



Australian Government  
National Water Commission

# A framework for managing and developing groundwater trading

**GHD**  
**Hamstead Consulting**  
**Vanessa O'Keefe**

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# Waterlines

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## **Waterlines**

This paper is part of a series of works commissioned by the National Water Commission on key water issues. This work has been undertaken by GHD and associates, Hamstead Consulting and Vanessa O'Keefe, on behalf of the National Water Commission.

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**Vanessa O'Keefe**

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## Abbreviations and acronyms

|          |                                                                      |
|----------|----------------------------------------------------------------------|
| ACCC     | Australian Competition and Consumer Commission                       |
| ACT      | Australian Capital Territory                                         |
| AMLRNRMB | Adelaide and Mt Lofty Ranges Natural Resources Management Board      |
| ASR      | Aquifer storage and recovery                                         |
| CEWH     | Commonwealth Environmental Water Holder                              |
| CHW      | Central Highlands Water                                              |
| COAG     | Council of Australian Governments                                    |
| CSG      | Coal Seam Gas                                                        |
| D&S; D/S | Domestic and stock                                                   |
| DECCEW   | Department of Environment, Climate Change, Energy and Water (ACT)    |
| DECCW    | Department of Environment, Climate Change and Water (NSW)            |
| DERM     | Department of Environment and Resource Management (Qld)              |
| DoW      | Department of Water (WA)                                             |
| DPIPWE   | Department of Primary Industries, Parks, Water and Environment (Tas) |
| DSE      | Department of Sustainability and Environment (Vic)                   |
| DWLBC    | Department of Water, Land and Biodiversity Conservation (SA)         |
| EFG      | Environmental flow guidelines (ACT)                                  |
| EPA      | Environmental Protection Agency                                      |
| GA       | Groundwater Area (WA)                                                |
| GAB      | Great Artesian Basin                                                 |
| GDE      | Groundwater-dependent ecosystem                                      |
| GL       | gigalitres (1 GL = 1000 ML)                                          |
| GMA      | Groundwater Management Area                                          |
| GMU      | Groundwater Management Unit                                          |
| G-MW     | Goulburn-Murray Water                                                |
| gw       | Groundwater                                                          |
| ha       | Hectares                                                             |
| HCV      | High conservation value                                              |
| km       | Kilometres                                                           |
| INRM     | Integrated natural resource management                               |
| IROL     | Interim Resources Operation Licence                                  |
| L/s      | litres per second                                                    |
| m        | Metres                                                               |
| MAR      | Managed aquifer recharge                                             |
| MDB      | Murray–Darling Basin                                                 |
| MDBA     | Murray–Darling Basin Authority                                       |
| MER      | Monitoring, evaluation and reporting                                 |
| ML       | megalitres (1 ML = 1,000,000 litres)                                 |
| mg/L     | milligrams per litre                                                 |
| NOW      | NSW Office of Water (NSW)                                            |
| NRETAS   | Natural Resources, Environment, The Arts and Sport (NT)              |
| NSW      | New South Wales                                                      |
| NT       | Northern Territory                                                   |
| NWC      | National Water Commission                                            |
| NWI      | National Water Initiative                                            |
| PAV      | Permissive Annual Volume (Vic)                                       |
| PCV      | Permissive Consumptive Volume (Vic)                                  |
| PWA      | Prescribed Wells Area (SA)                                           |
| PWRA     | Prescribed Water Resource Area (SA)                                  |
| Qld      | Queensland                                                           |
| RIWI     | Rights in Water and Irrigation Act (WA)                              |
| ROP      | Resource Operations Plan (Qld)                                       |
| RWC      | Rural Water Corporation (Vic)                                        |

|           |                                                                          |
|-----------|--------------------------------------------------------------------------|
| SA        | South Australia                                                          |
| SDL       | Sustainable diversion limit                                              |
| SE        | South-east                                                               |
| SAMDBNRMB | South Australian Murray–Darling Basin Natural Resources Management Board |
| SRW       | Southern Rural Water                                                     |
| sw        | Surface water                                                            |
| SY        | Sustainable Yield                                                        |
| Tas       | Tasmania                                                                 |
| TWS       | Town water supply                                                        |
| UIA       | Unincorporated Area (Vic)                                                |
| Vic       | Victoria                                                                 |
| WA        | Western Australia                                                        |
| WAE       | Water Access Entitlement (ACT)                                           |
| WAL       | Water Access Licence (NSW)                                               |
| WAP       | Water Allocation Plan (SA)                                               |
| WMA       | Water Management Area (ACT)                                              |
| WQ        | Water quality                                                            |
| WRMU      | Water Resource Management Unit (WA)                                      |
| WRP       | Water Resource Plan (QLD)                                                |
| WSP       | Water Sharing Plan (NSW)                                                 |
| WSPA      | Water Supply Protection Area (Vic)                                       |

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Consultation participants are listed in Appendix B and were most helpful in capturing the distinguishing features in groundwater planning, extraction management and trading in the various jurisdictions across Australia.

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# Executive summary

## Context

In many areas of Australia, demand for surface water and groundwater is now exceeding sustainable supply rates. The drought of recent years has exacerbated the situation and concern is growing that climate change may cause an ongoing decline in water availability. In the case of groundwater, demand is increasing as surface water becomes scarcer.

Groundwater trading activity is expected to increase in many parts of Australia because of the expanding demand for groundwater and increasing recognition and understanding of its limited availability in developed areas. Development of water trading can be impeded by a number of technical, social, administrative and political factors, some of which may also impede surface water trading. Other factors are peculiar to groundwater, such as the three-dimensional nature of aquifer systems, boundary uncertainties, water quality variations and local drawdown impacts. The issues associated with the distribution of groundwater extraction in particular add a degree of complexity in the management of groundwater trading.

Two primary mechanisms are used to distribute scarce resources: command and control determinations by governments, and market mechanisms. In Australia, both are employed to distribute water access in fully allocated systems<sup>1</sup>, using planning at the macro (water system) scale, and water trading at the micro (individual water user) scale. Markets encourage the efficient distribution of scarce water access between competing users. They enable water entitlements and allocations to be employed in their highest-value use and they can enable water users to respond rapidly to changes in climate, commodity prices and other value drivers. Water markets are well established in many Australian surface water systems, but are fewer in number and at an early stage of development for groundwater systems.

The 2004 National Water Initiative (NWI) established, among other things, an integrated framework of entitlement and allocation specifications, water planning and water trading. Groundwater trading arrangements need to be consistent with that framework. A core objective of the agreement is to promote actions that broaden and deepen the water market. It also encourages the clear definition of tradeable products (such as entitlements and allocations) to promote confidence in the market. Governments have agreed to facilitate efficient market operation where physically possible, minimise transaction costs, provide good market information, allow a mix of products to develop, and recognise the needs of the environment and protect against third-party impacts.

The NWI also provides specific directives on the actions that states and territories must undertake and establishes a set of principles (Schedule G) with which water trading rules should be consistent.

## This report

This report sets out a management framework for the trading of groundwater entitlements and allocations in Australia that can be practically applied in different situations. The framework only applies to trading in primary groundwater access. It does not address secondary distributions once groundwater has been extracted, such as the physical transfer (via pipes or channels) of pumped groundwater volumes between bore owners and other water users.

In developing the framework, the first step was to investigate and describe the current groundwater trading situation in Australia, from which a number of issues were identified. From these issues, and with consideration of the requirements of the NWI, competitive market theory, hydrogeologic parameters and groundwater management regimes, a number of principles were developed that provide the core content of the framework.

---

<sup>1</sup> Water systems where no additional entitlements to access water are being issued by Government.

Groundwater trading aims to encourage the efficient distribution of scarce water access between competing users. This will always require some level of input from governments in assessing trade applications, monitoring and reporting on groundwater resources and market activity, and revising water management plans and trading rules. Such administrative requirements result in transaction costs incurred by government and water traders. It is important that these are minimised where possible, but are commensurate with the scale and risks of anticipated trade and the economic benefits that arise from investing in enhancing trading arrangements. This has been a key consideration in developing the framework.

It is expected that the framework will provide guidance to all states and territories of Australia, and be of relevance to all groundwater systems where trading is taking place, or will take place sometime in the future. Expected outcomes include more thorough, yet focused and efficient, groundwater planning processes, efficient distribution of groundwater access, effective management of third-party impacts of groundwater extraction, and improved productivity of water-dependent industries.

The framework in general, or specific elements of it, will continue to evolve via other forums. It does not attempt to delve substantively into matters being addressed in the following Commission-funded projects being undertaken in parallel:

- scoping a decision-support system for assessment of groundwater trades
- assessment of groundwater licensing, metering and extraction estimation arrangements and techniques
- national assessment of surface water–groundwater connectivity
- regulation of market behaviour.

## **What makes a market**

Markets in groundwater access in Australia require some form of statutory powers to enable trading in water access, and confidence in the products, market operating environment and market operations. For markets in general, the most fundamental requirement is resource 'scarcity': that is, where the demand for the resource (in this case groundwater) exceeds the sustainable supply. In most Australian jurisdictions, when this happens, governments cease to grant additional entitlements to the resource. This may occur at the 'whole of groundwater system' level, or in more localised areas or 'zones' where the concentration of authorised extraction means that granting additional entitlements is likely to result in unacceptable third-party or environmental impacts.

Critical components of the operating environment are market boundaries, both physical and volumetric. Physical boundaries may be uncertain but need to be clearly defined. Likewise, for volumetric boundaries, factors such as 'sustainable yield' will not be certain, but entitlement and extraction limits must be clearly defined to provide the necessary market confidence.

Market operations include impact assessment of proposed trades. This is an area of particular significance for groundwater trading, and for a market to continue to operate effectively, assessment must be undertaken efficiently, yet be sufficiently robust to manage a range of potential third-party impacts.

In addition to impact assessment, government plays a central role in ensuring that the market is well informed and there is confidence in transaction processes. It should exercise appropriate discipline in announcing changes to the characteristics of traded products, as these will affect market values and trading activity. In the absence of a central market place (such as a stock market), water users are also dependent on government facilitating the provision of information that can be used in price discovery. Government may also have a role in regulating market operators and intermediaries.

## Current groundwater trading in Australia

A stocktake of the groundwater trading situation in Australia revealed a high degree of variation in both trading activity and approaches to trading, with variation occurring within and between jurisdictions.

All jurisdictions have legislation that enables groundwater trading. However, in the Australian Capital Territory, Tasmania and the Northern Territory, groundwater trading activity is either negligible or non-existent. This is due to a number of factors, including relatively recent introduction of enabling legislation and groundwater licensing, recent definition of individual groundwater management units, continued availability of groundwater rights on application, and limited demand from individual groundwater users.

In Queensland and Western Australia, groundwater trading is undertaken almost entirely on a temporary basis. In New South Wales, Victoria and South Australia, there are developing markets in temporary and permanent groundwater trading, with New South Wales experiencing the highest activity in both market areas. For the 2008–2009 season, about 55 per cent by number and 75 per cent by volume of recorded groundwater trading in Australia took place in three areas of New South Wales: the Lower Murrumbidgee deep, Lower Murray, and Lower Lachlan aquifers. Each of these is a large alluvial aquifer with relatively large licence numbers and volumes, and high water demand and scarcity.

Market activity is affected by a wide range of factors, including market size, groundwater access scarcity and market confidence. The physical size of groundwater management units can affect market size, and is itself subject to the criteria for and placement of unit boundaries. The level of uncertainty over the placement and longevity of existing boundaries will influence overall market confidence and activity levels. Confidence will also be influenced by factors such as the potential for dilution of tradeable groundwater rights by growth in other types of groundwater access that may not be volume-limited (e.g. stock and domestic access, town supply, and intercepting activities such as plantation forestry), and the level of information available to the public on groundwater management and market processes.

Where there is significant trading activity, jurisdictions are generally applying responsible and strategic approaches to developing and implementing trading rules, and assessing and mitigating the potential impacts of changing locations of groundwater extraction. Trading rules may include constraints on the direction of groundwater trades, minimal distances to other groundwater users and dependent ecosystems, and zonal density or total extraction limits. They may determine whether an application can be approved or not, or whether it may proceed subject to individual technical assessment. While the balance between rules and individual assessment varies, trading rules are often well documented in plans, but information is frequently lacking on guidelines and impact thresholds to support individual assessments.

In most jurisdictions, groundwater licences are in a bundled form, and include authorisation for a number of items including works (e.g. bores) and the use of water (e.g. irrigation) as well as the actual extraction of groundwater. In New South Wales, many groundwater licences have now been converted to a fully 'unbundled' NWI-compliant form, whereby the authorisation for groundwater access and extraction is independent of that for works and use, and annual 'allocations' reside within accounts that are linked to licensed entitlements. This situation provides a high degree of mobility for groundwater access and is a contributing factor to the high levels of market activity in these areas.

## A framework for managing and developing groundwater trading

This framework for groundwater trading provides a structure for the establishment or development of groundwater markets in a range of situations across Australian jurisdictions. It builds on economic theory, existing groundwater management arrangements, the NWI and related developments in national water management.

The framework sets out principles for establishing markets and determining the appropriate management arrangements to put in place, grouped into three areas:

- specifying market boundaries
- assessing potential market activity
- establishing appropriate management regimes.

## **Specifying market boundaries**

### *Physical boundaries*

Groundwater markets operate in, and possibly between, groundwater management units (GMUs), which are usually defined through statutory means. Their names vary depending on the jurisdiction, but they are the basic unit for specifying groundwater management regimes. In this framework they are generically referred to as groundwater systems.

*Principle 1. Groundwater systems should be based on physical aquifers or groups of aquifers. They should have clearly defined boundaries based on hydrogeological features such as geological units, groundwater flow 'catchments' and groundwater quality discontinuities, and should be vertically delineated into separate systems in cases where the vertical connection between adjoining aquifers is low. Processes for adjustment of boundaries should be transparent and clearly articulated.*

*Principle 2. Groundwater systems should be as large as possible, subject to hydrogeological connectivity limitations and discontinuities.*

In practice, using cadastral boundaries that align reasonably closely to physical system boundaries can provide operational clarity and reduce unintentional partitioning of jointly operated works.

Zones in groundwater systems may be established to cater for groundwater system heterogeneity and to support trading rules that reduce the cost of transaction processing and provide more certainty for market operation.

### *Trading between systems*

To prevent environmental and third-party impacts, trading from one location to another should only be permitted where there is an adequate hydraulic connection between the locations, so that the impacts of the change in location of extraction are offset by a physical movement of water. Trading across system boundaries requires offsetting flow changes across the boundary.

*Principle 3. Where a groundwater system is not adequately hydraulically connected to other systems, trade into or out of the system should be prohibited. However, trading between groundwater systems that are part of a larger connected aquifer system (e.g. one that spans a state boundary) should be enabled.*

*Principle 4. Trading may be enabled between a groundwater system and a connected surface water system where there is an adequate level of connectivity and mechanisms are in place to minimise environmental and other third-party impacts.*

If the rate of movement of water across system boundaries is low due to aquifer properties, this can make cross connection impacts of trade unmanageable, in which case the connection might be considered inadequate and trade prohibited.

If groundwater systems are established in accordance with principles 1 and 2, trade across system boundaries will only be feasible where systems are prevented from being joined into a single system solely because of administrative constraints (e.g. state boundaries).

Enablement of trading between systems also requires mechanisms to minimise third-party and environmental impacts associated with differences in the nature of the water entitlements and management regimes. This is particularly relevant for trading across state borders and between surface water and groundwater systems.

### *Entitlement and extraction limits*

Groundwater markets are also defined by the limits placed on water entitlements and extraction of water in the groundwater system. These limits are generally defined as part of water management planning or other statutory processes.

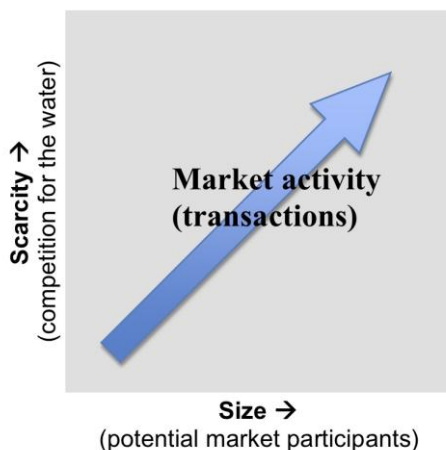
*Principle 5. Entitlement and extraction limits should be clearly specified. Processes for change in long-term limits, determining annual allocations or restricting extraction in times of water shortage should be transparent and clearly articulated.*

In implementing this principle it would be appropriate to publish the total quantities and types of entitlements on issue, and explain how changes to the extraction limit might affect the quantity of entitlement on issue, or the availability of water under entitlements.

### **Assessing potential market activity**

Groundwater markets can be characterised using two parameters: groundwater access scarcity and market size. Scarcity arises once government ceases to grant further entitlements, and increases with the use of existing entitlements. Size is a measure of the number of potential participants in a groundwater market. It can be indicated by the number of entitlements on issue (that is, the total number of licences, not licensed volumes). The two parameters of scarcity and market size together provide an indicator of potential market activity as illustrated in Figure 1.

**Figure 1 Market activity: a function of groundwater access scarcity and market size**



*Principle 6. Potential market activity can be assessed based on the level of scarcity or competition for groundwater rights, and the potential market size (indicated by the number of licences or entitlements on issue).*

### **Establishing appropriate management regimes**

#### *Deciding the level of investment in the trading management regime*

The level of investment in managing and enhancing groundwater trading can vary, and should be determined based on economic benefits of enhanced trading, and mitigation of risks to the environment and water users. Potential market activity can be used as an indicator of the level of investment warranted.

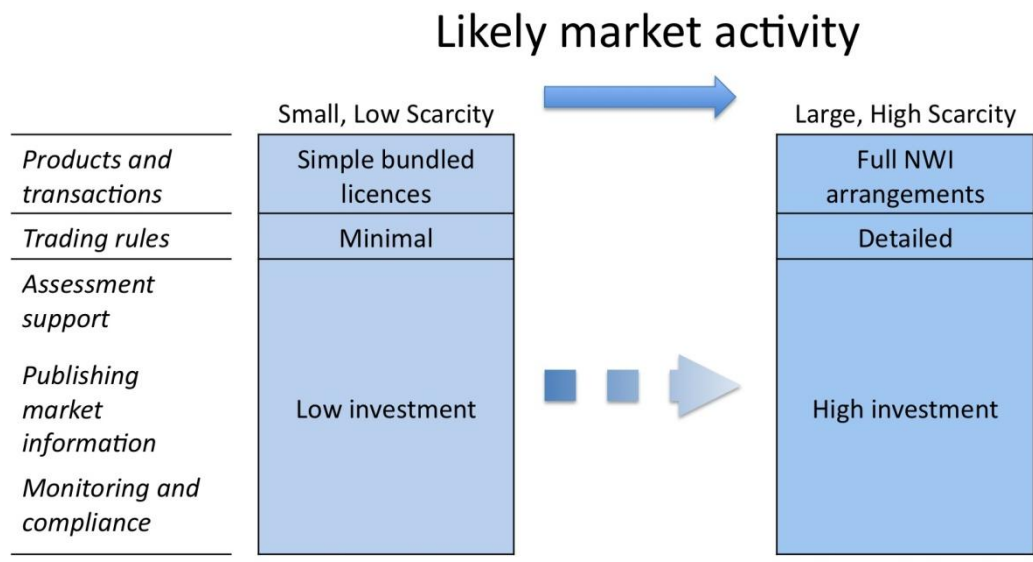
*Principle 7. The level of investment in the groundwater trading management regime should be commensurate with potential market activity.*

In Australia there are groundwater systems where water is scarce and there are a large number of potential market participants. Investment in mechanisms to make trading more efficient in these areas is likely to deliver good economic returns. In addition, in these systems the potential risks to the environment and other third parties associated with trading are greater, and investment in understanding of the system and in trade assessment tools will be critical. On the other hand, for the foreseeable future, there may be a large proportion of Australian groundwater markets that are

small, and/or may never have much market activity, and where low cost management is all that is warranted. There are also potentially large groundwater markets where scarcity is not currently a problem, and trading activity will remain low until scarcity increases. In these cases investment in management should increase as this occurs.

Figure 2 summarises how this can be done. It is further explained in the following discussion.

**Figure 2     Levels of management**



**Selecting product and transaction arrangements**

There are two tradeable water entitlement product and transaction arrangements in Australia. Under the bundled licence arrangement, the issued right is generally not perpetual and incorporates consent to take a volume of water over a specified period (generally annually), construct and use works to do so (e.g. bores), and apply the water to land. Trading is enabled through the cancellation or reduction of a licensed entitlement at one location, and the corresponding granting or increase of a licensed entitlement at another location, either permanently or temporarily. Under the unbundled NWI arrangement, the tradeable right is a perpetual water access entitlement as specified in the NWI (cl. 28-32), separated from approvals for works and application of water on land, with independently tradeable water allocations arising from it annually or from time to time.

*Principle 8. NWI-consistent products and transactions should be instated as a priority in groundwater systems where potential market activity is high and in other cases where it is cost effective.*

NWI-consistent arrangements might also be cost effective in areas with low groundwater market activity where market participants are likely to be using alternative water sources, on the same land, from other systems with NWI arrangements, or where connected surface water systems already have NWI arrangements. Bundled licence arrangements can be used to establish markets where unbundled NWI arrangements are not implemented.

**Investment in establishing trading rules**

Trading rules are, for the purposes of this report, matters that the consent authority must address when considering applications for trading transactions, and do not include rules governing the actual administration and processing of trading applications and market information. Their prime purpose is to prevent significant impacts on other water users (i.e. in market terminology, to protect their ‘exclusivity’) and on environmental and other public good services provided by the resource.

Trading rules are a way of identifying and managing, up front, the cumulative movement of entitlements that can take place without unacceptable impacts on the resource, ecosystems or other water users, reducing the need for impact assessment on a case-by-case basis for each transaction. They can thus reduce transaction costs and provide greater certainty to market participants. Establishment of these rules requires up-front investment in understanding of the hydrogeology of the groundwater system.

*Principle 9. System-specific trading rules should be based primarily around the management of trade to and from the system (if and as permitted under jurisdictional or basin principles), the establishment of zones and management of trade between these, and establishment of and management to local density limits and bore proximity limits. Such rules should be objective and easily understood and implemented.*

Bore proximity rules (including those for screen depth) limit the impacts on particular features (e.g. wetlands and other groundwater users) but do not necessarily cater for the varying potential impacts of different groundwater extraction rates from individual bores. Density rules, where expressed as a maximum volume per area, can address actual groundwater extraction irrespective of the number of bores in place, and can be supported by proximity rules. Zones allow for setting of sub-system entitlement and extraction limits, and also for variation in bore proximity and density limits to suit hydrogeological conditions. Zones also allow for control on the direction of groundwater trades to address local over-allocation or extraction. However, where there is sufficient hydrogeological knowledge, density rules provide a more transparent and ongoing approach than directional controls.

*Principle 10. Trading rules should be used to manage potential impacts of changes to the location of water extraction and not for other purposes.*

Trading rules should not be used to reduce over-allocation or limit development of underused entitlements, or to restrict who can own water entitlements or allocations. Where NWI arrangements are in place, management of the impacts of applying water to land (e.g. impacts such as rising water tables) should be regulated through water 'use' consents or other means rather than trading rules.

#### *Investment in assessment support*

Each movement of a groundwater right can affect the resource, dependent ecosystems and availability of water to holders of other water rights. Government approval of trades that involve movement of the location of extraction is intended to ensure any such impacts are addressed. Technical assessments are required to identify these possible impacts and means of mitigating them. These can be very costly and time-consuming. While trading rules can reduce these costs by addressing cumulative impacts, governments can also invest in supporting the remaining case-by-case assessment processes, thereby reducing assessment costs.

*Principle 11. Assessing authorities should have standard, publicly documented, assessment requirements for trades involving change of location of extraction. These would include appropriate methods and protocols for assessment, and pre-determined thresholds for the level of impact considered unacceptable. The levels of investment required in assessments should be tailored to the level of risk.*

These requirements would normally apply to all groundwater trading in the jurisdiction, and thus all groundwater systems regardless of level of trading activity.

*Principle 12. Investment in information and technical support tools for assessment in individual groundwater systems should increase with potential market activity.*

This includes such things as mapping of bores and groundwater-dependent ecosystems, and development and calibration of models to allow the drawdown impact of extraction to be predicted. In systems of high potential market activity with sensitive dependent ecosystems, ecosystem response (to drawdown) models could also be developed.

### *Investment in publishing market information*

Many groundwater users in Australia are not well informed about groundwater trading and markets. Uncertainty about how to trade and market value is a serious impediment to growth in market activity.

*Principle 13. For all markets, jurisdictions should make publicly available complete and up-to-date information on groundwater systems, tradeable products and their management, market activity, and trade assessment requirements and administrative processes.*

This would include information on such things as:

- groundwater system boundaries and volumetric size
- entitlements or shares in the system and the processes for changing these
- tradeable products and transaction types
- application forms and procedures
- processing times and costs
- trading rules and assessment requirements
- transaction numbers, types, volumes involved
- prices paid.

The release of periodic information should conform to a clearly defined schedule to provide all market participants with an equal opportunity to obtain and interpret that information.

### *Investment in monitoring and compliance for groundwater extraction*

Fundamentally, water rights authorise the extraction of water from aquifers. Compliance with the entitlement, and therefore protection of the exclusivity of all entitlements, relies on entitlement holders extracting no more than the authorised volume. Assessing this requires volumetric specification of licences and metering of water extraction.

Without adequate measurement and compliance, not only is the sustainability of the resource and dependent ecosystems at risk from over-extraction, but the exclusivity of other existing entitlements is also undermined. Trading is consequently stifled as entitlement holders can simply take additional water they need, rather than having to purchase it.

*Principle 14. Metering of extraction should be introduced in all groundwater systems where trading is possible, and should be a mandatory prerequisite for participants in a temporary (seasonal allocation) trade.*

*Principle 15. Compliance management of water rights should be implemented in all systems, with monitoring effort (e.g. meter reading frequency, proportion of groundwater bores metered) increasing in proportion to scarcity, regardless of market size.*

## **Implementing the framework**

The investment required to implement the framework outlined in this report will vary according to the current levels of, and approaches to, groundwater trading already in place, the growth in demand for groundwater trading in individual groundwater systems, and the desires and needs of individual jurisdictions.

The framework could be implemented at two levels:

1. jurisdictional actions to recognise, enable and operationalise particular aspects of the framework, at the jurisdictional level and for individual groundwater systems
2. Australian Government actions to promote the framework and support its adoption in future groundwater management and planning.

Practical, effective initiation and management of groundwater trading need to be supported by legislative provisions, policies, administrative procedures and systems, and technical tools. These

are largely the domain of individual jurisdictions, and their continued development and application will require sustained commitment over the next decade or so. Each jurisdiction could develop an implementation plan consisting of:

- development of a state policy covering establishment of groundwater trading, and principles and processes for trading management and support
- legislative changes needed to support NWI-compliant entitlement regimes for groundwater
- priority ranking of groundwater systems for implementation of groundwater trading
- review and refinement of physical boundary definitions
- review and refinement of entitlement/volumetric limits
- tools and assessments needed to enhance trading rules in potentially active areas
- development of policies, tools and guidelines for case-by-case assessment
- establishment of public entitlement and trading registers
- enhancing supply of additional information needed to inform markets
- implementing metering of extraction where needed
- enhancing compliance and enforcement where needed
- providing for cost recovery through fees and charges.

Progress in these areas can also benefit greatly from Australian Government guidance and support. There are already several Australian Government programs and specific projects that can contribute to development of groundwater trading nationally, including:

- the National Water Market System (which aims to improve the efficiency of state and territory water registers, transactions and market information functions)
- the proposed Murray–Darling Basin Plan
- the National Groundwater Action Plan, with projects in particular relating to developing better approaches to estimating sustainable yields (extraction limits), characterising and managing connected surface water and groundwater systems, and development of technical tools, including models, to assist in the assessment of groundwater trades.

Individual jurisdictions will undoubtedly draw from these programs, and may also seek Australian Government funding for development and implementation of aspects of groundwater trading and the underpinning entitlement and planning frameworks.

# 1. Introduction

Water trading is recognised as an important enabler of a more efficient and productive use of water in fully allocated water systems, and in optimising economic, social and environmental benefits. Water trading is a core component of the National Water Initiative (NWI), and is the main means through which limited water resources can be reallocated among consumptive uses (and, in some cases environmental uses). This provides a departure from less flexible allocated water arrangements that have historically been in place in many areas.

Groundwater trading has been taking place for some time in many parts of the country, but on a much smaller scale than surface water trading. As a practice, it is in its infancy. Because of the expanding demand for groundwater and the better recognition and understanding of its limited availability in developed areas, it is expected that trading will expand in many areas.

Development of groundwater trading can be impeded by a number of technical, social, administrative and political factors. Some of these can also be impediments to surface water trading and have been explored in that context. However, others are peculiar to groundwater, such as the three-dimensional nature of aquifer systems, boundary uncertainties, water quality variations and local drawdown impacts. The issues associated with the spatial locations of extraction from groundwater systems in particular add a degree of complexity in the management of groundwater trading.

The National Water Commission commissioned GHD and associates to undertake a national study on establishing water market and trading arrangements for groundwater access entitlements. The scope of the study included:

- describing the current status of, and issues associated with, groundwater trading in Australia
- developing a framework for managing groundwater trade that is consistent with the NWI and meets a range of other criteria proposed by the Commission
- describing actions to ensure that the above framework is operational on a consistent national basis
- identifying tools required to assist with the planning and management of groundwater trading activities
- describing a range of models (i.e. management regimes) for groundwater trading that can be practically applied to specific hydrogeological situations.

This report is the final output of this study. It sets out a framework for the management and development of trading of groundwater entitlements in Australia that can be practically applied in different situations. The framework only applies to primary groundwater access—it does not address secondary distributions once groundwater has been extracted, such as the physical transfer of pumped groundwater volumes between bore owners and other water users.

In developing the framework, the first step was to investigate and describe the current groundwater trading situation in Australia, from which a number of issues were identified. From these, and with consideration of the requirements of the NWI, competitive market theory, hydrogeologic parameters and groundwater management regimes, a number of principles were developed which provide the core content for the groundwater framework.

Groundwater trading aims to encourage the efficient distribution of scarce water access between competing users. This will always require some level of input from governments in assessing trade applications, monitoring and reporting on groundwater resources and market activity, and revising water management plans and trading rules. Such administrative requirements result in transaction costs incurred by government and water traders. It is important that they are minimised where possible, but are commensurate with the scale and risks of anticipated trade and the economic benefits that arise from investing in enhancing trading arrangements. This was a key consideration in developing the framework.

It is expected that the framework will provide guidance to all Australian jurisdictions, and be of relevance to all groundwater systems where trading is occurring, or will occur in the future. Expected outcomes include more thorough yet focused and efficient groundwater planning processes, efficient distribution of groundwater access, effective management of third-party impacts of groundwater extraction, and improved productivity of water-dependent industries.

The framework in general, or specific elements of it, will continue to evolve via other forums. It does not attempt to delve far into matters that are expected to be addressed in the following projects being undertaken in parallel:

- scoping a decision-support system for assessment of groundwater trades
- assessment of groundwater licensing, metering and extraction estimation arrangements and techniques
- national assessment of surface water – groundwater connectivity
- various studies on monitoring and compliance of market behaviour.

## 2. Background

### 2.1 Why use markets in groundwater management?

In Australia, demand for water now exceeds supplies in many areas. The recent drought has exacerbated the situation and concern is growing that climate change may cause an ongoing decline in water availability. For many river-water sources, rights to water for population growth, agriculture or industrial development can only be obtained by re-allocation of existing water rights. Due to this growing demand and shrinking availability, many water users are turning to groundwater as an alternative source. However, groundwater is not unlimited, and in an increasing number of systems demand is exceeding availability.

There are two primary mechanisms employed in distributing scarce resources: command and control determinations by governments, and market mechanisms. In Australia, both are employed to distribute water access in fully allocated systems<sup>2</sup>, with planning used to set limits to water rights, and water trading to redistribute those water rights once limits are reached.

Governments have the best information on, and the most interest in maximising, the broader social and economic benefits derived from water access. They periodically codify and make determinations on the size of the consumptive pool for a groundwater system and the distribution of that water access between categories of water users. In doing so they may recognise the high social values associated with essential human and animal needs, and act as an advocate for uses that are not well represented in a market (such as cultural heritage and the environment).

Private entities enjoy the benefits of their water use. They have a clearer understanding than government of the benefits that they derive from water access, and they use or trade their interests in water access to maximise the benefits they receive.

Markets encourage the efficient distribution of scarce water access between competing users. They enable water entitlements and allocations to be employed in their highest value use and they can enable water users to respond rapidly to changes in climate, commodity prices and other value drivers. Water markets are well established in many surface water systems, but there are fewer in groundwater systems and these are generally at an early stage of development.

### 2.2 The National Water Initiative

The 2004 NWI agreement establishes, among other things, an integrated framework of entitlement and allocation specifications, water planning and water trading. Groundwater trading arrangements need to operate within that framework.

One of the core objectives of the NWI is to promote those things that broaden and deepen the water market (cl. 3(v)). It encourages the definition of traded (cl. 31(iii)) products (such as entitlements and allocations) so that they promote confidence (cl. 25(vii) and 25(viii)). Governments (cl. 58) are to (i) facilitate efficient market operation where physically possible, (ii) minimise transaction costs and provide good market information, (iii) allow a mix of products to develop, (iv) recognise the needs of the environment and (v) protect against third-party impacts.

The NWI also provides specific directives for the actions that states and territories must undertake: to put in place registers of entitlements and trades, establish compatible administrative processes and competitively neutral water charges to support interstate trade, and to remove various institutional impediments to trade.

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<sup>2</sup> Water systems where no additional entitlements to access water are being issued by Government.

Schedule G of the NWI establishes a set of principles with which water trading rules should be consistent. Water trading rules must allow for 'permanent', 'lease' and other types of trades, and these must be formally registered. Significantly, the principles limit restrictions on trade to those addressing physical and heritage outcomes (environmental, hydrological, water quality, geographic features, delivery constraints, and heritage features). They require that rules do not result in 'sustainable yields' being exceeded but allow for the specification of trading zones and the use of adjustments (such as exchange rates) to take account of changes in things such as transmission losses or to enable the conversion of a water right from one category to another. There are a number of principles (or elements thereof) that expressly stop certain things from occurring (such as the use of exchange rates for recovering environmental water). The principles specifically consider groundwater trading, e.g. Principle 8: '... groundwater trading zones should be defined in terms of the ability to change the point of extraction of the water from one place to another, and protection of the environment'.

## 2.3 Definitions and terminology

### 2.3.1 Licences, entitlements and allocations

Licences, entitlements and allocations provide part of the fundamental enabling environment for water trading. The NWI provides the following definitions for water access products:

|                          |                                                                                                                                                           |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>water entitlement</b> | a perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water plan.       |
| <b>water allocation</b>  | the specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan. |

The above terminology and definitions are not applied consistently across Australia. Each jurisdiction applies its own variations, which are described in the jurisdictional 'stocktake' studies provided in Appendix C to Appendix J. A table of terminology comparisons for each jurisdiction, against 'benchmark' terms, is provided in Appendix L.

Water licences are not defined in the NWI, and have a range of meanings in different jurisdictions. However, a 'water licence' can generally be taken to be an instrument that may define a range of conditions of water access, including water entitlements and allocations.

A requirement of the 1994 Council of Australian Governments (COAG) water reform framework was the 'unbundling' of water licences that had historically been attached to land, and thus did not exist as an independent water right. This was common across Australia, and separation of water rights from land rights has since taken place to varying degrees.

### 2.3.2 Water systems and planning

The local terminology for water systems, especially in the context of water plans, varies widely between jurisdictions and provides part of the operating environment in which water trading may take place. The NWI provides the following definitions for water plans and systems:

|                   |                                                                                                                                                                                                                                                                                                                       |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>water plan</b> | statutory plan for surface and/or groundwater systems, consistent with the Regional Natural Resource Management Plans, developed in consultation with all relevant stakeholders on the basis of best scientific and socio-economic assessment, to provide secure ecological outcomes and resource security for users. |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**water system** a system that is hydrologically connected and described at the level desired for management purposes (e.g. sub-catchment, catchment, basin or drainage division and/or groundwater management unit, sub-aquifer, aquifer, groundwater basin).

For the purposes of comparing between jurisdictions and proposing trading management regimes in this report, the following terminology and definitions have been developed:

**planning area** a sub-jurisdictional area that is subject to discrete water management planning arrangements that address groundwater systems (and possibly surface water systems), where the arrangements are developed in consultation with relevant stakeholders on the basis of scientific and socio-economic assessment, and aim to provide secure ecological outcomes and resource security for users.

**groundwater system** an aquifer or group of aquifers that, hydrogeologically, is connected internally and described at the level desired for management purposes (e.g. fractured rock catchment, groundwater management unit, aquifer, groundwater basin). A groundwater system may be identical to, or a sub-area of, a planning area, and is generally the spatial unit to which groundwater licences are linked and for which records on entitlements and extraction are compiled, and most importantly for which entitlement or extraction 'limits' are set.

**zone** an internal division of a groundwater system that is hydrogeologically connected both internally and with adjoining zones, has a greater level of hydrogeological homogeneity than the parent groundwater system, and may be used to control groundwater extraction concentration. Trading may occur between zones but is often subject to restrictions driven by entitlement levels, extraction or stress.

Table 1 provides examples of these planning units for the Australian jurisdictions. It is recognised that existing planning areas, groundwater systems and other spatial planning units will not always fit neatly into these categories.

**Table 1 Adopted planning units: examples for Australian jurisdictions**

|     | Planning area                                                                                       | Groundwater system                                                                                                                                                                             | Zones                                                                                                                                                                                                                                                                                                                    |
|-----|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Qld | Individual water resource plan (WRP) areas, e.g. Burnett River basin                                | Individual groundwater management areas (GMAs) within WRP areas: <ul style="list-style-type: none"> <li>Coastal Burnett GMA</li> </ul>                                                         | GMA sub-areas: Kolan-Burnett, Burnett-Elliott, Elliott-Gregory, Farnsfield, Fairymead                                                                                                                                                                                                                                    |
| NSW | Initial water sharing plan (WSP) areas (established 2004–2007), e.g. Lower Murrumbidgee Groundwater | Individual water sources within WSP areas: <ul style="list-style-type: none"> <li>Lower Murrumbidgee Deep Groundwater Source</li> <li>Lower Murrumbidgee Shallow Groundwater Source</li> </ul> | <ul style="list-style-type: none"> <li>Declared local impact management areas defined according to local management needs (e.g. density of development).</li> </ul> For the Deep Groundwater Source: <ul style="list-style-type: none"> <li>Local Impact Management Area 1 and Local Impact Management Area 2</li> </ul> |

|     | Planning area                                                                                                 | Groundwater system                                                                                                                                                                               | Zones                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | Recent WSP areas based on macro approach (e.g. Draft NSW Murray–Darling Basin Porous Rock Water Sharing Plan) | Individual groundwater sources: <ul style="list-style-type: none"> <li>• Gunnedah-Oxley Basin</li> <li>• Western Murray Porous Rock</li> <li>• Sydney Basin</li> <li>• Oaklands Basin</li> </ul> | ‘Management zones’ in individual water sources (based on catchments, local impact management etc.)                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| ACT | Environmental flow guidelines area                                                                            | Individual water management areas (WMAs), e.g. Central Molonglo, Lower Molonglo                                                                                                                  | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Vic | Individual GMAs and water supply protection areas (WSPAs)                                                     | Individual GMAs and WSPAs, e.g. Mid Loddon GMA, Katunga WSPA                                                                                                                                     | Zones in GMAs and WSPAs<br>For the Mid Loddon GMA: <ul style="list-style-type: none"> <li>• Jarklin, Laanecoorie – Serpentine and Moolort Zones</li> </ul> For the Katunga WSPA: <ul style="list-style-type: none"> <li>• Management Zones 1061, 1062 and 1063</li> </ul>                                                                                                                                                                                                                                                            |
| Tas | Not applicable                                                                                                | Not applicable                                                                                                                                                                                   | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| SA  | Individual prescribed wells areas (PWAs) and prescribed water resource areas (PWRAs)                          | Individual PWAs or underground water systems of PWRAs, e.g. McLaren Vale PWA<br>Underground water systems of the Barossa PWA<br>Lower Limestone Coast PWA                                        | Aquifers and management areas in the PWAs and PWRAs.<br>For the McLaren Vale PWA: <ul style="list-style-type: none"> <li>• Quaternary sediments, Port Willunga Formation, Maslin Sands, and Fractured Rock.</li> </ul> For the Barossa PWA: <ul style="list-style-type: none"> <li>• Upper, Lower and Fractured Rock Aquifers</li> </ul> For the Lower Limestone Coast PWA: <ul style="list-style-type: none"> <li>• 61 management areas of the unconfined aquifer</li> <li>• 17 management areas of the confined aquifer</li> </ul> |
| WA  | Plan areas and sub-areas e.g. Murray Groundwater                                                              | Individual aquifers in sub-areas (often vertically stacked).                                                                                                                                     | Not usually used, but could have zones within aquifers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|    | Planning area                                                              | Groundwater system                                                                                                                           | Zones                                |
|----|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
|    | Area with 4 sub-areas:<br>Nambeelup, Coolup,<br>Pinjarra, Waroona          | e.g. For the Coolup sub-<br>area:<br><br>Superficial–Rockingham<br>sands<br><br>Upper Leederville<br><br>Lower Leederville<br><br>Cattamarra |                                      |
| NT | Tindall Limestone Aquifer<br>(bounded by the Katherine<br>River Catchment) | Tindall Limestone Aquifer<br>(bounded by the Katherine<br>River Catchment)                                                                   | Zones 1 and 2 of the water<br>system |

### 2.3.3 Water trading

The term water trading as used in the NWI refers to the buying and selling of rights to take water from a water system, rather than the buying or selling of water itself. These rights can be expressed as water access entitlements, or water allocations (see Section 2.3.1). The on-selling of water once it has been taken from a water system is not, for the purposes of the NWI, water trading. For example, a local government organisation delivering and selling water it has already taken from a river or groundwater system to another organisation or an industry is not the kind of water trading considered here; nor is the piping of water from one catchment or aquifer for use in another area.

