in these flows, then options markets could provide powerful instruments for modifying effective flow regimes cost effectively – and for establishing a source of revenue for such activities.

In some other sectors such as energy, secondary markets have become the dominant trading instrument – and the ability to sell or purchase options is shaping demand patterns in significant ways designed to increase overall market efficiency. This market has resulted in some interesting multi-party price cap products that still seek to share some of the risks extreme demands (on hydro-generation capability) across contract participants.

I do not envisage a comparable level of derivatives trading in water, but do believe it has an important role to play – and that some important changes are needed in the institutional environment if this is to occur. These relate especially to the nature and duration of approvals for transfers, to the scope for active trading between hydro and downstream activities, and with urban demand; and possibly to a longer term move to greater use of water tagging as an alternative to the exchange rates now being implemented.

It was against this background that we recommended in ACIL Tasman (2003) a move to allow, in all jurisdictions, approvals for temporary transfer of water for periods spanning more than one year, or for shorter period, but on a conditional basis at a point in time in the future that is defined by a trigger (water price, allocation level, commodity price index etc) that implies uncertainty as to timing. This could include removal of any arbitrary time limits on whether and when a transfer needs to be effected, once approval is granted.

A range of secondary market products and transactions might reasonably be expected to emerge in time, in the absence of market constraints. Some are already present in Australia, while others have arisen in overseas markets. Some generic types of instrument with good prospects for application to water markets include:

- Futures contracts that allow forward sale/purchase of access to water at an agreed price;
- Call options that allow the forward sale to a buyer of the right to acquire access to water on a agreed basis, if the buyer wants to exercise the option at the time;
- Put options that provide the holder of water entitlement with the right to sell access on agreed terms, at a time in the future, should the water holder want to exercise the option at the time;
- Swaps contracts designed to allow trading in the release pattern of water in a manner paralleling financial market uses of swaps to exchange, for example, fixed interest repayment terms for variable interest ones;
- Composite instruments, including tranches of options that become exercisable under different conditions and options over swaps contracts ('swaptions') – increasing the flexibility to match buyer and seller demands and physical alternative strategy for managing supply volatility.

The following boxes, all taken from ACIL Tasman (2003) provide an overview of the main features of these instruments.

Box 2 **Futures contracts**

- Commitment to a trade at *agreed price* at a *nominated time* in the future, eg:
  - forward sell water 5 years out, to coincide with planned fallow rotation (being done in Colorado).
  - Forward purchase tranches of water, at a known price, over several years to coincide with expected patterns of demand as a farm development matures – allows the developer to lock in costs of a key input
- Buyers could source futures contracts from a range of sources to produce a *portfolio* with significant stability over time, or with a specified supply profile suited to needs.
  - Colorado utilities can compile a stable increment to town supply via a series of futures based around different phases of farm rotation patterns.
- In return for both price and volume security, a fee would typically be paid, up-front, to the seller of the water, allowing holders of water to bring forward some of the benefits of the water at a future time, at the cost of some loss of flexibility.
  - Depending on the price struck for the contract, payments could be structured to flow the other way, with the seller of the water paying to lock in a future price.

Most of these instruments can be effected through secondary contracts, between supplier and user or (more commonly I expect) via a water trading market intermediary able to package portfolio products, manage a range of risks and access size economies). They could be based around the types of primary instruments now in place – though the flexibility of these instruments would be improved through further progress on removing rigidities and uncertainties from the primary instruments. In some cases, these instruments might be used to allow markets to develop 'work arounds' in respect of some constraints on the primary instruments, though this

may well be seen as less than ideal from a regulator's perspective. Conversely, however, this facility could be used to maintain pressure on regulators to review the economic cost of their constraints – and provide them with market-based shadow pricing in some cases.

Box 3 Call options – conditional commitment to supply

- Holder of water entitlement sells to another party the right to acquire water at a nominated time, or under nominated conditions, if the buyer of the option wishes to proceed with the sale.
  - The seller of the option is committed to supplying the water if wanted by the buyer; but
  - The buyer of the option has the right not to exercise the option.
- The conditions could be linked to drought declarations, rainfall, commodity price indexes etc – or might simply nominate a price that would normally be unattractively high to the buyer of the option, but that might become attractive in the event of a drought, for example.
- Can be used to provide a price ceiling to buyers of the option, in return for up-front payment of an option fee.
- Can allow the sellers of the option access to option fee income and allow enterprise planning based on reduced access to water when the price is very high.