Trading in water entitlements and allocations can involve change in ownership and/or change in the location of extraction. For example:

- a person can buy land and at the same time buy the water access entitlement associated with that land. In this case an ownership transfer occurs but there is no change in the location of extraction of the entitlement.
- a person can move an entitlement they own from one location to another some distance away. In this case there is a change in location of extraction but no change in ownership.
- a person can buy an entitlement and move it to take water at a different location. In this case an ownership transfer and change of location occur.

In practice, jurisdictions do not consistently report all of these cases as trade. Most commonly any change in location is considered to be a trade, regardless of ownership change, but changes in ownership without change in location are not always reported. In this report we consider trade to apply to all of the above cases; however, it is acknowledged that:

- the environmental and hydrogeological issues associated with groundwater trading predominantly arise from changes in the location of groundwater extraction
- for the purposes of market reporting, the different transaction types should be reported separately.

## 2.4 Theoretically competitive markets in groundwater

The NWI establishes overall objectives for groundwater trading by seeking establishment of tradeable and legally secure products, attempting to ensure that those products are exclusive (so that the owners incur all of the benefits as well as all of the costs – including third-party impacts), removing barriers to trade, and ensuring that some of the basic information requirements of markets are available. These are all design requirements for a theoretically competitive market.

Table 2 identifies conditions required for a competitive groundwater market and some of the issues arising from them. The table also identifies critical economic conditions, being minimal third-party impacts and efficient transaction costs (i.e. the cost of trading cannot exceed the marginal economic benefits provided by the trade itself). In some instances the conditions for a competitive market (such as scarcity) are essential, and in their absence the market would struggle to function. In other instances such as those of complete past, current and future information, the condition can only be aspirational. Where this is the case, there is generally a minimum required satisfaction of the condition, an optimal level (where the market operates efficiently), and an excessive level (where the investment in increasing satisfaction of the condition is not cost effective).

**Table 2 Competitive market requirements and application to water markets**

| Condition                               | Application in water markets                                                                                                                                                                                                                                                                                                                                                                   | The National Water Initiative and mechanisms to meet conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scarcity                                | If a water user can take or make claim to water access without requiring an entitlement, or through government granting an additional licence solely for the application cost, there is no motivation to participate to purchase water in a market. Governments maintain scarcity in water access through volumetric licensing and limiting total extractions allowed within a period of time. | The limits to entitlements may be set on a long- or short-term basis, provided they are set and maintained. Short-term limits may be appropriate where there may be future releases of additional water access and there is a desire to introduce a market mechanism in the interim, or where climate variability results in temporary but unacceptable water level drawdowns.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Trade is statutorily permitted/possible | There must be statutory powers to enable trade. These may be indirect, where trade is given effect through statutory licensing powers and related actions, or explicit, where trade has the support of trade-specific statutory powers, and is given effect through administrative processes.                                                                                                  | Clauses 31(iii) and (iv) of the NWI require that water access entitlements be tradeable and divisible. Jurisdictions bring trades into effect by either cancelling or reducing the seller's entitlement and issuing an equivalent entitlement to the buyer, or by directly changing the ownership and/or location of all or part of a water access entitlement or allocation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Market confidence                       | Buyers and sellers must have confidence in the characteristics of a traded entitlement or allocation, the records that secure ownership, the administrative processes that give effect to trade, and their price discovery. Uncertainty over title, the 'reliability' of the entitlement, and lengthy approval processes may affect market confidence.                                         | <p>Sub-clause 25(i) of the NWI requires that the water access and entitlement framework enhance the security and commercial certainty of water access entitlements by clearly specifying the statutory nature of those entitlements. Clauses 28 to 34 of the NWI go further in describing the minimum characteristics of an appropriate water access entitlement.</p> <p>Sub-clause 31(c) explicitly requires that water access entitlements be exclusive, so that the owner enjoys all of the benefits as well as the costs of ownership and use. In the context of trade this may be interpreted as a requirement for no 'externalities' (or 'third-party impacts').</p> <p>Confidence in price discovery requires that buyers and sellers have access to, and be willing to rely on, information regarding current offers in the market, or (at a minimum) recent prices paid in the market.</p> |

| Condition          | Application in water markets                                                                                                                                                                                                                                                                                                                                                                                              | The National Water Initiative and mechanisms to meet conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No market power    | A dominant entitlement holder in a market may have the potential to control the market and manipulate market prices. The risk of a market participant (or group of participants) gaining and exercising market power is affected by the primary and secondary distribution of entitlements and determined by both the level of market monitoring and the existence of (and preparedness to exercise) powers to intervene. | There are no references to this in the NWI. Some jurisdictions have specific regulatory powers to address this issue, while others rely on a more general power for the relevant minister to disallow an application to trade if this is in the public interest. Levels of market monitoring are generally poor and there is no process to identify and monitor all related party interests. Primary distributions of water entitlements and allocations may have resulted in potentially dominant entitlement holders in various groundwater sources, most commonly in smaller aquifers.                                                                    |
| Benefits maximised | The benefit of holding a water entitlement is generally limited to the use of water allocations accruing to it. The owners of entitlements and allocations may be assumed to maximise the expected benefits (monetary and non-monetary) from those water access products through the use or trade of allocations.                                                                                                         | Australia has a market-based economy where individuals and private firms have natural motivation to maximise the returns received from holding an asset. Entitlement holders maximise their benefits by either using any allocations and/or buying more (where the allocation market price is less than the benefits of use by the holder), or by selling those allocations (where the market price exceeds the benefits of their use by their holder).                                                                                                                                                                                                      |
| Complete knowledge | All relevant market information should be available to market participants so that they can make rational pricing decisions.<br><br>Information on the resource size, 'shares' in the resource and uncertainties surrounding these are also critical.                                                                                                                                                                     | Schedules F and G of the NWI require the recording of water trade statistics as part of the commitments to developing registers. The registers are also required to be publicly accessible. This provides historical trade information for approved transfers and assignments.<br><br>Jurisdictions provide only historical market trading statistics. Information about current market offers and prices is largely left to the private sector and is only available from brokers and exchange operators.<br><br>Publication of groundwater resource and market size information and associated uncertainties is at the discretion of responsible agencies. |

| Condition                                            | Application in water markets                                                                                                                                                                                                                                                                                                                                                                                                           | The National Water Initiative and mechanisms to meet conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Arbitrage opportunities are instantaneously resolved | Arbitrage opportunities (where someone buys and immediately sells at a higher price) need to be instantaneously resolved as they hinder rational pricing. They generally arise when a market participant has better knowledge than a buyer and seller who would otherwise transact directly.                                                                                                                                           | The NWI is silent on arbitrage opportunities. They are an artefact of market operations rather than policy. They are minimised when there is equal access to market information in general, and to buy and sell offers in particular, as discussed in the previous point. The most efficient means of reducing arbitrage opportunities is by ensuring that access to market offers and prices is exhaustive.                                                                                                            |
| No barriers to entry                                 | Removing constraints on the ownership of water entitlements or participation in the market increases the number of potential participants. It also allows debt funding to be secured over the entitlement. Where entitlements are not 'unbundled', ownership is effectively limited to landholders with appropriate approvals (e.g. for works and/or use of water).                                                                    | Sub-clause 60(iv)(a) and (b) require the immediate removal and phasing-out of institutional and jurisdictional barriers to trade in allocations and entitlements respectively.                                                                                                                                                                                                                                                                                                                                          |
| Minimal transaction costs                            | Transaction costs represent an impost on market participants and reduce the potential number of trades. They include administrative fees, price discovery activities, registry searches and/or brokerage charges, and can be minimised but generally not eliminated.                                                                                                                                                                   | Clause 58(ii) of the NWI requires governments to minimise transaction costs on water trades, including through good information flows in the market and compatible entitlement, registry, regulatory and other arrangements across jurisdictions.                                                                                                                                                                                                                                                                       |
| Homogeneous entitlements                             | Differences between entitlement characteristics and exogenous factors affecting access (such as the local level of development where this affects allocations and access triggers) result in different market values in the same category of entitlement. Groundwater and unregulated river water access is generally less homogeneous than for regulated rivers due to the effects of locality-specific conditions and circumstances. | <p>The NWI is silent on the issue of homogeneity, except to identify the core characteristics of water access entitlements.</p> <p>Allocations are generally homogeneous within any market as they represent a unit of a physical commodity (water).</p> <p>The NWI implicitly encourages one aspect of homogeneity through an insistence on competitive neutrality in water charges between jurisdictions with a contiguous water market (such as the Murray River) so that they do not act as a barrier to trade.</p> |
| Exclusivity                                          | Specification of water access entitlements and allocations should be exclusive so that all of the costs and benefits accruing to water users should be borne or enjoyed by their holders.                                                                                                                                                                                                                                              | There should be no unacceptable third-party impacts, including environmental impacts, arising from decisions to allow trades.                                                                                                                                                                                                                                                                                                                                                                                           |

| Condition                                                       | Application in water markets                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The National Water Initiative and mechanisms to meet conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recognition of public interest and dealing with market failures | There needs to be legal and practical recognition of multiple interests in water resources and third-party effects of trade, and appropriate mechanisms for resolving conflict.                                                                                                                                                                                                                                                                                                                  | Clause 23(iii) of the NWI requires its signatories to establish statutory provision[s] for environmental and other public benefit outcomes, and improved environmental management practices. As such, it recognises the interests of non-extractive entities and public interest generally. This is further supported by the NWI requirements for sustainable levels of extraction, and specifically in relation to trade, to 'recognise and protect the needs of the environment; and ... provide appropriate protection of third-party interests' (cl. 58). |
| Administrative capacity and efficiency                          | Water management agencies require administrative capacity (sufficient administrative authority, resources and information to manage water resources effectively), robust and clear institutional relationships (both at a given level of governance and between different levels of governance), legal/administrative clarity (including definition and recognition of water rights and trading rules, as well as transparent administrative actions) and capacity for institutional adaptation. | Clause 98 of the NWI recognises the significant knowledge- and capacity-building needs for its ongoing implementation. Many of the 'actions' in the agreement relevant to trading are aimed at the establishment and management approaches and systems designed ultimately to provide administrative consistency and efficiency.                                                                                                                                                                                                                              |
| General considerations                                          | The cost of market infrastructure and complexity should be commensurate with the expected benefits and risks arising from efficient water market outcomes.                                                                                                                                                                                                                                                                                                                                       | The justification for using a market to efficiently distribute water access is the marginal benefit it can provide when compared with command control decisions. The cost of market infrastructure and complexity of market participation should be commensurate with the benefits of using a market process and the likely demand for market transactions.                                                                                                                                                                                                   |

## 3. Current status and issues

### 3.1 Status evaluation structure

The structure used to evaluate current groundwater trading arrangements is shown in Figure 3 and includes four key areas:

- enabling environment
- operating environment
- market operation
- trade facilitation and monitoring.

The structure was critical to the consultation phase of the project, as it provided the basis for gathering and analysing information on current groundwater trading in Australia. Its elements represent the ‘theoretical’ legislative, administrative and technical aspects that might be considered appropriate or necessary for a mature groundwater market. It was not expected that any jurisdiction would have all these elements in place, and indeed such comprehensiveness may not be required in many circumstances. The information gathered from the analysis underpins the proposed framework for groundwater trading outlined in subsequent chapters.

#### 3.1.1 Enabling environment—legislation and policy

The enabling environment includes the state- or territory-based legislation and policies under which water rights are defined, the types of tradeable water rights that exist, the types of transactions that can occur, and any mechanisms or processes for market regulation.

The enabling environment will normally cater for a broad range of water management requirements, including those for surface water and groundwater trading.

#### 3.1.2 Operating environment—prerequisites to a market

The operating environment includes conditions that might be in place prior to commencement of groundwater trading in a particular area. This includes definition of the water system, in terms of both available resource (consumptive pools) and physical boundaries, the entitlements in the consumptive pools, and the scope of trading.

The operating environment includes groundwater-specific concepts and requirements, such as spatial boundaries (both lateral and vertical) that reflect aquifer conditions, and consumptive pools based on estimates of ‘sustainable yield’ or other groundwater extraction limits.

#### 3.1.3 Market operation

Market operation includes transaction processing and managing third-party impacts. Market operation requires attention to some groundwater-specific concepts, especially in relation to managing third-party impacts. This is a critical area in which groundwater trading can differ significantly from that of surface water. Third-party impacts can arise from increased groundwater extraction at a particular location following trading, creating increased drawdown of groundwater levels and potentially reducing the security of supply to other groundwater users and dependent ecosystems.

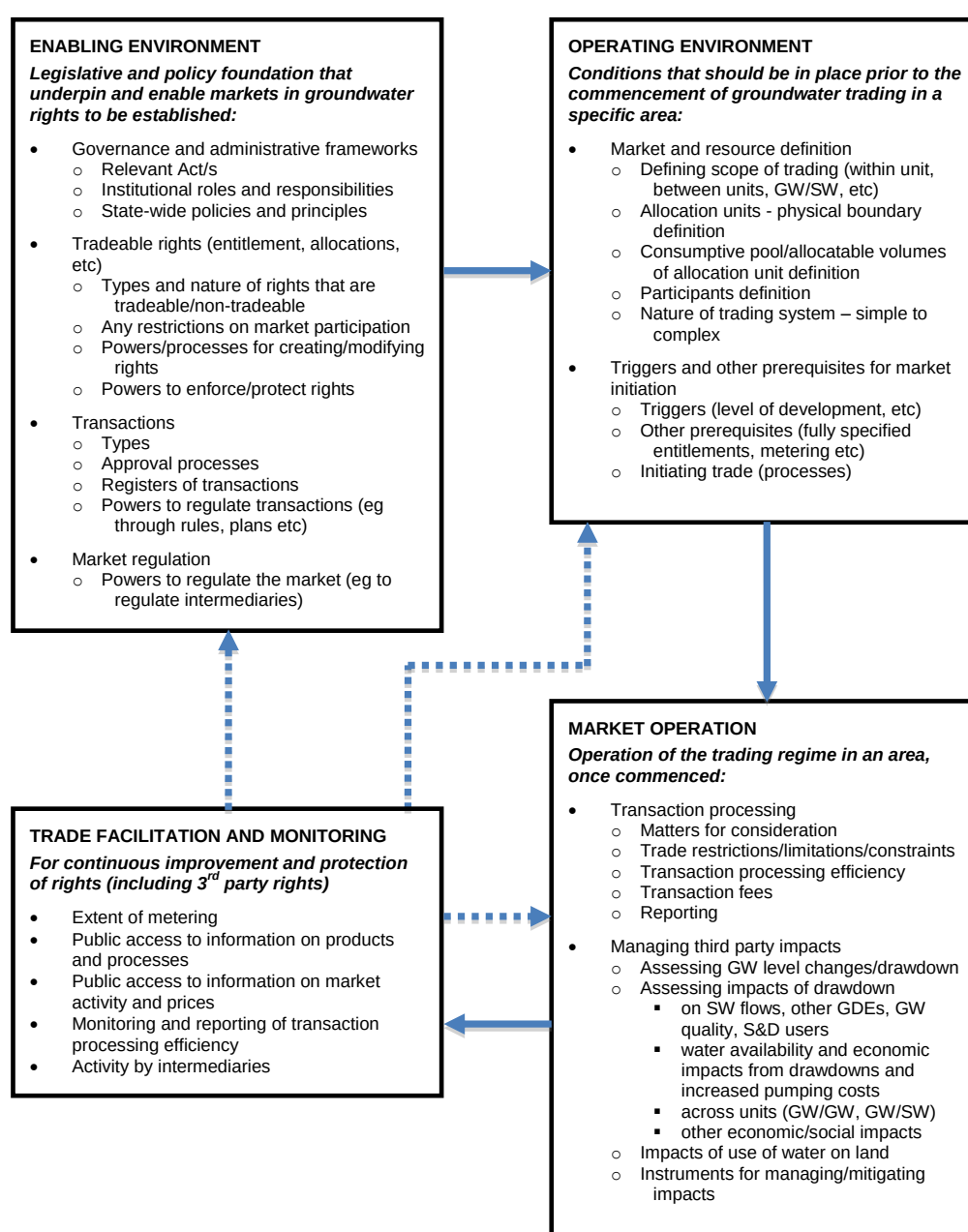
### 3.1.4 Trading facilitation and monitoring

Trade can be facilitated through the active provision of information on market activity, the state of the resource, and anything else that might affect the buying and selling of water entitlements and allocations. It can also be assisted by supporting intermediaries and, where necessary, their regulation. Monitoring, evaluation and reporting are required to encourage continuous improvement, and may include:

- agency performance (e.g. timeframes for processing applications)
- market activity (e.g. number of trades undertaken, water right volumes traded)
- aspects of the groundwater resource (e.g. groundwater extraction, levels and quality).

The performance of regulating agencies may be assessed against adherence to policies on determining groundwater trade applications, and on the content and timeliness of reporting on market activity.

**Figure 3 Structure for evaluation of current groundwater trading arrangements**



## 3.2 Consultation process

The GHD team consulted with key agency representatives in jurisdictions throughout Australia to ensure each jurisdiction was adequately represented in describing the current status of, and issues associated with, groundwater trading in Australia. Several non-government stakeholders were also consulted. The consultation phase was also critical to identifying circumstances and issues that might be encountered in moving towards a national framework for groundwater trading. The process for gathering this information can be summarised as:

- information search
- development of consultation processes and tools
- documenting available information in the format of a Current Situation and Issues statement for each jurisdiction
- identifying information gaps
- consulting with stakeholders to fill information gaps and ensure a thorough capture of information to represent the current situation and issues for each jurisdiction.

The questionnaire template used in consultation is provided in Appendix A

## 3.3 Current status of groundwater trading in Australia

The current status of groundwater trading in each Australian jurisdiction is described below. Market activity is covered in Section 3.4, and further details on the current status of groundwater trading are provided in Appendix C to Appendix J.

### 3.3.1 Queensland

#### Enabling environment—legislation and policy

Groundwater trading is administered under the *Water Act 2000* by the Department of Environment and Resource Management (DERM). The Act contains general objectives and principles for water management and refers to the content of resource operations plans (ROPs), which may limit the volume of water that may be transferred between different locations or for different purposes.

Tradeable groundwater rights comprise ‘annual entitlements’ accruing to licences, and ‘water allocations’ (which do not yet apply to groundwater). Non-tradeable groundwater rights include ‘nominal entitlements’ on licences, stock and domestic rights, and any groundwater that is not subject to a water resource plan (WRP).

Licences are bundled, but unbundling will occur in individual ROP areas under proposed conversion from water licences to water allocations. For current water licences, the holder must be the owner or occupier of the land, but with tradeable water allocations there will be no ownership restrictions.

Trade-related transactions include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location
- permanent change in location of all or part of an entitlement for licences in the Great Artesian Basin (GAB) only, but this will apply in ROP areas on conversion to water allocations

- trade in water allocations (as they are defined in the NWI) occurs as trade in ‘annual entitlements’ arising from water licences and ‘seasonal water assignments’ under water allocations
- trade in water entitlements interstate can potentially occur
- trade in water allocations interstate can potentially occur.

## Operating environment—prerequisites to a market

Groundwater management units (GMUs) are delineated on the basis of contiguous hydrogeological units, with GMU boundaries defined at the fine scale by cadastral boundaries. Zones are generally delineated on the basis of features including hydrogeological properties and numerical model cells.

Trade can potentially occur between GMUs but is not allowed in practice. Trade can occur between zones subject to plan rules.

Limits to groundwater system entitlements and extraction are set by either numerical modelling of groundwater flows, analytical water balance assessment or acceptance of current entitlement levels (in which case no system extraction limit is specified, and sustainable extraction is achieved through annual ‘announced entitlements’).

Trading typically happens following declaration of a WRP area and a moratorium on new licences. For NWI ‘entitlement’ equivalent trading, a ROP is required and subsequent conversion of licences to tradeable ‘allocations’. Requirements for trading include quantified entitlements and meters for seasonal water assignments. Additionally, conversion to unbundled entitlements (‘tradeable allocation’) is required for NWI-equivalent entitlement trade, except for such trade within the GAB and for change of owner.

## Operation of groundwater trading markets

Applications are determined by DERM, which also undertakes impact assessment. Processing fees range from \$128.30 for temporary trades to \$282.30 for permanent trades.

Total assessment workload is not large as trades are temporary only, apart from those in the GAB. Much of the risk is dealt with by rules established at the planning level, with numerical model output (where available) providing guidance. Rules are used to govern the movement of water rights between zones, and also within zones (e.g. constraints of the coastline).

## Trade facilitation and monitoring

Metering of groundwater extraction is limited and occurs only in WRP areas and some other priority systems, and there is little information publicly available on market activity. However, WRPs are available on the DERM website.

### 3.3.2 New South Wales

## Enabling environment—legislation and policy

Groundwater trading is administered in New South Wales under the *Water Management Act 2000* and the *Water Act 1912* (depending on the groundwater system) by the NSW Office of Water (NOW). The Water Management Act contains general objectives and principles for water management and enables the making of orders for access licence dealing principles, and ‘dealing’ rules in statutory water sharing plans (WSPs). ‘Dealings’ are various types of trade-related transactions.

Under the Water Management Act, tradeable groundwater rights include aquifer access licences (entitlements), and groundwater allocations accruing to licences (including to aquifer access licences and local water utility and other specific-purpose access licences in some cases). Non-tradeable groundwater rights include ‘basic landholder rights’ (domestic and stock, and native title),

supplementary water access licences, and entitlements associated with local water utility and other specific-purpose access licences.

Licences are fully unbundled, being separated from use rights and rights to construct and operate works. They are not attached to specific parcels of land (but an access licence must nominate works through which water is taken before it can be taken). There are no restrictions on licence ownership.

Trade-related transactions enabled include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location
- permanent change in location of all or part of an entitlement can occur locally, between zones, and between some water sources within one WSP
- trade in water allocations (as they are defined in the NWI) occurs as assignment of allocations from one licence account to another
- trade in water entitlements interstate
- trade in water allocations interstate.

## Operating environment—prerequisites to a market

GMUs are generally delineated on hydrogeology (including aquifer geometry and water quality), and zones within these on the basis of features including water quality differences, water level/pressure drawdown, surface water subcatchments, or level/density of development. GMUs are referred to as ‘water sources’ under the *Water Management Act 2000*, or ‘groundwater sources’ in WSPs.

Trade between GMUs is not precluded under the Act, although the current statutory Minister’s Access Licence Dealing Principles prohibit trade between hydrologically disconnected units. Trade can take place between zones subject to plan rules.

Limits to entitlements and extraction are generally based on either numerical modelling of groundwater flows or analytical water balance assessment to estimate long-term annual average recharge.

Full trading arrangements apply following implementation of a WSP with associated trading rules. Where there is no WSP, a simpler trading arrangement can be triggered by demand and implemented under the *Water Act 1912* and associated policy. Requirements for trading include volumetric entitlements for all trades, and meters on bores for temporary or allocation trades.

## Operation of groundwater trading markets

NOW determines applications, and also undertakes impact assessment (which can be an additional cost to the applicant for ‘complex’ assessments). Processing times can range from 1–5 days for temporary trades, to 2–12 weeks for permanent trades, with processing times influenced by the water volume involved, level of assessment required, and season or time of the year. Fees range from:

- for temporary trades, \$50 plus \$0.50/ML traded, up to a maximum of \$150
- for permanent trades, \$370.69 plus \$17.06/ML greater than 20 ML for more complex assessments where site visits are required.

Assessment is undertaken by hydrogeologists using hand calculations, simple local drawdown models and more complex analytical (e.g. ‘Hotspots’) models. Statewide criteria are available on acceptable drawdown impacts, but groundwater sources in WSPs have specific distance and other bore-related rules (such as casing depth rules) designed to protect groundwater-dependent ecosystems (GDEs) and other water users. These rules are specified in WSPs and become mandatory conditions on access licences and work/use approvals. Extraction limits can be applied to individual bores or groups of bores as an impact mitigation option and also to negate further

assessment of trades to these bores. Assessment can also be reduced by use of trading zones, while impact mitigation options also include distance conditions.

## Trade facilitation and monitoring

About 35 per cent of 10 000 high yield bores are currently metered. Groundwater extraction (excluding domestic and stock use) is metered in most major groundwater systems. Information available on the NOW website includes WSPs, products and services, entitlement volumes per GMU, annual trade activity per GMU and processing efficiency statistics. Professional intermediaries are active in the major systems, including the Namoi, Gwydir, Murrumbidgee and Murray.

### 3.3.3 Australian Capital Territory

#### Enabling environment—legislation and policy

Groundwater trading in the Australian Capital Territory is administered under the *Water Resources Act 2007* by the Environment Protection Authority (EPA) within the Department of the Environment, Climate Change, Energy and Water (DECCEW). The Act enables preparation and approval of environmental flow guidelines (EFG) to meet aquatic ecosystem needs, and which must consider environmental, economic and social impacts, and requires that transfers of water access entitlements (WAEs) be consistent with conditions of the WAE and the territory plan.

Tradeable groundwater rights comprise WAEs and tradeable water allocations incorporated in a 'licence to take water'. Non-tradeable groundwater rights include stock and domestic rights, 'surviving allocations' from the former *Water Resources Act 1998*, and non-tradeable WAEs arising from conversion of surviving allocations.

Licences are partially unbundled, being separated from land and use rights. To take and use water, a 'licence to take water' is required. There are no restrictions on licence ownership.

Trade-related transactions include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location
- permanent change in location of all or part of an entitlement
- temporary change in location of all or part of an entitlement
- trade in water allocations (as they are defined in the NWI) occurs only as temporary transfer for the remainder of the water year (as water 'allocations' have not been applied to groundwater)
- trade in water entitlements interstate can potentially occur, but is not yet in practice
- trade in water allocations interstate can potentially only occur as temporary transfer for the remainder of the water year (as water 'allocations' have not been applied to groundwater), but is not yet in practice.

#### Operating environment—prerequisites to a market

GMUs are mainly fractured rock and are delineated on the basis of surface-flow catchment boundaries. There are no zones for groundwater management within GMUs.

Trade can potentially occur between GMUs but does not happen in practice.

Entitlements and extraction are limited to 10 per cent of estimated recharge in each GMU, as specified in the ACT Environmental Flow Guidelines.

Trading was made possible once the *Water Resources Act 2007* commenced, and for individuals trading can occur once a WAE has been purchased from DECCEW.

## Operation of groundwater trading markets

DECCEW determines applications, and is also responsible for undertaking impact assessment.

There have been insufficient trades in the ACT to warrant, or enable the development of, robust assessment processes. In addition, the risk of significant impacts from trade are small as the total entitlement level for each GMU is only 10 per cent of long-term average annual recharge.

## Trade facilitation and monitoring

The DECCEW website provides public access to information on products and services.

### 3.3.4 Victoria

#### Enabling environment—legislation and policy

Groundwater trading in Victoria is administered under the *Water Act 1989* by the Department of Sustainability and Environment (DSE) and rural water corporations (RWCs). The Act refers to general water management purposes and enables policies and guidelines that RWCs must comply with in assessing applications. This is expressed as state policy for managing take and use licences, and as local management rules. Additionally, local trading rules can be specified in statutory management plans prepared for GMUs that are gazetted as water supply protection areas (WSPAs).

Tradeable groundwater rights comprise a Section 51 'take and use licences' and Section 36 bulk entitlements held by water authorities, while non-tradeable groundwater rights include stock and domestic rights.

Licences are bundled and linked to a property, but held by a person (licence ownership does not automatically transfer with land). Also, to construct a bore a person must obtain a Section 67 bore construction licence.

Trade-related transactions include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location
- permanent change in location of all or part of an entitlement (permanent transfer)
- Temporary change in location of all or part of an entitlement (temporary transfer)
- trade in water allocations (as they are defined in the NWI) occurs only as temporary transfer for the remainder of the water year
- trade in water entitlements interstate can potentially occur, but is not yet in practice for groundwater
- trade in water allocations interstate can potentially only occur as temporary transfer for the remainder of the water year (as water 'allocations' have not been applied to groundwater), but is not yet in practice for groundwater.

#### Operating environment—prerequisites to a market

GMUs have historically been delineated by drawing convenient boundaries around areas of high demand in hydrogeological units. This is changing, with greater consideration being given to using hydrogeological unit boundaries. Zones are delineated largely on the basis of demand and/or administrative boundaries.

Trade cannot occur between GMUs, but can occur between zones subject to local rules.

Permissible consumptive volumes (PCVs) define the limit on issuing entitlements, and are generally published with the basis stated. In many cases the basis is the level of entitlements in place when the PCV is gazetted. Water management plans can also define entitlement limits. Extraction limits are generally not defined.

Trading is typically triggered by stopping issuing new licences through declaration of a PCV or development of a plan. If a WSPA is declared, no permanent trading can take place until a plan is made. Requirements for trading include volumetric licences and meters for temporary trade.

## Operation of groundwater trading markets

RWCs determine applications (apart from those for town supply, which are determined by DSE), but impact assessment is undertaken by the applicant or a representative. Assessment and processing times can range up to 12 weeks for temporary trades, and longer for permanent trades, in accordance with the level of assessment required. Fees range from:

- for temporary trades, \$235 to several thousand dollars depending on volume and other factors
- for permanent trades, \$775 to several thousand dollars depending on volume and other factors

Assessment is undertaken by the proponent's representatives using a range of methods, including simple drawdown models. RWCs have criteria available on acceptable impacts, with some groundwater sources having specific drawdown criteria, distance conditions and GDE exclusion zones to be adhered to. Potentially affected bores may have to be identified by consultation with neighbouring landholders. Assessment is commensurate with the level of risk (as gauged by distance and volume), and impact mitigation options include negotiation and compensation to affected parties, and licence conditions such as linking extraction to monitoring.

## Trade facilitation and monitoring

Metering of groundwater extraction is comprehensive, and the DSE and RWC websites provide information on issues, products and services and access to groundwater plans. Market activity information is provided in RWC annual reports. There is little activity by professional intermediaries, apart from local real estate agents.

### 3.3.5 Tasmania

#### Enabling environment—legislation and policy

Groundwater trading in Tasmania is administered under the *Water Management Act 1999* by the Department of Primary Industries, Parks, Water and Environment (DPIPWE). The Act includes general objectives for water management (s. 6), and enables rules in statutory plans. Guiding Principles for Water Trading (DPIWE, 2004) also set out how the department interprets and applies the Act in assessing applications.

Tradeable groundwater rights comprise licences and water allocations (equivalent to entitlement) on licences. A water licence is a right to take water from a specified water resource. Under the *Water Management Act 1999* (sections 56, 83, 84), conditions on a water licence may relate to the area or location that the water is able to be taken from, areas the water is to be used on, and the specific purpose for which the water may be used. A licence is held by a person (that is, licence ownership does not automatically transfer with land transfer), and there are no statutory limitations to ownership but in practice the licence holder has been required to occupy land and use the water. Non-tradeable rights are not specified but it is noted that any person can take groundwater without a licence, except for types and purposes specified in declared areas or in statutory plans.

As at May 2010, no groundwater licences were required anywhere in Tasmania.

Trade-related transactions include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location
- permanent change in location of all or part of an entitlement
- temporary change in location of all or part of an entitlement
- trade in water allocations (as they are defined in the NWI) could be effected by fixed-period transfer for the remainder of the water year.

## Operating environment—prerequisites to a market

No GMUs, zones or subsequent limits to entitlements and extraction have yet been established, and the ability to trade between GMUs and zones is yet to be determined.

Trading can occur once a plan has commenced in a particular area, and licences to take groundwater have been issued.

## Operation of groundwater trading markets

DPIPWE determines applications and also undertakes impact assessment. Timeframes and fees for groundwater application processing are not yet available.

Assessment methods are not yet determined, but will range from simple desktop analyses to detailed modelling, depending on risk.

## Trade facilitation and monitoring

No information is available at present.

### 3.3.6 South Australia

## Enabling environment—legislation and policy

Groundwater trading in South Australia is administered under the *Natural Resources Management Act 2004* and the *Groundwater (Border Agreement) Act 1985* by the Department for Water. The Natural Resources Management Act requires the preparation of water allocation plans (WAPs) with trade provisions and enables the preparation of regulations specific to trade.

Tradeable groundwater rights comprise licences and water access entitlements on licences, while non-tradeable rights include stock and domestic rights.

Licences are bundled with allocations implicitly linked as an assigned yield from the underlying entitlement. There are no stated limitations to ownership.

Trade-related transactions include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location
- permanent change in location of all or part of an entitlement (permanent transfer)
- temporary change in location of all or part of an entitlement (temporary transfer)
- trade in water allocations (as they are defined in the NWI), effectively carried out through temporary reassignment of entitlement
- trade in water entitlements interstate can potentially occur, but is not yet in practice for groundwater
- trade in water allocations interstate can potentially occur as temporary reassignment of entitlement for the remainder of the water year (as water 'allocations' have not been applied to groundwater), but is not yet in practice for groundwater.

## Operating environment—prerequisites to a market

GMUs and zones are delineated based on a range of considerations, including administrative boundaries (e.g. south-east region), hydrogeology and surface catchments.

Trade can occur between some adjoining GMUs and between zones in accordance with WAP rules.

The processes used to determine limits to entitlements and extraction are generally documented in reports associated with preparation of WAPs.

Prescription of a water source triggers establishment of a WAP and enables the issue of a licence, which is private property and can therefore be traded. Metering is required for volumetric trade.

## Operation of groundwater trading markets

The Department for Water determines applications and also undertakes impact assessment. Service commitment timeframes are 10–20 days for temporary trades and 20–30 days for permanent trades, depending on processing requirements (for temporary trades) and assessment requirements (for permanent trades). Fees for all trade applications are \$583 (plus \$154 for assessment), or \$361 if there is no change in location.

Well documented and enforced trading rules, including use of management zones and exclusion zones, negate much individual assessment. Where required, assessment is undertaken by hydrogeologists, generally using hand calculations for drawdown analysis with the Theis equation. Drawdown analysis is applied in some areas using the '16 km<sup>2</sup> test' (or 2.25 km radius) and pre-determined impact thresholds. Impact mitigation options include consideration of reduced volume of trade that would not result in unacceptable impacts.

## Trade facilitation and monitoring

Metering of groundwater extraction is limited, and only takes place in prescribed areas. Department and NRM Board websites provide access to plans and information on products and services. A website associated with the licence register provides annual statistics on trading activity for each WSP area.

### 3.3.7 Western Australia

## Enabling environment—legislation and policy

Groundwater trading in Western Australia is administered under the *Rights in Water and Irrigation Act 1914* by the Department of Water (DoW). The Act enables plans to include 'matters that are to guide the management by the Minister ...' of water resources, including for approval of transfers of licences and water entitlements, and of agreements.

Tradeable groundwater rights comprise 5C 'take' licences (including the unused portions of entitlements, which may be traded subject to favourable assessment of the proposed usage), while non-tradeable rights include domestic and stock rights, other 'exempt' rights, town supply licences in some circumstances, environmental water and return flows.

Licences are bundled and linked to a property, but are held by a person (licence ownership does not automatically transfer with land). The holder must be the owner or occupier of land to which the licence relates, or be authorised under agreement to use the land, or be a public utility and be authorised to undertake a proposed water-using activity.

Trade-related transactions include:

- change in ownership only of entitlement, permanently or for a fixed period, without change in location

- permanent change in location of all or part of an entitlement (as a ‘transfer of licences and entitlements’)
- temporary change in location of all or part of an entitlement (as ‘agreements with licensees to take water’)
- trade in water allocations (as they are defined in the NWI), which could be carried out under ‘agreement’ (above).

## Operating environment—prerequisites to a market

GMUs are mainly contiguous hydrogeological units, while zones are also generally determined on the basis of hydrogeology.

Trades between GMUs (aquifers), and between zones, are permitted only within sub-areas and where demand in the receiving GMU or zone will remain below sustainable yield. However, such trades are not occurring in practice.

The methodologies for setting limits to entitlements and extraction are documented by DoW and made public along with ‘allocation decisions’.

Trading generally only occurs where a plan is in place, and if no further licences are being granted, or if granting new licences would cause unacceptable impacts. Further requirements for trading include the establishment of sustainable allocation limits, total GMU entitlements being ‘within’ these limits, and entitlements being volumetrically quantified.

## Operation of groundwater trading markets

DoW’s determination of applications is guided by *Operational policy 5.13 Water entitlement transactions for Western Australia*. Impact assessment is undertaken by the applicant or a representative. DoW reviews assessments and can request more information/studies, including an ‘operating plan’ to mitigate impacts. No information is available on typical processing timeframes, but these are understood to be influenced by complexity of assessment, information requirements and assessment requirements (including that by other agencies such as EPA). The fee for all trade applications is \$200.

Applicants submit a hydrogeological assessment report, assessing impacts of the proposed abstraction on the groundwater resource, existing users, GDEs (including surface flows), and water quality. The level of assessment required is determined by DoW and the report prepared in accordance with DoW policy on hydrogeological reporting (*Operational policy no. 5.12 – Hydrogeological reporting associated with a groundwater well licence*). Applicants are required to assess impacts on current and future water use, but not on broader socioeconomic impacts. There is little difference between assessments for temporary and permanent trades. Statewide policies or plan provisions provide some guidance on acceptable impacts. Impacts can potentially be mitigated through licence conditions, including requirements for approved ‘operating strategies’. Trading rules do not significantly reduce the level of assessment required.

## Trade facilitation and monitoring

Metering of groundwater extraction is very limited, but expansion is proposed. Information on plans, products and services is available on the DoW website, but there is no publicly available information on market activity. Activity by intermediaries is non-existent or minor.

### 3.3.8 Northern Territory

## Enabling environment—legislation and policy

Groundwater trading in the Northern Territory is administered under the *Water Act 1992* by the Controller of Water Resources in the Department of Natural Resources, Environment, The Arts and

Sport (NRETAS). There are no specific heads of power in the Act relating to trading of groundwater, except in relation to the transfer of a groundwater extraction licence with a property transfer (s. 92). It is within the provisions relating to water allocation plans that a water trading regime is inferred. S. 22B(5) of the Act specifies that 'a water allocation plan is to ensure in the water control district that ... the right to take or use water under a licence ... is able to be traded (in part or in full)'. In practice, no water trading has yet occurred in the territory, and the only place in which it has been practically enabled is the Katherine-Tindall Limestone Aquifer.

The Act has no specific statutory provision for creating policies, rules and guidelines, etc. for trading that have statutory force, apart from statutory water allocation plans (WAPs). The Controller has flexibility to create and apply policies and guidelines as they see fit.

Tradeable groundwater rights comprise s.60 extraction licences, while non-tradeable rights include stock and domestic rights, other non-licensed extraction and 'unused' portions of entitlements (as in the Katherine-Tindall Water Allocation Plan).

Licences are bundled and linked to a property, but are held by a person (licence ownership does not automatically transfer with land). The holder must be the owner or legal occupier of land to which the licence relates.

Trade-related transactions include:

- change in ownership only of a licence, permanently or for a fixed period, without change in location
- change in location of all or part of a licence ('permanent trade')
- change in location of all or part announced allocations under a licence by transfer from one licence to another ('temporary trade').

Trading is achieved by the amendment of existing licences, and/or their surrender and cancellation, and granting of new licences using existing provisions of the Act (s. 60 granting, ss. 93 & 94 amendment and surrender).

## **Operating environment—prerequisites to a market**

The water sources in the territory are generally constructed around areas of higher demand and where possible, they align with hydrogeological units. The water source may be further broken down into 'zones' for entitlement or trade management. In the Katherine plan, zones have been established based on proximity to connected rivers.

Trades between GMUs have not occurred but are not precluded by legislation. Trades between zones are allowed for within limits (as in the Katherine plan), but are not yet happening.

Territory Integrated Natural Resource Management (INRM) policy (subject to the provisions of a WAP) allows for:

- in the north, 20 per cent of recharge allowed for extraction
- in the south, use of 80 per cent of storage over 100 years.

WAP extraction limits are more complex and tailored to specific hydrogeological conditions.

In practice, trade is enabled by an approved WAP. Further requirements include an entitlement or extraction limit applying to the WAP, volumetric entitlements and history of use.

## **Operation of groundwater trading markets**

NRETAS is responsible for determining applications and undertaking impact assessments, and may require the applicant to carry out studies or provide further information.

Basic requirements are in place for assessment but there have been insufficient trades in the Northern Territory to warrant, and under which to test and develop, detailed assessment processes.

## Trade facilitation and monitoring

Metering of groundwater extraction is very limited. The NRETAS website provides access to plans, products and services.

### 3.3.9 Australian Government

There are a number of ways in which Australian Government authorities may regulate, influence and assist, or participate in groundwater trading and markets. The primary Acts governing this interaction are:

- *Water Act 2007*
- *National Water Commission Act 2004*
- *Trade Practices Act 1974*

These Acts, their administering authorities, and functions that may interact with groundwater trading and markets are discussed below. The role of the Australian Department of Sustainability, Environment, Water, Population and Communities is also discussed in relation to the development of the National Water Market System.

#### **Water Act 2007**

Under the Commonwealth Water Act, for Murray–Darling Basin states only:

- the Murray–Darling Basin Authority (MDBA) is to prepare, and review every 10 years, a Basin Plan, which:
  - specifies limits ('sustainable diversion limits') on the quantity of water that may be taken from the water resources of each water resource plan area. As such, it establishes the groundwater market boundaries in terms of long-term average annual resource availability and geographic extent. It could be possible for a single market to encompass more than one water resource plan area, depending on the hydrologic connectivity of the areas.
  - identifies the risks to the condition, or continued availability, of the basin water resources. In this sense, the plan should provide critical information to groundwater market participants regarding uncertainties associated with the market boundaries, particularly resource availability.
  - sets objectives and outcomes for trading in water access rights
  - sets rules for the trading or transfer of tradeable water rights in relation to Basin water resources, including interstate transfers
  - establishes requirements for accreditation of state water resource plans including in relation to the matters above.
- MDBA may maintain a basin water information service. This should provide critical market information for basin groundwater resources.
- the National Water Commission audits the effectiveness of the implementation of the Basin Plan and the state water resource plans.

For all states and territories, the Act:

- establishes the office of Commonwealth Environmental Water Holder (CEWH) within the Department of Sustainability, Environment, Water, Population and Communities, which has the following functions to protect or restore the environmental assets of the basin, and other areas outside the basin, so as to give effect to relevant international agreements:
  - purchasing, disposing of, and otherwise dealing in water and water access rights
  - taking or using water from environmental water holdings, or entering into contracts to do so
  - various other administrative matters, including administering the Environmental Water Holdings Special Account, and reporting
- gives the Bureau of Meteorology various functions in relation to water information, including:

- collecting, interpreting, disseminating, reporting, and giving advice; water information includes raw or value-added information or metadata on the ‘... availability, distribution, quantity, quality, use, trading or cost of water; or ... water access rights
- compiling and maintaining the National Water Account, and issuing National Water Information Standards
- undertaking studies and providing advice on water information and water resources more generally.
- charges the Australian Competition and Consumer Commission (ACCC) with providing advice on market rules and other things.

#### **National Water Commission Act 2004**

Under the *National Water Commission Act 2004*, among other functions, the Commission is charged with assisting ‘with the implementation of the NWI, and to undertake activities that promote the objectives and outcomes of the NWI’. It undertakes biennial assessments to monitor the progress of jurisdictional implementation of the NWI. The COMMISSION has invested in a wide range of schemes, including the National Groundwater Action Program. This funds various technical and policy projects aimed at better informing the implementation of sustainable groundwater management across the nation. The centrepiece of the action plan is the National Groundwater Assessment Initiative, which funds various projects relevant to groundwater trading such as harmonising groundwater terminology across the country, formulating better approaches to estimating sustainable yields (extraction limits), and characterising and managing connected surface water and groundwater systems.

#### **The Competition and Consumer Act 2010 (commenced 1 January 2011)**

The *Competition and Consumer Act 2010* is a reconstruction and refinement of the *Trade Practices Act 1974* and continues to be administered by the ACCC. In combination with state and territory fair trading arrangements, the Act provides a set of general protections that apply universally, where not explicit.

The primary objective of the Act remains to protect consumers in their business dealings. The Act is generally reactive, relying on an individual (or entity) to lodge a complaint with the Commission when it considers that rules have been broken, and to apply under the Act to have this situation made good. There is scope to apply the provisions of the Act to water market intermediaries and individuals involved in water market transactions.

#### **Australian Department of Sustainability, Environment, Water, Population and Communities**

The Australian Department of Sustainability, Environment, Water, Population and Communities ‘is working with state and territory governments to develop the National Water Market System to improve the inter-operation of water registers and transactions and the availability of market information ...’.

The objectives of the National Water Market System are to ensure:

- up-to-date information about the water market is easily accessible and readily available, increasing market transparency and allowing for more informed water trading decisions
- that each jurisdiction has a high-performing water register that accurately records water rights and supports water accounting and resource management
- transaction times for trades and other dealings are not limited by water register processes or functions.

The system, to include a website, will ensure high-performance state and territory registers, and data transfer between these. As a first step, the website provides information about:

- what makes up the Australian water market
- water trading rules and procedures

- water management
- water allocation announcements
- government support and water programs
- state and territory water registers.

## 3.4 Groundwater market development

Overall, current groundwater market activity is relatively low. The statistics in Table 3 are from the 2008–2009 water year. They are sourced from the Australian Water Markets Report 2008–2009, except for New South Wales, where data came from the NOW website, and Victoria, where data was obtained from various sources, including the DSE website and rural water authority reports. While groundwater trading has been operating for several years in a number of areas around the nation, it is on a much smaller scale than surface water trading and, in general, is still in its infancy. For the 2008–09 water year, approximately 308 GL of groundwater access (both entitlements and allocations) were traded under 1284 transactions (Table 3), compared with about 3650 GL and 30 766 transactions for surface water (adapted from NWC 2009).

Because of interjurisdictional differences in definitions and reporting, it is likely that some trades that are changes in ownership but not location may be included in the New South Wales statistics, but are unlikely to be included in those for the other jurisdictions. Thus the numbers shown in this report should be taken as indicative only.

**Table 3 Summary of state trading activity for 2008–2009**

|                                   | Number | Volume (ML) |
|-----------------------------------|--------|-------------|
| <b>NSW</b>                        |        |             |
| Licence/entitlement transactions  | 187    | 87 628      |
| Allocation transactions           | 673    | 192 861     |
| <b>Vic</b>                        |        |             |
| Permanent transactions            | 8      | 1 437       |
| Temporary transactions            | 182    | 15 112      |
| <b>Qld</b>                        |        |             |
| Seasonal water assignments        | 73     | 5 069       |
| <b>SA</b>                         |        |             |
| Licence transactions              | 49     | 3 630       |
| Licence transactions (area-based) | 48     | N/A         |
| <b>WA</b>                         |        |             |
| Licence transfers                 | 64     | 2 282       |
| <b>Totals</b>                     | 1 284  | 308 019     |

There was no trading activity reported for the Northern Territory and Tasmania, and only two 'change of ownership' trades for the Australian Capital Territory.

Approximately 55 per cent by number, and 75 per cent by volume, of these transactions were in three areas, the Lower Murrumbidgee, Lower Murray and Lower Lachlan aquifers, all large alluvial aquifers with relatively large licence numbers and volumes, high water demand and low availability.

Further detail on the levels of groundwater licensing, extraction and trading in groundwater systems and jurisdictions are shown in the sample data in Table 4.

Sample data is presented for selected jurisdictions as number of items (licences or trades) per groundwater system, and as annual volumes in megalitres per groundwater system. All water management areas for the ACT are represented, while for other jurisdictions the data only represents the groundwater systems that are subject to the higher levels of planning, being:

- for Queensland, those subject to water resource plans and/or water allocation documents
- for New South Wales, those subject to water sharing plans
- for Victoria, those declared as water supply protection areas
- for South Australia, those declared as prescribed areas, and subject to water allocation plans.

**Table 4 Groundwater system licensing, usage and trading statistics for 2008–2009**

|                                                                                                                                               | Qld   | NSW     | Vic                                         | SA      | ACT |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|---------------------------------------------|---------|-----|
| Groundwater systems evaluated                                                                                                                 | 8     | 48      | 26                                          | 14      | 14  |
| Systems represented for licence data                                                                                                          | 0     | 48      | 25                                          | 14      | 14  |
| Systems represented for allocation (temporary) trades                                                                                         | 8     | 48      | 11                                          | 11      | 14  |
| Systems represented for entitlement (permanent) trades                                                                                        | 0     | 48      | 4                                           | 10      | 14  |
| The statistics below are determined on a 'per groundwater system' basis for a recent water year (2008–09 where possible), with volumes in ML: |       |         |                                             |         |     |
| Min no. of licences                                                                                                                           | n/a   | 0       | 10                                          | n/a     | 0   |
| Max no. of licences                                                                                                                           | n/a   | 324     | 1 445                                       | n/a     | 22  |
| Median no. of licences                                                                                                                        | n/a   | 29      | 108                                         | n/a     | 2   |
| Min entitlement volume                                                                                                                        | n/a   | 0       | 2 939                                       | 2 023   | 0   |
| Max entitlement volume                                                                                                                        | n/a   | 269 987 | 241 033                                     | 755 035 | 684 |
| Median entitlement volume                                                                                                                     | n/a   | 2 765   | 13 837                                      | 85 778  | 16  |
| Min usage volume                                                                                                                              | n/a   | 0       | 24                                          | n/a     | n/a |
| Max usage volume                                                                                                                              | n/a   | 287 712 | 57 154                                      | n/a     | n/a |
| Median usage volume                                                                                                                           | n/a   | 2 141   | 5 051                                       | n/a     | n/a |
| Min no. of allocation trades                                                                                                                  | 0     | 0       | 0                                           | 1       | 0   |
| Max no. of allocation trades                                                                                                                  | 36    | 291     | 53                                          | 39      | 0   |
| Median no. of allocation trades                                                                                                               | 4     | 5       | 7                                           | 4       | 0   |
| Min allocation trade volume                                                                                                                   | 0     | 0       | 0                                           | 0       | 0   |
| Max allocation trade volume                                                                                                                   | 1 530 | 101 098 | 4 031                                       | 2 153   | 0   |
| Median allocation trade volume                                                                                                                | 535   | 1,274   | 880                                         | 161     | 0   |
| Min no. of entitlement trades                                                                                                                 | 0     | 0       | 0                                           | 1       | 0   |
| Max no. of entitlement trades                                                                                                                 | 0     | 42      | 4                                           | 13      | 0   |
| Median no. of entitlement trades                                                                                                              | 0     | 0       | -----<br>-----<br>-----<br>-----<br>--<br>2 | 5       | 0   |
| Min entitlement trade volume                                                                                                                  | 0     | 0       | 0                                           | 8       | 0   |
| Max entitlement trade volume                                                                                                                  | 0     | 21 840  | 600                                         | 1 643   | 0   |
| Median entitlement trade volume                                                                                                               | 0     | 0       | 306                                         | 100     | 0   |

Notes:

- 'Change of ownership' trades are included for NSW, but not for other jurisdictions
- Entitlement volumes for South Australia include volumes to arise from volumetric conversion in the south-east region, but do not include potential volumes to be allocated for plantation forestry
- Data was sourced largely from the 2009 Australian Water Markets report, with additional entitlement data from recent South Australia WAPs, NSW trading data from the NSW registers, and Victoria data from various sources including the DSE website and rural water authority reports.

## 3.5 Discussion and analysis

### 3.5.1 Governance and administrative framework

#### 1 Statutory enablement of trading

Legislation in all jurisdictions enables groundwater trading, in some cases setting out products and transactions in great detail, in others minimally so. Beyond this, some legislation provides general guidance on objectives and how markets are to be established and operated, and specific principles or requirements for deciding applications to trade (based on consideration of environmental and third-party impacts). In most cases, matters for consideration required by legislation when processing new licences also apply to trade transactions. In general, details are very limited which has the advantage of giving jurisdictions considerable flexibility, but at the expense of reduced certainty for market participants.

#### 2 Capacity to make market establishment and operation guidelines and rules

Generally there is capacity in the relevant legislation to establish policies and/or rules that can guide establishment and operation of trading regimes, typically through plans or policies. This provides the jurisdictions with capacity to provide greater structure to market establishment and operation processes, certainty to the public regarding how markets will be operated, and the mechanisms for changing market boundaries and parameters over time.

Trading policies and rules can be either statutory or non-statutory. Statutory policies and rules are created under specific provisions of the legislation that set out what their content will be and the effect they will have, and are generally given effect via ministerial orders or form part of statutory water allocation plans. They are binding in that agencies administering trading are obliged to conform to them, and decisions taken based on them either cannot be appealed on merit grounds, or are likely to be upheld by the relevant appeals body. The legislation often sets out the process for developing them, including consultation. Examples are the state Access Licence Dealing Principles and access licence dealing rules in water sharing plans in New South Wales, rules in water allocation plans in South Australia and those in Queensland water resource plans.

Non-statutory policies and rules are typically statements of how the agency intends to interpret and apply the legislation in administering water entitlements. Examples include the Western Australian state water management policies and water management plans, and local management rules in Victoria. Their force relies on continuing government commitment to conform to them, which may change over time. Where they are developed through substantial public processes and signed off by the minister, they are more likely to be adhered to by agency staff. However, it is easier for governments to change administrative policies without having to resort to statutorily defined processes or parliament. This means entitlements and environmental provisions are at greater risk of being compromised in fully allocated systems to cater for new high-profile developments, particularly when water markets are thin or non-existent.

Agency decisions based on non-statutory policies and plans can generally be appealed on merit grounds under the principles set out in the legislation. However, robustly developed and publicly available policies and rules are likely to be given weight by judges as they

demonstrate that the agency has acted reasonably in interpreting and applying the legislation.

In summary, statutory policies and rules give more certainty and thus confidence to markets and are thus preferred.

### **3 Responsibility for groundwater markets**

In most cases responsibility for groundwater trading lies in each jurisdiction with the agency responsible for water management. The exceptions are in Victoria, where state policy for groundwater trading sits with DSE, but almost all plan development and transaction management is delegated to rural water authorities; and in South Australia where regional NRM boards are responsible for developing statutory water allocation plans that include trading rules. Where development of water system specific trading rules lie with regional authorities, State-wide policies and guidelines become increasingly important for protecting environmental and other third party interests, and ensuring market and process integrity.

## **3.5.2 Products**

### **4 Water entitlements and characteristics**

The NWI outlines characteristics for water access entitlements agreed to by signatories (NWI cl. 28–32). These include entitlements being:

- unbundled from land and from water use approvals
- defined as a share of a consumptive pool
- perpetual
- mortgageable in a similar way to land
- able to be cancelled only where the holder breaches their responsibilities and obligations.

Water rights have historically been linked to land rights, and separation from land has been sought under both COAG water reforms and the NWI (cl. 28 – ‘The consumptive use of water will require a water access entitlement, separate from land’).

Further ‘unbundling’ can occur, with separation of rights for water usage and the works required for water extraction. Tradeable delivery rights have also been issued by some infrastructure providers but generally not with groundwater. Unbundling creates a more open market, with a greater potential range of participants, more clearly defined assets that enable discrete financing, and more efficient transaction processes.

In practice there are variations on these arrangements. Some states, for example, have arrangements that are close to the NWI model but do not meet all of the specifications. NSW has progressed to a fully unbundled situation in many areas and is progressively unbundling the remainder, and Queensland is shortly to unbundle in a few areas. However, unbundling is not currently happening elsewhere, with legislation in many jurisdictions often not allowing for full unbundling of groundwater entitlements. In some jurisdictions, groundwater ‘rights’ have not been established in any form in some areas (unproclaimed or undeclared areas), and extraction is allowed outside any firm entitlement framework, without volumetric limits on the rate of extraction or related compliance management (such as metering). Where rights are established, groundwater entitlements are generally not unbundled, and are expressed as a fixed volume (in some cases an area) rather than a share, have a fixed term rather than being perpetual, are not mortgageable in the way land is, and in some cases can be cancelled or reduced for reasons other than breach of conditions (e.g. for non-use of water in Western Australia).

In some cases jurisdictions are proceeding with conversion from irrigated area-based to volumetric licences, and/or reducing licensed entitlement volumes (e.g. South Australia and Western Australia), and may see these as essential steps to take before achieving further consistency with NWI-preferred characteristics.

With bundled licences, the linkage to land prevents non-water users from owning licences, thereby restricting the number and diversity of market participants. It also makes transaction processing more costly and time consuming as the impacts of how the water is used on the land must be assessed with the impacts of extraction from a particular location. The administrative costs of full specification and unbundling of rights is significant, and in many cases will require statutory change.

It may be that some jurisdictions have made the decision that the cost of conversion to, and management of, water access entitlements for groundwater that have all the preferred NWI characteristics is generally greater than the benefits of doing so. This is likely to be true in many situations, but is worthy of further analysis. The fact that the NWI-preferred characteristics result in products that are much more amenable to effective market operation must be considered. See Section 4.4.2 for further discussion.

## **5 Maintaining a location for unbundled entitlements**

A matter raised during consultation in Queensland, whose government is currently finalising arrangements for unbundling groundwater entitlements, is the extent that the entitlement remains tied to a location.

Practice with unbundling entitlements on Queensland rivers has been to associate the entitlement not with a specific point on the river, or parcel of land, but with a zone of the river. In such a zone the entitlement can be used anywhere without requiring agency consent for changing location. There are simply administrative arrangements with the resource operations licence holder (e.g. SunWater, South East Queensland Water, Fitzroy River Water) to ensure the appropriate meter for water extraction is linked, and to confirm contractual arrangements such as orders, deliveries and payments. These river zones were established on the basis that there is minimal risk in moving entitlements around within them.

Applying this to groundwater, however, is less practicable. Any movement of groundwater extraction could have local impacts resulting from the cone of drawdown. Where groundwater entitlements are linked solely to a zone, as is done with surface water, there is a significant risk of local impacts if additional controls are not introduced.

Two options to manage trade-generated drawdown risks come to mind. The first is to adopt the zonal model and also put in place an alternative local impact management regime (e.g. local extraction limits on bore approvals). The second is to include in the entitlement definition of location points where water can be taken, and also to require approval for change in such points. This is the approach taken in New South Wales, where entitlement trades can take place within a system or zone but a further process of 'nominating' a particular work at a particular location must be undertaken and assessed for the extraction to be enabled. Further analysis is needed of these and other potential options.

## **6 Water entitlements and seasonal allocations**

All jurisdictions allow for some form of issued groundwater entitlement. However, several do not allow for water allocations<sup>3</sup> (e.g. the ACT, Tasmania and Western Australia). The practice of having variable annual water allocations allows for active management of the groundwater resource, depending on estimated water availability and/or groundwater level behaviour. Where groundwater allocations are specified in an account that is separate from the entitlement (e.g. in New South Wales), they provide a means for 'temporary' transfer of water rights without having to vary the entitlement amount. Without such allocations, 'temporary' trading is effected by altering the entitlements themselves for a fixed period, which can be a much more cumbersome process.

## **7 Inconsistent terminology**

Definitions and terminology vary widely around Australia, limiting the ability to accurately compare and contrast between jurisdictions, and creating confusion when trading across

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<sup>3</sup> Allocations are defined by the NWI. Many jurisdictions have 'allocations' that are actually water access entitlements according to the NWI definition.

jurisdictional boundaries. Only the ACT has adopted nationally agreed terminology (NWI Schedule B (ii)—water access entitlements and water allocations) but, as described above, it has not implemented variable annual or seasonal water allocations for groundwater.

## **8 Restrictions on ownership of water rights**

The only significant restrictions on ownership of groundwater entitlements are the requirement to be a landholder (in most jurisdictions), in some cases that the water be reasonably capable of being used on the land, and in Western Australia the financial capacity of the proponent to undertake the proposed development. Also in Western Australia, transaction applications that will result in a single licensee gaining access to more than 50 per cent of the total water availability in a water system are scrutinised to minimise speculation and market manipulation.

This issue is linked to unbundling, as discussed, with the greater level of unbundling allowing for fewer restrictions on ownership, which has implications for broader market participation and the efficiency of financing.

## **9 Security interests (mortgages, etc.)**

Entitlements are effectively contingent assets (as a claim over possible future water allocations) and in many instances, where the resource is constrained and access limited, have a large capital value. As such they should be able to be used as a secured asset for debt financing of a business (including the purchase of a licence itself). If, for example, a holder of an entitlement wishes to use the value of that entitlement as security for a mortgage, or get a mortgage to help them buy the entitlement in the first place, the mortgagee would look to ensure it could access that security should the mortgagor default. Approaches currently in place include (in increasing benefit to the security interest holder):

- do nothing – i.e. it is up to the mortgagee to protect its interest through private contracts
- administrative arrangements by the consent agency such as:
  - requirement that the applicant for a trade provide a statutory declaration that any interested parties in the entitlement have been notified and/or provided approval
  - the consent agency notifying parties who have registered their interest with the agency
  - the consent agency requiring approval of parties who have registered their interest prior to transaction processing
- real property-style statutory arrangements for security interests, including a requirement for approval from registered security interests, the ability for registered security interests to ‘enter into possession’ should the borrower default, prioritisation of registered interests, and right of such interests over any other interests.

The more robust the measures, the less the risk for mortgagees in using the entitlement as security, and the more likely they are to grant significant loans and offer lower interest rates. Thus the measures are of benefit not just to lenders, but also to the water entitlement holders.

Unbundled entitlements have a distinct advantage with respect to using water entitlements as security for obtaining finance. They reduce the security risk to the lender, which can subsequently reduce the cost of debt financing. For instance, a lending institution can secure debt finance against the licence discretely (rather than as part of a land/water package) with the knowledge that it may take possession despite it not being a landholder and with confidence of the continuity of the water asset should the land be sold.

Only the fully unbundled entitlements in New South Wales and Queensland (currently only implemented for surface water in Queensland) offer a good representation of real property-style arrangements for security interests. All other cases have less sound options.

## **10 Groundwater extraction outside the regulatory framework or consumptive pool**

In most jurisdictions there are large areas where there are no requirements for licensing of groundwater extraction. Only in New South Wales, Victoria and the ACT is groundwater

licensing comprehensive in coverage. In the other states there are statutory processes for proclaiming areas where licensing is required.

In areas where groundwater licensing is required, all jurisdictions allow for groundwater access for stock and domestic use in rural areas that is not quantified on individual entitlements (a bore or works approval is generally required, but no explicit extraction right). In most cases the overall estimated stock and domestic use is budgeted for in determining limits to licence entitlements, and some jurisdictions are now preventing access for domestic purposes in urban areas where water supply is provided by a local utility. Provisions exist in most statutes to limit the volumes taken by stock and domestic users, and to prohibit use entirely in limited circumstances.

Mining and town supply are treated in various ways. For example, Victoria and South Australia include water supply for these activities in the regulatory consumptive pool, thereby requiring those seeking further access for these purposes to purchase water rights via the market. Conversely, in New South Wales water sharing plan areas, further rights can be issued for town supply (but not mines), potentially reducing the security of access by other water users, while in other areas policies may prohibit further licences from being issued, with exemptions for those that support 'high social, economic or national security' needs, which may include mining. As towns and mines are often major water users, constraint on their market participation, or differential treatment, is an impediment to market efficiency, and potentially 'devalues' the traded rights over time, affecting market confidence.

Plantation forestry can likewise affect groundwater recharge and the resultant consumptive pool, and is factored into extractive water budgets in South Australia, but not elsewhere.

### **3.5.3 Trade-related transactions**

#### **11 Range of groundwater transactions**

The range of potential groundwater transactions depends largely on the particular products available. Most jurisdictions allow for change in ownership and extraction location of both NWI-equivalent entitlements and allocations (where they exist).

The diversity of transactions is directly linked to the level of unbundling. Where fully unbundled, there are separate transactions for:

- change in entitlement ownership (without any effect on location)
- lease of entitlement (without any effect on location)
- change in location where entitlement can be exercised (for a fixed period or permanently)
- change in allocation ownership and the location at which it can be exercised
- encumbrance transactions such as registering mortgages, caveats etc
- approvals for works such as bores, storages
- approvals for using water on land.

Each of these transactions can be carried out independently or in combination.

The unbundled transactions allow for greater efficiency. Those that have no natural resource implications (e.g. change of ownership, lease, encumbrances) can have agency consent waived without risk to the resource or other water users' ability to exercise their rights. Impacts of use of water on land can be pre-approved in one process without having to be reassessed for each entitlement transaction. Transactions that result in a change in location of extraction only have to consider impacts of extraction, and do not have to address impacts of use or ownership changes. Encumbrances can be properly managed without a reliance on ad-hoc agency administrative processes. Having separate trading of allocations recorded in separate accounts provides for streamlined 'temporary' trading, which in many areas is the majority of trading activity.

Where still bundled the common transactions are:

- change of ownership associated with change in land ownership/occupation
- permanent transfer of entitlement, by cancelling a licence and issuing a new licence for a different location
- temporary transfer of entitlement, by reducing the annual water right on one entitlement and correspondingly increasing it on another, for a defined period (typically the current water year).

Compared with the unbundled transactions, these are less diverse but have the disadvantage of requiring issues of ownership, location and use always to be considered for permanent or temporary transfers. They are therefore more onerous to assess. Temporary trading in particular is far more cumbersome than dealing with water allocations recorded in separate accounts. However, they do not require the same level of rigour in registration and transaction management.

Overall, as discussed above, unbundled transactions are generally more trade-friendly.

## **12 Interstate trade**

Interstate trade can potentially take place between jurisdictions where productive and utilised aquifers extend across jurisdictional borders, but this is not yet practised. Areas of potential interstate trade include the Border Rivers area of Queensland/New South Wales, the Lower Murray/Katunga area of New South Wales/Victoria, the Victoria/South Australia border limestone aquifer, and the GAB. An intergovernmental agreement, including administrative processes and coordinated record-keeping, is required, and comparability of entitlements and allocations between jurisdictions is preferable.

## **3.5.4 Market and resource definition**

### **13 Groundwater system and zone boundary definitions**

As shown in Section 2.3.2 Table 1, groundwater systems have various names in different jurisdictions. Groundwater systems can be a single aquifer, multiple aquifers, or a part (i.e. a zone) of a large or complex aquifer, and in some areas what are referred to as zones have the characteristics of groundwater systems. An aquifer may also be split into two or more systems because of jurisdictional boundaries. Not surprisingly, this causes confusion and misunderstanding when comparing jurisdictional approaches.

Groundwater system boundaries are defined in various ways, including:

- by hydrogeological type/properties, and groundwater flow
- by potential and actual extractive stress, typically using land administrative boundaries (e.g. parishes, hundreds).

Jurisdictions are generally moving away from the second approach. The MDBA, in recently setting sustainable diversion limit (SDL) areas for groundwater, considered factors including the physical features of groundwater systems, and the ways in which water recharges or discharges from the systems.

Variations to these approaches include the use of cadastral boundaries to approximate the hydrogeological boundary at the fine scale, and surface catchment boundaries as a surrogate for groundwater flow (used in fractured rock systems, such as those in the ACT). Groundwater quality may also be considered, especially in setting boundaries to shallow coastal groundwater systems.

Zones are used to facilitate groundwater management in a groundwater system, and are often based on aquifer properties, groundwater quality, or component area of the

groundwater flow regime (i.e. recharge or discharge areas). In some areas they are also based on land administrative units. There is commonly significant hydrogeological connection across these 'administrative' zone boundaries. Zones provide a means to limit excessive concentration of extraction in parts of the groundwater system. Again, cadastral boundaries may be used to define the zone boundary at the fine scale.

As aquifers operate in three dimensions, groundwater systems and zones may also be defined on a vertical basis (as is the case in some jurisdictions). Where the aquifer comprises a distinct geological type such as alluvial sediments overlying fractured rock, the vertical extent may be governed by geological definition. However, in cases of geological and hydrogeological uncertainty, depth boundaries (in metres below ground) may be established.

From a groundwater trading perspective it is important that the physical boundaries of the market are fixed as far as possible, and that these be based on entire aquifers, rather than arbitrary administrative or demand concentration boundaries. Where the hydrogeology is uncertain, processes for change should be well documented and this information made available to market participants.

#### **14 Movement of water rights between groundwater systems and between zones**

Movement of water rights should not, in principle, be allowed between groundwater systems that are poorly connected. To allow it would result in a system-wide impact on the rights of the receiving system, because there is no compensating reduction or increase in water movement across the system boundary. In its final advice to the MDBA, ACCC (2010) recommends that groundwater trade be allowed in appropriately set trading zones, but not at all where there is low or no hydraulic connectivity between groundwater trading zones.

There has been desire in some jurisdictions to use the market to correct perceived 'overallocation' in particular systems by allowing trade to other disconnected underallocated systems. This is inconsistent with the ACCC recommendations, which view trading between disconnected water sources, in particular to address over-allocation, as economically inefficient, and that 'such trading restrictions concentrate the burden of addressing over-allocation on trading parties only' (ACCC 2010). The ACCC notes that such restrictions also seem to contradict the following basin water market and trading principle (from Schedule 3, cl. 4 (10) of the Water Act): 'Exchange rates must not be used to achieve other outcomes such as to alter the balance between economic and environmental protection or to reduce overall water use'.

The market value of (and indeed economic value derived from) groundwater entitlements in disconnected systems may be significantly different. Market values in fully allocated or over-allocated systems are likely to be significantly higher than in systems that are not fully allocated, where indeed they have little or no market value if government is still granting licences. The value derived from crops or other uses in disconnected systems may also vary significantly, particularly if the systems are geographically distant and geology, climate, soil types, and market influences differ. To expect the relatively few new or expanding users in under-allocated systems to participate in a completely different market will not only distort any potential local market, but as the ACCC points out, will also place an undue burden on these players.

A less market-distorting approach may be to use market mechanisms such as auction, tender or shelf prices to distribute entitlements in underallocated systems. This would reflect the 'willingness to pay' of new or expanding users in these systems, and presumably the potential economic value derived from the entitlements. The funds generated from this market distribution could then be used to purchase and retire entitlements in the over-allocated systems. However, this could still be viewed as placing an unfair burden on new or expanding developments, with no contribution from current users or the broader community who also accrue the benefits of groundwater extraction regimes that are sustainable in the medium to longer term. Fairer cost-sharing arrangements, taking into consideration the NWI risk-sharing arrangements, should perhaps be considered.

As discussed previously, some groundwater systems have been defined based on administrative boundaries or demand concentration rather than hydrogeological boundaries. In such cases there may be hydraulic connections across system boundaries, but trade is often prohibited between systems as a general rule. A potential situation for future inter-system movement of water rights is where a separate groundwater system is established for each jurisdiction within the one aquifer that spans jurisdictional borders. These 'systems' are hydrogeologically connected, so in reality each unit is a zone in a greater water system.

In most cases zones as defined by jurisdictions are internal divisions of groundwater systems. Movement of entitlement or allocations between zones is often governed by particular rules in plans to prevent excessive concentrations of extraction. Such rules may aim to prevent continual migration of water rights into highly committed areas (which are often areas of desirable groundwater quality or yield), or to reduce extraction in areas where it could contribute to increased aquifer degradation, for example in areas of coastal Queensland that are at risk of sea-water intrusion. Use of zones in this way, with associated rules concerning trade across zone boundaries, is a valid impact management tool and can make for more efficient transaction processing.

## **15 Movement of water rights between groundwater and surface water**

Movement of water rights between groundwater and surface water can potentially occur in most jurisdictions but is currently practised only in limited cases where some alluvial aquifers immediately adjoin rivers. In such cases, the taking of groundwater from the usually narrowly defined alluvial aquifer may occur:

- as if it was from the river, and surface water licences are used to manage this take, or
- under 'conjunctive' or 'mixed take' entitlements (e.g. the Callide Valley in Queensland) where a single entitlement can authorise water to be taken from groundwater or surface water.

The different nature of the surface water and groundwater rights presents a challenge to movement of rights between them, as does the uncertainty about the quantity and lag of movement of water between the sources. There is a strong risk that allowing trade between surface water and groundwater systems could affect the water rights of the receiving location. Determining 'conversion rates' between the very different rights is fraught with complexity. In most systems, a megalitre of groundwater entitlement represents a 'high-security' megalitre of supply. In an unregulated river, a megalitre of entitlement does not represent actual supply, but rather a chance to extract should some specified flow conditions occur in the river.

For example, moving of water rights from an aquifer to a small river can result in an immediate effect on river flows, with the compensating increase in base flows discharging from the groundwater to the river occurring some time later (perhaps even many years, depending on lag times). In addition, if the river is 'unregulated', the impact of the trade cannot be confined to transacting parties – all rights holders on the river will feel the impacts of the additional river extraction.

Likewise, if river entitlements are moved to the 'connected' groundwater system, all groundwater users in the receiving system will potentially be affected by the increased extraction, and all surface water rights holders will benefit. The third-party impacts are difficult, if not impossible, to corral.

These risks are lowest in areas where groundwater licences have already been issued with conditions equivalent to those of the licences for the linked surface water resource, and where the level of connection is high. This occurs in a number of catchments in Victoria and Queensland.

As well as the technical and policy difficulties associated with trades between surface water and groundwater, there are the potential issues of market distortion discussed in relation to trade between disconnected groundwater systems. Significant analysis would need to be undertaken on the issue of trading between surface water and connected groundwater, and

firm policies and practices established (including the use of conversion factors or exchange rates) before such transactions were enabled.

The ACCC, in its draft advice to the MDBA (2009), and repeated in its final advice (2010), recommended that water resource plans only permit trade of water access rights between surface water and groundwater in highly or moderately connected systems, and then only when particular requirements can be met. It also recommended that trade between surface water and groundwater systems with a low level of connectivity (or none) should be prohibited.

Irrespective of connectivity, there may be significant risks to government, the environment and the rights of existing licence holders associated with trades between surface water and groundwater. A simpler approach to the issue may be to leave it to existing markets to sort out. A surface water licence holder wishing to take groundwater could simply sell their surface water entitlement on the surface water market, realising its value in that market, and use the funds to purchase an entitlement in the connected groundwater market, paying the price demanded by that market, or vice versa.

## 16 Volumetric market size

Jurisdictions generally define volumetric limits on the amount of water that can be taken from a water system within a period of time. These are commonly derived from or equivalent to sustainable yield (SY). They may be called sustainable extraction limits or sustainable diversion limits (SDLs), and are expressed as an average annual volume. A particular challenge is the high level of uncertainty involved in determining these limits. Even when there is considerable expenditure on investigations and modelling, the uncertainties about system behaviour, future climate and ecosystem water requirements are substantial.

The MDBA, in its recent considerations of SDLs for groundwater systems of the Murray–Darling Basin, acknowledged that recharge provides an ‘envelope’ within which sustainable levels of groundwater extraction can be developed. The groundwater SDLs considered in the *Guide to the proposed Basin Plan* (MDBA 2010) were then determined by considering the contribution of each groundwater system to maintaining environmental water requirements at local and regional scales, then determining the level of extraction that can be sustained.

Jurisdictions also define limits to the volume of entitlements on issue. Entitlement limits are often set at the level of entitlement on issue when a moratorium on issue of entitlements has been put in place, but in some cases are set above or below it. Entitlement limits can therefore be:

- the same as the sustainable extraction limit
- less than the sustainable extraction limit, which often happens where there is a high level of uncertainty in the calculation of the sustainable extraction limit and current entitlements are also below the limit
- above the sustainable extraction limit, which usually means that one of the following management approaches is being taken:
  - action to reduce entitlements already issued
  - a decision to accept the risk of having entitlements above the limit because current abstractions are lower than the sustainable extraction limit, or it is felt that extraction will return to within specified limits and the system will recover following the cessation of a fixed period of ‘overuse’ of water by fixed-term uses such as mining, or because extraction levels are being managed through annual announced allocations in response to water level behaviour.

A concern for market confidence is that in many cases, the relationship between the sustainable extraction limit and the entitlement limits are not well documented, nor the level of uncertainty in the sustainable extraction limits. While maintaining entitlements above the (long-term) sustainable limit may be valid to enable short-term economic activity, the

entitlement limit/sustainable limit ratio must be well understood by market participants, so that any entitlement transaction price reflects the (long-term water) 'value' of the entitlement. In addition, uncertainty surrounding the sustainable extraction limits, as well as processes for their change, should be well clearly described in literature available to market participants (see below).

## **17 Changing volumetric market size**

Limits on the issue of entitlements and/or on total extraction of water are the main mechanisms employed for managing groundwater extraction. Most aquifers are managed on a longer-term basis, with no annual or seasonal variation in water available to entitlements regardless of annual or seasonal climate variations, making use of aquifer storage to buffer over dry periods<sup>4</sup>. In some systems, allocation carryover provisions are in place to allow individual entitlement holders to manage short-term climate and commodity price variability themselves. In many systems (particularly those where the sum of entitlements exceeds the sustainable extraction limits), restrictions on access based on monitoring of water level or quality are added, to provide a risk management mechanism to protect the aquifer should levels or quality decline further than expected. Thus the entitlement limit, in most systems, defines the total volume of water markets. Where the sum of entitlements exceeds the sustainable extraction limit, the long-term (or full development) value of one megalitre of entitlement is less than the face value of one megalitre.

The NWI advocates a model where water access entitlements are a fixed share of a varying 'consumptive pool', the concept being that the pool can vary to reflect changing climate or knowledge, without varying the entitlements as such. This system operates in New South Wales, and by default in Queensland and Victoria where allocation announcements of less than 100 per cent of licensed entitlements are possible. However, even with this approach in place, there is a strong user expectation of receiving one megalitre per unit share of entitlement.

Because of the uncertainties in forecasting future climate and in understanding of system behaviour and ecosystem water requirements, it must be anticipated that sustainable extraction limits will change over time. There need to be mechanisms for adapting to such changes without distorting markets. For example, increasing the limit and allowing issue of new entitlements after a market has been operating could, depending on how it is done, affect market prices. Likewise, if the market is unaware of potential reductions in overall resource availability limits, reducing the limits can affect the value of entitlements.

There needs to be an expectation that volumetric market size in groundwater systems is likely to vary over time in response to climate change and better understanding of the hydrogeology, as well as an understanding that the means used to implement such variations can have an impact on markets (through impacts on the value of products themselves and demand for trading to accommodate businesses adjusting to the change). It is preferable if the means for doing so are established ahead of time and are market-sensitive, so that market confidence is not impaired by this uncertainty, and the uncertainty is recognised in the prices paid for entitlements.

## **3.5.5 Trade initiation**

### **18 Triggers and prerequisites for trade**

In general terms, trade is triggered by scarcity and enabling of trading transactions. For groundwater this translates to a requirement to have water entitlements specified numerically, a moratorium or embargo on the issue of new entitlements, unmet demand for water, current water entitlement holders willing to sell, and water entitlements that are

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<sup>4</sup> There are exceptions, such as the Katherine-Tindall aquifer in the NT, where volumes available to groundwater licences are announced each year at the end of the summer wet season, and in NSW where groundwater plans include provision for reducing annual allocations to entitlements to less than one megalitre per unit share in the future.

statutorily well defined and able to be traded.

Common prerequisites to trade are volumetric entitlements, defined management units and extraction limits, and metering of groundwater extraction. In some cases, metering of extraction is only considered a prerequisite for temporary (seasonal 'allocation') trade. In cases of over-allocation and over-use, a desirable prerequisite to establishing very clear market boundaries and rules may be implementation of a water management plan that clearly describes the process for reducing entitlements, or for maintaining use within specified sustainable limits.

## **19 Trading in underallocated groundwater systems**

Trading is generally not precluded in 'underallocated' systems (i.e. where entitlement on issue is less than the sustainable extraction limit), but in practice does not normally occur because additional entitlement can be obtained (for a nominal fee) on application. Seasonal trade of allocation has taken place in some systems (e.g. in New South Wales) that were still considered 'underallocated', and enabled those users who could not obtain additional entitlement to gain access to additional water on a seasonal basis.

An example was noted in northern Victoria, where the entitlement limit for a groundwater system was increased after further investigations, and additional entitlement was issued through a tender. However, this is uncommon, and in most cases of underallocated systems entitlements are issued on application until the available extraction limit is taken up. This is appropriate where demand for additional water is low, so there would be little point in using competitive means to issue available water. It could simply pose an artificial barrier to legitimate and sustainable development. But where demand is substantial, using a tender or auction method is clearly advantageous to allow the value of the water entitlement to become clear and to encourage its use where it will deliver the most return. This is worthy of further analysis.

A market may also be used in local impact areas of underallocated systems. While from a whole-of-system perspective the system may be underallocated, there may be areas of high demand where issue of further entitlements may have an unacceptable impact on other users or dependent ecosystems. In these cases, users wishing to enter that area or expand their operations would have to purchase access from other entitlement holders within the local impact area.

## **3.5.6 Transaction processing**

### **20 Requirement for government consent**

All trade transactions require government assessment and consent, except for pure ownership changes of unbundled water access entitlements in New South Wales and Queensland (this currently applies only to surface water in Queensland) and leases in Queensland. In such cases there are no risks to the environment or other users' access to water in the transaction, so there is no need for government assessment or consent to protect against them. Private financial interests in the entitlement that might be affected are protected through the requirement to provide evidence of their consent as a condition of registration of the transaction. The removal of unnecessary consents is clearly an improvement to administrative and market efficiency.

### **21 Trading rules**

Trading rules are generally interpreted as matters that the consent authority must address when considering applications for trading transactions. Their prime purpose is to prevent significant impacts on other water users (i.e. in market terminology, to protect their 'exclusivity') and on environmental and other public good services provided by the resource. Rules provide a means of short-circuiting the assessment of potential impacts for each application, and for addressing cumulative impacts of trades, which are difficult to assess on an application-by-application basis. For the purposes of this report, they do not include rules governing the actual administration and processing of trading applications and market

information.

Well designed trading rules can substantially improve market operation by creating greater certainty about what can and cannot be done, rather than having such decisions made over and over again for every application. In doing so, they can also substantially reduce the costs of processing applications.

Some states (e.g. New South Wales and Victoria) have state-wide rules set by ministerial order, with local rules defined in plans under these. This approach lends itself to more consistency across the jurisdiction.

Examples of types of rules that effectively pre-assess many potential impacts in a 'bulk' process, and should prevent environmental and third-party impacts, include:

- prohibition of transactions in clearly defined circumstances (such as within certain distances of other extraction, rivers or other GDEs)
- limits such as zonal maximum and minimum entitlements (for permanent trades) or use (for temporary or allocation trades), maximum entitlement densities, etc.

Trading rules have been used as surrogates when the prerequisites for markets (see Issue 18, Section 3.5.5) are not properly addressed. For example, if the sustainable extraction limit has not been defined, but entitlements are no longer being issued because it is likely that the system is over-allocated, trading rules have been used to limit development of 'sleeper' entitlement, thereby increasing the unit value of the remaining entitlements. Examples of such current rules in some groundwater plans are:

- rules that limit traded volumes to ensure extraction does not exceed historical levels
- rules preventing 'permanent' trade
- rules limiting temporary trade to 'top-ups' in years of restrictions.

Such rules restrict market activity. It is clearly beneficial to move as quickly as possible to put in place the necessary prerequisites (clearly defined sustainable extraction limits, entitlement limits and pathways for reducing entitlements or extraction if needed) and to remove any trading barriers that are not directly related to managing environmental and third-party impacts.

In some cases, rules themselves are used as a means to reduce entitlement—for example rules requiring part of the entitlement to be surrendered as a condition of transfer. Again it is argued that it is more efficient to use other means to address this issue rather than impair the market, and unfair to place the adjustment burden only on those wishing to use the market. The NWI Schedule G cl. 3 and 9 recognise that trading restrictions are inefficient means for addressing over-allocation. This subject is also addressed under Issue 14 (Section 3.5.4) of this report.

Some types of rules are in place to prevent those who are not water users obtaining entitlements, e.g. requirements to hold land and/or be able to demonstrably use the water. This has the effect of limiting market participants unnecessarily. Where there are no such restrictions, there have been concerns raised that non-users may obtain water entitlements to hold them or to drive up water prices, but there is no empirical evidence to support this. Rather, the water rights are being deployed either by sale to water users or for environmental purposes.

## **22 Processing costs**

Administrative processing fees range from about \$200 to \$775 for groundwater entitlement trades, and from about \$128 to \$235 for groundwater seasonal allocation trades. Additional fees in some states apply to cover technical assessment and advertising. Further, in most states applicants are required to commission and pay for investigations and assessments where the proposed extraction is considered to have substantial risks and requires detailed investigation and quantification of potential impacts.

As a general observation, fees vary greatly from state to state, and total application costs can be high, creating a substantial cost threshold for someone considering trading. The cost of processing for applicants is also affected by the time taken to make determinations. Trade processing commitments have been made by most institutions with respect to surface water or water trade more generally.

## **23 Responsibility and costs for undertaking technical assessment**

A variety of methods exist for undertaking technical assessment, with most being variations on:

- assessment by jurisdictions, with minor assessment costs absorbed in administration and general operations, and costs for more complex assessment (possibly subsidised) charged to the applicant
- assessment by the applicant or an independent consultant, at the applicant's expense.