Box 4 Put Option – conditional commitment to accept water

- An enterprise might sell to the holder of water entitlement the right to require the enterprise to purchase access to a volume of water, at a nominated time, or under nominated conditions, if the buyer of the option wishes to proceed with the sale.
  - The seller of the option is committed to supplying the water if wanted by the buyer; but
  - The buyer of the option has the right not to exercise the option.
- The conditions could be linked to rainfall, commodity price indexes etc – or might simply reflect periodic or temporary surplus of water in the enterprise holding the entitlement.
- Can be used to secure a guaranteed market for water that is surplus to needs
- Can provide the sellers of the option access to option fee income and access to water on known terms around which to plan opportunistic usage:
  - Cash crops;
  - On-farm storage for later use;
  - Storage in dam for later hydro or other use.

Box 5 **Swaps and Swaptions**

- Swaps are normally financial derivatives used in relation to interest rate or currency risks.
- A common application of an interest rate swap is to allow 2 parties to convert the nature of the interest payments they face – for example, they might swap a fixed interest schedule for a variable interest schedule, without changing the underlying principal.
- If underlying water entitlement is viewed as principal, compulsory release requirements on dam operators as fixed interest payments and discretionary releases as variable interest payments, then there is an interesting analogy.
- Swaps-like contracts might be useful in negotiating time-shifting arrangements between multiple parties, including hydro/other uses.
- A swaption is simply the option to require another party to enter into a swap contract.
  - Swaptions could add to the flexibility of swaps instruments for use in time shifting and could be structured to provide additional hedge cover in respect of other options being sold.
  - The right to exercise a swaption could be held by parties upstream or downstream from the other contracting party – or conceivably in another catchment.

More trading across uses/sectors

Under existing arrangements, there remain limitations on the ability of water users to trade entitlements across certain uses, particularly when such a trade would involve water moving from, say, agriculture to another sector. While the majority of trades to date have been, and are likely to continue to involve, trades between irrigators, relaxing such restrictions may open up even more opportunities to generate value through an even wider range of divergence in the value of water entitlement between different users and/or users at different times.

Wider opportunities for trade across uses and sectors finding complementary trades that would favour the use of secondary market instruments. Overseas, and limited domestic, experience certainly points to the scope for futures and options being beneficially traded between irrigation and urban usage, while trades between hydro power and irrigation or urban usage could add greatly to the depth of these secondary markets.

Trading in groundwater

Comment was made earlier on the question of managing groundwater, possibly through entitlement based on water in-storage. Such an arrangement would need to be based on a system of groundwater source water accounting, inclusive of recharge monitoring or modelling and extractions. Options trades, as well as temporary and permanent transfers amongst extractors from a single groundwater source, could facilitate efficient allocation of the resource, again accompanied by incentives to look to changes in demand patterns to deliver trading flexibility. Such arrangements could facilitate better husbandry of resource, including across seasons.

Inter-jurisdictional trading

Considerable attention has been focussed on the issue of interstate trading, with concerns in some quarters that this market has been slow to develop. The major area of interest has, for reasons of integrated hydrology and demand, been the Murray-Darling Basin and, in particular, trade between NSW and Victoria – though Queensland and South Australia are both stakeholders in the system. Different jurisdictions have developed there water supplies at different times and using different philosophies in respect of levels of allocation and the nature of reliability management. This has resulted in significant differences in the character of water rights, even in respect of opposite sides of the same river.

The reasons for these differences are historical, but they now represent an opportunity for a water user to blend a more diverse set of rights to better meet demand needs; for a holder of rights to look to trade into a market where the special characteristics of the available water may have greater value; and an obstacle to trade because of the complications involved in moving water into areas where the normal rights are differently configured. There are, of course, also all the same concerns that arise with moving water between areas within jurisdictions – possibly complicated by the involvement of additional regulators. The MDBC offers some scope for consolidating these planning processes in respect of that Basin and has been very active in developing the rules that apply to markets across borders within the Basin.

While there are a number of relevant underlying factors, one concern that has sometimes been expressed is that the large number of different types of entitlements that exist might itself be an impediment to trade. Alternative ways of dealing with this issue include: attempting to get uniformity in entitlement definition; use of exchange rates to enable trade between entitlements in different locations and/or of different inherent and policy-induced reliability, and "tagging" of water.