Where assessment is undertaken by the applicant, for example in Victoria and Western Australia, costs for work by independent consultants are known to range from several thousand to tens of thousands of dollars, and may take several weeks or months to complete. The Queensland framework allows for assessments to be undertaken by the applicant (s.130) at the applicant's expense, as well as pre-assessed trades (s.129).

The costs of assessment can make the marginal cost of trade high, and thereby inhibit the market. This said, the potential impacts and costs to other users and the public of groundwater extraction are significant, and the uncertainties surrounding groundwater behaviour at particular locations are considerable. The impacts need to be assessed, and it is appropriate that the beneficiaries (that is, the transferees) bear these costs. Furthermore, by requiring applicants to cover the cost of assessment, the risk of incurring costs to assess unrealistic or aspirational applications is eliminated.

## **24 Requirements for impact assessment (including advertising)**

In determining applications for trade transactions, all jurisdictional legislation requires consideration of impacts on the environment and third parties. However, the ways in which these requirements are expressed, and in which they may be put into effect, vary considerably.

One way to reduce marginal assessment costs is for more assessments to be done in 'bulk' as part of water planning processes or otherwise, leading to rules with defined zonal or local limits. Where this is done, the assessment can be replaced by simple compliance with the rule, with the option of allowing applicants to commission further studies if they believe their case is an exception. For example, an assessment may result in a 'density' rule that states a maximum extraction per square kilometre (probably conservative to cover a range of situations), but with the proviso that an applicant can commission further studies to justify a higher density in a particular situation.

Bulk assessments will not, however, cover all possible impacts, particularly localised effects in highly heterogeneous aquifers. To expedite trade assessment and reduce costs in such cases, readily available standard tools, and methods developed or commissioned by the resource managers and available for use by the proponents' consultants or for in-house assessment, may be an option.

Some jurisdictions have developed publicly available risk-based guidelines for impact assessment that take account of such things as the proximity of the proposed location of extraction to other bores and GDEs. In the South Australia south-east region, water allocation plans provide guidance on the acceptable level of drawdown impact of new extraction, the distance from the extraction point at which this is to be assessed (a 2.25 km radius under the '16 km<sup>2</sup> test) and the process for analysis (using the Theis equation). Specific 'rules of thumb' included in guidelines can reduce costs if well known. For example, if the assessment level is much less where the proximity to other bores is more than a defined distance, applicants can take this into account when preparing applications. There

would be value in further development of such guidelines and inclusion of more easily definable risk-based thresholds for different levels of assessment, which could reduce the time and cost of case-by-case assessments.

As mentioned earlier, transactions with bundled entitlements generally require greater assessment because all the bundled elements have to be considered—for example, how the water is to be used. Unbundling allows this to be separated from the marginal cost of trade.

Advertising is frequently used for ensuring potential impacts are identified and considered. However, because there is normally no limitation on who can object, this can impede transaction processing where there are parties seeking to impede the trade for other reasons. For the fully unbundled entitlements in New South Wales, there is advertising associated with applications to sink bores, but none associated with water access entitlement transactions, as it is felt that plan rules and expert assessment are adequate to identify the marginal implications of increased local extraction on approved bores. There would be value in further analysis of where advertising is and is not appropriate, given the considerable overhead it places on processing of trading transactions.

### **3.5.7 Methods for assessment and mitigation of impacts**

#### **25 Influence of different hydrogeological conditions**

Hydrogeological conditions can influence the type, severity and uncertainty of potential impacts. This influence can be dealt with to some extent by the establishment of groundwater systems and zones, with macro internal heterogeneity (such as broadly varying groundwater quality and extractive stress) catered for by internal zoning and associated trading rules.

Where investigations can be carried out to demonstrate that broader-scale risks are minimal if zonal trading rules are adhered to, it can result in a greatly reduced case-by-case assessment process that only needs to consider extremely localised effects. The extent to which this can be achieved will depend on the nature of the system and the level of information on, and understanding of, system behaviour. In high-yielding, highly developed aquifers, it is likely that substantial investment in understanding will be efficient and a high level of management using zoning will be possible.

#### **26 Standards applied to assessments**

There is very little documentation of assessment approaches, techniques and standards, including definition of unacceptable impacts. Some jurisdictions have guidelines for assessment requirements as mentioned above (e.g. South Australia). Trading rules and distance conditions are used extensively in some jurisdictions (e.g. Queensland and South Australia) and act to reduce assessment requirements.

#### **27 Determining ‘acceptable’ degrees of impact**

New or increased groundwater extraction at any location can increase the amount of seasonal and/or long-term groundwater level drawdown, and may result in increased pumping costs to groundwater users, reduced bore yields and reliability of supply, and reduced support to dependent ecosystems.

A range of approaches have been used to specify ‘acceptable’ impacts on other water users and the environment, including specifying a percentage of the available drawdown in the aquifer, percentage of the available drawdown in a particular bore, or an absolute drawdown level (in metres below static water). Surrogates such as distance conditions are also used in addition to, or as an alternative to, drawdown limits. This is often the case for trading rules for managing impacts on linked surface water resources and GDEs.

Applications may attract some form of advice from agencies on what may constitute an acceptable application. This appears to be mainly a non-statutory approach adopted at the

operational level to avoid the need for repeated applications until one is accepted.

As a general principle, market certainty would be increased if decision thresholds were more codified and less reliant on officer discretion.

## **28 Impacts on stock and domestic groundwater users**

A common assessment requirement is the potential impact on stock and domestic bores in the vicinity. Where they are shallow, increased local drawdown effects through trade to nearby production bores can make them unusable. Impact mitigation measures include deepening the affected bores or offering alternative water supply.

Where the location of these is on a register, as in New South Wales (but with varying accuracy), the cost of assessment is reduced through not having to do fieldwork to identify them, or avoiding proximity to them where possible. It would be worth requiring registration of these bores in developed systems, where this is not already done.

It is noted that previous policy on this issue (ARMCANZ 1996) recommended that 'inefficiently constructed' bores (i.e. shallow stock and domestic bores) should not be an impediment to groundwater development, which in this context would include trade. The policy stopped short, however, of assigning responsibility for costs associated with making good the stock and domestic supply.

## **29 Impact mitigation mechanisms**

Rather than outright refusal, an application is often approved subject to conditions to mitigate identified potential impacts. Impact mitigation measures include:

- limitations placed on the volume of water right to be traded, or the location it is to be traded to
- overriding limits to extraction rate or annual extraction volume at a bore or borefield, irrespective of the entitlement volume traded (this can be effected in an unbundled licence context)
- impact mitigation works, e.g. deepening nearby domestic and stock bores, or providing them with alternative water supplies
- environmental offsets
- imposing monitoring and response triggers.

Generally, rather than outright refusal, permitting such mitigation measures allows more trading to take place without incurring undue risks.

## **30 Assessment assumptions, especially on assumed level of surrounding development**

Various approaches can be used in the technical assessment of potential local drawdown impacts, largely comprising:

- assessing the potential impact of the application alone, without consideration of existing conditions or other impacting activities
- assessing the cumulative impact of the application in conjunction with those of other water users, assuming others are extracting in accordance with recent history
- assessing the cumulative impact of the application and other water users, assuming that others will extract full licensed entitlement or other extraction limit.

Any of these approaches may be acceptable, depending on the objective of the assessment, knowledge of the groundwater system and its level of development, information available on water entitlements and extraction, other controlling mechanisms (e.g. density limits) and expectations of third parties. However, it is generally acknowledged that entitlement trade assessments should be undertaken on a cumulative impact basis, assuming full development of existing entitlement within the local area, while

for temporary trades, extraction at recent levels may be an appropriate assumption allowing short-term economic use of other under-used entitlements.

### **3.5.8 Monitoring, reporting and facilitating groundwater trade**

#### **31 Public access to information on products and processes**

Jurisdictional agencies generally publish information on tradeable products and processes for trading on their websites and in brochures.

Groundwater users are generally not well informed about groundwater trading, however, largely due to the lack of market development.

#### **32 Public access to information on market activity and prices**

This is an area where information is scarce. In addition, evidence from interviews suggests that uncertainty about the value of the products is a major inhibitor to trading, with many groundwater users who might trade adopting a 'wait and see' approach.

#### **33 Monitoring and reporting of transaction processing efficiency**

This is almost non-existent for groundwater transactions, except in New South Wales, where processing time targets and percent achievement of targets are reported on the NOW website, and in Queensland, where reporting on temporary groundwater trades is carried out to meet COAG requirements. Comments from water users and agencies indicated a wide range of processing times. The differing nature of transactions (bundled versus unbundled) and assessment requirements makes it difficult to benchmark, and would require breaking up transaction processing into different elements.

#### **34 Metering**

Metering of groundwater extraction varies from comprehensive in some areas to almost non-existent in others. It is expanding, but slowly. Without metering it is difficult to see how temporary/water allocation trading can occur. Most jurisdictions have developed metering/monitoring policies which are slowly being implemented. The costs associated with introducing metering, and the associated cultural changes required of water users, are not insignificant.

#### **35 Activity by intermediaries**

In most cases, there is relatively little activity by intermediaries in groundwater trading, largely because there is little trading. This is especially the case in groundwater systems with small markets. However, there is significant use of intermediaries for trading in some of the large inland alluvial aquifers of New South Wales, such as the Lower Murrumbidgee, that have relatively large and active markets. It is expected that intermediary activity will expand with markets, building on the base of capacity already in place for surface water trading.

## 4. A framework for managing and developing groundwater trading

### 4.1 Overview

This framework for groundwater trading provides a structure for the establishment or development of groundwater markets in a range of situations arising across Australian jurisdictions. It builds on economic theory, existing groundwater management arrangements, the NWI and related developments in national water management. It identifies a number of essential precursors for trade to occur and investment that can be undertaken to increase the efficiency of markets as need demands.

The framework sets out principles for establishing markets and determining the appropriate management arrangements to put in place, grouped into three areas:

- specifying market boundaries
- assessing potential market activity
- establishing appropriate management regimes.

In very general terms, the demand for groundwater trade is triggered by scarcity, and it is operationalised once administrative tools and processes for enabling and managing transactions are put in place in a groundwater system. For groundwater systems in most Australian jurisdictions, trade prerequisites include:

- an embargo or moratorium on the issue of new entitlements (either in the entire groundwater system, or smaller zones or areas)
- water entitlements specified numerically, statutorily well defined and able to be traded
- unmet demand for water
- water entitlement holders willing to sell
- metering of groundwater extraction (for at least temporary or seasonal 'allocation' trade).

Less well defined in current practice are market prerequisites that ensure well defined market boundaries, such as:

- management units (geographical market limits)
- groundwater extraction limits (resource limits)
- share or entitlement limits
- the processes for managing any uncertainty surrounding these.

Groundwater trading regimes may be established or amended as required, or as part of a change in overall groundwater management regime. In establishing or changing overall management or trading regimes, consideration should be given to the full range of principles provided in the following sections.

## 4.2 Specifying market boundaries

The first step in defining groundwater trading regimes is to establish the basic limits within which trading is to occur.

### 4.2.1 Physical boundaries

Groundwater markets are based on groundwater management units, usually defined by statutory means. They have various names depending on the jurisdiction, but are the basic unit for defining groundwater management regimes. In this framework they are generically referred to as groundwater systems.

Movement of rights is generally allowed within groundwater systems on the basis that the system-wide impact of taking water at the new location is offset by the reduction in take at the original location because of the hydraulic connection between the locations. For further discussion of system boundaries refer to Section 3.5.4.

In practice, the heterogeneity of the aquifers, and the time taken for water movement, means that concentrations of extraction in any one part of the system can cause undesirable effects that would not occur if extraction were more evenly distributed. Zoning of systems and development of trading rules designed to manage these impacts is a common and sensible management tool.

Appropriately established zones with associated entitlement and/or use limits and rules can make for more efficient transaction processing by reducing the case-by-case assessment requirements and providing more certainty for market participants.

The need to change system or zone boundaries may arise over time, especially where the groundwater management area is based on administrative needs rather than hydrogeology, or where the hydrogeology is very uncertain. Such potential or planned changes will affect market certainty and the confidence of individual licence holders. Processes for change should be well documented and this information made available to market participants.

*Principle 1. Groundwater systems should be based on physical aquifers or groups of aquifers. They should have clearly defined boundaries based on hydrogeological features such as geological units, groundwater flow 'catchments' and groundwater quality discontinuities, and should be vertically delineated into separate systems in cases where the vertical connection between adjoining aquifers is low. Processes for adjustment of boundaries should be transparent and clearly articulated.*

*Principle 2. Groundwater systems should be as large as possible, subject to hydrogeological connectivity limitations and discontinuities.*

In practice, using cadastral boundaries that align reasonably closely to physical system boundaries can reduce ambiguity and reduce unintentional partitioning of jointly operated works.

Zones within groundwater systems may be established to cater for groundwater system heterogeneity and to support trading rules that reduce the cost of transaction processing and provide more certainty for market operation.

### 4.2.2 Trading between systems

If groundwater systems are defined according to these principles, movement of water rights should not, in principle, be allowed between groundwater systems, because they are not hydrogeologically linked or the linkage is minimal. Where both systems are fully allocated, such movements would affect the rights of the receiving system because there is no compensating reduction or increase in water movement across the system boundary. As discussed in Item 14 of Section 3.5.4, and consistent with ACCC (2009), using the market to correct perceived 'over-allocation' in some systems by allowing trade to other disconnected under-allocated systems is not recommended. The possible exception to this is adjoining systems that are hydraulically connected but are

separated solely because of cross-jurisdictional limitations. There may be pressure in the future to allow movement of water rights across jurisdictional borders, where separate groundwater systems are established in each jurisdiction within one aquifer. In hydrogeological terms, these separate units are in effect zones within the greater water system.

The differing nature of the surface and groundwater rights presents a challenge to movement of rights between them, as does the uncertainty about the quantity and lag of movement of water between the sources. There is a strong risk that allowing movement could affect the water rights of the receiving location as well as the environment, as discussed in Item 15 of Section 3.5.4. Significant analysis is needed on the issue of trading between surface water and connected groundwater, and firm principles and practices need to be established, before such transactions are enabled. Potentially more efficient and less risky alternatives, such as allowing the existing separate markets to operate and users to tailor their supply through these, should also be explored (see Item 15 of Section 3.5.4). See also Section 4.4.3.

*Principle 3. Where a groundwater system is not adequately hydraulically connected to other systems, trade into or out of the system should be prohibited. However, trading between groundwater systems that are part of a larger connected aquifer system (e.g. one that spans a state boundary) should be enabled.*

*Principle 4. Trading may be enabled between a groundwater system and a connected surface water system where there is an adequate level of connectivity and mechanisms are in place to minimise environmental and other third-party impacts.*

### 4.2.3 Entitlement and extraction limits

As outlined in Items 16 and 17 of Section 3.5.4, volumetric limits on the amount of water that can be taken from a water system within a period of time, commonly called sustainable extraction limits, sustainable diversion limits or sustainable yields, are generally expressed as an average annual volume. The nationally agreed definition of sustainable yield (Appendix M) goes a step further, combining these overall extraction limits with other rules relating to management of the impacts of extraction on water levels and quality. It thus defines sustainable yield as a 'regime' rather than a simple volumetric limit.

There is considerable uncertainty surrounding the elements of groundwater extraction limits and sustainable yields. Because of the uncertainties in forecasting future climate and in the understanding of system behaviour and ecosystem water requirements, it must be anticipated that sustainable extraction limits will change over time. There should be clear market information about these uncertainties, and well articulated mechanisms for applying any necessary changes without distorting markets and unfairly disadvantaging individual entitlement holders.

The term 'market shares' is used here in the sense of the quantity of tradeable water entitlements that will be on issue in a defined groundwater system. Groundwater entitlements can either be effectively shares in a variable resource, or fixed volume. Share-type groundwater entitlements are most often expressed in terms of a nominal volume, but sometimes in terms of unit shares whereby the number of shares issued is fixed but their value may change over time. Using a company analogy, the limit to the quantity of share-type groundwater entitlements is the equivalent of the number of shares that are on issue. As company shares have a variable dividend depending on company profit, so tradeable groundwater entitlements that are shares may have a variable annual allocation depending on water levels or recharge. Water made available from time to time may be expressed as a volumetric value of a share or, in the case of shares expressed as nominal volumes, as a proportion of the nominal volume. Fixed-volume groundwater entitlements, on the other hand, have an unchanging maximum annual volume of water that can be taken, with no mechanism to change the value of that volume without changing the conditions on individual licences in the system.

As outlined in Item 16 of Section 3.5.4, the relationship between system extraction limits and the entitlements on issue is very variable, both within and between jurisdictions. The quantity of entitlements on issue (expressed as a volume, whether fixed or nominal) can be:

- the same as the sustainable extraction limit
- less than the sustainable extraction limit, taking a precautionary approach
- above the sustainable extraction limit, with measures in place to contain use within the limit over the medium or long term.

A concern for market confidence is that in many cases, the relationship between the sustainable extraction limit and the entitlement limit is not well documented, nor is the level of uncertainty in the sustainable extraction limit. While entitlements remain above the (long-term) sustainable limit, the entitlement limit/sustainable limit ratio must be well understood by market participants, so that any entitlement transaction price reflects (long-term water) 'value' of the entitlement. In addition, measures should still be implemented to control 'over-extraction', and uncertainty surrounding the sustainable extraction limits, as well as processes for their change, should be well documented and available to potential market participants.

*Principle 5. Entitlement and extraction limits should be clearly specified. Processes for change in long-term limits, determining annual allocations or restricting extraction in times of water shortage should be transparent and clearly articulated.*

In implementing this principle it would be appropriate to publish the total quantities and types of entitlements on issue, and explain how changes to the extraction limit might affect the quantity of entitlement on issue, or the availability of water under different entitlements. The nature of the entitlements, being fixed annual volume or shares with varying annual allocations, should be clearly articulated. If they are shares, the manner in which annual allocations are determined should be specified.

#### 4.2.4 Addressing 'dilution' of existing rights

In all jurisdictions there are types of water rights or activities that are outside of the entitlement regime, but nonetheless can affect the water available under tradeable entitlements (see Item 10 of Section 3.5.2 for discussion). Examples include unlicensed stock and domestic bores and plantation forestry. The National Water Initiative sets out provisions for addressing these where they become significant, involving bringing them into the entitlement regime once threshold levels are exceeded. In the case of Western Australia, allocations provided to plantations will be brought into the trading regime once the land use changes.

In other instances, there are activities that fall within the entitlement regime, but are not subject to the embargoes or moratoriums on the issue of further entitlements. Examples include local water utility (town supply) access licences and other specific purpose access licences in New South Wales. The granting of these can dilute the value of existing entitlements and distort markets by affecting individual perceptions of security of access to water entitlements.

It is expected that non-tradeable rights or activities that could significantly affect water availability under tradeable groundwater entitlements will be identified in water management plans or other processes for every water system with a water market, and the risks associated with dilution of existing rights explained through that process.

### 4.3 Assessing potential market activity

Figure 4 represents a suggested approach to characterise groundwater markets in a way that can be used to inform decisions on the type of trading management regime that should be instated.

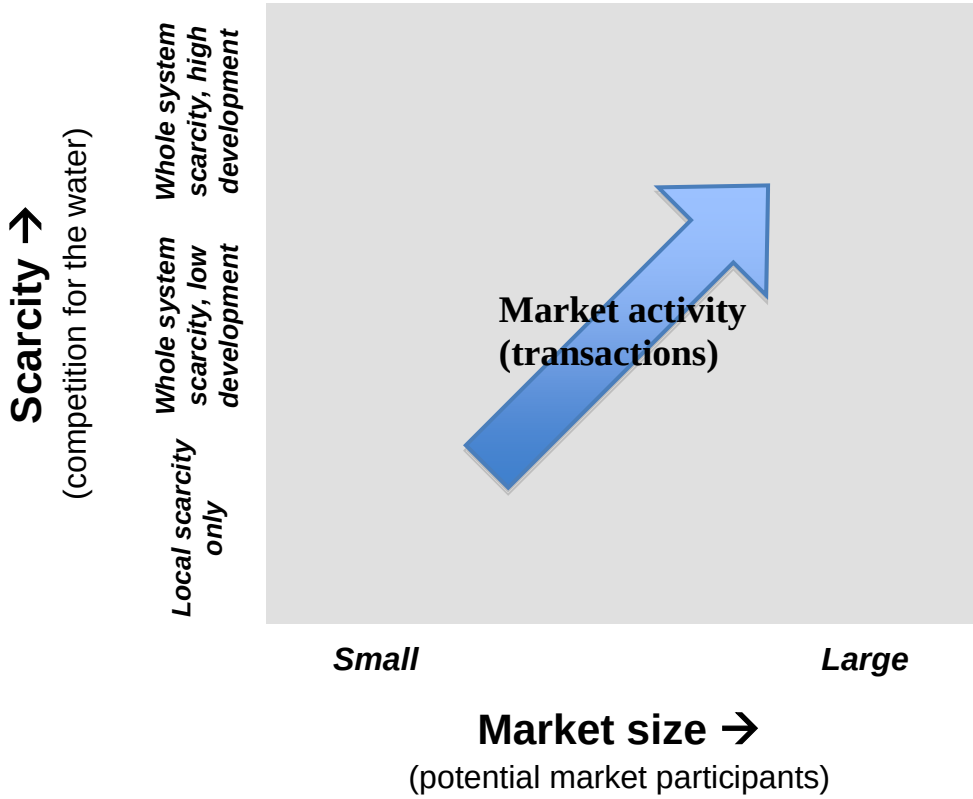
**Scarcity** is a fundamental prerequisite to any market and is initially created when government ceases to grant further entitlements. Scarcity will then increase with the development of existing

entitlements in a system—that is, as the system’s annual groundwater extraction approaches the sustainable extraction limit.

Without groundwater access scarcity, a groundwater market simply does not exist. For fully operating groundwater markets to exist, the Government must not be granting additional entitlements on application, either at a particular time or for the foreseeable future, in a particular area or zone, or in the system overall. There can be ‘whole-of-system’ scarcity where there is no issue of further entitlements anywhere in the system. There can also be circumstances where, from a whole-of-system perspective, there is no scarcity, but in certain areas or zones within the system the *full development* of all access entitlements in the area or zone will result in unacceptable or unsustainable local drawdowns (i.e. affecting existing users or the environment). In such areas the issue of further entitlements within the area or zone would be unwise, and would dilute the rights of existing entitlement holders. This is what is referred to as ‘local’ scarcity in Figure 4. Where there is whole-of-system scarcity, there is also likely to be local scarcity in some areas in the system.

Scarcity increases with the level of use, or development, of entitlements. Thus there are many areas where new entitlements can no longer be issued (i.e. whole-system scarcity applies) but the level of extraction of water under those entitlements is well below the maximum available. In such cases, the demand for trade is likely to be much lower than in systems where there is development on the ground, and entitlements are being used at too close to full potential.

**Figure 4     Market activity**



It is noted that some jurisdictions have considered the use of market mechanisms such as auctions, tenders, or a shelf price for the initial allocation of groundwater entitlements. Such market ‘allocation’ techniques are generally used in the absence of scarcity, and as such are outside the scope of this report.

A special case exists in Western Australia, where a ‘use it or lose it’ policy co-exists with the market. An area or system may be fully allocated for a period during which the market, as outlined here, may operate. At a subsequent time, entitlement may be cancelled under the ‘use it or lose it’ policy, and made available for re-allocation by the Government, either via an application waiting list

or some other market mechanism (yet to be implemented). In this situation, the scarcity pre-condition is met at some times and not at others, as the 'use it or lose it' policy is periodically applied. The 'use it or lose it' policy is currently under review.

**Size** is a measure of the number of participants in a potential groundwater market. It can be indicated by the number of licences or entitlements on issue and, when considered with the total quantum of entitlements and factors such as GDEs and sustainable yield, provides an indication of the level of 'risk' associated with groundwater management. The number of potential participants in a groundwater market (and subsequent market size) is influenced by groundwater system size. However, it can also be influenced by other factors such as land use, bore yields, groundwater quality and subsequent individual water needs. Hence groundwater system size is not necessarily a reliable indicator of market size.

As Figure 4 shows, there are no easily identifiable discrete categories, but rather a continuum from small to large market size, and from low to high scarcity.

In small and medium-sized markets with only local groundwater access scarcity, and in small markets with whole-of-system scarcity, there are likely to be very few market participants and activity may be low. The demand for very sophisticated trading arrangements is questionable, particularly given the comparatively high establishment costs.

In contrast, in medium and large markets with whole-of-system (and presumably also local) scarcity, markets may need to be more sophisticated and responsive to many and varied transactions over short periods (seasonally). The Lower Murrumbidgee groundwater system in New South Wales is such an example, where over 100 GL of groundwater was traded temporarily in a single water year (Table 4). More robust trading arrangements should ensure that water can quickly move to satisfy demands, while the potential for environmental and other third-party impacts of the trades are minimised.

*Principle 6. Potential market activity can be assessed based on the level of scarcity (or competition for groundwater rights), and the potential market size (indicated by the number of entitlements on issue).*

## 4.4 Establishing appropriate management regimes

### 4.4.1 Deciding the level of investment in the trading management regime

Management regimes for groundwater markets consist of the following elements:

- types of tradeable products and transactions (simple to complex)
- investment in establishing trading rules (low to high)
- investment in reducing the need for and cost of case-by-case assessment costs (low to high)
- investment in gathering and publishing market information (low to high)
- investment in publishing information on market characteristics and operation (low to high)
- investment in gathering and publishing information on market activity and prices (low to high)
- investment in supporting market intermediaries (low to high)
- investment in monitoring and compliance of water extraction (low to high)
- investment in monitoring and compliance of market behaviour (low to high).

Different management regimes will have different levels of each of these elements. For example, large, high scarcity markets would be best served by a management regime that has diversity in products and transactions, and high levels of investment in the remaining elements. On the other

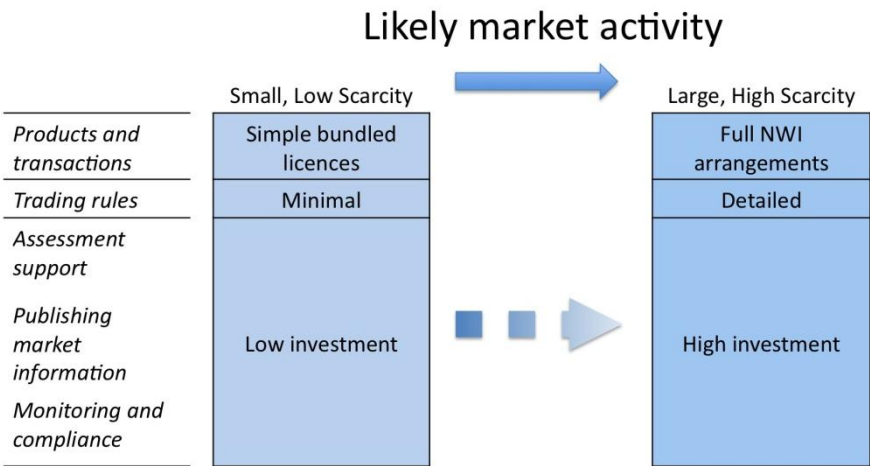
hand, small, low scarcity markets could be appropriately served by a management regime consisting of fewer and simpler products and transactions, and low levels of investment in the remaining elements.

The level of investment in managing and enhancing groundwater trading can vary, and should be determined based on economic benefits of enhanced trading, and mitigation of risks to the environment and water users. Potential market activity can be used as an indicator of the level of investment that is warranted.

*Principle 7. The level of investment in the groundwater trading management regime should be commensurate with potential market activity.*

In Australia there are existing groundwater systems where water is scarce and there are a large number of potential market participants. Investment in mechanisms to make trading more efficient in these areas is likely to deliver good economic returns. In addition, in these systems the potential risks to the environment and other third parties associated with trading are greater, and investment in understanding of the system and in trade assessment tools will be critical. On the other hand, for the foreseeable future, there may be a large proportion of Australian groundwater markets that are small, may never have much market activity, and where low-cost management is all that is warranted. There are also potentially large groundwater markets where scarcity is currently low, and trading activity will remain low until scarcity increases. In these cases investment in management should increase as this occurs. Figure 5 summarises how this can be done.

**Figure 5 Levels of management**



Further detail on the variation of approaches within each of these elements, with information on application to different market categories, is presented in the sections that follow.

#### 4.4.2 Selecting product and transaction arrangements

There are two tradeable water entitlement product and transaction arrangements in Australia that are applicable:

- the *bundled licence arrangement*, where the issued right incorporates consent to take a volume of water on an ongoing basis, construct and use works to do so (e.g. bores) and apply the water to land. The licence is tied to a specified location, usually a land parcel, and to hold the licence a person has to own or have legal access to land overlying the groundwater system. Trading is enabled through the cancellation or reduction of a licensed entitlement at one location, and the corresponding issue or increase of a licensed entitlement at another location, either permanently or temporarily.
- the *unbundled NWI arrangement*, where the tradeable right is a water access entitlement as specified in the NWI (cl. 28-32), separated from approvals for works and application of water on

land, able to be held by any person, mortgageable, recorded on a high-standard public register, with independently tradeable water allocations arising from it annually or from time to time.

All jurisdictions have the enabling statutory provisions for the bundled licence arrangement. While only some currently have the statutory provisions to enable the NWI arrangement, all are committed to it as NWI signatories. As discussed in Section 3.5.2, in practice there are variations on these arrangements, with some states, for example, having arrangements that are close to the NWI model but not meeting all of the specifications.

The bundled licence arrangement is conceptually simple, has lower establishment and administration costs, but typically higher costs for assessment of transactions because of the bundling. It offers a lower level of certainty for the holder as the licence can be more readily cancelled or modified (especially if licence conditions are not complied with) and may expire after a given period (subject to assessment, and, again, normally only if licence conditions are not complied with). It also limits market participants to holders of land overlying the groundwater system.

To establish or transition to unbundled NWI arrangements can be complex and expensive. However, there is a much wider range of transaction options available, individual transactions can be much cheaper for the applicant, there is a much higher level of certainty regarding the ongoing nature of the entitlement, there is flexibility to use the entitlement as independent collateral for loan finance, and any person can hold an entitlement or allocation. Where hydrologically discrete groundwater systems are remote, small, or where the demand is very low and there are few potential market participants, costs associated with unbundling may not be warranted in the short term, and might be deferred until such time as it is required. Where transaction numbers are expected to be high, the benefits to market operation and economic activity derived from the use of entitlements are likely to exceed the additional costs compared to the bundled licence arrangement.

The unbundled NWI arrangements are not prescriptive as to how the water access entitlements are associated with a particular work for taking water. As discussed in Section 3.5.2, even localised movements in groundwater extraction sites can cause impacts in a way that is not likely on regulated or even unregulated rivers. Therefore there is a need to ensure these possible impacts are assessed rather than allowing unfettered movement of groundwater rights within a large area. This can be achieved through setting up the products and transactions so that any change in the works with which an entitlement is associated requires government consent that includes consideration of possible impacts. Alternatively, it can be addressed through other arrangements such as management through conditions on work approvals.

An additional consideration in selecting the appropriate arrangement is the arrangements in place in other water markets in the proximity. Three cases are apparent:

- where much of the land where the groundwater is being used also has access to surface water, having bundled licences for groundwater and NWI arrangements for surface water (or vice versa) introduces administrative challenges (e.g. there can be two overlapping consents for applying water to land) and confusion for landholders. In this case, there is an impetus for aligning arrangements. For example, it would probably be worthwhile to adopt NWI arrangements for the groundwater, even if the groundwater market was small with low scarcity. In such cases, the establishment costs for the NWI arrangements would also be much lower because a lot of the legal, administrative and information system arrangements would already be in place for management of the surface water system
- where a groundwater system and a surface water system are highly connected, so that cross-system trade may be possible, the same considerations as the previous point apply
- where what is essentially one groundwater system is divided in two because of administrative constraints such as state boundaries. In this case it would be preferred for both jurisdictions to adopt the same arrangements to reduce administrative difficulties and confusions for market participants in establishing interstate trade.

*Principle 8. NWI-consistent products and transactions should be instated as a priority in groundwater systems where potential market activity is high and in other cases where it is cost-effective.*

Bundled licence arrangements can be used to establish markets where unbundled NWI arrangements are not implemented.

In establishing the NWI arrangements, wherever a change in location of extraction of a water access entitlement or water allocation is proposed, government consent, based on consideration of local trading rules and impacts, should be required. However, transactions should not require consent involving impact assessment where they relate solely to changes in ownership of the water right or financial or other encumbrances.

#### **4.4.3 Investment in establishing trading rules**

Trading rules are, for the purposes of this report, matters that the consent authority must address when considering applications for trading transactions to or within a groundwater system, and do not include broader trading principles and policies (usually applicable to a jurisdiction or the Murray–Darling Basin), or rules governing market participants, the actual administration and processing of trading applications and market information. Their prime purpose is to prevent significant impacts on other water users (i.e. in market terminology, to protect their ‘exclusivity’) and on environmental and other public good services provided by the resource.

As discussed in Item 21 of Section 3.5.6, system-wide and/or zonal trading rules designed to environmental and other third-party impacts can:

- simplify transaction processing and reduce transaction costs
- address the cumulative impacts of trades, and
- provide unambiguous and consistent information to market participants.

On the other hand, many trading rules currently in place are unnecessary barriers to trade that could be replaced by alternative, more efficient, means to address the intended outcomes.

*Principle 9. System-specific trading rules should be based primarily around the management of trade to and from the system (if and as permitted under jurisdictional or basin principles), the establishment of zones and management of trade between these, and establishment of and management to local density limits and bore proximity limits. Such rules should be objective and easily understood and implemented.*

Bore proximity rules (including those for screen depth) limit the impacts on particular features (e.g. wetlands and other groundwater users) but generally do not cater for the varying impacts that can arise from different groundwater extraction rates from individual bores. Density rules, where expressed as a maximum volume per area, can address actual groundwater extraction irrespective of the number of bores in place, and can be supported by proximity rules. Zones allow for setting of sub-system entitlement and extraction limits, and also for variation in bore proximity and density limits to suit hydrogeological conditions. Zones also allow for control on the direction of groundwater trades to address local over-allocation or extraction. However, where there is sufficient hydrogeological knowledge, density rules provide a more transparent and ongoing approach than directional controls.

*Principle 10. Trading rules should be used to manage potential impacts of changes to the location of water extraction and not for other purposes.*

They should not be used to reduce over-allocation or limit development of underused entitlements, or to restrict who can own water entitlements or allocations. Where NWI arrangements are in place, management of the impacts of applying water to land (e.g. rising water tables) should be regulated through water ‘use’ consents or other means than trading rules.

Where NWI arrangements are in place, management of the impacts of applying water to land (e.g. impacts such as rising water tables) should be regulated through water ‘use’ consents or other means rather than using groundwater extraction right trading rules.

#### 4.4.4 Investment in assessment support

While trading rules can reduce the costs of assessing trading transactions, they are unlikely to eliminate the need for some sort of case-by-case assessment, except where the transaction relates solely to ownership and encumbrances. As described in Sections 3.5.6 and 3.5.7, jurisdictions currently have a range of approaches to assessment.

Jurisdictions can reduce the cost and time of case-by-case assessments by investing in standardised processes, providing pre-prepared databases of bore and GDE locations, and having ready to use drawdown assessment models. These can be used by the assessing agency and made available to applicants and their consultants. The extent to which this is worth doing will depend on the likely quantity of trading transactions.

Certainty can be increased if assessment methods and standards, and decision criteria, are published and used.

As with trading rules, considerations in approving trading transactions should be limited to impacts on the resource, dependent ecosystems and water availability under other water rights. Possible issues relating to ownership or economic development should be left to other mechanisms.

*Principle 11. Assessing authorities should have standard, publicly documented, assessment requirements for trades involving change of location of extraction. These would include appropriate methods and protocols for assessment, and pre-determined thresholds for the level of impact considered unacceptable. The levels of investment required in assessments should be tailored to the level of risk.*

These requirements would normally apply to all groundwater trading in the jurisdiction, and thus all groundwater systems regardless of the level of trading activity.

*Principle 12. Investment in information and technical support tools for assessment in individual groundwater systems should increase with potential market activity.*

This includes such things as mapping of bores and groundwater-dependent ecosystems, and development and calibration of models to allow prediction of drawdown impacts of extraction. In systems of high potential market activity with sensitive dependent ecosystems, ecosystem response (to drawdown) models could also be developed.

Applicants should be given the opportunity to mitigate or offset identified unacceptable impacts wherever possible, rather than have their applications refused.

Where applications relate to permanent relocation of entitlement, then cumulative impact assessment should be undertaken, and it should be assumed that bores in the vicinity of the new location will be used to the full extent currently possible under associated water rights. Where applications relate to movement of water allocations or temporary relocation of entitlement, continued abstraction at recent levels could be assumed.

Advertising to identify potential impacts of trade should only be used where alternative documented and publicly available mechanisms are not considered sufficient to identify possible significant impacts.

#### 4.4.5 Investment in publishing market information

The core justification for using a market mechanism to distribute scarce categories of water access is the asymmetry in the distribution of information—private investors know best the potential value of water access to them, while government is in a better position to consider more general distribution across the landscape.

The competitive market requirements identified in Table 2 show the importance of making available low-cost, accurate and timely information. In theory, all relevant information must be available to all market participants, to:

- understand the ability (or inability) to trade a particular water access between locations
- meet principles that will be used by government in assessing any application
- support price discovery, in relation to:
  - characteristics of the products being traded so that the benefits and costs can be valued
  - the process by which government will announce short-term changes such as announced allocations.
- assist with the timeliness, accuracy and relevance of government announcements.

## **Market characteristics and operation.**

Government is in a good position to ensure that any and all administrative information, or rules and the like, are available and supported through cost recovery (or at least on a user-pays basis).

Information that affects the potential to change the location of groundwater extraction should be readily available to potential market participants. Such information includes:

- market boundaries, volumetric size and the uncertainties associated with these as discussed in Section 4.2
- the product and transaction arrangements that apply in the market, as established under law and policy, as discussed in Section 4.4.2
- trading rules and assessment requirements, as discussed in Sections 4.4.3 and 4.4.4
- times taken by agencies to process transactions
- any reform processes that may affect an entitlement in the future.

This information should be made available for all types of entitlements and allocations, regardless of size or scarcity, as the marginal additional investment will generally be low. The main cost would be to maintain the material in an up-to-date form, noting that this may already be required by government staff assessing trade applications.

Access to information on specific characteristics of any entitlement can be provided through sophisticated web-based registers or from agency files on request. For large, high-scarcity markets the former is preferred, but for small, low-scarcity markets, the number of transactions may not warrant this investment (though it might be achieved at low marginal cost if state systems are already set up for large markets).

For larger, higher-scarcity markets, information on individual tradeable entitlements should be made accessible on searchable public web-based registers. This may also apply to other markets where the costs of doing so are small. Furthermore, there should be a culture of continuous (or at least date-determined) release of information to ensure that information available to the market is equitably distributed.

## **Market activity and prices**

There is no central 'market place' in which groundwater is traded and in which information on the prices paid, current bids and current offers is available. In many instances, particularly in small or immature markets, there is little or no information on which potential market participants can make rational decisions. Initial trades require participants to carefully assess the value of water to them, and other issues likely to affect demand and supply within the market, including current levels of activation.

In the absence of a central market place, participants are dependent on alternative sources such as:

- advertisements in local publications

- informal networks of water brokers
- internet based market trading platforms
- published historical prices paid during government tenders.

In low-scarcity, small markets, where transaction numbers are low, information on reasonable price will be particularly hard to find through these sources. Anecdotal advice obtained during the stocktake phase of this project was that many groundwater entitlement holders are holding back from selling because of lack of certainty about the asking price. In such cases, market participants can only look to nearby systems for guidance.

*Principle 13: For all markets, jurisdictions should make publicly available complete and up-to-date information on groundwater systems, tradeable products and their management, market activity, and trade assessment requirements and administrative processes.*

This would include information on such things as groundwater system boundaries and volumetric size, entitlements or shares in the system and the processes for changing these, tradeable products and transaction types, application forms and procedures, processing times and costs, trading rules and assessment requirements, and transaction numbers, types, volumes involved, and prices paid. The release of periodic information should conform to a clearly defined schedule to provide all market participants with an equal opportunity to obtain and interpret that information.

#### **4.4.6 Investment in monitoring and compliance in market behaviour**

There are three areas of inappropriate market behaviour that could lead to inefficient (and inequitable) market outcomes. These are:

- intermediaries not performing their fiduciary duty to always act in the best interests of their client
- use of market dominance by a participant, or a group of colluding participants, to distort prices in their favour
- limiting access to information so that decisions may be made on the basis of knowledge that is not available to both participants in a trade.

Water market intermediaries can assist buyers and sellers to come into contact and compete for trades, and assist in completing trading transactions. For water systems with low market activity, advertising, word of mouth and assistance by local solicitors and real estate agents currently provide adequate support. However, in the larger regulated rivers (and some large unregulated rivers) the number of active agents is now high and diverse. As demand for groundwater trade increases, new local agents and those currently operating in other water markets will play an increasing role in facilitating groundwater trade.

Governments can take a proactive or reactive role in protecting consumer rights. There are two approaches to managing market activity. A highly proactive approach is taken under the *Corporations Act 1999* on the regulation of companies, trade in their securities, securities market operators and the (additional) duties of intermediaries (dealing in, or providing advice on, securities). The interests and activities of market participants are actively monitored by governments and/or their agents. This monitoring is costly, and the benefits it provides consumers must be offset against the cost of implementation and ongoing management.

A more general, reactive, approach is taken under the ACCC-administered *Competition and Consumer Act 2010* (replacing the *Trade Practices Act 1974*) and under similar forms of fair trading legislation and bodies, wherein, on the complaint of an aggrieved party, government may take action to protect a consumer's interest. The Act states that businesses and individuals (in this case those involved in the water market) must not engage in false or misleading conduct, and that they

must not make false or misleading representations. A consumer who considers these rules have been broken is entitled to apply under the Act to have their situation made good.

There have been several investigations into the need for tailored regulation and support of water investors and water market intermediaries using legislative and non-legislative mechanisms:

- COAG considered the issue in 2008 but took the view that there was little evidence of any systemic problems in the industry and opted to produce information for consumers and intermediaries on their rights and obligations. Following a reconsideration of the issue in 2009, COAG's Water Reform Committee still saw no evidence of systemic problems in existing arrangements but agreed to commission further analysis.
- There is scope to improve the behaviour of (and/or transparency) of water market intermediaries. A recent study (Ashton 2010) noted that 14 per cent of surveyed market participants had, in the past two years, had a concern with an intermediary. The ACCC has released a series of brochures informing market participants and intermediaries of their legal rights and responsibilities to assist the market. It would be easy to over-regulate water brokers, given the size of many markets and brokers operating in them. However, there may be some merit in requiring water brokers to be registered, and to demonstrate knowledge of their fiduciary duties.
- In December 2010 the ACCC identified potential opportunities to improve customer protection, notably the need to better manage the separation of client and broker monies and processes for declaring and managing conflicts of interest.

Regulation is under consideration through the National Water Market information systems, and potential instruments are being considered to address concerns or risks associated with intermediation. Recommendations on support, and regulation, of market intermediaries are not discussed here as this is the subject of further work.

Government water agencies can intervene to address market dominance, by simply refusing to approve a trade on a public interest basis, where the trade is considered to be manipulative or might result in a participant gaining a dominant position. Some jurisdictions have legislative powers to refuse a trade under such circumstances. However, to do this effectively it is necessary to identify potentially manipulative trades and, by inference, dominant market positions. The declaration and monitoring of transactions between any and all related parties is required if government intends to pre-emptively manage market manipulation in this way. To date there is little or no evidence of government investment required to establish a primary database of related parties, although some trade application forms require the declaration of related party transactions. The cost of monitoring market manipulation in groundwater is potentially low given the scale of most markets and the often small number of participants.

Government water agencies can also manage the release of information pertinent to groundwater markets so that no individual, or group, gains a market advantage. In order to do this it is necessary to exercise significant discipline when making policy announcements and releasing policy statements. For instance, announcing a change in short-term carryover rules to a limited number of market participants would place them in an advantageous position. This could easily be rectified by making such announcements in a more formal and wholesale manner. There is nothing stopping government formalising the process by which it releases market-sensitive information, nor requiring the declaration of any and all existing interests in water access, and to update those records over time on the consideration of any trade application.

#### **4.4.7 Investment in monitoring and compliance for groundwater extraction**

Fundamentally, water rights authorise the extraction of water from aquifers. All jurisdictions either have, or are moving to, volumetrically defined entitlements, whether they are using the bundled licence arrangement or the NWI arrangement. Compliance with the entitlement, and therefore protection of the exclusivity of all entitlements, relies on entitlement holders extracting no more than the authorised volume. Assessing this requires metering of water extraction.

This is even more important where trade is involved. Without trade, compliance with volumes can be approximated through monitoring of such things as areas under irrigation. This sort of approximation may be sufficient in systems where there is minimal scarcity. However, as scarcity increases and trading becomes active, more accurate measurement is needed. Because trading is specified in terms of volumes, and is frequently not whole entitlements, accurate measurement of the extraction of water is essential to allow compliance with the resulting entitlement or allocation following trade to be assessed. Without it, trading is stifled and exclusivity of entitlements is at risk, because entitlement holders can take an amount of additional water which cannot be measured or reported.

Agencies responsible for compliance with water rights need to actively promote compliance. This involves education, monitoring and enforcement action where needed. It is expected that this effort should be in proportion to scarcity, regardless of market size, since the risks to other users and the environment of non-compliance by a single user are, if anything, higher in smaller markets.

*Principle 14. Metering of extraction should be introduced in all groundwater systems where trading is possible, and should be a mandatory prerequisite for participants in a temporary (seasonal allocation) trade.*

*Principle 15. Compliance management of water rights should be implemented in all systems, with monitoring effort (e.g. meter reading frequency, proportion of groundwater bores metered) increasing in proportion to scarcity regardless of market size.*

## 5. Implementation

The current status of groundwater trading in Australia is described in Section 3.3. Implementation of groundwater trading has occurred to varying degrees, with approaches to trading differing between jurisdictions, and also between groundwater systems in individual jurisdictions.

Demand for groundwater trading cannot be accurately predicted. However, for the purposes of this report, it is assumed that demand for trading will continue to increase, with many more groundwater systems being recognised as fully allocated over the next five years, and that individual jurisdictions will increasingly seek to adopt and implement groundwater management regimes that are consistent with the NWI.

The investment required to implement the framework outlined in this report will vary according to the current levels of, and approaches to, groundwater trading already in place, the growth in demand for groundwater trading in individual groundwater systems, and the desires and needs of individual jurisdictions.

The framework outlined in this report could be implemented at two levels:

1. Jurisdictional actions to recognise, enable and operationalise particular aspects of the framework, at both the jurisdictional level and for individual groundwater systems.
2. Australian Government actions to promote the framework and support its adoption in future groundwater management and planning.

Practical and effective initiation and management of groundwater trading need to be supported by legislative provisions, policies, administrative procedures and systems, and technical tools. This section outlines some of these elements, with a focus on implementation of the framework principles discussed in Chapter 4. A distinction is made between markets categorised as ‘small and low scarcity’ (referred to here as simple systems), and those ‘large, high-scarcity’ systems (referred to here as mature systems), as outlined in Section 4.3. As discussed, there will be some sort of continuum rather than discrete categories, but the ‘end points’ perhaps serve as a useful guide for further consideration by jurisdictions. The implementation elements in Table 5 to Table 12 are suggestions only. They represent mechanisms that are likely to achieve the stated principles, and serve as a ‘toolkit’ for jurisdictions to consider when developing groundwater trading regimes. This section also outlines possible areas for Australian Government assistance to further the development and implementation of groundwater trading in Australia.

### 5.1 Jurisdictional actions for implementing the proposed framework

#### 5.1.1 General

There are some very fundamental elements that should be in place when initiating and administering groundwater trading (Table 5). These include basic statutory enabling provisions and administrative guidelines, procedures and systems. A statewide policy, either statutory or non-statutory, providing trading principles and processes for the market, is also highly recommended. Such a policy might include:

- overall objectives of groundwater trading
- the legislative and policy context
- statewide principles to guide the regulation and management of groundwater trading
- articulation of policies and approaches to defining market boundaries, including:
  - groundwater systems—their spatial boundaries and volumetric limits

- limits on entitlements or shares in groundwater systems
- for intersystem trade (between groundwater systems, between surface water and groundwater, and interstate)
- triggers and prerequisites for groundwater trading
- transaction types
- transaction processes
- policies for managing third-party, resource and dependent ecosystem impacts
- information management.

**Table 5 General implementation actions**

| <b>Statutory enabling provisions</b>                                                                                                                                                       |                                                                                                                               |                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                                                                                                          | <i>Large high-scarcity markets</i>                                                                                            | <i>Justification<sup>5</sup></i>                                                                                                                                         |
| Explicit statutory enabling of trading through an ability to cancel and correspondingly grant licences, and vary entitlements permanently and temporarily, on application.                 | Explicit statutory enabling of trading and a range of transactions, including entitlement and allocation <sup>6</sup> trades. | Administrative power.<br>Market confidence.                                                                                                                              |
| Requirement to gain consent for permanent trade from all licence holders and registered (selling) landholders and mortgagee if licence is attached to the land or separately mortgageable. | Full real property-style statutory arrangements for security interests (see Section 3.5.2).                                   | Exclusivity—protection of rights of all interests in licence.<br>Market confidence.<br>Principle 8: NWI-style licences and transactions for large high-scarcity markets. |
| Requirement for consistency with Act objects and principles and general licensing ‘matters for consideration’ when assessing trades.                                                       | Requirement for consistency with Act objects and principles and with statewide statutory trading policies.                    | Recognition of public interest and dealing with market failures.<br>Consistency with publicly (statutorily) agreed resource management principles and approaches.        |
|                                                                                                                                                                                            | Statutory register of water trades.                                                                                           | Principle 13: Publicly available information.<br>Complete knowledge.                                                                                                     |

<sup>5</sup> Justifications link the actions to the framework principles outlined in this document, and to the elements of *Table 2: Competitive market requirements and application to water markets*.

<sup>6</sup> NWI definition of allocation, as opposed to entitlement

| <b>Policies and administrative procedures/systems</b>                                                                       |                                                                                                                        |                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                                           | <i>Large high-scarcity markets</i>                                                                                     | <i>Justification</i>                                                                                                         |
| Administrative statewide policy, including principles and processes for initiation of trading and for assessment of trades. | Statutory statewide policy, including principles and processes for initiation of trading and for assessment of trades. | Market confidence.<br>Complete knowledge.<br>Minimise arbitrage opportunities.<br>Administrative efficiency and consistency. |
| Administrative guidelines and procedures for transaction processing.                                                        | Administrative guidelines and procedures for transaction processing.                                                   | As above.<br>Principles 11 and 13: Clear, publicly accessible trading processes and requirements.                            |
| Administrative register of water trades.                                                                                    |                                                                                                                        | Principle 13.                                                                                                                |

## 5.1.2 Market boundaries

As outlined in Section 4.2, establishment of market boundaries involves the clear articulation of: the spatial boundaries (both lateral and vertical) of a groundwater system; the volumetric extraction limits associated with these; the entitlement shares in those limits, and; any provisions for, or prohibitions on trades between water systems, be they groundwater and groundwater, or groundwater and surface water. Table 6 outlines some of the actions that might be required to establish such boundaries in practice.

**Table 6 Market boundaries—implementation actions**

| <b>Statutory enabling provisions</b>                                                                   |                                                                                                                                                                                                                           |                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                      | <i>Large high-scarcity markets</i>                                                                                                                                                                                        | <i>Justification</i>                                                                                                                               |
| Statutory ability to establish and alter groundwater systems (management units) by ministerial action. | Statutory ability to establish and alter groundwater systems (management units), by ministerial action or through statutory plans. Statutory process for alteration defined, including requirement for public exhibition. | Principles 1 & 2: Definition of and change to groundwater systems.<br>Market confidence.<br>Complete knowledge.<br>Recognition of public interest. |
| Statutory ability to establish and alter groundwater system volumetric limits.                         | Statutory ability to establish and alter groundwater system volumetric limits, by ministerial action or through statutory plans. Statutory process for alteration defined, including requirement for public exhibition.   | Principle 5: Definition of and change to groundwater entitlements.<br>Market                                                                       |

|                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                            |                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                            | confidence.<br>Complete knowledge.<br>Recognition of public interest. |
| Statutory ability to place/amend embargo or moratorium on applications for additional groundwater entitlements.                                                                                                                                                                                                 | Statutory embargo/moratorium in place with limits to shares or entitlements on issue in groundwater system established via statutory water allocation/management plans or other statutory mechanisms, with processes for change articulated.                                                               | As above.                                                             |
| <b>Policies and administrative procedures/systems</b>                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                       |
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                                                                                               | <i>Large high-scarcity markets</i>                                                                                                                                                                                                                                                                         | <i>Justification</i>                                                  |
| Administrative statewide policy, including (hydrogeological) basis for determining groundwater system boundaries, volumetric extraction limits, share or entitlement limits, and any allowance for or prohibition of trades between water systems (groundwater to groundwater or groundwater to surface water). | Statutory statewide policy, including (hydrogeological) basis for determining groundwater system boundaries, volumetric extraction limits, share or entitlement limits, and any allowance for or prohibition of trades between water systems (groundwater to groundwater or groundwater to surface water). | As above, plus:<br>Principles 3 & 4: system connectivity and trading. |
| <b>Technical tools</b>                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                            |                                                                       |
| Methods/procedures for characterising or estimating: <ul style="list-style-type: none"> <li>groundwater system extent</li> <li>volumetric extraction limits (whole of system and zones)</li> </ul>                                                                                                              | Methods/procedures for characterising or estimating: <ul style="list-style-type: none"> <li>groundwater system extent</li> <li>volumetric extraction limits (whole of system and zones)</li> <li>connectivity with adjacent systems (surface water and groundwater).</li> </ul>                            | Principle 12: Investment in information and technical support tools.  |

### 5.1.3 Market categorisation

Section 4.3 explored the notion of applying a rational basis for categorising groundwater systems to determine likely market activity, and therefore the level of management effort that should or could be directed at the establishment and administration of groundwater markets. The approach recognises the limited resources available to water resource managers, and the inefficiency of a 'one size fits all' approach. Groundwater access 'scarcity' and market 'size' were considered as two logical inputs into the categorisation, with further qualitative consideration of other factors such as systems already in place in adjoining surface or groundwater systems. Table 7 outlines some of the possible actions required to implement this categorisation. This approach is probably just one of many that could be applied, and jurisdictions will have their own views on categorisation. In any event, it is recommended that some categorisation be applied to systematically determine when groundwater trading should be initiated, and when more sophisticated trading arrangements of these should be triggered.

**Table 7      Market categorisation implementation actions**

| <b>Policies and administrative procedures/systems</b>                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <i>All systems</i>                                                                                                                                                                                                                                                                                                                                                                                                  | <i>Justification</i>                                                                                                       |
| As above, administrative or statutory statewide policy, including groundwater system basis for determining groundwater system volumetric extraction limits, and share or entitlement limits.                                                                                                                                                                                                                        | Principles 6 & 7: Risk management.<br>Market confidence.<br>Complete knowledge.<br>Administrative capacity and efficiency. |
| Simple (rule-of-thumb) policies for acceptable authorised extraction densities for different hydrogeological settings to manage local scarcity. These might be re-negotiated via statutory water allocation/management plans for mature systems as notions of 'acceptable' drawdowns are further explored, and more detailed technical analysis of aquifer characteristics and groundwater behaviour is undertaken. | Administrative capacity and efficiency.<br>Minimise transaction costs.                                                     |
| Administrative policy on market 'size' that might warrant higher level of management, followed by market size classification.                                                                                                                                                                                                                                                                                       | Administrative capacity and efficiency.                                                                                    |
| Systems to track local and system-wide scarcity.                                                                                                                                                                                                                                                                                                                                                                    | Administrative capacity and efficiency.                                                                                    |
| Categorisation of systems according to market size and groundwater access scarcity.                                                                                                                                                                                                                                                                                                                                 | Administrative capacity and efficiency.                                                                                    |
| <b>Technical tools</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                            |
| Simple approaches/calculations to support rule-of-thumb policies for characterising theoretical cumulative drawdowns in different hydrogeological settings.                                                                                                                                                                                                                                                         | Principle 12: Investment in information and technical support tools.                                                       |

### 5.1.4      Products and transactions

Section 4.4.2 recommended moving towards unbundling of entitlements and enabling the full range of transactions in large, high-scarcity markets, while potentially remaining with bundled entitlements with more limited transactions in the smaller markets where demand for groundwater trading is likely to be limited. There will be a major and lengthy legal and administrative effort to 'unbundle' licences, and careful preparation of and documentation of policies and processes are recommended. Table 8 outlines some of these key implementation actions.

**Table 8      Products and transactions—implementation actions**

| <b>Statutory enabling provisions</b>                                                     |                                                                                                                                                      |                                                         |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                        | <i>Large high-scarcity markets</i>                                                                                                                   | <i>Justification</i>                                    |
| Statutory provision for 'bundled' water entitlements with requirement for volumetric (or | Statutory provision for 'unbundled' water entitlements, including: <ul style="list-style-type: none"> <li>perpetual volumetric (or share)</li> </ul> | Principle 8: Products and transactions.<br>Exclusivity. |

|                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| share) entitlements.                                                                                                                                                                                                              | entitlements <ul style="list-style-type: none"> <li>• separate 'use' and 'work' consents or approvals</li> <li>• separately tradeable water 'allocations'</li> <li>• ability to mortgage.</li> </ul>                                                                                                                                                                                                | Homogenous entitlements.                                                                                                                            |
| Statutory ability to: <ul style="list-style-type: none"> <li>• require monitoring and reporting of use</li> <li>• locate extraction precisely</li> <li>• restrict extraction from time to time at specified locations.</li> </ul> | Statutory ability to: <ul style="list-style-type: none"> <li>• require monitoring and reporting of use</li> <li>• locate extraction precisely</li> <li>• restrict extraction from time to time at specified locations.</li> </ul>                                                                                                                                                                   | Principle 8: Products and transactions.<br>Principle 15: Compliance management.<br>Recognition of public interest and dealing with market failures. |
| As in Table 5, explicit statutory enabling of trading, an ability to cancel and grant licences, and to vary entitlements permanently and temporarily, and to require consent of legal interests in licence for permanent trades.  | Specific statutory provisions enabling: <ul style="list-style-type: none"> <li>• change of ownership of all or part of entitlement</li> <li>• change in location at which all or part of entitlement can be exercised – permanent, and perhaps temporary (lease)</li> <li>• trade of water allocations</li> <li>• registration of security interests and consent thereof as per Table 5.</li> </ul> | Administrative power.<br>Market confidence.                                                                                                         |
| Statutory requirements for product and transaction 'registers'.                                                                                                                                                                   | Statutory requirements for product and transaction 'registers', as well as registers of security interests.                                                                                                                                                                                                                                                                                         | Principle 13: Information<br>Complete knowledge.<br>Market confidence.                                                                              |
| <b>Policies and administrative procedures/systems</b>                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                     |
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                 | <i>Large high-scarcity markets</i>                                                                                                                                                                                                                                                                                                                                                                  | <i>Justification</i>                                                                                                                                |
|                                                                                                                                                                                                                                   | Detailed policies, procedures and systems for 'unbundling' of licences including (among many other things): <ul style="list-style-type: none"> <li>• verification and resolution of licence/works location</li> <li>• verification and resolution of ownership/security interests</li> <li>• managing transition to unbundled licences.</li> </ul>                                                  | Administrative capacity and efficiency.<br>Complete knowledge.<br>Market confidence.                                                                |
| Development, population and ongoing management of systems and public 'registers' for bundled entitlements, and for registration of transactions.                                                                                  | Development, population, and ongoing management of systems and public 'registers' for entitlements, works, and use consents, and for registration of transactions.                                                                                                                                                                                                                                  | Administrative capacity and efficiency.                                                                                                             |
| Development and population of systems for tracking                                                                                                                                                                                | Development, population, and ongoing management of systems for managing                                                                                                                                                                                                                                                                                                                             | Administrative capacity and                                                                                                                         |

|                                                                                                                    |                                                                                                                    |                                                                |
|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| 'temporary' trades.                                                                                                | water allocation 'accounts'.                                                                                       | efficiency.<br>Minimal transaction costs.                      |
| Development and implementation of protocols for delivery of required information to national water markets system. | Development and implementation of protocols for delivery of required information to national water markets system. | Administrative capacity and efficiency.<br>Complete knowledge. |

### 5.1.5 Trading rules

Section 4.4.3 recommended establishing trading rules to reduce case-by-case assessment costs and provide greater certainty to market participants. Such rules are essential to manage both the rate and location of extraction, as both of these factors are critical to the extent of groundwater level drawdown that may affect the environment and other groundwater users. This will require increasingly detailed understanding of the hydrogeology of the system, as system scarcity and demand for groundwater trading increase. The level of understanding and degree of certainty provided to the market should therefore increase in proportion to market size and groundwater access scarcity, with trading rules established via statutory plans in the larger, high demand systems. It should be noted that such trading rules are unlikely to cater for all situations, and there will be a need for at least some case-by-case technical assessment of trades (see Section 5.1.6 below).

**Table 9** Trading rule implementation actions

| Statutory enabling provisions                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                                                   | <i>Large high-scarcity markets</i>                                                                                                                                                                                                                                                                                                                                                                            | <i>Justification</i>                                                                                                                                                                                         |
| Conditions on licences making their trade subject to administrative rules established from time to time by the administering authority.                                                                                                                             | Statutory requirement for allocation (management) plans to include trading rules consistent with statewide principles established in statutory policy.                                                                                                                                                                                                                                                        | Administrative powers.<br><br>Complete (licence holder) knowledge.                                                                                                                                           |
|                                                                                                                                                                                                                                                                     | Conditions on licences making their trade subject to administrative rules established from time to time by the administering authority.                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                              |
| Policies and administrative procedures/systems                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                              |
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                                                   | <i>Large high-scarcity markets</i>                                                                                                                                                                                                                                                                                                                                                                            | <i>Justification</i>                                                                                                                                                                                         |
| Administrative policies or default rules (for example) for: <ul style="list-style-type: none"><li>• establish trading zones, including threshold extraction densities, declaration of zones</li><li>• inter-system trade of entitlements and allocations.</li></ul> | Trading rules established in water allocation/management plans, including relating to: <ul style="list-style-type: none"><li>• limits on entitlements/shares and use in each zone</li><li>• establishment of trading zones, including declaration of zones</li><li>• conditions relating to distance from GDEs, other extraction, etc</li><li>• inter-system trade of entitlements and allocations.</li></ul> | Principles 9 & 10: Trading rules<br><br>Complete (market) knowledge.<br><br>Administrative efficiency.<br><br>Minimal transaction costs.<br><br>Market confidence.<br><br>Recognition of public interest and |

|                                                                                                                                                                                                                                                                                       |                                                                                                    |                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                       |                                                                                                    | dealing with market failure.                                                                                |
| Procedures and systems for administering rules and tracking entitlements and allocations in zones.                                                                                                                                                                                    | Procedures and systems for administering rules and tracking entitlements and allocations in zones. | Administrative capacity and efficiency.                                                                     |
| <b>Technical tools</b>                                                                                                                                                                                                                                                                |                                                                                                    |                                                                                                             |
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                                                                     | <i>Large high-scarcity markets</i>                                                                 | <i>Justification</i>                                                                                        |
| Methods/procedures for defining: <ul style="list-style-type: none"> <li>• maximum extraction densities for aquifer types</li> <li>• zonal volumetric extraction limits based on the above</li> <li>• distance conditions from dependent ecosystems, other extraction, etc.</li> </ul> |                                                                                                    | Principle 12: Investment in technical information and tools.<br><br>Administrative capacity and efficiency. |

## 5.1.6 Assessment

Section 4.4.4 recognised the need for continuing case-by-case assessment of most groundwater trades to manage those cumulative and more local impacts on the resource itself, dependent ecosystems and availability of water to holders of other water rights not effectively managed by system or zonal trading rules. It also recommended publicly documented standard assessment methods and protocols for transparency and to maximise market confidence, and assessment tools (such as local models) to increase the efficiency and consistency of transaction processing. Again, the cost of developing such tools is likely to be justified in the larger markets with high scarcity where demand for trading is greatest.

**Table 10 Trade assessment implementation actions**

| <b>Statutory enabling provisions</b>                                                                                                                                                 |                                                                                                                             |                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                                                                                                    | <i>Large high-scarcity markets</i>                                                                                          | <i>Justification</i>                                                                                                     |
| Matters for consideration when assessing trades established in legislation.                                                                                                          | Matters for consideration when assessing trades established in legislation.                                                 | Administrative powers.                                                                                                   |
|                                                                                                                                                                                      | Statutory requirement for decisions to be consistent with any state-wide policy made under the Act.                         | Principle 11: Publicly documented assessment processes and requirements.                                                 |
|                                                                                                                                                                                      | Statutory requirement for decisions to be consistent with the provisions of any statutory water allocation/management plan. | Recognition of public interest and dealing with market failures.                                                         |
| Application processes established in legislation, including ability to require information from applicants, advertise where appropriate, charge, grant with conditions, reject, etc. |                                                                                                                             | Consistency with publicly (statutorily) agreed resource management principles and approaches.<br><br>Complete knowledge. |

| <b>Policies and administrative procedures/systems</b>                                                                                                                                                                                                                      |                                                               |                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                                                          | <i>Large high-scarcity markets</i>                            | <i>Justification</i>                                                                                                      |
| State-wide policies on: <ul style="list-style-type: none"> <li>• assessment methods and protocols</li> <li>• acceptable impacts</li> <li>• advertising</li> <li>• applicant information requirements</li> <li>• charging for assessment/application processing.</li> </ul> | As for simple system.                                         | As above, plus:<br><br>Principle 13:<br>Information publicly availability.<br><br>Administrative capacity and efficiency. |
| <b>Technical tools</b>                                                                                                                                                                                                                                                     |                                                               |                                                                                                                           |
| <i>Small low-scarcity markets</i>                                                                                                                                                                                                                                          | <i>Large high-scarcity markets</i>                            | <i>Justification</i>                                                                                                      |
| Case-by-case assessment procedures and methodologies, including techniques for characterising cumulative drawdowns in different hydrogeological settings.                                                                                                                  | System by system local (cumulative) impact assessment models. | Principle 12:<br>Investment in information and technical support tools<br><br>Administrative capacity and efficiency.     |

## 5.1.7 Market information

Sections 4.4.5 discussed the importance of widely available information for efficient market operation. Information on the market boundaries (spatial definition of the groundwater system, resource limits and entitlement limits), and uncertainties and processes for change associated with these are particularly important. Information on products and transaction processes, as well as on market activity and prices should also be readily available.

**Table 11 Market information implementation actions**

| Statutory enabling provisions                                                  |                                                                                                                                                                                                                        |                                                                      |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| <i>Small low-scarcity markets</i>                                              | <i>Large high-scarcity markets</i>                                                                                                                                                                                     | <i>Justification</i>                                                 |
| Statutory requirement for public water access licence register                 | As for small, low scarcity, plus: <ul style="list-style-type: none"><li>• Statutory requirement for water allocation or management plans to include market boundaries (Table 7) and trading rules (Table 9).</li></ul> | Principles 11 & 13:<br>Market information.<br><br>Market confidence. |
| Statutory requirement for public trading register                              |                                                                                                                                                                                                                        |                                                                      |
| Policies and administrative procedures/systems                                 |                                                                                                                                                                                                                        |                                                                      |
| <i>Small low-scarcity markets</i>                                              | <i>Large high-scarcity markets</i>                                                                                                                                                                                     | <i>Justification</i>                                                 |
| Policy and processes for registers—processes, content, ongoing management etc. |                                                                                                                                                                                                                        | Principles 11 & 13:<br>Market information.<br><br>Market confidence. |
| Publicly accessible information on groundwater systems and their               |                                                                                                                                                                                                                        |                                                                      |

|                                                                                                                                               |                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| market boundaries, relevant allocation or management plan (as appropriate).                                                                   | Complete knowledge.<br>No market power.<br>Minimise arbitrage opportunities.<br>Minimise transaction costs.<br>Administrative capacity and efficiency. |
| Publicly accessible information on groundwater trading activity (perhaps reports derived from trading register), including price information. |                                                                                                                                                        |
| Publicly accessible information on groundwater trading processes, including processing times.                                                 |                                                                                                                                                        |
| <b>Technical tools</b>                                                                                                                        |                                                                                                                                                        |
| Systems for registers.                                                                                                                        |                                                                                                                                                        |

## 5.1.8 Monitoring and compliance

As discussed in Section 4.4.7, monitoring of extraction and ensuring compliance with licence conditions and market rules is essential not only for market confidence, but for protection of the resource and dependent ecosystems, and of the rights of all users. This is especially the case in situations where groundwater entitlements are under-used but could rapidly move to full use with the implementation of trading. Monitoring of extraction (in many cases metering) will become an increasingly necessary tool in groundwater markets.

**Table 12 Monitoring and compliance implementation actions**

| <b>Statutory enabling provisions</b>                                                                    |                                                                                             |                                                |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------|
| <i>Small low-scarcity markets</i>                                                                       | <i>Large high-scarcity markets</i>                                                          | <i>Justification</i>                           |
| Statutory ability to require monitoring (including metering) of groundwater extraction.                 |                                                                                             | Administrative power.                          |
| Statutory ability to enforce compliance with licence conditions.                                        |                                                                                             | Complete (market) knowledge.<br>Exclusivity.   |
| <b>Policies and administrative procedures/systems</b>                                                   |                                                                                             |                                                |
| <i>Small low-scarcity markets</i>                                                                       | <i>Large high-scarcity markets</i>                                                          | <i>Justification</i>                           |
| Development and implementation of monitoring and compliance policy, including detailed metering policy. |                                                                                             | Principles 14 & 15: Monitoring and compliance. |
| Mandatory metering for temporary/allocation trades.                                                     | Full metering in all mature systems, with reading and/or self-reporting with random audits. | Providing/enforcing exclusivity.               |
| <b>Technical tools</b>                                                                                  |                                                                                             |                                                |
| <i>Small low-scarcity markets</i>                                                                       | <i>Large high-scarcity markets</i>                                                          | <i>Justification</i>                           |
| Systems to support monitoring/metering, linked to licensing systems.                                    |                                                                                             | Administrative capacity and efficiency.        |

## 5.2 Possible Australian Government actions

There are already several Australian Government programs and specific projects that can contribute to the implementation of broadly consistent approaches to groundwater trading nationally. These were briefly referred to in Section 3.3.9 and include:

- the water markets system
- the forthcoming Murray–Darling Basin Plan, and in particular its definition of groundwater systems and their ‘sustainable diversion limits’, and its establishment of water trading rules
- the National Groundwater Action Plan, in particular projects relating to:
  - developing better approaches to estimating sustainable yields (extraction limits)
  - characterising and managing connected surface water and groundwater systems
  - development of technical tools, including models, to assist in the assessment of groundwater trades.

Further and ongoing work should be undertaken in these critical areas. In particular, the technical aspects of establishing extraction limits, characterising surface water/groundwater connectivity, and development of local impact assessment tools will require sustained effort, as will adequate and consistent information collection on groundwater trades for reporting on the National Water Market System website. Australia is at the forefront of groundwater policy development and reform, and its progress is being watched by other water resource managers worldwide. The development of reliable, credible, and cost-effective technical approaches to enable practical implementation of these policy innovations is critical.

This report and its trading principles should assist jurisdictions in the development of policy approach to groundwater trading. Eventually these policy positions will need to be embedded in legislation and, importantly, in statutory water allocation or management plans. The Australian Government could consider providing further assistance in this area. There may be some scope for the development of ‘model provisions’ for groundwater trading. These could be provisions for statutes or their regulations, and for water allocation or management plans. Once developed, further assistance could be provided to jurisdictions to tailor these provisions to their unique statutory and planning frameworks.

Individual jurisdictions may seek Australian Government funding for development and implementation of aspects of groundwater trading and the entitlement and planning frameworks that underpin these.

## 6. Applying the framework—case studies and issues

The following case studies (Sections 6.1 and 6.2) provide an illustration of how the framework may be applied to individual groundwater systems.

Discussion is also provided (Section 6.3) on applying the framework to specific water uses and issues.

### 6.1 Case study: Trading regime for the Lower Murrumbidgee Deep Groundwater Source (NSW)

#### 6.1.1 Groundwater system description

The Lower Murrumbidgee Deep Groundwater Source is located in south-western New South Wales. It is an example of a large, relatively homogeneous and highly developed groundwater system, and of a highly active trading market. It also provides an example of user-driven local impact management and the use of potentially varying, stress-defined management zones (Furness and Kumar 2008).

The groundwater system consists of confined and semi-confined alluvial aquifers of the eastern Murray Geological Basin, and is overlain by the Lower Murrumbidgee Shallow Groundwater Source. Significant characteristics of the Lower Murrumbidgee Deep Groundwater Source include:

- large system size (volume and average annual recharge)
- high level of scarcity, being over-allocated, over-used and undergoing planned entitlement reduction
- high level of conjunctive water use, with many groundwater users also having access to regulated surface water.

Further details are provided in Table 13. The location of the Lower Murrumbidgee is shown in Figure 6.

**Table 13 Lower Murrumbidgee groundwater system details**

|                             |                                                                           |  |  |
|-----------------------------|---------------------------------------------------------------------------|--|--|
| <b>Groundwater system:</b>  | Lower Murrumbidgee Deep Groundwater Source                                |  |  |
| <b>Location:</b>            | south-western NSW                                                         |  |  |
| <b>Geol environment:</b>    | broad sedimentary basin (Murray Geological Basin)                         |  |  |
| <b>Main aquifers:</b>       | alluvial sands and gravels of the Calivil Fm and Renmark Group            |  |  |
| <b>Boundary - spatial:</b>  | geological formation and flow boundaries; some surface feature surrogates |  |  |
| <b>Boundary – vertical:</b> | geological formation and depth below ground                               |  |  |
| <b>Recharge sources:</b>    | throughflow, river leakage, rainfall and irrigation practices             |  |  |

|                         |               |                          |               |
|-------------------------|---------------|--------------------------|---------------|
| <b>Annual recharge:</b> | 335 000 ML/yr | <b>Extraction limit:</b> | 270 000 ML/yr |
|-------------------------|---------------|--------------------------|---------------|

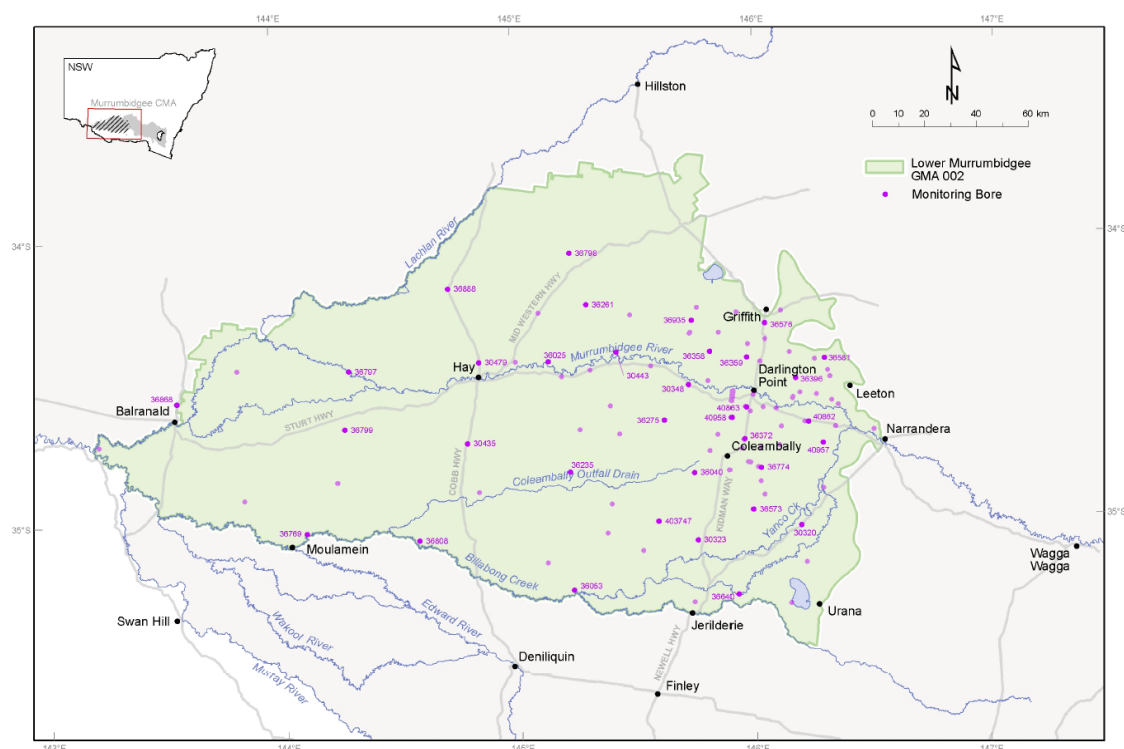
|                     |                        |                          |              |
|---------------------|------------------------|--------------------------|--------------|
| <b>System area:</b> | 31 372 km <sup>2</sup> | <b>System thickness:</b> | 100 to 300 m |
|---------------------|------------------------|--------------------------|--------------|

| Licences and extraction 2008–09 |              | Groundwater trading 2008–09 |            |
|---------------------------------|--------------|-----------------------------|------------|
| <b>No. of licences held:</b>    | 290 licences | <b>Allocations (temp):</b>  | 291 trades |
| <b>Entitlement volume:</b>      | 269 987 ML   |                             | 101 098 ML |
| <b>Extraction volume:</b>       | 287 712 ML   | <b>Entitlement (perm):</b>  | 42 trades  |
|                                 |              |                             | 21 840 ML  |

Sources: NSW Government (2006), NOW website

**Figure 6 Area underlain by the Lower Murrumbidgee Groundwater Sources**



Source: Kumar (2010a)

## 6.1.2 Groundwater trading—enabling environment

### Governance and administrative framework

Groundwater management in the Lower Murrumbidgee is carried out by the NSW Office of Water under the *Water Management Act 2000*. The Act includes general objectives and principles for water management, and enables statutory access licence dealing (trading) principles, and development of statutory water sharing plans and subsequent trading rules.

### Products and consumptive pool

Tradeable groundwater rights comprise aquifer access licences (entitlements) and groundwater ‘allocations’ accruing to licences. Non-tradeable groundwater rights comprise ‘basic rights’ (domestic and stock, and native title rights) and local utility access (town supply) licences (however, ‘temporary’ trade of town water allocations can occur in some cases).

Access licences are fully unbundled, being separated from land, use rights and works (bores). While licences are not attached to specific locations or parcels of land, they are linked to the groundwater system, and the ‘effective’ location is identified through the location of works (bores) that are nominated on the licence at any point in time. Under the Act, there are no restrictions on ownership of access licences.

While the groundwater entitlement volume in the Lower Murrumbidgee is effectively capped, the Act allows for granting of further licences and entitlement for town supply and mining. Should this occur, it would be at the expense of the security of access to groundwater by other users, which could take effect through reduced available water determinations (equivalent to announced allocations).

## Trade-related transactions

Transactions include change in ownership, permanent and temporary change in location of all or part of an entitlement, and trade in water allocations (this refers to water allocation as per the NWI definition). The Act allows for interstate trade of both entitlements and allocations, but these are not enabled under the Lower Murrumbidgee Water Sharing Plan (NSW Government 2006).

### 6.1.3 Groundwater trading—operating environment

#### Market and resource definition

The water sharing plan (WSP) for the Lower Murrumbidgee Groundwater Sources is the primary instrument for directing groundwater management in the Lower Murrumbidgee Deep Groundwater Source. It defines the resource, entitlement levels, extraction limits, and trading rules. It also allows for the declaring of local impact management areas.

The deep groundwater source is over-allocated in relation to current recharge and sustainable yield estimates, and a critical feature of the WSP is to reduce entitlements in a planned and transparent manner over a 10-year period from 2006.

The groundwater system is defined spatially by groundwater flow lines and the extent of the main aquifers, with surface features such as roads and cadastral boundaries used as surrogates and to provide a clear administrative boundary between adjoining, linked groundwater systems. The vertical extent is defined by a combination of geological formation boundaries and depth limits.

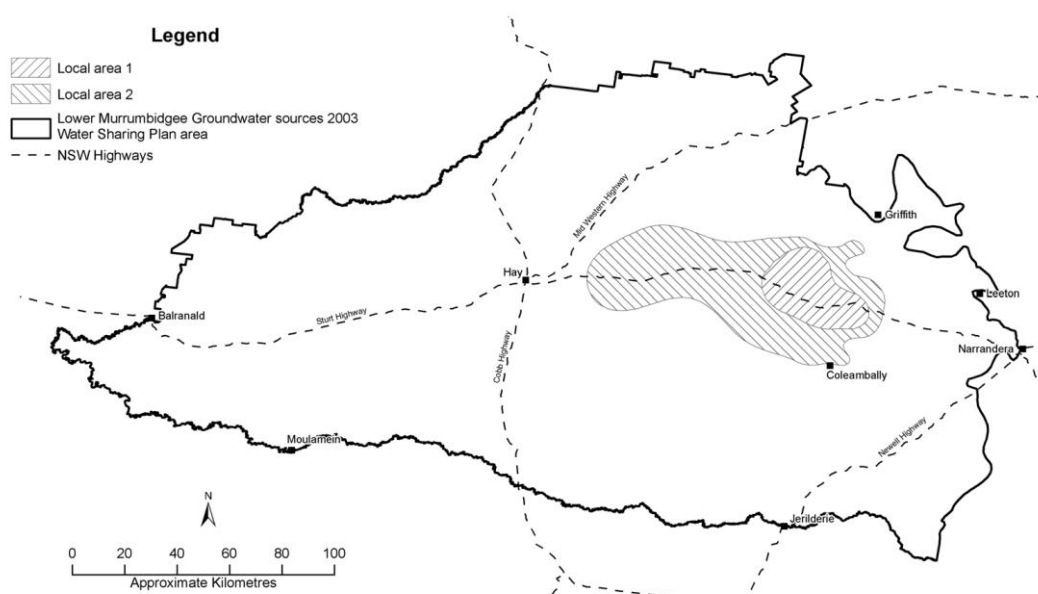
The WSP does not contain any fixed 'zones'. However, since its commencement in 2006, local impact management areas have been declared to manage continuing localised groundwater level drawdown and are discussed further below. Also, the entire Lower Murrumbidgee consists of both the Shallow and Deep Groundwater Sources, which are managed under separate rules in the one water sharing plan, and, as groundwater rights can be traded between them, are almost akin to zones of the larger system. The separation of shallow and deep groundwater management is required to meet the differing needs of the confined and unconfined aquifers.

In August 2007 two 'local impact management areas' were formally gazetted and restrictions were placed on trades. This was done in consultation with local groundwater users, and in response to concerns of increasing seasonal drawdown in these areas, and the potential for extraction rights to migrate over time from outlying areas of poorer groundwater availability to areas of better availability, leading to increased drawdown impacts on neighbouring bores (Kumar 2010b; Kumar P, pers comm). The need for the local impact management areas highlights the inability for individual impact assessment to deal effectively with cumulative impacts. The two areas are shown in Figure 7.

The local impact areas were determined by setting threshold drawdown criteria to develop a 'trigger surface', which was then compared with a contoured groundwater piezometric surface to create a map of 'trigger exceedence'. This formed the basis for defining the local impact areas (Furness and Kumar 2008).

Trading into the management areas from outside is not permitted, nor is trade from management area 2 to management area 1. The local impact management area boundaries could potentially be changed at the commencement of any season in response to recent groundwater level drawdown. However, this would be done only if essential, and in consultation with groundwater users (Kumar P, pers comm).

**Figure 7 Lower Murrumbidgee local impact management areas**



Source: Kumar (2010a)

## Trade initiation and rules

Temporary trading of groundwater allocations and metering of extraction volumes had been undertaken for several years before commencement of the water sharing plan. However, the WSP allowed for commencement of permanent trading of entitlement. A critical prerequisite for this trading was confirmation of the system extraction limit, and of a process for reducing entitlements to this amount.

Trading rules are provided in the WSP. These mainly relate to the type and destinations of trades, and include:

- prevention of trades to water systems not included in the WSP
- prevention of trades that would result in unacceptable local impacts
- allowance for trading between the Shallow and Deep groundwater sources (subject to entitlements remaining less than the extraction limit in each water source).

In addition, extraction of groundwater from a new or replacement bore is excluded within 200 m of designated high priority groundwater dependent ecosystems or any creek or river for those exercising basic landholder rights, and 1,000 m for extraction authorised by access licences, unless the bore only draws water from an aquifer at approved depths and has an impermeable seal constructed within the bore annulus to prevent water ingress from the restricted aquifer. Applications that do not meet these requirements are not approved, while those that do meet the requirements are subject to an appropriate level of assessment as described below.