Achieving uniformity is infeasible: water comes from different sources with different reliability characteristics reflecting both physical and storage management variations. In any event, uniformity is not a pre-requisite for trade: all that is required is for the ability to convert one entitlement to another – or to retain the entitlement in its original form, with all the associated features. Indeed, lack of uniformity is one of the reasons why trade can be expected to deliver benefits – and care should be taken to ensure that the market rules that are developed do not, in the interests of administrative efficiency, destroy one of the main reasons why a cross-border trade makes economic sense.

The approach to date has involved the use of exchange rates where there is a need to reflect different reliabilities or system losses. However, with around 14 different types of entitlement in the Murray Darling Basin, there is an understandable concern that an exchange rate system will get very complicated. They will almost necessarily require on-going monitoring and fine tuning. Similar issues albeit on a lesser scale, arise in relation to trade of entitlements between Queensland and New South Wales in the Border Rivers Catchment.

An alternative and possibly less complex solution is to avoid the need for exchange rates by permitting entitlement holders in one State to hold water entitlements issued in another. In effect, a user could hold a portfolio of entitlements (eg relatively high security Victorian entitlements and lower security NSW entitlements) to suit their risk preferences and needs. This would require a system of "tagging" water so that at any point in time it could be determined

whether a user was using, say, their Victorian or NSW entitlement. While there are some administrative and financial issues to resolve in establishing such a system, these would not seem to be *necessarily* more onerous than those in a system of exchange rates, though they are likely to be loaded more heavily towards the implementation end of tagging relative to exchange rates that will fall as an ongoing cost. In effect, if low volumes are trade are likely for all time, these costs might favour the exchange rate mechanism – while expectations of growing and extensive trading, whether temporary, permanent or through derivatives, would make the administrat5ive costs of tagging relatively more attractive.

In principle, having the ability to accumulate water from different sources, with different characteristics, adds to the flexibility users have to sculpt a mix of entitlements, and their demand patterns, to deliver a cost effective outcome. In practice, tagging would involve added complexity at the user end – but complexity that might be avoided through the activities of intermediaries seeking access to the same range of sources, but using size economies to allow delivery of a mix of products with different features – and allowing spreading of the costs of managing the information.

Tagging links more naturally to the above discussion of groundwater sources, could conceivably evolve towards wider application of entitlements based on water in storage, and could certainly complement development of stronger water accounts and water bank concepts. In the case of MDBC, current policy development is predicated on the use of exchange rates. A medium term move towards tagging, coupled possibly with some of these other elements, all of which could underpin sounder water trading, would make sense. Conceptually at least, transition from exchange rates to tagging should be relatively straightforward and evolutionary in nature. Most of the information gathered to allow determination of exchange rates would remain valuable to a market in tagged product.

Active trading in environmental entitlements

The externality cost of affecting river flows as a result of extractive use is being addressed through the implementation of environmental flow regimes, typically in the form of prescribed river flow requirements. An alternative or complement to such an arrangement could be the introduction of active trade in these flow entitlements, either absolutely or above some specified base regime. This could well permit a resource manager the flexibility to adapt the flow regime to changing information and hydrology conditions, to effectively transfer flows from one river system to another unlinked system – through complementary sale and purchase etc.

In doing so, such an agent would be explicitly attributing and posting a marginal value to environmental flows in a way that could add significantly to the quality of the information available to the market – and hence to encouraging more efficient trades amongst extractive users, as well as between extractive users and environmental demands.

The scope for an environmental trader to build the aggregate value of environmental flows through cross system and through time trades in actual river flows, reflecting differentials in the marginal value of flows in different parts of the system at different points in time – and variations in the commercial value of the same water – could be considerable.

In principle, such activity could be possible on a 'self funding basis' – with a requirement that sales match purchases. Alternatively, there would be scope for various forms of additional funding to be used over time to grow the total pool of environmental flows.

Box 6 The Oregon Water Trust

The Oregon Water Trust (OWT) was founded in 1993 by a coalition of agricultural, environmental, legal and tribal interests. It is a not-for-profit organisation that purchases water on the market for in-stream flow purposes, primarily for fish habitat. Its mission is to acquire water rights "through gift, lease or purchase and commit these rights under Oregon law to in-stream flows in order to conserve fisheries and aquatic habitat and to enhance the recreational values and ecological health of watercourses".