## 6.1.4 Groundwater trading—market operation

### Transaction processing

Applications for temporary (seasonal allocation) trades are processed by State Water, with technical assessment by NOW. Applications for permanent trades are processed and assessed by NOW. Costs of impact assessment undertaken by NOW are charged to the applicant to a

maximum of \$1500 per assessment as determined by IPART. For complex situations, NOW may request an additional fee for higher-level assessment, or seek additional information or assessment by the applicant at the applicant's expense. Temporary trade assessments are generally completed within 5 to 10 working days, while permanent trade assessments may take several weeks or months.

## Methods for assessment and mitigation of impacts

In a fully unbundled situation, groundwater can potentially be traded freely between access licences that have no bores nominated. The licence is simply a location to store the entitlement asset. Similarly, for licences that do have nominated works, individual licensees may wish hold additional entitlement that will not be put to productive use via those works, i.e. the allocation accruing to the excess entitlement may be earmarked for temporary transfer to other licensees. To cater for this situation in the Lower Murrumbidgee NOW has taken the approach of setting 'extraction limits' for individual bores or groups of bores when faced with a significant trade application. The extraction limit is applied to work approvals and not to access licences, and may remain indefinitely until there is a change in circumstances in the local area. It sets an overriding limit to extraction irrespective of the volume of entitlement held on an access licence, or the volume of allocation in the linked account, allows for simpler processing of future trades, and pre-caters for impact mitigation.

Trade impact assessment and setting of extraction limits is undertaken to protect the rights of neighbouring groundwater users. The only high-priority GDEs recognised in the WSP are prior stream aquifers in the shallow groundwater source. For temporary trades (of annual allocation), assessment is only undertaken if the resulting account volume will exceed 150 per cent of the access licence entitlement.

Assessment is generally done using spreadsheet analysis with the Theis equation, although this technique does not cater well for complex situations with other groundwater users and multiple bores, and for such cases the purpose-designed 'Hotspots' model is used. For most assessments of complex situations, recent extraction volumes or applied 'extraction limits' are assumed in the analysis. Extraction at full entitlement level may also be assumed for some cases, but in a fully utilised groundwater system and a highly active market, it is not necessarily a more realistic or more conservative assumption.

Acceptable impact is taken to be less than 5 per cent of the 'available head' at the subject neighbouring bore. Available head is defined as the height of the pre-development water level above the top of the confined aquifer. Mitigation measures largely comprise a change in location for proposed bores, or applying an extraction limit for new or existing bores. If the applicant does not agree with having an extraction limit applied, then the options are generally to withdraw the application or amend the proposed trade volume. Additional options include deepening the affected bore, or supplying water to the affected party.

### 6.1.5 Groundwater trading—trade reporting, facilitation and market activity

#### Reporting and facilitation

Metering of groundwater extraction has been undertaken on irrigation bores in the Lower Murrumbidgee since the 1980s, and is continuing under the WSP.

Data is available from registers on the NOW website for:

- licences—types, numbers and groundwater system entitlement volumes
- trades—types and numbers, and annual trade volumes for different transaction types
- transaction processing efficiency.

A number of professional intermediaries are actively involved in facilitating groundwater trading in the Lower Murrumbidgee.

## Market activity

The Lower Murrumbidgee deep groundwater source has the most active groundwater trading market in Australia. In 2008–09 a total of 101 098 ML of annual allocation was traded under 291 transactions, and 21 840 ML of entitlement was traded under 42 transactions (NOW website registers). The annual temporary trade volume was 37 per cent of total entitlements, and 35 per cent of total annual extraction.

The main factors that may be contributing to this activity are:

- the size of the groundwater system, both volumetrically and spatially, which influence its extraction limit and number of groundwater users
- the homogeneous nature of the groundwater system, which allows for relatively unimpeded trade
- scarcity of water, being an over-allocated and over-used groundwater system
- the presence of large irrigation schemes which have suffered surface water scarcity under the recent drought, prompting many surface water irrigators to seek groundwater access in recent years (especially to maintain permanent plantings)
- an active groundwater association that interacts closely with state government
- well-informed groundwater users, many of whom are also users of regulated surface water and are familiar with the concepts of water trading
- a relatively high level of certainty in the water market, with the WSP providing the process for managing entitlement levels and NOW providing information on both the groundwater market activity and status of the groundwater resource.

### 6.1.6 Evaluation of the Lower Murrumbidgee in relation to the framework for groundwater trading

The Lower Murrumbidgee groundwater trading regime has been evaluated in relation to the framework for groundwater trading. The evaluation is provided in Table 14.

**Table 14 Application of the framework to the Lower Murrumbidgee groundwater systems**

| Framework element/principle                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Current situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Potential changes                                                                                                                          | Discussion – benefit and feasibility of changes                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Specifying market boundaries</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |
| Physical boundaries:                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |
| Groundwater systems should be based on physical aquifers or groups of aquifers. They should have clearly defined boundaries based on hydrogeological features such as geological units, groundwater flow 'catchments' and groundwater quality discontinuities, and should be vertically delineated into separate systems in cases where the vertical connection between adjoining aquifers is low. Processes for adjustment of boundaries should be transparent and clearly articulated. | System boundary was set at commencement of the WSP (spatial map and text) and considered 'fixed' for the 10-year term of the plan. The boundary effectively encapsulates the groundwater system, but follows a combination of cadastral and administrative features (e.g. parish boundaries, roads, railway line and Murrumbidgee Irrigation Area main canal). Processes for establishing the zone boundaries and for their potential change are not described in publicly available documents. | No changes recommended. However, an alternative may have been to accurately follow the groundwater system boundary.                        | Accurate representation of the physical system boundary is subject to available bore log information and subjective judgements on the transition from bedrock to alluvial aquifers, and, at the lower end of the system, on the distinction between adjoining alluvial systems. It may also bisect landholdings and place multiple bores on one landholding into different groundwater systems. |
| Groundwater systems should be as large as possible, subject to hydrogeological connectivity limitations and discontinuities.                                                                                                                                                                                                                                                                                                                                                             | Very large system, but with potential hydrological connectivity to other Murray Geological Basin systems, including the adjacent Lower Lachlan and Lower Murray systems. These areas are managed as separate systems due to their separate recharge sources, with flow lines only converging at their lower ends. The Lower Murrumbidgee Deep underlies the Lower Murrumbidgee Shallow, and they are managed as separate                                                                        | No change recommended. However, the Deep and Shallow systems could potentially be managed as separate zones within one groundwater system. | The creation of fixed zones within a 'water source' (equivalent to a groundwater system) was not an option at the time of plan development.                                                                                                                                                                                                                                                     |

| Framework element/principle                                                                                                                                                                                                                                                                           | Current situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Potential changes                                                                                                                                                                          | Discussion – benefit and feasibility of changes                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                       | groundwater systems. Vertical delineation is defined by a combination of geological formation and depth criteria, and driven by differing issues and management needs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |
| Trading between systems:                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |
| Where a groundwater system is not adequately hydraulically connected to other systems, trade into or out of the system should be prohibited. However, trading between groundwater systems that are part of a larger connected aquifer system (e.g. one that spans a state boundary) should be enabled | Trade is allowed between the Lower Murrumbidgee Deep and the overlying, partially connected Lower Murrumbidgee Shallow groundwater system. However, trade with other adjoining systems is prohibited. Whilst the Lower Murrumbidgee Deep is hydraulically connected to the adjoining Lower Lachlan and Lower Murray systems at their lower ends, their main recharge sources (Lachlan, Murrumbidgee and Murray rivers) are quite distinct, and the aquifers operate largely as separate flow systems, especially within their low salinity/high productivity areas. Given the above and their relatively large size, they can be effectively treated as discrete systems. | A similar outcome could be achieved by the deep and shallow systems being designated as separate zones within a single groundwater system. No change proposed for other adjoining systems. | At commencement of the WSP, the <i>Water Management Act 2000</i> did not allow for fixed groundwater management zones to be created within groundwater 'sources'. However, local impact management areas can be created after plan commencement to deal with issues as they arise. |
| Trading may be enabled between a groundwater system and a connected surface water system where there is an adequate level of                                                                                                                                                                          | Trading is not permitted between groundwater and surface water.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Enable trade between groundwater and surface water.                                                                                                                                        | The Lower Murrumbidgee Deep groundwater system and the Murrumbidgee Regulated River are both large and activity water trading                                                                                                                                                      |

| Framework element/principle                                                                                                                                                                                                                 | Current situation                                                                                                                                                                                                           | Potential changes | Discussion – benefit and feasibility of changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| connectivity and mechanisms are in place to minimise environmental and other third-party impacts.                                                                                                                                           |                                                                                                                                                                                                                             |                   | markets, and water users with physical access to both can currently trade out of one and into the other as required. In this sense, direct trade between the two may not offer much benefit. To enable trade between groundwater and surface water, consideration would need to be given to the role of the interconnecting Lower Murrumbidgee Shallow groundwater system, implications of the significantly differing storage and flow characteristics, e.g. the river has an available storage to average flow ratio of 0.6:1, while the groundwater system has a storage to recharge ration of about 1000:1, differing security of supply and potential conversion factors, the potential benefits and limitations associated with trading between the two. |
| Entitlement and extraction limits:                                                                                                                                                                                                          |                                                                                                                                                                                                                             |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Entitlement and extraction limits should be clearly specified. Processes for change in long-term limits, determining annual allocations or restricting extraction in times of water shortage should be transparent and clearly articulated. | This information is provided within the WSP, apart from processes for change in long-term limits. However, the WSP is fixed for a 10-year period, which limits the implications of any uncertainty. No changes recommended. | nil               | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Assessing potential market activity</b>                                                                                                                                                                                                  |                                                                                                                                                                                                                             |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Framework element/principle                                                                                                                                                                                   | Current situation                                                                                                                                                                                                                                                                                                                             | Potential changes | Discussion – benefit and feasibility of changes |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------|
| Potential market activity can be assessed based on the level of scarcity or competition for groundwater rights, and the potential market size (indicated by the number of licences or entitlements on issue). | The Lower Murrumbidgee Deep groundwater source is one of the most active groundwater trading markets in Australia. Scarcity is high, as indicated by recent usage above the long term average annual extraction limit, and above end of WSP target entitlement levels. It is also relatively large, with approximately 290 licences on issue. | nil               | n/a                                             |
| <b>Establishing appropriate management regimes</b>                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                               |                   |                                                 |
| Deciding the level of investment in the trading regime:                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                               |                   |                                                 |
| The level of investment in the groundwater trading management regime should be commensurate with potential market activity                                                                                    | Unbundled licensing arrangements and implementation of 'local impact management areas' are commensurate with the high degree of scarcity and large market size.                                                                                                                                                                               | nil               | n/a                                             |
| Selecting product and transaction arrangements:                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                               |                   |                                                 |
| NWI-consistent products and transactions should be instated as a priority in groundwater systems where potential market activity is high and in other cases where it is cost effective                        | NWI-consistent ('unbundled') water access entitlement arrangements are in place. This was done as part of the WSP implementation. Priority in WSP development was given to the larger groundwater systems with high levels of entitlement scarcity.                                                                                           | nil               | n/a                                             |
| Investment in establishing trading rules:                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                               |                   |                                                 |

| Framework element/principle                                                                                                                                                         | Current situation                                                                                                                                                                                                                                                                                                     | Potential changes                                                                                                           | Discussion – benefit and feasibility of changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trading rules should be based primarily around the establishment of zones, local density limits and bore proximity limits that are objective and easily understood and implemented. | Density or zonal limits have not been established.                                                                                                                                                                                                                                                                    | Establish density and/or zonal extraction limits for local impact management areas and remainder of the groundwater system. | Given that zonal boundaries are based on groundwater level drawdown, and may change over time, investment in establishing zonal density and extraction limits may not be warranted. In addition, density limits may have to vary across the system, and hence require an additional level of zoning. However, well-founded density limits may provide an alternative trade/extraction management option in the future once groundwater abstraction has been sufficiently re-distributed under the local impact management area rules. For the 'unbundled' situation, density would have to be defined by the individual 'extraction limits' placed on work approvals (i.e. applying to individual bores), rather than referring to aquifer access licence entitlements. |
| Trading rules should be used to manage potential impacts of changes to the location of water extraction and not for other purposes.                                                 | Specific rules have been established to meet the needs of the groundwater system. These include rules that limit the direction of trade between local impact management areas, and between local impact management areas and other parts of the groundwater system. Trading rules are not being used to address over- | nil                                                                                                                         | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Framework element/principle                                                                                                                                                                                                                                                                                                                                                                    | Current situation                                                                                                                                                                                                                                                                                                                                                                                                                       | Potential changes                                                                                                                               | Discussion – benefit and feasibility of changes                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                | allocation or limit development of under-used entitlements.                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                        |
| Investment in assessment support:                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                        |
| Assessing authorities should have standard, publicly documented, assessment requirements for trades involving change of location of extraction. These would include appropriate methods and protocols for assessment, and pre-determined thresholds for the level of impact considered unacceptable. The levels of investment required in assessments should be tailored to the level of risk. | Assessment methods and decision parameter thresholds are not publicly documented.                                                                                                                                                                                                                                                                                                                                                       | Assessment methods and parameter thresholds to be publicly documented.                                                                          | This should be feasible and may benefit those water users who may choose to seek independent advice, and would assist in ensuring consistency within jurisdictions and over time. It may also reduce the need for advice to individual applicants, and reduce the number of unsuccessful applications. |
| Investment in information and technical support tools for assessment in individual groundwater systems should increase with potential market activity                                                                                                                                                                                                                                          | Relatively high level of information and supporting tools. State database provides ready access to locational data (coordinates) for mapping of bore locations (however, locations of stock and domestic bores are subject to driller advice only and may not be accurate); metered irrigation bores are generally accurately located. 'Hotspots' analytical model developed for trade impact analysis and used for complex situations. | Further modelling to evaluate optimal abstraction volumes against drawdown criteria, and set density limits for different parts of the aquifer. | Robust density limits have the potential to negate much future assessment of individual cases, and could be used for setting 'extraction limits' on all bores, and for revising these as circumstances change.                                                                                         |
| Investment in publishing market information:                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                        |

| Framework element/principle                                                                                                                                                                                                                         | Current situation                                                                                                                                                             | Potential changes                                                                                                                                                                                                                                                                     | Discussion – benefit and feasibility of changes                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| For all markets, jurisdictions should make publicly available complete and up to date information on groundwater systems, tradeable products and their management, market activity, and trade assessment requirements and administrative processes. | Much of the recommended information is available from the NOW website via the WSP and specific web pages.                                                                     | Statistics to be more readily available on number and total volume of individual entitlements, and average annual extraction limits (system, and for any zone). Clear separation of change of ownership (or, conversely, change of location or nominated work) from other trade data. | Entitlement levels and extraction limit information is available from WSPs and reports, but could also be collated and made available in a format that is much simpler to access. Separation of data on trade types may not be fully achievable. |
| Investment in monitoring and compliance for groundwater extraction:                                                                                                                                                                                 |                                                                                                                                                                               |                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                  |
| Metering of extraction should be introduced in all groundwater systems where trading is possible, and should be a mandatory prerequisite for participants in a temporary (seasonal allocation) trade.                                               | Metering is taking place as suggested.                                                                                                                                        | nil                                                                                                                                                                                                                                                                                   | n/a                                                                                                                                                                                                                                              |
| Compliance management of water rights should be implemented in all systems, with monitoring effort (e.g. meter reading frequency, proportion of groundwater bores metered) increasing in proportion to scarcity regardless of market size.          | This is generally the case, although system size, individual entitlement volumes and overlap with regulated surface water systems also appear to influence compliance effort. | Increased roll-out of groundwater extraction metering in lower scarcity situations, including increased mid-season data to prevent (rather than just detect) non-compliance.                                                                                                          | Water extraction metering has recently been the subject of national and jurisdictional investigations and will not be discussed further in this report.                                                                                          |

## 6.2 Case study: trading regime for water supply protection areas of the Loddon Valley (Vic)

### 6.2.1 Groundwater system description

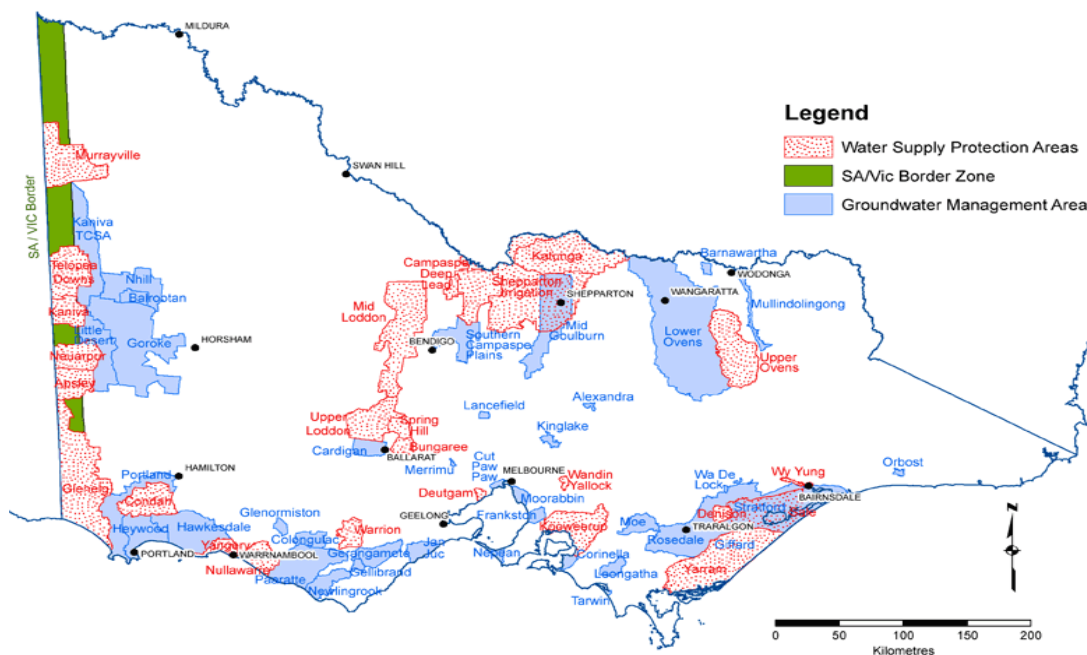
The Upper Loddon and Spring Hill Water Supply Protection Areas (WSPA) were adjoining groundwater systems until 1 August 2010, when they were abolished and replaced with the new Loddon Highlands WSPA (which also includes some adjoining previously unincorporated areas). The Mid Loddon adjoined the Upper Loddon WSPA and now adjoins the Loddon Highlands WSPA. For this case study, discussion and data presentation is made in the context of the previous WSPA configuration of separate WSPA's for the Upper Loddon and Spring Hill. A map showing these areas is provided in Figure 8. The groundwater systems consist of both confined alluvial and overlying volcanic rock aquifers, with the alluvial aquifers predominant in the Mid Loddon and diminishing in significance towards the Spring Hill area, and the converse applying to the volcanics.

Significant characteristics of the Loddon groundwater systems include:

- small market sizes, recent change and uncertainty in groundwater system boundaries
- town water supply providers as active market participants
- outsourcing of trade impact assessments.

Further details are provided in Table 15.

**Figure 8** Groundwater systems of Victoria, including the Mid Loddon and former Upper Loddon and Spring Hill WSPAs



Source: DSE website

<http://www.ourwater.vic.gov.au/environment/groundwater/management/GMUs-map>

**Table 15 Mid Loddon, Upper Loddon and Spring Hill groundwater system details**

|                             |                                                                                                                                                                  |  |  |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <b>Groundwater system:</b>  | Mid Loddon, Upper Loddon and Spring Hill Water Supply Protection Areas                                                                                           |  |  |
| <b>Location:</b>            | central Victoria                                                                                                                                                 |  |  |
| <b>Geol environment:</b>    | Murray Geological Basin alluvials and volcanics in the Mid Loddon, grading to predominantly volcanics and some underlying alluvials in Spring Hill area.         |  |  |
| <b>Main aquifers:</b>       | Calivil Fm alluvials in Mid Loddon; Newer Volcanics (basalt) and underlying Calivil Fm in Upper Loddon; Newer Volcanics in Spring Hill area                      |  |  |
| <b>Boundary – spatial:</b>  | administrative                                                                                                                                                   |  |  |
| <b>Boundary – vertical:</b> | defined by geological formation in Mid Loddon; unspecified for Upper Loddon; 70 m depth limit in Spring Hill, except for volcanic cones where depth is unlimited |  |  |
| <b>Recharge sources:</b>    | direct rainfall, throughflow and river leakage                                                                                                                   |  |  |

|                     |                      |                          |                      |
|---------------------|----------------------|--------------------------|----------------------|
| <b>System area:</b> |                      | <b>System thickness:</b> |                      |
| Mid Loddon          | 3000 km <sup>2</sup> | Mid Loddon               | geologically defined |
| Upper Loddon        | n/a                  | Upper Loddon             | geologically defined |
| Spring Hill         | 235 km <sup>2</sup>  | Spring Hill              | mostly 70 m          |

|                         |     |                                |                |
|-------------------------|-----|--------------------------------|----------------|
| <b>Annual recharge:</b> |     | <b>Extraction limit (PCV):</b> |                |
| Mid Loddon              | n/a | Mid Loddon                     | 33 905 ML/yr*  |
| Upper Loddon            | n/a | Upper Loddon                   | 13 648 ML/yr** |
| Spring Hill             | n/a | Spring Hill                    | 5062 ML/yr**   |

|                                        |              |                                    |                       |
|----------------------------------------|--------------|------------------------------------|-----------------------|
| <b>Licences and extraction 2008/09</b> |              | <b>Groundwater trading 2008/09</b> |                       |
| <b>No. of licences held**:</b>         |              | <b>Allocations (temp)**:</b>       |                       |
| Mid Loddon                             | 97 licences  | Mid Loddon                         | 21 trades<br>3,235 ML |
| Upper Loddon                           | 115 licences | Upper Loddon                       | 21 trades<br>1440 ML  |
| Spring Hill                            | 55 licences  | Spring Hill                        | 13 trades<br>325 ML   |
| <b>Entitlement volume**:</b>           |              |                                    |                       |
| Mid Loddon                             | 34 014 ML    |                                    |                       |
| Upper Loddon                           | 13 264 ML    |                                    |                       |
| Spring Hill                            | 4909 ML      |                                    |                       |
| <b>Extraction volume**:</b>            |              | <b>Entitlement (perm):</b>         |                       |
| Mid Loddon                             | 19 422 ML    | Mid Loddon                         | nil                   |
| Upper Loddon                           | 5066 ML      | Upper Loddon                       | not permitted         |
| Spring Hill                            | 2041 ML      | Spring Hill                        | not permitted         |

Sources:

\* - Goulburn-Murray Water (2009a)

\*\* - Goulburn-Murray Water (2009b)

## 6.2.2 Enabling environment

### Governance and administrative framework

Groundwater management in the Upper and Mid Loddon and Spring Hill WSPAs is carried out by Goulburn-Murray Water (G-MW) under the *Water Act 1989* and policies and regional strategies set by the Department of Sustainability and Environment (DSE). The Act enables state policy for managing take and use licences, guidelines and rules in management plans for WSPAs that Rural Water Authorities are obliged to comply with.

DSE has responsibility for state policy and state and regional strategies, while G-MW is responsible for groundwater licensing, trading, monitoring and compliance. Both DSE and G-MW are involved in resource assessment and the development of management plans.

### Products and consumptive pool

Tradeable products comprise 'take and use licences', and their associated volumetric entitlements. Take and use licences are not unbundled, and include conditions on the location and purpose of groundwater extraction. To take the water the holder must also have a s. 67 licence to operate a bore at the specified location. Licence ownership is restricted to the owner of the land to which the licence applies, and the holder must be able to reasonably use the licensed amount of water on the land.

Non-tradeable products include domestic and stock rights.

Entitlements in all three WSPAs are 'capped', and no additional entitlements can be issued. New entrants and those seeking additional access to water, including any requirement for urban or mining supply, must meet their needs via the market.

### Trade-related transactions

Permanent transfers can only be undertaken in the Mid Loddon, and have only been available since June 2009. Transactions largely comprise change of owner, location and volume.

Temporary transfers apply in all WSPAs and are given effect by noting on the transferors licence that the volume is reduced for the specified period, and issuing the corresponding volume to the transferee as a new licence or a change to an existing licence for the same period.

## 6.2.3 Operating environment

### Market and resource definition

The Mid Loddon WSPA was declared in 2002 and amalgamated a number of areas, including the Bridgewater GMA, Salisbury West GMA and Zone 1 of the Moolort GMA (DSE 2010a). An embargo is in place on new groundwater licences, and groundwater is managed under the 'Mid-Loddon Groundwater Management Area Local Management Rules, June 2009' (G-MW 2009a). A PCV of 33,905 ML was declared under the 2009 local management rules, and an announced allocation of 100% applied in 2008/09 (G-MW 2009b).

The Upper Loddon WSPA was declared in 2003 and amalgamated a number of areas including the Ascot GMA, Tourello GMA and Zone 2 of the Moolort GMA (DSE 2010a). Since then an embargo on new licences has been in place. An announced allocation of 100% applied in 2008–09 (G-MW 2009b).

The Spring Hill area was declared a WSPA in 1999 as allocations were high relative to the permissive annual volume (PAV) at the time. A groundwater management plan was subsequently enacted in October 2002 (SHGSPACC 2002). In developing the plan it was recognised that there seemed little problem with the resource at the time, and the plan established a program for

monitoring, metering and review (DSE 2010a). The plan also established zones and prohibited new allocations. A PCV of 5,062 ML/year has been declared, which is the volume of irrigation/commercial licence entitlements in place when the groundwater management plan was implemented in 2002. As the drought conditions in Victoria intensified and recharge to the aquifer systems decreased water levels in the systems also began to fall. Restrictions on abstractions were ultimately invoked by G-MW and an announced allocation of 64 per cent applied in 2008–09 (G-MW 2009b).

The boundaries of the three WSPAs are all largely based on administrative considerations relating to intensities of bores and subsequent groundwater extraction. However, the boundary between the Mid and Upper Loddon is hydrogeologically driven by the change in predominance of usage from alluvial to volcanic aquifers. In addition, groundwater allocation and abstraction intensity may act as a surrogate for hydrogeology, especially in the Mid Loddon where the main alluvial aquifer is confined and not accurately mapped. In the Upper Loddon and Spring Hill areas, the actual volcanic rock hydrogeology does not constitute a single and homogeneous flow system, and nor possibly do individual surface catchments. Hence other criteria, such as groundwater allocation and abstraction, have needed to be considered in setting groundwater system boundaries.

The vertical depth limit of the Mid Loddon extends to the base of the alluvial aquifers, and includes three spatial management zones, being the Jarklin Zone (north of the Waranga eastern Channel), Laanecoorie-Serpentine Zone and Moolort Zone.

The zones are based on the current conceptual understanding of the groundwater system; long-term average sustainable yield from the Laanecoorie-Serpentine Zone; and an understanding of managing for salinity benefits to the Jarklin Zone (G-MW 2009a).

The Upper Loddon WSPA was declared to cover aquifers at all depths and was subdivided into three management zones, namely the Ascot 1008 Zone, Waubra 1009 Zone and Clunes 1010 Zone.

The Ascot zone is centred around, an intensive irrigation area where extraction occurs from both the alluvial and volcanic aquifers. The Waubra zone again is centred on an area containing a high density of irrigation bores extracting from the volcanics whilst the Clunes zone forms the interconnecting link between the alluvial aquifers under extraction in the Ascot zone and the Mid Loddon WSPA to the north.

The Spring Hill WSPA included all aquifers down to 70 m depth, and covers the full depth of any aquifers in volcanic cone areas (SHGSPACC 2002). It included four management zones, being the Mooongghip 1001 Zone, Blampied 1002 Zone, Forest Hill 1003 Zone and Smeaton 1004 Zone. These zones are defined by administrative boundaries. The zones again have been centred around, areas of high density licensed allocation or where additional development of the volcanic aquifer system could take place.

The management zones in the former Spring Hill and Upper Loddon WSPAs are recognised in the new Loddon Highlands WSP (G-MW 2010).

## Trade initiation and rules

Temporary trading within the Mid Loddon WSPA commenced in January 2006. Permanent trading of entitlements only started in June 2009. Groundwater trading in the Mid Loddon is considered to provide:

- greater flexibility for licensed groundwater users to increase production
- an opportunity to improve groundwater management through redistribution
- market opportunities for sleeper licences
- drought management options (G-MW 2009a).

Temporary and permanent transfer of groundwater entitlement in the Mid Loddon is permitted within and between zones, subject to local rules that aim to protect the environment and other

groundwater users, and to prevent over-allocation of individual administrative zones and within a 5 km radius of the buyers bore.

A buffer has been applied to zone boundaries to enable groundwater licence entitlement to be transferred between bores within 5 km of each other across zone boundaries, provided that interference and intensity rules are satisfied.

Temporary trading commenced in the Upper Loddon WSPA in January 2007. Local trading rules were again developed with the aim to protect the environment and other groundwater users and to prevent over allocation of individual administrative zones. The trading rules that operated within the former Upper Loddon WSPA are presented in Table 16.

**Table 16 Trading rules—former Upper Loddon WSPA**

| Zone | Can buy from     | Can sell to |
|------|------------------|-------------|
| 1008 | 1008             | 1009, 1010  |
| 1009 | 1008, 1009, 1010 | 1009, 1010  |
| 1010 | 1008, 1009, 1010 | 1009, 1010  |

Temporary trading commenced in the Spring Hill WSPA in the 2001–2002 financial year. In the Spring Hill area, temporary transfers were only permitted within zones, except for transfers from the Forest Hill Zone or Blampied Zone to the Smeaton Zone or the Mollongghip Zone. The trading rules that operated in the former Spring Hill WSPA are presented in Table 17.

**Table 17 Trading rules—former Spring Hill WSPA**

| Zone | Can buy from           | Can sell to      |
|------|------------------------|------------------|
| 1001 | 1001, 1002, 1003, 1004 | 1001, 1004       |
| 1002 | 1002                   | 1001, 1002, 1004 |
| 1003 | 1003                   | 1001, 1003, 1004 |
| 1004 | 1001, 1002, 1003, 1004 | 1001, 1004       |

A number of general trading rules consistent between all WSPAs were also in place, namely:

- transfers can occur between licensed holders within their specified trading zone
- transferred entitlement may be restricted or banned from use, if adverse interference occurs to adjacent groundwater users
- if the sellers bore is equipped, the works must be metered in order to trade part or the whole entitlement
- the buyer must have a groundwater licence and metered diversion point before purchasing water entitlement
- the sellers can only trade to the annual capacity of the bore
- transferred entitlement is available for use from the date of approval of trade until the following 30 June.

## 6.2.4 Market operation

### Transaction processing

G-MW requires applicants to advertise their intention for permanent transfers exceeding 19 ML, and to notify all persons with properties within 1 km of the bore where extraction will be increased.

To support the granting of a transfer G-MW also regularly requests that a hydrogeological assessment be conducted to address matters to be taken into account as listed in Section 40 of the *Water Act 1989*. These matters include items such as:

- the existing and projected availability of water in the area
- the permissible consumptive volume, if any, for the area
- the existing and projected water quality in the area
- any adverse effect that the allocation or use of the water under the entitlement is likely to have on existing authorised users of water, a waterway or an aquifer, the drainage regime or the maintenance of the environmental water reserve in accordance with the environmental water reserve objective
- government policies concerning the preferred allocation or use of the water resources
- the needs of other potential applicants
- in consideration of an application the licensing authority must give effect to an approved management plan for any relevant water supply protection area.

The assessment combines a desktop review of existing information coupled with onground works such as conducting a pump test. The detail of the assessment and the duration of onground testing typically relates to the size of the annual volume sought.

The onground testing is often conducted for a relatively short duration in comparison to, for example, an irrigation season with the results of the testing utilised to predict likely impacts to neighbouring users and the environment over an extended extraction period. A number of guideline limits for licensing are used, such as a maximum loss of 10 per cent of the available drawdown in neighbouring bores in a poorly described aquifer system and up to a 20 per cent loss in a well defined system.

If the assessment satisfies the guidelines for licensing a licence is subsequently issued. To provide further protection to the neighbouring users and the environment, should the impacts from the extraction vary from those predicted in the assessment, a number of mitigating conditions are attached to the licence, such as:

- the applicant is to reduce the time to which extraction occurs per day, to allow for recovery in the aquifer system between extraction events and maintain drawdown in neighbouring bores to acceptable limits
- the applicant must lower their extraction rate to reduce the drawdown to acceptable limits in neighbouring bores
- the applicant could, if possible, deepen the affected bores and lower pumps (at their cost) to maintain operational capacity and ensure continuity of supply
- if agreement is reached between the applicant and any affected user, the applicant can be licensed at the requested annual volume and extraction rate if they supply affected users with a volume of water to which they are entitled/licensed.

## **6.2.5 Trade reporting, facilitation and market activity**

### **Reporting and facilitation**

Goulburn-Murray Water includes data for each WSPA in its annual report, including the following:

- total entitlement volume
- number of licences
- entitlement limit
- announced allocation
- annual extraction volume

- number and volume of trades.

There appears to be little involvement of water brokers in groundwater trading in these areas, with most trading taking place through the use of local contacts, advertising and real estate or stock and station agents.

## **Market activity**

For 2008–09, temporary trading was most active, as a proportion of both entitlements and usage, in the Upper Loddon, and least active in the Spring Hill area. Overall across the Mid Loddon, Upper Loddon and Spring Hill areas, 5000 ML was traded, being 10 per cent of total entitlements and 19 per cent of total annual extraction (G-MW 2009b).

Recent amalgamation of the Spring Hill and Upper Loddon areas will provide a larger market in that area, but trading may well stay at modest levels until there is significantly greater demand for groundwater in these areas.

Permanent groundwater entitlement trading commenced in the Mid Loddon in 2009–10, although no permanent trades occurred. With annual extraction well below both the PCV and total entitlement limits, there is a lack of water scarcity for many existing licensees, and many with an interest in either buying or selling may be content to see how the market evolves before committing to trades.

### **6.2.6 Evaluation of the Loddon groundwater systems in relation to the framework for groundwater trading**

The Loddon groundwater trading regime has been evaluated in relation to the framework for groundwater trading. The evaluation is provided in Table 18.

**Table 18 Application of the framework to the Loddon groundwater systems**

| Framework element                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Current situation                                                                                                                                                                                                                                                                                                               | Potential changes                                                                                             | Discussion—benefit and feasibility of changes                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Specifying market boundaries</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                 |                                                                                                               |                                                                                                                                                                                                                                                                                                       |
| Physical boundaries:                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                 |                                                                                                               |                                                                                                                                                                                                                                                                                                       |
| Groundwater systems should be based on physical aquifers or groups of aquifers. They should have clearly defined boundaries based on hydrogeological features such as geological units, groundwater flow 'catchments' and groundwater quality discontinuities, and should be vertically delineated into separate systems in cases where the vertical connection between adjoining aquifers is low. Processes for adjustment of boundaries should be transparent and clearly articulated. | With a dominant administrative basis to the boundaries, the likelihood of change is high. Boundaries attempt to cover a large extent of the aquifer system, and follow roads, streams etc for convenience. The SAFE <sup>7</sup> project and new management plans being prepared may provide further information on boundaries. | Amending boundaries to encapsulate entire alluvial aquifers and/or groundwater flow systems of the volcanics. | Accurate representation may require a higher level of hydrogeological knowledge than is currently available. Boundaries that capture entire groundwater flow systems may be less likely to change in future, provide greater market certainty to water users and reduce future administrative effort. |
| Groundwater systems should be as large as possible, subject to hydrogeological connectivity limitations and discontinuities.                                                                                                                                                                                                                                                                                                                                                             | Size issue acknowledged by DSE and G-MW with the recent amalgamation of the Upper Loddon WSPA, Springhill WSPA and Unincorporated Areas. Have grouped both alluvials and volcanics into one system, acknowledging that interconnectivity does occur in places, particularly around the                                          | Further consideration of enlarged groundwater systems with greater alignment with hydrogeological boundaries. | As above. Also, larger groundwater systems provide for greater market activity and reduced administrative effort in producing and updating management plans.                                                                                                                                          |

<sup>7</sup> SAFE (Secure Allocations, Future Entitlements) is a National Water Commission-funded project to redefine groundwater management boundaries and to assist groundwater management across Victoria. Finalisation of boundaries is scheduled for June 2011 (DSE, 2010b).

| Framework element                                                                                                                                                                                                                                                                                      | Current situation                                                                                                                                                                                                    | Potential changes                                                                                                                                                                                                                                                                                                                                                                                                      | Discussion—benefit and feasibility of changes                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                        | volcanic cones. Away from the cones some distinction could be possible. Groundwater system still appears to be largely defined by administrative needs, rather than by discrete aquifer or groundwater flow systems. |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                        |
| Trading between systems:                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                        |
| Where a groundwater system is not adequately hydraulically connected to other systems, trade into or out of the system should be prohibited. However, trading between groundwater systems that are part of a larger connected aquifer system (e.g. one that spans a state boundary) should be enabled. | Trading can only occur within individual groundwater systems.                                                                                                                                                        | Enlarged groundwater systems to fully encompass entire aquifers may create enlarged trading markets and negate any perceived need for trading between systems. Trade between systems may be feasible if managed consistent with the principles of this document, i.e. both systems should have clearly identified entitlement levels, entitlement limits and extraction limits, and processes for managing extraction. | Expanded groundwater systems and subsequent trading areas may occur as an outcome of the SAFE project. |
| Trading may be enabled between a groundwater system and a connected surface water system where there is an adequate level of connectivity and mechanisms are in place to minimise environmental and other third-party impacts.                                                                         | Trade between groundwater and surface water is not mentioned in planning documents, and is not being undertaken.                                                                                                     | nil                                                                                                                                                                                                                                                                                                                                                                                                                    | n/a                                                                                                    |

| Framework element                                                                                                                                                                                                                           | Current situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Potential changes                                                                                                                                                                                                                                                                                                                                                                                                | Discussion—benefit and feasibility of changes                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Extraction and entitlement limits:                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                              |
| Entitlement and extraction limits should be clearly specified. Processes for change in long-term limits, determining annual allocations or restricting extraction in times of water shortage should be transparent and clearly articulated. | PAVs and PCVs are ‘extraction limits’, and for these systems are set at existing entitlement levels. PAV for Spring Hill and PCV for Mid Loddon and new Loddon Highlands provided in planning documents. PCVs also available on DSE website (GMU details) for Spring Hill, Upper Loddon and Mid Loddon, and in the 2008–09 G-MW annual report. Figures are not consistent between the various sources. How changes to PCVs may occur, and impact on entitlements, is not specified. Allocations can be reduced based upon volume in storage/groundwater levels.<br><br>Recharge estimates are not available. This may lead to lack of confidence in extraction limits. | Information on the actual quantity of entitlements issued, and those available to be issued, may be best limited to only two locations—an updatable website register and the latest planning document. Both figures should be available to avoid confusion.<br><br>System recharge estimates should be made available on websites or annual groundwater resource status reports etc., including the method used. | Combined with information on recharge estimates, this would enable all interested parties to make their own judgements on entitlement value. |
| <b>Assessing potential market activity</b>                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                              |
| Potential market activity can be assessed based on the level of scarcity or competition for groundwater rights, and the potential market size (indicated by the number of licences or entitlements on issue).                               | DSE has approached groundwater planning prioritisation according to consideration of ‘value’ and ‘risk’ for which scarcity and size can be considered partial surrogates.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No change recommended.                                                                                                                                                                                                                                                                                                                                                                                           | Scarcity and size are measurable parameters which may be used on their own or as contributing factors to the ‘value’ and ‘risk’.             |

| Framework element                                                                                                                                                                       | Current situation                                                                                                                                                                                                                                                                                                                                                     | Potential changes                                                                                                                                                                                                                                                                                       | Discussion—benefit and feasibility of changes                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Establishing appropriate management regimes</b>                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                 |
| Deciding the level of investment in the trading regime:                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                 |
| The level of investment in the groundwater trading management regime should be commensurate with potential market activity.                                                             | Scarcity is not high within these systems, with recent annual extraction levels generally well below the PCVs. These systems are not large (except maybe the Upper Loddon) from a groundwater perspective. The new Loddon Highlands is large, with about 170 licences. Given the general lack of scarcity and size, the current management regime may be appropriate. | Greater certainty of future planning arrangements (including clarity of recharge estimates, entitlement limits and entitlement levels, and boundary settlement) may provide an improved platform for managing under greater scarcity (and size) in the future (and may enable greater market activity). | Actions occurring and proposed under the SAFE project may assist in this area.                                                                                                                  |
| Selecting product and transaction arrangements:                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                 |
| NWI-consistent products and transactions should be instated as a priority in groundwater systems where potential market activity is high and in other cases where it is cost effective. | Bundled system in place, and no plans for unbundling.                                                                                                                                                                                                                                                                                                                 | Scarcity and size may not be sufficient at present to warrant the investment required for unbundling.                                                                                                                                                                                                   | Unbundling should be considered within the context of existing unbundled surface water entitlements (in the Mid Loddon) and outcomes of the SAFE project, as well as current scarcity and size. |
| Investment in establishing trading rules:                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                 |
| Trading rules should be based primarily around the establishment of zones, local density limits and bore proximity limits that are objective and easily understood and implemented.     | Zones have been established in all areas and are used in trading rules. Spring Hill: Permanent trades. Temporary trading prohibited into selected zones. Mid Loddon:                                                                                                                                                                                                  | Include density limits in the Loddon Highlands trading rules.                                                                                                                                                                                                                                           | Density rules may allow removal of the more restrictive rules that govern the direction of trade between zones.                                                                                 |

| Framework element                                                                                                                                                                                                                                                                                                                                                                              | Current situation                                                                                                                                                                                                                                                                                                                         | Potential changes                                                                                                                                                                                                                                                                                  | Discussion—benefit and feasibility of changes                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                | Temporary and permanent trades allowed in and between zones, with both subject to zonal entitlement limits, and entitlement density limits. (Loddon Highlands: as Spring Hill).                                                                                                                                                           |                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                         |
| Trading rules should be used to manage potential impacts of changes to the location of water extraction and not for other purposes                                                                                                                                                                                                                                                             | Trading rules have been established which mainly limit the zones to which trading may occur. Mid Loddon also includes entitlement density limitations. Both types of rules provide certainty to applicants and reduce assessment need. Trading rules are not being used to address over-allocation or development of unused entitlements. | nil                                                                                                                                                                                                                                                                                                | n/a                                                                                                                                                                                                                                                                                                                     |
| Investment in assessment support:                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                         |
| Assessing authorities should have standard, publicly documented, assessment requirements for trades involving change of location of extraction. These would include appropriate methods and protocols for assessment, and pre-determined thresholds for the level of impact considered unacceptable. The levels of investment required in assessments should be tailored to the level of risk. | Methods/protocols and acceptable impact thresholds are not clearly documented.                                                                                                                                                                                                                                                            | Public documentation of methods used in-house, and preferred methods to be used by proponents or their agents.<br><br>Public documentation of impact thresholds. These may be absolute drawdown levels, additional drawdown, or drawdown as a proportion of available head or saturated thickness. | This will allow for consistency in the methods used, and assist in achieving actual and perceived consistency in outcomes.<br><br>Public documentation may allow proponents to partially self-assess before submitting applications and thereby reduce administrative effort in dealing with inappropriate applications |
| Investment in information and technical                                                                                                                                                                                                                                                                                                                                                        | Generally acknowledged by DSE and                                                                                                                                                                                                                                                                                                         | Maintain higher standard bore                                                                                                                                                                                                                                                                      | Risks will still occur due to old data,                                                                                                                                                                                                                                                                                 |

| Framework element                                                                                                                                                                                                                                                                                    | Current situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Potential changes                                                                                                                                                                                                                                                                                                                                                                                                                      | Discussion—benefit and feasibility of changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| support tools for assessment in individual groundwater systems should increase with potential market activity.                                                                                                                                                                                       | G-MW. Some information (e.g. mapped locations of existing bores) is considered insufficiently reliable to be used in assessments, so inspections are undertaken.                                                                                                                                                                                                                                                                                                                                                                                     | information sets for the more highly active trading areas. This could be done by improved data collections (e.g. inspections at bore construction stage), and giving higher priority for data entry.                                                                                                                                                                                                                                   | and time lags between bore construction and database entry. A compromise alternative may be to assume that the identified land parcel for a bore location is correct, but that the location of the bore within that land parcel is not reliable. This may negate some potential inspections, although reliability would still be subject to the information time-lag problem. Even with database updates following trade assessment inspections, the time lag for new bores to be represented on a database may still prevent assumption of sufficient reliability. |
| Investment in publishing market information:                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>For all markets, jurisdictions should make publicly available complete and up to date information on groundwater systems, tradeable products and their management, market activity, and trade assessment requirements and administrative processes</li> </ul> | <ul style="list-style-type: none"> <li>Market boundaries are available in plan documents (on G-MW website) and on Watermove website. Volumetric size is available in plan documents, GMU detail summaries (DSE website) and G-MW annual reports (on G-MW website). Product and transaction arrangements are available on G-MW website and Watermove. Trading rules are available in plan documents and summarised on Watermove. Assessment requirements are not provided.</li> <li>Information on individual entitlements is not publicly</li> </ul> | Publish statistics on number and volume of individual entitlements, average annual extraction limits (system, and for any zone), historical allocation announcements. Processing times for groundwater trades to be recorded on the Victoria water register, with clear distinction made between types of trades, groundwater data and that for surface water trades. Inclusion of relevant groundwater data on the Watermove website. | A large range of information is readily available, although multiple information locations create risk of inconsistencies. Data should be published in a consistent manner and location, such as that offered by the Watermove website. This could be the primary location for this data, with RWC annual reports providing a secondary reporting facility.                                                                                                                                                                                                         |

| Framework element                                                                                                                                                                                                                                                                            | Current situation                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Potential changes | Discussion—benefit and feasibility of changes |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------|
|                                                                                                                                                                                                                                                                                              | <p>available. Names of licence holders are generally withheld for privacy reasons.</p> <ul style="list-style-type: none"> <li>Victoria water register provides information on processing times but does not include information on groundwater trades. Watermove contains limited info re groundwater trades. Transaction numbers, volumes and prices are only for surface water. G-MW annual reports provide annual numbers and volumes traded for the reporting year.</li> </ul> |                   |                                               |
| <ul style="list-style-type: none"> <li>Investment in monitoring and compliance for groundwater extraction:</li> </ul>                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                                               |
| <ul style="list-style-type: none"> <li>Metering of extraction should be introduced in all groundwater systems where trading is possible, and should be a mandatory prerequisite for participants in a temporary (seasonal allocation) trade.</li> </ul>                                      | <ul style="list-style-type: none"> <li>Being done by G-MW.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                              | nil               | n/a                                           |
| <ul style="list-style-type: none"> <li>Compliance management of water rights should be implemented in all systems, with monitoring effort (e.g. meter reading frequency, proportion of groundwater bores metered) increasing in proportion to scarcity regardless of market size.</li> </ul> | <ul style="list-style-type: none"> <li>Being done by G-MW.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                              | nil               | n/a                                           |

## 6.3 Applying the framework to individual water uses and issues

The framework has been designed to facilitate groundwater trading in any groundwater system within Australia, irrespective of location and purpose for groundwater extraction. It is designed as a groundwater system management tool, not as a solution to individual groundwater management issues. However, elements of the framework, including the overall concept of setting boundaries and enabling market activity, may provide guidance to dealing with individual issues such as those being faced in relation to the mining and fossil fuels industries.