The ability of OWT to become a participant in the market was only made possible by a change in the legislative definition of 'beneficial use' under Oregon's water code in 1987 to include leaving water in-stream. This change reflected concerns about the impacts on salmon and trout populations of insufficient in-stream flows. Previously only extractive uses such as irrigation, mining or domestic use were included within the definition. However, in-stream flow rights were defined to be held in trust by the Water Resources Department.

The OWT has negotiated over 50 temporary and permanent transfers since its inception and protected flow in over 450 river miles throughout Oregon. It has focussed attention on basins that have historically supported significant fisheries where low flows are affecting a significant aquatic resources, where there is a high likelihood of ecological benefit, and where it can measure, monitor and enforce its rights. Within each basin OWT identifies priority streams for which stream flow is a limiting factor for fish habitat and water quality and there is potential for acquiring water rights to convert to in-stream use to enhance flows.

Although on several occasions legislators have proposed prohibiting the transfer of agricultural water to any other use, these have been rejected. One change that has occurred, however, is that in-stream flow rights may now be held directly by private organisations.

Facilitative Measures

A number of measures can be identified that would indirectly facilitate the development of new products/transactions in the water market.

Approvals

In terms of direct facilitation, especially of derivatives markets, the earlier discussion of the need to address aspects of the approvals process – especially in relation to rights to contract for conditional trades at a future time – is highly relevant. Should the recent COAG commitment flow through to greatly expanded scope for permanent transfers, I would hope that there be no remaining impediments to conditional transfers on any such water. More generally, there should be scope for safely approving some forms of conditional transfer, even where the risks in allowing a permanent transfer are judged to be too great.

For example, I could see a 10 year options contract being agreed that limits the total transfer allowed across this period to, say, 20 per cent of entitlement. The challenge would then be to find get the timing/option exercise arrangements right to extract maximum value from that 20 per cent. The US experience with urban utilities acquiring portfolio of forward sale contracts matched to cropping fallow years may have less application in Australia but is another case of contracts that place a cap on volumes transferred, but over a rolling 5-year period – thus providing greater confidence for all parties in their forward planning and investment.

A related issue is that of 'onus of proof' in relation to adverse impacts of transfers. Clearly some process will be demanded, and is appropriate, but it is appropriate that these recognise:

- The costs associated in delaying approval of what will prove to be beneficial transfers;
- The environmental benefits that might occur in response to lower extractive demand at the seller's site;
- The environmental benefits associated with greater river and channel flows where the sale is to a user downstream;
- A requirement for case by case establishment of net benefits may involve net costs because of the associated delays and beneficial transfers that fail to occur – especially given the starting point in many areas of a system that is heavily stressed by current usage patterns.
  - The default in the event of non-transfer will, in many cases, not be environmentally benign.

These last considerations feed into the next point – the use of pricing instead of or as well as regulation to address external impacts.

Attribution of externality costs

There is nothing original in stressing the value in improving pricing and/or other instruments to reduce the severity of any externalities by bringing users to account better for the impacts of their demands on the resource – in allowing more efficient trading. There are two dimensions to this:

- Unlimited freedom to trade can be quite counterproductive where there are major externalities – unpriced or underpriced impacts on other stakeholders, with inadequate facilities for the affected parties to resolve the problem by entering the market; and
- The presence of substantial pricing limitations has been used as an argument for slowing the creation of more flexible trading instruments – restriction on trade has been seen as an instrument for managing externalities;
  - and more generally has probably produced distorted signals as to where the important pressures for improved specification lie.

Externality pricing represents the textbook solution to the problem of externalities, but clearly feasibility and cost effectiveness have been major problems, and there have also been concerns with the equity consequences of its introduction into an existing set of allocations and approvals. Accurate externality pricing is not currently feasible in respect of many impacts.

There has been a lot of emphasis in post-COAG reform processes in moving to cost reflective pricing, but an issue that has received relatively little attention has been that of getting the *marginal cost* of water to the point where it reasonably reflects the costs the system saves as a result of a

user reducing usage – the incremental (and avoidable) cost of marginal water usage. These are the costs that should underpin trading.

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