Coal seam gas (CSG) extraction and other mining operations can be major interceptors of groundwater. In most cases, even where the water is not required for consumptive purposes, it may not be feasible or practical to return the intercepted water to the source aquifers, resulting in large-scale consumptive demand.

The issues associated with large-scale consumptive demand from CSG and other operations are varied and depend greatly on the depth and lateral extent of the source aquifer/coal seam, and its connectivity with productive water supply aquifers. The potential for groundwater trading to play a role in meeting the CSG consumptive demand also depends largely on these factors.

Groundwater trading may offer options for meeting CSG groundwater demand in areas where the coal seam can realistically be conceptualised as part of a larger groundwater system in which there are existing entitlements, and where the CSG demand is well within the level of system 'extraction limit' and existing demand. This may not always be the case, or these parameters may not always be known. Alternatively, if the coal seam is deemed to be part of a groundwater system with no current demand and entitlements, the impacts of CSG groundwater extraction will need to be assessed and decisions made on the volumes that may be authorised for extraction over the life of the mining operation. In either case, the groundwater trading framework principles provided in Section 4 of this report may provide guidance for developing appropriate solutions. In particular, spatial and volumetric boundaries, if not already in place, should be determined independently of the mining enterprise concerns. This may not be a simple exercise as the aquifers may be much deeper and much less understood than those normally dealt with for groundwater extraction management. Aquifer boundaries and connectivity with adjacent and overlying aquifers may be poorly known, and water balance factors even less certain.

As with any groundwater trading proposal, it will only be when a groundwater 'system' has been independently defined by spatial and volumetric boundaries, products created and transactions types defined that consideration can be given to groundwater trading and how it may be implemented.

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# Appendix A. Research/consultation questionnaire

## A national study on groundwater trading

Trading is recognised as an important facility to enable a more efficient and productive use of water, and optimise social, economic and environmental benefits. Water trading is a core component of the NWI, and is the main means through which available water resources can be reallocated amongst uses (including environmental uses), providing a departure from less flexible allocated water arrangements that have historically been in place in many areas.

Groundwater trading has been applied for some time in a number of areas around the nation, but on a much smaller scale than that for surface water. As a practice, it is in its infancy. Because of the expanding demand for groundwater and the better recognition and understanding of its limits, it is expected that groundwater trading will expand in many areas across the nation.

Development of groundwater trading can be impeded by a number of technical, social, administrative and political factors, some of which may also be faced by surface water trading. However others, such as the three dimensional nature of aquifer systems, boundary uncertainties, water quality variations and local drawdown impacts, are peculiar to groundwater. The issues associated with the distribution of extraction from groundwater systems in particular add a degree of complexity in the management of groundwater trading.

The Commission has commissioned GHD and associates to undertake a national study on establishing water market and trading arrangements for the trading of groundwater access entitlements in Australia. Amongst other things, the study is to recommend:

- a Framework for managing groundwater trade that is consistent with the National Water Initiative and meets a range of other criteria proposed by the Commission
- actions to ensure that the above framework is operational on a consistent national basis
- tools to assist with the planning and management of groundwater trading activities
- a range of Models for groundwater trading that can be practically applied to specific hydrogeological situations.

The study team consists of Arthur Buckingham, Scott Lawson and Tracey Allen (GHD); and Mark Hamstead and Vanessa O'Keefe (independent consultants).

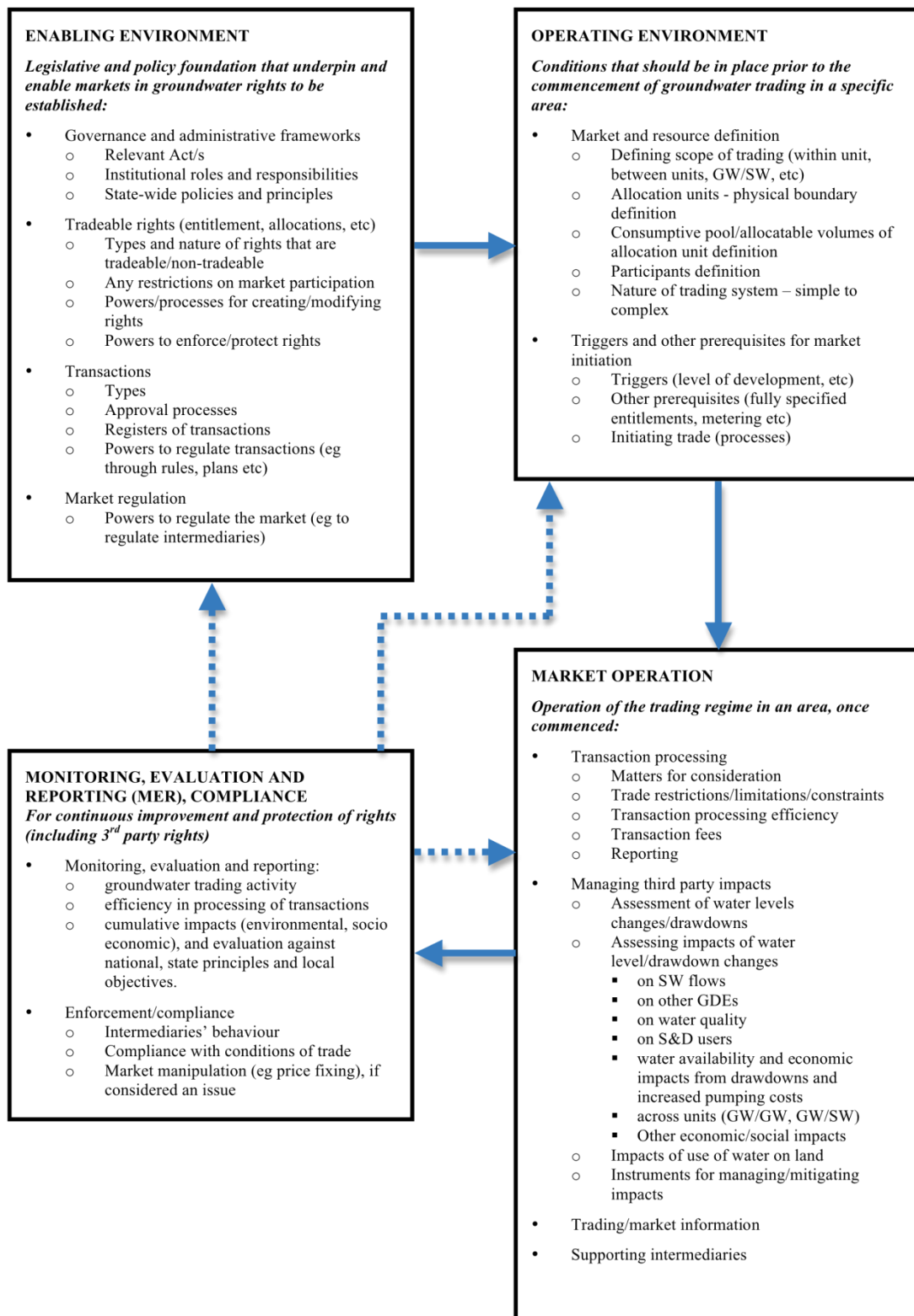
The initial part of this study is a stocktake of the current situation with groundwater trading in Australia, including identification of current issues, impediments and practical limitations. To do this the study team will gather information through desktop assessment of available documents and interviews with agency staff and stakeholders.

Information provided by participants is confidential, and comments will be aggregated so that no individual comments can be identified.

It is the intention of the Commission to publish the final report on its website.

# Framework for stocktake

The framework for the gathering and analysis of information is shown below.



## Questions for interviews

### Questions for non-government stakeholders

- Is groundwater trading needed? Why? In what situations?
- What in your view are the main impediments to its establishment and to its efficient operation? What should be done to correct these?
- What are the risks you see in having groundwater trading?
- Do you have any examples of impediments, problems and solutions applied?
- What could be done to reduce cost and time in processing transactions?
- Do you see any problems with system boundaries?
- Is there sufficient and timely provision by government of information relevant to the market?
- Are there sufficient market intermediaries? Are they sufficiently educated?
- Are you aware of any inappropriate behaviour by market intermediaries or others?

### Questions for agency staff:

- Can you provide any policy, guideline, advisory or status documents that specifically address groundwater trading ?
- Is groundwater trading needed? Why? In what situations?
- What in your view are the main impediments to its establishment and to its efficient operation? What should be done to correct these?
- What are the risks you see in having groundwater trading?
- Do you have any examples of impediments, problems and solutions applied?

In addition, agencies are invited to consider the specific questions, and comment on the responses determined from desktop analysis, as set out in the following text.

## Groundwater trading in .....

### Governance and administrative framework

#### Legislation

Describe the legal arrangements that underpin tradeable water rights. Which Act applies, does it contain specific provisions relating to trading (if so what are they), are there overall principles relating to the management/administration of trading within the Act (if so what are they).

## **Institutional responsibilities**

Describe the main entities responsible for managing tradeable groundwater rights.

## **Policies**

Describe any jurisdiction-wide policies relating to trading – general description and matters covered.

## **Groundwater management units**

What are the principal and secondary units for managing groundwater (e.g. GMUs/zones)? Are these established statutorily?

Do plans exist for some/all of these units, and if so, which, and do they include trading arrangements/rules?

What is the relationship between these units and NWI 'designated water resources'<sup>8</sup>?

## **Groundwater licences and entitlements**

Describe (generally) the main licences and entitlements for groundwater.

Is MAR allowed? If so describe the nature of the rights and how they are established and monitored?

## **Unlicensed groundwater rights**

Describe any unlicensed rights to groundwater e.g. stock and domestic.

---

<sup>8</sup> Under the NWI:

- A consumptive pool is the amount of water that can be made available for consumptive use in a given water system under the rules of the relevant plan (Sched B)
- water access entitlements are shares of the consumptive pool of a designated water resource (cl. 28)

All licences in a designated water resource will thus have the same seasonal water determinations.

## **Impacting activities outside of the groundwater management framework**

Other than the above, what significant activities that could impact on the availability of groundwater are outside of the entitlement framework e.g. (mining, plantation forestry, oil and gas, sw-gw interconnections)? How much of a risk are they to consumptive pools? Are there any mechanisms in place to protect tradeable rights from these impacts?

## **Market regulation**

Are there any powers to regulate the operation of the trading market (e.g. behaviour of market intermediaries, price manipulation etc)?

## **Tradeable rights**

### **Licences and entitlements**

Describe the characteristics of licences and entitlements for groundwater. Cover the right granted, term, conditions, who can hold, links to land, associated requirements (e.g. bore licence), level of unbundling. Compare to WAE requirements as per NWI.

### **Water allocations**

Do water allocations for groundwater exist? are they separable from licences? (NWI defines water allocations as the specific volumes of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan)

### **Other tradeable rights**

Are there any other tradeable rights relevant to groundwater? e.g. extraction rights? if so describe

### **Entitlement statistics**

If possible, insert a table showing, for each management area: licence numbers, total entitlement volume, limits on entitlement or extraction, estimated use for a recent year, whether or not trading is enabled.

## **Trade-related transactions**

### **Types of transactions**

Describe in detail the trade-related transactions for licences/entitlements and water allocations – legislative provision, policies and administrative practices. Explain how they are

given effect (i.e. by altering the licence, cancelling and issuing a new licence, adjusting balances of corresponding water allocation accounts etc).

## **Transaction processing**

Describe in general the statutory steps involved in processing applications for each transaction type identified above (including requirements of Act and policies, and administrative procedures). Include any requirements to advertise, standing to object, etc.

## **Market and resource definition**

### **Scope of trading**

What is (generally) the potential 'scope' of GW trading? Eg. only 'within' allocation units (or even zones within these), across allocation units (e.g. GW GMU to GW GMU, GW GMU to SW area, across border).

### **Establishing physical unit/zone boundaries**

How are physical unit/zone boundaries defined?

- Based on aquifers or administrative boundaries?
- Vertical or just lateral?
- Is it different for different types of aquifer?
- Any combined surface water – groundwater units?

What issues are there with current boundaries?

What are the uncertainties in processes for determining boundaries? Are these documented and published?

### **Defining consumptive pool/allocatable volumes**

What approach do you use to set limits to entitlements, extraction on a long term basis?

What approach do you use to set short term (e.g. seasonal) allocations/limits to extraction?

Are these objective, repeatable and transparently documented?

What is the process to change such limits once set?

What are the uncertainties in processes for determining boundaries and allocatable volumes? Are these documented and published?

### **Restrictions on market participants**

Who can participate in groundwater trading (note: may be different for different transactions)? Are there any restrictions?

## Levels of trading

Are there multiple types of trading regimes possible?

(e.g. simple permanent trade only with bundled licences, to complex multiple types of transactions with fully unbundled licences)

If so what approach is used to determine the appropriate level of assessment ? to apply?  
(level of development? type of aquifer? number of licences?)

## Trading initiation

### Triggers

What are the triggers for establishing groundwater trading?

(e.g. a defined level of development, potential demand, moratorium on issue of new entitlements, a statutory plan, reaching a defined extraction limit etc)

Do you make provision for commencing trading in management units which are under-allocated?

(e.g. by issuing licences by periodic auctions, or by allowing cross unit trade from over to under-allocated systems.) If so what triggers it?

### Prerequisites

What are the prerequisites for establishing groundwater trading (other than resource definition)?

(e.g. quantified entitlements, metering, unbundled entitlements etc)

## Initiating groundwater trading in an area

What process do you use to initiate trading in an area?

(e.g. commence a plan, ministerial announcements, information days, unbundle licences, put entitlements on register etc)

## Transaction processing

### Transaction impact assessment

Describe in general terms the matters to be considered when assessing the impacts of applications for transactions that are not prohibited by rules.

### Fees for transactions

List the fees for processing transactions

## Trading rules

List details of the documented rules that direct the kinds of transactions that may or may not be approved or must be considered/complied with as part of the transaction assessment. Amongst other things note whether cross unit/zone movement is allowed or not. Include:

- Statutory constraints
- Policy (state-wide) constraints
- Local (GMU or other) rules

Do these vary with aquifer type?

## Transaction processing efficiency

Describe typical and target processing times for different types of transactions in different areas. Use hard data if available.

What aspects of transaction processing are the most expensive and take the longest time?  
What could be done to improve processing?

## Stamp duty

Are transfers subject to stamp duty?

## Assessments of potential water level changes/drawdowns

Who is responsible for the assessments? E.g. proponent or agency?

How are potential changes in water levels associated with trades determined? Models, methods, hand calcs?

Are there any technical requirements/standards applied to assessments?

Do technical requirements vary depending on the system/aquifer type/geographic location?

Are both long-term water level changes and changes in seasonal drawdown assessed?

Do water level change assessments assume full development of existing entitlements?

## Managing impacts of trade

Describe the current approach used to manage the following kinds of potential impacts of trading.

Note particularly whether it is done through trading rules or restrictions (e.g. across zone limits, maximum densities, distance rules, extraction rate limits) or other means, e.g. fees, separate use licences, etc

What alternative mechanisms are being or should be considered?

## System-wide drawdown effects

## Local drawdown effects

## Effects of use of water on land

## Effects of movement of economic activity

## Facilitating groundwater trading

### Metering

Broadly, to what extent is metering in place for groundwater extraction?

What are the plans and process for expanding metering?

Who pays for meters?

(Note another Commission project is looking in detail at groundwater metering)

### Access to market information

What information is available to potential market participants regarding:

- where a market is operating, and the nature of that market (simple to complex)
- product information (characteristics, annual fees, obligations etc)
- numbers of transactions, volumes, prices paid
- resource information (e.g. likelihoods and risks affecting future water availability)
- how to apply for transactions, how to complete forms and prepare necessary information
- trading rules
- relevant government announcements that can affect market prices (e.g. seasonal allocation announcements)

How and in what form is it made available?

### Intermediaries

What intermediaries (e.g. brokers, exchange operators etc) are active in the groundwater trading market? What access do intermediaries have to govt information systems for bulk searches, registration of transactions, applications for transactions?

What regulations govern the operation of intermediaries?

Are there any programs in place to educate or otherwise facilitate intermediaries?

What, if any, are the reporting requirements of intermediaries?

## Monitoring and compliance

### Monitoring and evaluation

Describe arrangements (responsibilities, methods) in place to monitor and report on:

- groundwater trading activity

- efficiency in processing of transactions
- cumulative impacts (environmental, socio economic)

## **Current trading statistics**

Compile a table of the following information

For each system where trading is operative; 'level' of market enabled; numbers, volumes and prices of transactions for last x years ?.

## **Enforcement/compliance**

Describe arrangements (responsibilities, methods) in place to detect and react to:

- inappropriate behaviour by intermediaries
- market manipulation (e.g. price fixing)
- compliance with conditions of trade

Are these considered to be significant risks?

## Appendix B. Consultation participants

| Name               | State/Territory | Organisation               |
|--------------------|-----------------|----------------------------|
| Randall Cox        | Qld             | DERM                       |
| Louisa Rochford    | Qld             | DERM                       |
| Warwick Clarke     | Qld             | DERM                       |
| Ian Johnson        | Qld             | Qld Farmers Federation     |
| Gordon Delaney     | Qld             | SunWater                   |
| Jan Gill           | NSW             | DECCW                      |
| George Gates       | NSW             | DECCW                      |
| Mark Harris        | NSW             | DECCW                      |
| Jenny Egan         | Vic             | DSE                        |
| Gerry Egan         | Vic             | DSE                        |
| Patrick O'Halloran | Vic             | DSE                        |
| Randall Knot       | Vic             | DSE                        |
| Pat Russell        | Vic             | Central Highlands Water    |
| Brendan Cossens    | Vic             | Goulburn-Murray Water      |
| Terry Flynn        | Vic             | Southern Rural Water       |
| Craig Parker       | Vic             | Southern Rural Water       |
| Trevor James       | Vic             | Landholder (Loddon Valley) |
| Ludovic Schmidt    | Tas             | DPIPWE                     |
| Neil Power         | SA              | DWLBC                      |
| Drew Laslett       | SA              | DWLBC                      |
| Adam Sincock       | SA              | DWLBC                      |
| Jenny Awbery       | SA              | AMLRNRM Board              |
| Cameron Welsh      | SA              | SAMDBNRM Board             |
| Phillip Kalaitzis  | WA              | DoW                        |
| Diana Leeder       | NT              | NRETAS                     |
| Ian Lancaster      | NT              | NRETAS                     |

# Appendix C. Groundwater trading stocktake – Queensland

## *Governance and administrative framework*

### **Legislation**

The *Water Act 2000* sets out the water entitlement and planning framework in Queensland. All rights to the use, flow and control of all water in Queensland are vested in the state (s.19). The taking of underground water requires an authorisation, licence or allocation anywhere in the state if it is artesian water, and in areas declared by a water resource plan or under the Water Regulation 2002 for subartesian water. Outside of these areas taking of subartesian water is not regulated.

A development permit under the Sustainable Planning Act 2009 is required to authorise the construction of bores for artesian water and for subartesian water in declared areas.

Water planning occurs in a two stage process involving, for each catchment, a water resource plan (WRP) and a subsequent resource operations plan (ROP). Apart from transfer of holder associated with change of land, water trading cannot occur until it is provided for in a WRP and ROP, or a regulation to the Act.

WRPs are the fundamental water planning instruments that establish an allocation framework for the plan area's water resources. WRPs are generally catchment based for water in water courses (i.e. rivers, lakes, dams and springs which are not connected to artesian water) within the catchment, and can include subartesian water and overland flow water if deemed necessary. The Great Artesian Basin WRP is an exception, as it applies to artesian water and connected subartesian water in an area that spans parts of several surface water catchments. To date the WRPs have been established with an initial focus on surface water resources. They are subsequently amended to encompass groundwater resources, i.e. Pioneer Valley (Draft) and Burnett.

WRPs include the following provisions:

- outcomes, including ecological outcomes for sustainable management of water for the plan area
- environmental flow and water allocation security objectives for specified performance indicators
- strategies to achieve the outcomes
- water and natural ecosystem monitoring and reporting to assess effectiveness of management strategies
- implementation schedule. (*Water Act 2000* s. 46).

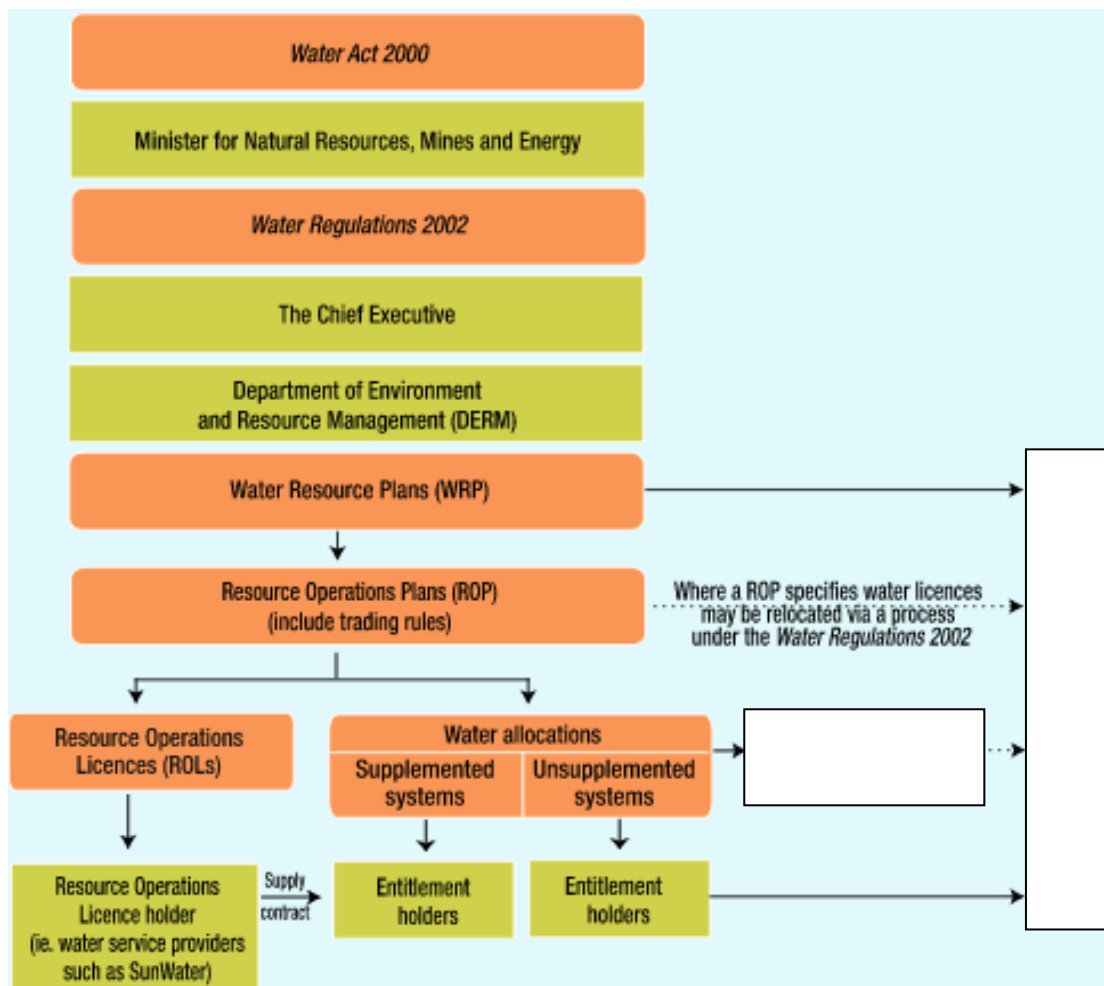
WRPs are implemented through ROPs. ROPs are structured to ensure that water in a plan area is managed in a way that is consistent with the objectives and outcomes specified in the WRP for that area. ROPs include detailed rules and requirements for water sharing, including for:

- seasonal water assignment
- environmental flow management
- operation of infrastructure

- grant, amendment or conversion of water entitlements/authorisations to a tradeable water allocation (Note: a water authorisation is a water licence, interim water allocation or other authority to take water).
- issue of resource operations licences and distribution operations licences for the management of delivery of allocations where applicable
- water allocation change (water trading)
- water and natural ecosystem monitoring and reporting (s. 98).

Water licences provide the holder with the right to take and use water, and are attached to land. They are generally not transferable, but there are some exceptions. Water allocations are granted pursuant to a WRP and ROP. They are the Queensland implementation of the National Water Initiative water access entitlement, and have full tradability.

**Figure 9 Management arrangements for water trading in Queensland**



Source: adapted from NWC website <http://www.nwc.gov.au/www/html/1607-water-markets.asp>

Note: WMS is the 'Water Management System' (formerly the Water Entitlements Registration Database).

The Act defines underground water as artesian water and subartesian water, where artesian water means water that occurs naturally in, or is introduced artificially into, an aquifer, which if tapped by a bore, would flow naturally to the surface; and subartesian water means water that occurs naturally in, or is introduced artificially into, an aquifer, which if tapped by a bore, would not flow naturally to the surface.

The principal regulatory mechanism for groundwater is management of licences, allocations and bore construction through:

- declaring of groundwater areas, thereby requiring licences or allocations to take water
- granting, subject to conditions, or refusing applications relating to water licences and water allocation
- determination of seasonal water allocations to holders of water allocations
- amendment of licences and allocations
- making of WRPs
- making of ROPs specifying rules that must be complied with in making the above decisions and determinations.

Depending on the instrument that enabled the trading to occur, trading rules for particular Groundwater Management Areas (GMAs) are recorded in either:

- ROPs
- Rules made pursuant to the regulation to the Act.

The finalised ROP sets out the frameworks for trading. In several other cases in the declaration of an area for management, where water sharing is a management issue, the declaration under the Water Regulation will specify the water sharing rules. By establishing a framework for water use accounting, these rules ensure there is an accountable and auditable trail for the movement of water use within and between water licenses.

## **Institutional responsibilities**

The agency for managing tradeable groundwater rights in Queensland is the Department of Environment and Resource Management (DERM). DERM has responsibility for state policy, development of WRPs and ROPs and administration of groundwater licences and allocations.

Some other aspects of groundwater management are undertaken by Resource Operations Licence (ROL), such as SunWater, South East Queensland Water and Fitzroy Water. ROL holders are involved in groundwater management only in respect to certain aquifers that are highly connected to ROL-administered surface water supply schemes. Their groundwater management activities include metering of groundwater extraction and endorsement/accounting of seasonal groundwater assignments. Unique features of these schemes include:

- the taking of groundwater under 'surface water' licences (Proserpine River Water Supply Scheme), and
- 'passive' managed aquifer recharge schemes, whereby weirs on selected creeks and rivers aim to increase groundwater recharge and maintain security of groundwater extraction (e.g. Three Moon Creek and Callide Valley Water Supply Schemes).

In the Lower Burdekin, SunWater supplies surface water to the North and South Burdekin Water Boards, which then undertake managed aquifer recharge activities to sustain groundwater extraction. The groundwater extraction in this area is unregulated and unlicensed.

## **Policies**

There are no state policies on groundwater trading apart from the general provisions of the Act itself. Trading arrangements are tailored to each area through WRPs and ROPs, or through local water sharing rules made pursuant to the regulation to the Act.

## Groundwater management units

Declared areas are the basis for subartesian water planning and management in Queensland. Areas can be declared either by regulation or by a WRP. They are commonly either referred to as groundwater management areas (GMAs), or include one or more GMAs. WRPs that include groundwater management rules have been made for the following areas:

- Great Artesian Basin (the Plan covers artesian water, connected subartesian water and connected springs, and includes 25 management areas which may up to 8 management units)
- Pioneer Valley (the Plan includes the Pioneer GMA and 17 groundwater sub-areas)
- Burnett Basin (the Plan includes the Coastal Burnett Groundwater Management Area, which is subdivided vertically into upper and lower units and which contain four and one groundwater sub-areas respectively).

In some cases areas have been declared under WRPs but seasonal water assignment is enabled through the regulation because the amendments to the ROPs to implement groundwater management have not been completed.

Existing declared subartesian water areas are listed in

Table 19 and illustrated in Figure 10.

**Table 19 Declared subartesian areas in Queensland**

Source: *Water Act Regulation 2002*, schedules 4,10,11

| Groundwater management area | Seasonal water assignment enabled through regulation | Seasonal water sharing announcements apply |
|-----------------------------|------------------------------------------------------|--------------------------------------------|
| Bluewater                   |                                                      |                                            |
| Border Rivers               | √                                                    | √                                          |
| Bowen                       |                                                      | √                                          |
| Burdekin                    |                                                      | √                                          |
| Cairns Coast                |                                                      |                                            |
| Callide                     | √                                                    | √                                          |
| Cattle Creek                |                                                      |                                            |
| Central Lockyer             |                                                      | √                                          |
| Clarendon                   |                                                      |                                            |
| Coastal Burnett             | √                                                    | √                                          |
| Condamine                   | √                                                    | √                                          |
| Cook                        |                                                      |                                            |
| Cressbrook Creek            |                                                      |                                            |
| Dryander                    |                                                      |                                            |
| Duck Farm                   |                                                      |                                            |

| Groundwater management area | Seasonal water assignment enabled through regulation | Seasonal water sharing announcements apply |
|-----------------------------|------------------------------------------------------|--------------------------------------------|
| Eastern Downs               |                                                      |                                            |
| Farnborough                 |                                                      |                                            |
| Fitzroy                     |                                                      |                                            |
| Fraser Island               |                                                      |                                            |
| Great Artesian Basin (GAB)  |                                                      | √                                          |
| Highlands                   |                                                      |                                            |
| Lower Balonne               |                                                      | √                                          |
| Mid Brisbane River          | √                                                    |                                            |
| Monto                       |                                                      |                                            |
| Moreton Island              |                                                      |                                            |
| Mossman                     |                                                      |                                            |
| Mulgildie                   |                                                      |                                            |
| North Stradbroke Island     |                                                      | √                                          |
| Oakey Creek                 | √                                                    | √                                          |
| Pioneer                     | √                                                    | √                                          |
| Sarina                      |                                                      |                                            |
| Toowoomba City Basalts      | √                                                    |                                            |
| Upper Georgina              |                                                      |                                            |
| Upper Hodgson Creek         | √                                                    | √                                          |



**Figure 10 Declared subartesian areas in Queensland**

Source: DERM website - <http://www.derm.qld.gov.au/water/declaredareas/declaredsubartesian.html>

The areas subject to WRPs are managed in ways that are largely consistent with that for NWI 'specified water resources'. However, in GMAs where licences/historic lawful take have not been converted to water allocations, licences apply and the NWI shared consumptive pool concept is not implemented to the full extent. Currently there are no GMAs where tradeable water allocations (i.e. NWI water access entitlement equivalent) have been implemented, though this is expected to occur in the Pioneer and Coastal Burnett once the ROP for each is finalised.

## Groundwater licences and entitlements

*Water licences* provide the holder with the right to take and use water, and are required to take or interfere with groundwater in declared subartesian areas or in areas defined in a water resource plan. They have a fixed period after which they must be renewed, and are attached to land. They cannot be transferred to different land (though the holder of the licence can be transferred where the land to which it attaches transfers), except where a ROP provides for this, which is currently only in the Great Artesian Basin (GAB).

*Nominal entitlement* is the volume of water authorised to be taken during a water year as specified on the water licence. The volume of water that a licence holder may use during a water year may be varied by an *announced entitlement* (Department of Environment and Resource Management, 2009).

The announced entitlement is a percentage of the licence holder's nominal entitlement that may be taken in a water year. It will be decided and announced before the start of the water year and may be increased during the water year.

*Annual entitlement* is the volume of water able to be taken by a licence holder for that water year. The annual entitlement is calculated by multiplying the nominal entitlement for the water licence by the announced entitlement, plus or minus any seasonal water assignments, carry-over or forward draw.

*Water allocations* are the Queensland implementation of the National Water Initiative water access entitlement, being a perpetual, tradeable right to a share of the available water in a defined water resource. Water allocations are granted pursuant to a water resource plan and resource operations plan. In groundwater areas within WRPs, the WRP may provide for the conversion of existing groundwater licences and historic lawful take of groundwater to fully or partially tradeable water allocations. However it is not always the case, and in many areas groundwater licences may remain as such for the foreseeable future.

Rights to take a volume of water under a water licence or allocation may be assigned to another person. Such assigned rights expire at the end of the year, unless provision is made in the WRP/ROP for their continuance. A *notice of seasonal water assignment* becomes a right that is held and tradeable independent of the water licence or allocation from which it arose.

At the time of writing there were no water allocations pertaining to groundwater though it is expected that they will be created soon (e.g. in the Pioneer and Coastal Burnett where the WRP for each provides for their creation, but the ROP amendments to implement this have not been completed).

MAR occurs in several locations e.g. Lower Burdekin, Three Moon Creek, Callide Creek.

MAR is only undertaken on a managed infiltration basis, where there is no measurement of or preferential rights to the recharged volumes.

## Unlicensed groundwater rights

Outside of declared subartesian areas, subartesian water may lawfully be taken without a licence. This is the case even in areas of substantial groundwater use such as the Lower Burdekin Board areas. There are no immediate plans to introduce licensing to the Burdekin Board areas, largely because there is not considered to be a need for it. Water use is limited by land acreage under irrigation, and the cost of pumping water. In the Burdekin area the groundwater in the aquifer comes from a mixture of local rainfall recharge, managed recharge from the river by the board, and returns from irrigation. A substantial part of the water applied to crops infiltrates back to the aquifer. It would be a challenge to define a water licence that takes account of these varying aspects of the water source.

Within declared subartesian areas, purposes specified in the regulation or WRP can be exempted from requirements to hold a licence or allocation (see Table 19) – typically stock and domestic is exempted.

## Impacting activities outside of the groundwater management framework

Under current arrangements there is potential for growth in town water supply access to groundwater. However this is done via provision being made for it in WRPs. Stock and domestic access in peri-urban areas is now being regulated to the extent that in some areas new stock or domestic water users in reticulated urban settings will have to purchase access to groundwater.

Coal seam gas extractors have a statutory right to take groundwater, arising from historic arrangements with the petroleum industry in the Great Artesian Basin. However these extractors also have an obligation to 'make good' any adverse impacts arising from the exercise of this statutory right. Such rights do not apply to other mining activities.

## Market regulation

There are no powers beyond the general powers in the Commonwealth Trade Practices Act. Not seen to be a concern,

## *Tradeable rights*

## Licences and entitlements

A water allocation relating to groundwater will state the following (s.127):

- details of the person who holds, and how the person holds, the allocation
- a nominal volume for the allocation
- the location from which the water may be taken
- the purpose, including, for example, agricultural, industrial or urban, for which the water may be taken
- conditions
- the resource operations plan under which the water allocation is managed
- the maximum rate for taking water
- the flow conditions under which the water may be taken
- the volumetric limit

- the water allocation group to which the allocation belongs
- the water management area that includes the location from which the water may be taken.

Water allocations will be held in perpetuity. They can be held by any legal entity, and will generally comply with the specification of a water access entitlement in the NWI.

DERM is currently considering the manner in which the location should be specified on groundwater allocations. In surface water systems the practice has been to specify a zone of the river system. This is done to minimise regulation. The holder of a water allocation can lawfully take water from the water resource anywhere within the specified zone without having to apply for consent to do so, and without changing the parameters of the allocation as shown on the register. All that is required is to advise the water authority (ROL holder) which meters will be used to measure extraction of groundwater. The zones are defined in such a way that there is confidence that there is little risk of impacts in change in location of extraction within the zone. Moving across zone boundaries does however normally require consent and assessment of possible impacts.

Applying this to groundwater is problematic, as there is always a risk of impacts for any significant movement of the location of extraction. Whether there can be a way of allowing free movement within zones subject to additional local rules (e.g. distance or intensity rules), or whether the only reliable solution is to revert to case by case assessment of all movements has not been resolved.

A water licence relating to groundwater generally states:

- holder
- land to which the licence attaches
- location from which the water may be taken
- conditions, including such things as volumes and allowed purposes.

A development permit under the *Sustainable Planning Act 2009* is required to authorise the construction of bores for artesian water and for subartesian water in declared areas.

## Water allocations

As mentioned above, Queensland's 'water allocations' are the equivalent of NWI water access entitlements. The equivalent of NWI water allocations are not explicitly named in Queensland, but they exist as rights to take a volume of water arising from a Queensland water allocation (or licence), that may be assigned to another person. These rights accrue to the holder of the water allocation from time to time, and are recorded in water accounts in the name of the holder. If assigned, a notice of seasonal water assignment becomes a right that is held and tradeable independent of the water allocation from which it arose.

At the time of writing there had been no conversions of groundwater licences to Queensland 'water allocations'. Groundwater licences generally have a fixed annual maximum volume ('nominal entitlement'), which may be subject to a seasonal announced percentage ('announced entitlement') where the regulation enables it (see Table 21). This results in an 'annual entitlement', which is similar in concept to a NWI water allocation.

## Other tradeable rights

None.

## Entitlement statistics

Not available.

## Trade-related transactions

### Types of transactions

For Queensland GMAs, all water entitlements (at the time of writing) are defined through licences and the following transactions apply:

- *Licence transfer (holder only)*  
The change of the holder of the licence, where the land to which the licence attaches is transferred. Given effect by issuing a new licence.
- *Licence relocation (including transfer)*  
Transfer of location and holder of a water licence, permanently moving the water licence from the land to which it is attached, to another parcel of land. Effected by cancelling the transferred licence and issuing a new licence. For groundwater licences, this is only enabled within the GAB.
- *Licence seasonal water assignment*  
Assignment of the right to take some or all of the water available under a water licence to another person. It implicitly allows for relocation of the right to another location. Effected by issuing a notice of seasonal water assignment, plus reducing the assignor's/seller's annual entitlement to account for the volume of water that has been the subject of seasonal water assignment and increasing the assignee's/buyer's annual entitlement.

Where water entitlements are defined through water allocations (not applicable to groundwater at the time of writing), the following transactions apply:

- *Water allocation transfer*  
The passing of the legal or beneficial interest in the water allocation to another person or legally competent entity. Given effect by registering the 'transfer' in the Water Allocations Register.
- *Subdivision of water allocation*  
The dividing of water allocation into two or more water allocations. Given effect by making application to DERM and then by registering the subdivision in the Water Allocations Register.
- Amalgamation of water allocations.

The amalgamation of water allocations into one water allocation is given effect by making application to DERM and then by registering the amalgamation in the Water Allocations Register.

- *Lease of water allocation*  
The passing of the benefits and responsibilities associated with holding the allocation to another person for a fixed period. Given effect by registering the lease in the Water Allocations Register.
- *Change of water allocation*  
A changes of one or more resource management attribute of a water allocation. The most common change sought by water allocation holders is to move the allocation to a different location. Contractually, it can be undertaken as part of a transfer or independently (for example, the water allocation may be retained by the existing owner but moved to a different location). Given effect by seeking approval from DERM, then registering the change in the Water Allocations Register.

- *Seasonal water assignment of water allocation*  
Assignment of the right to take some or all of the water available under a water allocation to another person. It implicitly allows for relocation of the assignment to another location. Given effect for unsupplemented (i.e. unregulated) water supply by issue of a notice of seasonal water assignment by DERM, or by approval by ROL holder for supplemented (i.e. regulated) supply.

## ***Transaction processing***

### **Transaction processing steps**

#### *Licence transfer (including relocation)*

- Holder of licence lodges application in approved form with fee to DERM. Form includes details and consent of assignee.
- Application must be accompanied by written consent of any persons with a financial or other interest in the land to which the licence is attached.
- DERM decides application based on WRP/ROP rules and other matters.
- if it is approved, DERM gives a notice to the applicant.
- The applicant must, within 30 days, advise DERM of intention to proceed with the transfer or the approval lapses.
- DERM cancels, amends or issues new licences as necessary to give effect to the transfer. (See Water Act Regulation 2002 ss. 15A-15F).

#### *Licence seasonal water assignment*

- holder of water allocation or seasonal water assignment notice lodges application in approved form with fee to DERM. Form includes details and consent of assignee (s. 231).
- DERM decides application based on seasonal assignment rules. If it conforms to rules it must be approved, if it does not it must be refused (s. 233).
- if it is approved, DERM gives a notice to the application. The assignment takes effect from the day the notice is served (s. 233).

#### *Transfer, lease, subdivision, amalgamation or change of water allocation* (as it might apply to groundwater) (ss. 127–135, ss. 150, 151)

- Apart from transfers and leases (for which the relevant documents simply need to be lodged and recorded on the Water Allocations Register) the holder applies to DERM on the approved form with the accompanying fee.
- For a 'permitted' change, no assessment or advertising is required, apart from an application for assessment being required under s. 129.
- If it does not meet the criteria for a 'permitted' change, then assessment is required. Assessment is done by and at the expense of the applicant.
- If further information is required (as per ss. 131 and 132 of the Act), then DERM must advertise and invite submissions on the application.
- DERM decides application based on WRP/ROP objectives and rules, and for change applications consideration of impacts on other water entitlement holders and natural ecosystems and the public interest.

- For subdivision and amalgamations, application is required to DERM and an assessment is made. No advertising is required.
- DERM notifies the applicant, and if it is approved provides a certificate.
- DERM notifies the applicant, and if change, subdivision or amalgamation is approved provides a dealing certificate.
- For the dealing to take effect, the holder must lodge the certificate with the registrar of water allocations within 40 days (unless otherwise stated on the certificate). Consent of any registered mortgagee must also be provided, and any other relevant titles requirements. The registrar must record the dealing (i.e. change, subdivision or amalgamation) if the certificate and the consents are provided.
- The dealing has effect the day it is registered on the Water Allocations Register.

*Seasonal water assignment of water allocation (groundwater and un-supplemented surface water)*

- The holder of water allocation or seasonal water assignment notice lodges application in approved form with fee to DERM. Form includes details and consent of assignee (s. 143).
- DERM decides application based on seasonal assignment rules. If it conforms to rules it must be approved, if it does not it must be refused (s. 144).
- If it is approved, DERM gives a notice to the application. The assignment takes effect from the day the notice is served (s. 144).

Note that advertising is not required for seasonal trade of annual entitlement. For water allocations, advertising is required for 'changes' that are not mentioned in ROPs, and which require further information (as per ss. 131 and 132 of the Act).

## **Market and resource definition**

### **Scope of trading**

There is no legal constraint on trade movement, but in practice it is only allowed within the GMA, and frequently only within zones. This is recognised in the WRP and ROP plan development. In places there is recognition of surface water to groundwater connectivity but as yet no formal basis for trade across this connection.

### **Establishing physical unit/zone boundaries**

GMA boundaries are based on geological formation boundaries, but at the fine scale follow cadastral boundaries. The basis for internal zone boundaries varies, and includes the use of numerical model cells. Vertical separation of groundwater units also occurs.

In many cases, the GMA is embedded within a surface water catchment, and both groundwater and surface water are managed under the one WRP. An example of this, and vertical separation of groundwater units, occurs with the Burnett Basin, where the WRP includes the Coastal Burnett Groundwater Management Area, which is subdivided vertically into upper and lower units that comprise four and one groundwater sub-areas respectively.

### **Defining consumptive pool/allocatable volumes**

Access to groundwater is described within WRPs and policies (e.g. DERM, 2009) that define the water sharing rules for the particular groundwater management areas, as prescribed in section 64 of the Water Regulation 2002 (the Regulation) and the seasonal water assignment rules prescribed in section 15 of the Water Regulation 2002.

Long-term access limits are mainly set by either numerical modelling of groundwater flows, analytical water balance assessment or acceptance of current entitlement levels (in which case no extraction limit is specified, and sustainable extraction is achieved through annual 'announced entitlements').

Short-term (seasonal) water access is largely governed by 'announced entitlement', being a percentage of the licensed nominal entitlement that can be taken that season. Announced entitlements are described in 'water sharing rules' policy documents that are prepared for individual GMAs, and are determined with consideration to factors such as:

- trends in underground water levels
- long term average sustainable yield
- historical water use
- anticipated water use
- water available to supplement water licences in the area
- weather conditions, including weather forecasts
- other issues, such as risk of sea-water intrusion.

## **Restrictions on market participants**

Licences can only be held by landholders. Seasonal water assignment under licences generally requires the assignee to have authorised, metered works to take the seasonally assigned water.

There are no constraints on who can hold water allocations or seasonal water assignment notices.

## **Levels of trading**

There is the ability to have, on an ongoing basis, a range of different trading regimes, such as:

- transfer of licences with transfer of associated land
- as above plus seasonal assignment of water under licences
- as above plus change of location of licences (GAB only at present) and is a 'hybrid case' as the resource is large in comparison to the use, occurs across large tracts and holdings with limited potential of adverse impacts to existing users through changed locations of extraction
- full implementation of water allocations and seasonal water assignments.

## ***Trading initiation***

### **Triggers**

The initial trigger for tradeable groundwater is the declaration of an area and a moratorium on new development. The initial focus is usually then on determining the volumes of entitlements of existing users, and studies to more definitively define limits on available water. It can be done ahead of a WRP process, or as part of a WRP process. Water users may be issued with licences or move straight to allocations if the entitlements are being resolved as part of the ROP.

Seasonal assignments can occur only where it is provided for either in the regulation or through a WRP/ROP. This is done once entitlements are established and meters installed.

WRP and ROP groundwater development is triggered by priority need based on aquifer stress, and can provide for fully tradeable water allocations.

Trading is not undertaken in under-allocated GMUs.

## Prerequisites

Quantified licence volumes and metering for seasonal assignments. For 'permanent' trade of allocation (NWI entitlement equivalent), require a WRP, ROP and licences converted to tradeable allocations.

## Initiating groundwater trading in an area

Trading follows from declaration of a moratorium and subsequent processes.

### *Transaction processing*

## Transaction impact assessment

For transactions involving change of location:

- objectives of WRP where relevant
- where advertised, consider lodged submissions
- the 'public interest'
- impacts on other water entitlement holders and ecosystems.

A range of measures is being considered for assessing the impacts of trading in water allocations. No such trades have yet been carried out.

## Fees for transactions

|                                                 |                                                                                                                                                                                                                                                         |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Licence transfer (change of holder only)        | \$99.05                                                                                                                                                                                                                                                 |
| Licence relocation (including transfer)         | \$290.70                                                                                                                                                                                                                                                |
| Licence seasonal water assignment               | \$132.10                                                                                                                                                                                                                                                |
| Water allocation transfer                       | \$127.90 and \$27.00 for each additional lot at the same time (including land transfers).                                                                                                                                                               |
| Subdivision or amalgamation of water allocation | \$99.05 application fee + \$127.90 for registration of subdivision documents + \$55.20 for each new title to be issued.                                                                                                                                 |
| Lease of water allocation                       | \$127.90 registration fee only.                                                                                                                                                                                                                         |
| Change of water allocation                      | \$99.05 and \$19.70 for each additional application made at the same time for s. 129 and s. 129A application. If s. 130 application, cost of researching and investigation of the application, assessed on a case by case basis, plus registration fee. |

|                                               |                                                                                    |
|-----------------------------------------------|------------------------------------------------------------------------------------|
| Seasonal water assignment of water allocation | \$132.10                                                                           |
| Registration of relevant transactions         | \$127.90 and \$27.00 for the registration of each additional lot at the same time. |

## Trading rules

From the Act:

- Seasonal water assignments only apply to the water year in which the application is made (s. 142).

Local rules:

- GAB ROP  
[http://www.derm.qld.gov.au/wrp/pdf/gab/gab\\_rop.pdf](http://www.derm.qld.gov.au/wrp/pdf/gab/gab_rop.pdf)
- seasonal water assignment of licence rules for various areas made pursuant to the regulation (Border Rivers, Bowen, Burdekin, Callide Valley, Coastal Burnett and Condamine GMAs):  
[http://www.derm.qld.gov.au/water/management/water\\_sharing\\_rules/index.html](http://www.derm.qld.gov.au/water/management/water_sharing_rules/index.html)

The example below is from Coastal Burnett GMA local rules.

Generally seasonal water assignment:

- is prohibited if the location of take of the assigned water is not within a polygon as shown on AP13821 [i.e. within the GMA]
- between sub-areas is not allowed, a seasonal water assignment across the Burnett or Elliott Rivers is not allowed
- application is allowed only if the volume of the proposed assignment is equal to or less than the volume of the assignors'/seller's unused announced entitlement
- not allowed where the assignor/seller or the assignee/buyer has an unpaid water invoice
- only allowed if the assignee/buyer has works authorised to take the seasonally assigned water (i.e. the works must be authorised to take water for the purpose for which the seasonally assigned water will be used). These works must be metered.

In the Burnett-Elliott, Elliott-Gregory and Fairymead sub-areas a seasonal water assignment is allowed only if:

- the direction of the assignment is away from, or parallel to, the coast, or
- the chief executive considers that the approval of the seasonal water assignment might potentially help control saltwater intrusion in the area.

In the Kolan-Burnett sub-area a seasonal water assignment between polygons (that relates to water within the Elliott Formation) is allowed only if the assignment is west of, or parallel to, the following lines:

- the line from the northern end of Lindemans Road (Lindemans Road junction with L13 RP109126 and L2 RP221362), south-east (approximately along the 'escarpment') to the north-east corner of polygon G57
- the line from the north-east corner of polygon G57, south along the boundary between polygons G57 and G58, to intersect with Bundaberg-Gin Gin Road

- the line from the intersection with Bundaberg-Gin Gin Road south of the boundary between polygons G57 and G58, west to Splitters Creek, following the boundaries of G1 and G2.

In addition, in the Kolan-Burnett sub-area, a seasonal water assignment is:

- only allowed if the chief executive considers that the approval of the seasonal water assignment might potentially help control saltwater intrusion in the area
- not permitted from above the 'escarpment' to below the 'escarpment' in the Kolan-Burnett sub-area. The 'escarpment' is a topographic feature that is described as the steep drop in land elevation that was eroded in earlier geological times
- not permitted between groundwater aquifers unless the chief executive considers that a potential consequence of approving the seasonal water assignment is an environmental benefit. For example, if the chief executive considers an assignment will reduce stress on the aquifer from which the assignment is being made, then the application for seasonal water assignment may be approved
- not allowed between a groundwater source and a surface water source
- not allowed to a polygon that has shown a recent rise in salinity if the chief executive considers that a potential consequence of approving the seasonal water assignment might be a further increase in salinity, which may adversely affect water users
- not allowed between polygons where the assignment is from a polygon that has a greater announced entitlement than the polygon to which water is to be assigned. For example, if the G12 polygon has an announced entitlement of 80% and the G13 polygon has an announced entitlement of 70%, a seasonal water assignment cannot occur from the G12 to the G13 polygon
- is not allowed where the water levels in the nodal bores of the polygon to which the water is being assigned and the water levels in the nodal bores of adjacent polygons:
  - are below the minimum desired operating levels that have been determined by the Department
  - if the trend in water levels shows a decline, the water levels must be above 0.25 metres of the determined minimum operating levels.

## Transaction processing efficiency

The DERM website ([www.derm.qld.gov.au/water/trading/service\\_standards.html](http://www.derm.qld.gov.au/water/trading/service_standards.html)) provides information on Queensland's performance against service standards for processing temporary and permanent water trades. The service standards are set by Council of Australian Governments requirements. For the period 1 July 2009 to 30 April 2010, DERM processed 109 unsupplemented intrastate seasonal water assignments, with 81% processed within 5 business days. The service standard is to process 90% within 5 business days.

## Stamp duty

Transfers are subject to stamp duty.

## ***Assessments of potential water level changes/drawdowns***

33. Who is responsible for the assessments? e.g. proponent or agency?

34. How are potential changes in water levels associated with trades determined? Models, methods, hand calculations? Are there any technical requirements/standards applied to assessments? Do technical requirements vary depending on the system/aquifer type/geographic location? Are both long-term water level changes and changes in seasonal drawdown assessed? Do water level change assessments assume full development of existing entitlements?

There is minimal assessment undertaken with seasonal assignment.

For water allocations, assessment will be required for 'changes' that are not mentioned in ROPs (s. 130 of the Act).

DERM is yet to confirm a consistent approach to assessment of water allocation (equivalent to NWI water entitlement) trades. It may be subject to the way zones are set up and the manner in which allocation are linked to locations. Again, the Pioneer and the Burnett WRP's set out a series of rules for monitoring and reporting together with the development of the trigger levels.

Technical assessments are generally not required for seasonal trade of annual entitlement.

## ***Managing impacts of trade***

### **System-wide drawdown effects**

For example, on GDEs, surface water, adjoining aquifers, other bores, water quality etc; resulting from activation of sleepers.

Sea-water intrusion and water quality are major concerns with coastal aquifers. Trading rules designed to control this by encouraging less extraction near the coastline (e.g. Coastal Burnett), other areas have defined bore density where the total and mutual interference is a concern. Other mechanisms of 'discovery armistice' used to draw out sleepers, assignment of smaller portion of entitlement based on historic use, etc.

### **Local drawdown effects**

For example, on GDEs, surface water, adjoining aquifers, other bores, water quality etc from allowing increased local concentrations of extraction.

Distance conditions and other rules, and small zones, being considered for local impact control.

### **Effects of movement of economic activity**

For example, loss of local community infrastructure through cumulative movements of water-dependent economic activity out of an area.

Not considered significant because of the localised nature of aquifers and limited range of movement.

## *Facilitating groundwater trading*

### **Metering**

Water extraction metering occurs largely on an as-required basis, with metering in priority areas including:

- areas where SunWater has an active role in groundwater management (i.e. where SunWater undertakes 'passive' managed aquifer recharge (e.g. Three Moon Ck and Callide Water Supply Schemes) and/or groundwater extraction is managed under surface water licences (Proserpine Water Supply Scheme)
- areas subject to a WRP (GAB, Coastal Burnett and Pioneer).

There is no metering (or licensing) of groundwater extraction in the Lower Burdekin where the North and South Burdekin water boards undertake managed aquifer recharge.

According to the May 2005 Metering Water Extractions policy, generally, all new meters will be purchased, installed, maintained and read through contracts awarded by the department. The department will establish and maintain processes which ensure contracts are awarded on a competitive basis.

### **Access to market information**

The Queensland DERM website provides information on types of trades that can potentially occur, and access to WRPs and water management rules for particular areas made pursuant to the regulation that contain local rules for groundwater trading.

### **Education and awareness**

Generally groundwater users have a low awareness and understanding of trading opportunities. In most areas their focus is on establishing their entitlement volumes and system rules.

### **Intermediaries**

Not significant as the level of groundwater trading is low and is currently limited to seasonal water assignment in just a few areas.

## *Monitoring and compliance*

### **Monitoring and evaluation**

DERM maintains records of groundwater trading statistics that is available from its website at [http://www.derm.qld.gov.au/water/trading/market\\_info.html](http://www.derm.qld.gov.au/water/trading/market_info.html). Cumulative impacts may be gauged from data such as that from metered extractions and routine groundwater level and quality monitoring.

### **Current trading statistics**

The following trading information was taken from the Commission's Australian Water Markets Report 2008–09.

**Table 20 Groundwater licence relocations in Queensland**

| Area | 2007-08 |     | 2008-09 |    |
|------|---------|-----|---------|----|
|      | Number  | ML  | Number  | ML |
| GAB  | 7       | 323 | 0       | 0  |

**Table 21 Groundwater licence seasonal water assignments in Queensland**

| Area                | 2007-08 |      | 2008-09 |      |
|---------------------|---------|------|---------|------|
|                     | Number  | ML   | Number  | ML   |
| Border Rivers       | 8       | 1126 | 4       | 795  |
| Coastal Burnett     | 65      | 1946 | 36      | 1341 |
| Condamine           | 20      | 1625 | 19      | 1530 |
| Oakey Creek         | 7       | 200  | 5       | 154  |
| Callide Valley      | 1       | 10   | 0       | 0    |
| GAB                 | 1       | 300  | 2       | 600  |
| Pioneer             | 2       | 415  | 3       | 470  |
| Upper Hodgson Creek | 5       | 275  | 4       | 179  |

## ***Demand for trading***

The immaturity of entitlement regimes means that significant groundwater trading is a little way off. In most areas groundwater users are very much focused on defining what their entitlements are rather than thinking about trading in entitlements.

In northern parts of Queensland there is currently little demand for trade, as current water availability and rainfall generally more than meet requirements. However there is often a scarcity in the dry season and demand may pick up over time.

In the MDB, demand is likely to increase rapidly once Basin Plan SDLs are applied.

The small and scattered nature of aquifers limits potential market participants.

## ***References***

National Water Commission 2009, *Australian Water Markets Report 2008–2009*, NWC, Canberra

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# Appendix D. Groundwater trading stocktake – New South Wales

## *Governance and administrative framework<sup>9</sup>*

### **Legislation**

The *Water Management Act 2000* (the Act, s. 392) stipulates that the Crown has the right to the control, use and flow of all water in rivers, lakes and aquifers, and all water conserved by any works that are under the control or management of the Minister, and all water occurring naturally on or below the surface of the ground. The Act defines an aquifer as 'a geological structure or formation, or an artificial landfill, that is permeated with water or is capable of being permeated with water'.

The Crown confers rights to take water on individuals, corporations and other entities through water access licences. Separate rights are also conferred on these entities to construct and use works to take this water ('water supply works approvals'), and to use the water so taken at a particular location ('water use approvals'). The Act sets out a regime for regulation of conferred water access rights that provides for rules and processes for their issue, trading and adjustment. Powers to enforce compliance with water rights and obligations are provided.

Applications for the issue and transfer (and in the case of works and use approvals, renewal) of these licences are assessed by the relevant authority and may be refused or granted subject to conditions. Taking of water under aquifer access licences is subject to 'available water determinations' made from time to time (usually annually) by the Department under delegation from the Minister, and consistent with the relevant approved statutory water management plan.

Each water access licence is designated to be of a particular category. Categories are defined by the Act and regulations to the Act (s. 57). Most water access licences for groundwater are categorised as 'aquifer access licences'. Other categories that may also allow access to groundwater include 'local water utility access licences' and 'supplementary water access licences'. Water access licences are also designated to relate to a single specified water source. When available water determinations are made for a water source, the available water can be differentially made available to different categories, allowing for prioritisation of allocation by category.

Groundwater trading is enabled through specific 'dealing' (trading) provisions in the Act (ss. 71L to 71Z).

The water sharing provisions of a management plan, usually made as a standalone statutory 'water sharing plan', must include, inter alia, the establishment of access licence dealing rules for the area or water source. These dealing rules must comply with the access licence dealing principles (which 'prevail to the extent of any inconsistency, and must not deal with interstate tagged trading management, and subject to these, may regulate or prohibit any dealing...').

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<sup>9</sup> Note that this discussion refers to legal and administrative arrangements under the *Water Management Act 2000* (WMA). Most of the major groundwater use in NSW is administered under this Act. There are many areas of the State, albeit with lesser groundwater use, that are still administered under the *Water Act 1912*. It is expected, however that the management of all groundwater will transit to the WMA over the next 2 years, as (macro) water sharing plans for these remaining areas are made.

## Institutional responsibilities

The agency responsible for managing groundwater in NSW is the Office of Water within the Department of Environment, Conservation, Climate Change and Water (DECCW). Broadly, DECCW has responsibility for administering the Act including groundwater licensing, trading, monitoring and compliance, for development and implementation of state policy. Either the Department (under delegation from the Minister) or government/community water management committees are charged with the development of statutory water management plans, with ultimate responsibility for their approval ('making') lying with the Minister responsible for water. The access licence register is administered by the Department of Lands.

## Policies

An Order is in force pursuant to s. 71 of the Act (the Access Licence Dealings Principles 2004) that establishes the state-wide framework and constraints for 'dealings' under the Act. This instrument sets out the general principles that must be applied in the consideration of applications for any dealings, including principles relating to potential impacts on water sources, impacts on indigenous, cultural, heritage or spiritual matters, impacts on water users, and maximising social and economic benefits. It also sets out specific principles in relation to each different type of dealing, including the circumstances in which they are prohibited. Extracts from the Order are shown in attachment 1 to this appendix.

## Groundwater management units

The principal management unit for groundwater in NSW is the groundwater source, the boundaries of which can fall across more than one river basin. A groundwater source is a distinct hydrogeological unit, delineated on hydrological boundaries/aquifer extent. In the case of alluvial aquifers, significant bedrock highs disrupting the flow of groundwater generally represent a boundary between water sources. A groundwater source is the unit within which an entitlement represents a share of (or more correctly shares in) the water available to a category of licence. Water sharing plans can be, and are, developed for one or multiple groundwater sources. Groundwater sources are established statutorily via water sharing plans, and may be further disaggregated into zones if it is considered necessary to manage local impacts or density of extraction. Long term average annual extraction limits (LTAAELs) are set for each groundwater source, essentially defining the resource available for extraction from that area each year, subject to annual available water determinations and other plan provisions. Groundwater source are managed in accordance with statutory water sharing plan provisions (including the mandatory trading provisions). The NSW 'groundwater sources' closely resemble the NWI 'specified water resources'<sup>10</sup>.

Existing groundwater sources and associated approved statutory plans are listed in Table 22. As discussed these statutory plans must establish access licence dealing rules for the area or water source. The list does not include plans and water sources where alluvial groundwater is managed as 'one resource' with closely connected unregulated surface water resources. Approved plans where this applies (number of water sources in brackets) are for the Bellinger River Area (11), the Coffs Harbour Area (13), the Lower North Coast (21), Wybong Creek (1), and the Hunter (39). Draft plans have also been prepared for managing the groundwater resources of the Sydney Greater Metropolitan Region, and the alluvial resources of the Richmond river area, the Brogo and Bega rivers area, the Tweed river area, the Towamba area, and the Murrah-Wallaga catchment. Draft plans are also currently being prepared for the remaining systems, including the large inland porous and fractured rock systems.

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<sup>10</sup> Under the NWI:

- A consumptive pool is the amount of water that can be made available for consumptive use in a given water system under the rules of the relevant plan (Sched B)
- water access entitlements are shares of the consumptive pool of a specified water resource (cl. 28)

**Table 22 Groundwater sources and plans in NSW**

| <b>Water sharing plan</b>                                            | <b>Groundwater sources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NSW Great Artesian Basin                                             | Eastern Recharge<br>Southern Recharge<br>Surat<br>Warrego<br>Central                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Kulnura Mangrove Mountain                                            | National Park, State Forest and Drinking Water Catchment,<br>Wollombi Brook,<br>Brisbane Water,<br>Ourimbah Creek,<br>Wyong River,<br>Upper Mangrove,<br>Lower Mangrove and Popran Creeks<br>Mooney Mooney and Mullet Creeks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Lower Macquarie                                                      | Lower Macquarie Zone 1<br>Lower Macquarie Zone 2<br>Lower Macquarie Zone 3<br>Lower Macquarie Zone 4<br>Lower Macquarie Zone 5<br>Lower Macquarie Zone 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Lower Gwydir                                                         | Lower Gwydir                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Tomago Tomaree Stockton                                              | Tomago<br>Tomaree<br>Stockton                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Lower Lachlan                                                        | Lower Lachlan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Stuarts Point                                                        | Stuarts Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Lower Murray                                                         | Lower Murray                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Lower Murrumbidgee                                                   | Lower Murrumbidgee shallow<br>Lower Murrumbidgee deep                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Upper and Lower Namoi                                                | Upper Namoi Zone 1, Borambil Creek<br>Upper Namoi Zone 2, Cox's Creek (Mullaley to Boggabri)<br>Upper Namoi Zone 3, Mooki Valley (Breeza to Gunnedah)<br>Upper Namoi Zone 4, Namoi Valley (Keepit Dam to Gin's Leap)<br>Upper Namoi Zone 5, Namoi Valley (Gin's Leap to Narrabri)<br>Upper Namoi Zone 6, Tributaries of the Liverpool Range (South to Pine Ridge Road)<br>Upper Namoi Zone 7, Yarraman Creek, (East of Lake Goran to Mooki River)<br>Upper Namoi Zone 8, Mooki Valley (Quirindi—Pine Ridge Road to Breeza)<br>Upper Namoi Zone 9, Cox's Creek (up-stream Mullaley)<br>Upper Namoi Zone 10, Warrah Creek<br>Upper Namoi Zone 11, Maules Creek Groundwater Source<br>Upper Namoi Zone 12, Kelvin Valley<br>Lower Namoi |
| Alstonville Basalt                                                   | Alstonville<br>Tuckean<br>Bangalow<br>Coopers<br>Wyrallah<br>Lennox                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Dorrigo Plateau Surface Water Source and Dorriggo Basalt Groundwater | Dorrigo basalt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Peel                                                                 | Peel alluvium<br>Peel fractured rock                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## Groundwater licences and entitlements

In NSW where water sharing plans are in place, and the Water Management Act 2000 applies, the 'categories' of groundwater access licences include:

- *Local water utility* access licences
- *Domestic and stock* access licences. These should not be confused with domestic and stock basic rights (see later), but are required where a bore (or bore field) in one parcel of land is used to supply water to another parcel of land. This is usually the case where there is a pipeline servicing a number of properties, and is fairly uncommon, except in the GAB.
- *Aquifer* access licences (and subcategories thereof)
- *Supplementary water* access licences.

Local water utility, and domestic and stock access licences have priority over aquifer access licences. The vast majority of groundwater licences in NSW are aquifer access licences. As discussed, in addition to holding an access licence to extract and use groundwater, the licence holder must have a works (bore) approval to construct and use a work (and that must be 'nominated' by the relevant access licence) and a use approval to use the water on a particular parcel of land.

## Managed aquifer recharge

NSW has not yet developed a policy of provisions for addressing this. MAR activity is minor.

## Unlicensed or unembargoed groundwater rights and other impacting activities outside of the groundwater management framework

Domestic and stock *basic rights* in NSW do not require a licence, although approval is required to construct the work (bore) from which the right will be exercised. Domestic and stock bores are rarely metered, and are normally exempt from embargoes.

There are embargoes on applications for new groundwater licences in most of the NSW groundwater sources, including the entire NSW Murray–Darling Basin. The exceptions include the remaining fold belts and porous rock systems from which only small quantities of usable groundwater can be extracted, the GAB (with the exception of the recharge areas), some fractured rock systems in the north west of the State, and smaller coastal resources.

There are also minor exemptions to new licence embargoes provided for in the regulations to the Act, and in most plans exemptions apply to local water utilities, aboriginal cultural access licences, and in some cases (volume limited) Aboriginal commercial access licences.

The impacts on groundwater resources of land use changes fall outside the regulatory framework for water in NSW. At this stage, activities such as forestry, which may change groundwater recharge processes, are not licensed. Other (for example mining) activities that use water require a licence. Where these do not explicitly use water, but may impact on groundwater resources, the aquifer interference provisions of the Act can potentially be used to manage that impact (though this has not yet been done at this point), and in certain circumstances access licences will be required, bringing them inside the consumptive pool.

## Market regulation

There are no explicit provisions in the Act to regulate the operation or behaviour of market intermediaries, or price manipulation. Where concerns have arisen recently, these have been referred to the ACCC by concerned parties for action under Trade Practices legislation.

## *Tradeable rights*

### Licences and entitlements

As discussed, a groundwater licence established and managed under the Act is fully unbundled in NSW into an access licence, a work or works approval and a use approval. All three rights must be held to take and use the groundwater. Approvals must be extended (renewed) after 10 years. Access licences are generally perpetual, the exception being 'specific purpose' access licences that are generally cancelled with the cessation of the specific purpose or activity.

There are no restrictions on ownership (i.e. who can hold) access licences.

An access licence entitles its holder:

- (a) to specified shares in the available water within a specified water management area or from a specified water source (the 'share component'), and
- (b) to take water:
  - (i) at specified times, at specified rates or in specified circumstances, or in any combination of these, and
  - (ii) in specified areas or from specified locations, (the 'extraction component').

... [T]he share component of an access licence may be expressed:

- (a) as a specified maximum volume over a specified period, or
- (b) as a specified proportion of the available water, or ...
- (d) as a specified number of units.

Shares in available water may be assigned generally or to specified categories of access licence (s. 56).

In practice, the share components of groundwater access licences under the Act are specified as a 'number of units'.

An access licence is subject to such conditions as the Minister may from time to time impose:

- (a) which must include such conditions as are required to be imposed on the licence by this Act or by any relevant management plan ( 'mandatory conditions'), and
  - (b) which may include such other conditions, such as:
    - (i) conditions to give effect to any agreement between an applicant and objector ..., and
    - (ii) conditions relating to the protection of the environment,
- as the Minister thinks fit ( 'discretionary conditions') (s. 66).

Discretionary conditions may not be imposed on an access licence after it has been granted unless the Minister:

- (a) has given written notice to the holder of the access licence that the Minister proposes to impose such conditions, and
- (b) has given the holder of the access licence a reasonable opportunity to make submissions to the Minister with respect to the proposed conditions, and
- (c) has taken any such submissions into consideration' (s. 67).

The vast bulk of groundwater licences are aquifer access licences. They, and the water allocations accruing to them, are the core tradeable rights in groundwater. They have the following features:

- Subject to local impact management restrictions that may be applied, they are highly reliable, receiving 100% (or 1ML/unit share) of entitlement every year. In NSW a policy decision has been made to, as far as possible, manage groundwater systems as high security systems. This recognises that in most areas, the groundwater storage is sufficient to buffer climate variability, and that there is no particular advantage in running a 'boom/bust' system.
- Accounting occurs on a longer-term basis in most plan areas. At the start of each water year, licence accounts are 'credited' with a volume of water available for extraction (as discussed above usually 100% (or 1ML/unit share) of entitlement. Unused water allocations in accounts can be 'carried over' between water years, providing the allocations in an account don't exceed specified limits. Plans also impose limits on the amount of water that can actually be used (and debited from an account) in each water year.
- Both the entitlements themselves, and the allocations accruing to the accounts of entitlements, can be traded. Restrictions apply in most groundwater sources managed in accordance with a water sharing plan. These restrictions generally preclude any trade which would increase the extraction within nominated distances from a river or other groundwater dependent ecosystem, or may cause undue interference with the exercise of other extractive rights (both basic rights and licensed rights).
- Generally, trading of licences is not permitted between water sources.
- Conversion of aquifer access licences to another category is not permitted.
- Aquifer access licenses are mortgageable.

Other categories of licences can be traded only in limited ways if at all. Local water utility and domestic and stock access licences have the following features:

- Subject to local impact management restrictions that may be applied, they are highly reliable, receiving 100% (or 1ML/unit share) of entitlement every year.
- Accounting occurs on an annual basis Allocations that have accrued to the licences in a water year are forfeited at the end of the water year if not used (or traded where permitted).
- They can only be used for the specified purpose (e.g. town water supply to a particular town, or domestic supply to particular properties) and cannot be 'traded' to be used otherwise. Local water utility licences can however sell the annual allocation accruing to them under particular circumstances.

## Water allocations and other tradeable rights

Under the NSW Act, water allocations exist separately from the access licence entitlements. Specific volumes of water are allocated to groundwater access licences in a given season (usually annually). These are recorded in a water allocation account that is attached to the access licence, and as such are transferred with the access licence. However they may be 'assigned' from one water access licence to another by a dealing that simply debits the account of one licence and credits the account of another, without altering the share (entitlement) or ownership of the water access licence itself. This is commonly called 'temporary' trading.

Subject to any account management rules, water allocations remain in the water allocation account until used or traded, or 'forfeited' from the account in accordance with the account management rules in the relevant plan.

The Act also enables 'extraction rights', being the rights to take water in specified areas or from specified locations. In theory, these could be separately tradeable, although this is not currently operational for groundwater.

## Entitlement statistics

Statistics for the 2008–09 water year are provided in Table 23.

**Table 23 NSW WSP areas—entitlement statistics for the 2008–09 water year**

| Water system                                 | No. of access licences | Entitlements (ML/yr) | Recent usage (ML/yr) |
|----------------------------------------------|------------------------|----------------------|----------------------|
| Alstonville Plateau Zone 1                   | 57                     | 2765                 | N/A                  |
| Alstonville Plateau Zone 2                   | 74                     | 2752                 | N/A                  |
| Alstonville Plateau Zone 3                   | 24                     | 1293                 | N/A                  |
| Alstonville Plateau Zone 4                   | 2                      | 24                   | N/A                  |
| Alstonville Plateau Zone 5                   | 2                      | 38                   | N/A                  |
| Alstonville Plateau Zone 6                   | 1                      | 5                    | N/A                  |
| Dorrigo Basalt                               | 9                      | 190                  | 0                    |
| Kulnura Mangrove Mountain Zone 1             | 0                      | 0                    | N/A                  |
| Kulnura Mangrove Mountain Zone 2             | 3                      | 25                   | N/A                  |
| Kulnura Mangrove Mountain Zone 3             | 2                      | 24                   | N/A                  |
| Kulnura Mangrove Mountain Zone 4             | 36                     | 675                  | N/A                  |
| Kulnura Mangrove Mountain Zone 5             | 14                     | 469                  | N/A                  |
| Kulnura Mangrove Mountain Zone 6             | 30                     | 385                  | N/A                  |
| Kulnura Mangrove Mountain Zone 7             | 56                     | 936                  | N/A                  |
| Kulnura Mangrove Mountain Zone 8             | 56                     | 735                  | 740                  |
| Lower Gwydir                                 | 172                    | 32430                | 22037                |
| Lower Lachlan                                | 84                     | 108000               | 86324                |
| Lower Macquarie Zone 1                       | 30                     | 21680                | 15772                |
| Lower Macquarie Zone 2                       | 18                     | 22608                | 13638                |
| Lower Macquarie Zone 3                       | 28                     | 9353                 | 5558                 |
| Lower Macquarie Zone 4                       | 6                      | 5101                 | 4042                 |
| Lower Macquarie Zone 5                       | 7                      | 2477                 | 397                  |
| Lower Macquarie Zone 6                       | 29                     | 7326                 | 1649                 |
| Lower Murray                                 | 324                    | 83572                | 67108                |
| Lower Murrumbidgee - Deep                    | 290                    | 269987               | 287712               |
| Lower Murrumbidgee - Shallow                 | 30                     | 5201                 | 3545                 |
| NSW Great Artesian Basin - Surat             | 43                     | 6861                 | 1770                 |
| NSW Great Artesian Basin - Warrego           | 6                      | 498                  | 0                    |
| NSW Great Artesian Basin - Central           | N/A                    | N/A                  | N/A                  |
| NSW Great Artesian Basin - Eastern Recharge  | N/A                    | N/A                  | N/A                  |
| NSW Great Artesian Basin - Southern recharge | N/A                    | N/A                  | N/A                  |
| Stuarts Point                                | 25                     | 3735                 | 3735                 |
| Tomago Tomaree Stockton - Tomago             | 13                     | 26055                | 0                    |
| Tomago Tomaree Stockton - Tomaree            | 14                     | 851                  | 0                    |
| Tomago Tomaree Stockton - Stockton           | 26                     | 997                  | 0                    |
| Upper and Lower Namoi Zone 1                 | 36                     | 1600                 | 489                  |
| Upper and Lower Namoi Zone 2                 | 30                     | 7200                 | 6679                 |
| Upper and Lower Namoi Zone 3                 | 62                     | 17261                | 5163                 |
| Upper and Lower Namoi Zone 4                 | 169                    | 25692                | 13809                |
| Upper and Lower Namoi Zone 5                 | 72                     | 15996                | 9838                 |
| Upper and Lower Namoi Zone 6                 | 32                     | 11448                | 676                  |
| Upper and Lower Namoi Zone 7                 | 16                     | 3697                 | 934                  |
| Upper and Lower Namoi Zone 8                 | 66                     | 15996                | 6106                 |
| Upper and Lower Namoi Zone 9                 | 30                     | 11330                | 2141                 |
| Upper and Lower Namoi Zone 10                | 5                      | 1420                 | 17                   |
| Upper and Lower Namoi Zone 11                | 26                     | 2203                 | 641                  |
| Upper and Lower Namoi Zone 12                | 19                     | 1999                 | 112                  |
| Upper and Lower Namoi - Lower Namoi          | 214                    | 86001                | 59364                |

## *Trade-related transactions*

### **Types of transactions**

Water access licences, are generally tied to a location through:

- the licence being tied to a specified water source, and optionally a zone within the water source
- the requirement that water allocations on the licence can only be taken through works nominated on the licence.

Thus dealings that change the location where water rights can be exercised involve changing either the water source, zone or nominated works on the licence, or the assignment of rights within a licence to a separate licence at a different location.

The 'dealings' provisions of the Act provide for the following transactions:

- transfer of ownership of access licences (no change in location at which the right can be exercised)
- term transfer (lease) of ownership of access licences (no change in location)
- assignment of rights under access licences (effectively a permanent transfer of the rights associated with one access licence to another access licence, that may be at a different location)
- amendment of share component of access licences, where an access licence in a specified water source or water management area is cancelled and a new one granted in a different water source or water management area (i.e. change of location to a different water sources)
- amendment of extraction component of access licences, whereby the times, rates or circumstances specified in the licence, or the areas or locations specified in the licence may be varied (for example to change the zone from which water may be taken)
- assignment of water allocations between access licences
- interstate transfer of access licences and water allocations
- access licences to 'nominate' water supply works at particular locations
- dealing on default, whereby a security interest may apply to transfer ownership of an access licence if default is made in the payment of any debt or performance of any other obligation under a contract or other legally enforceable arrangement secured by the security interest.

An application for the Minister's consent to a dealing is to be dealt with in accordance with the water management principles in the Act (s. 5), the access licence dealing principles (see section below on policies), and the access licence dealing rules established by any relevant management plan (s. 20).

### **Transaction processing**

The steps that apply to trading type transactions are:

1. Buyer and seller come into contact and agree on price.
2. Contracts –the parties to the dealing enter into a contract or other arrangement to proceed with the dealing.

3. Searches – the purchaser carries out such searches and checks as they deem necessary to ensure they know what they are getting. These could include a search of the licence register to verify the details of the licence and check for security interests and an inquiry with State Water regarding the status of the licence water allocation account and licences fees paid or coming due.
4. Minister's consent – the licence holder or holders apply for consent to the dealing to the Department that acts for the Minister. (This does not apply to dealings that do not require Minister's consent, e.g. transfer of owner, and term transfer.) If refused the applicant has a right of appeal to the Land and Environment Court.
5. Settlement – the parties to the dealing settle and the necessary papers are handed to the purchaser. This includes discharges of interests or written consents from interest holders and the licence certificate. Where only one party is involved this step involves the licence holder obtaining consents where necessary from security interest holders.
6. Registration – presentation of the completed and, where necessary, stamped forms to Department of Lands for registration of the dealing. Where issued the licence certificate must be presented at the same time. The dealing does not take effect until it is registered.

For water allocation assignment dealings ('temporary' transfers) the last 2 steps do not apply. When Minister's consent is given to a water allocation assignment the Department immediately changes the relevant water allocation accounts and registers the dealing.

The Department has recently introduced a facility for on-line completion and lodgement of applications for Minister's consent.

There is no advertising of any type for water access licence transactions. However, applications for approvals to construct new bores or pumps, or use water on land, which are required if the trade is for use in a new or expanded development, may be advertised as part of the process for obtaining those approvals.

## ***Market and resource definition***

### **Scope of trading**

The Minister's access licence dealing principles prohibit trade from a groundwater source to a regulated river or unregulated river water source, or vice versa, or if there is no hydrologic connection between the water sources of the cancelled and issued licences. As groundwater sources are by and large hydrologically discrete, trade between groundwater sources is generally prohibited. Trades between management zones of a single water source are generally permitted subject to any extraction or other limitations established in the plan. Such limitations are restricted to those formulated to limit extraction congestion and protect impacts on third parties, and/or to limit impacts on river flows and other groundwater dependent ecosystems.

### **Establishing physical unit/zone boundaries**

Groundwater sources in NSW are generally discrete hydrogeological units, the boundaries of which may be slightly adjusted to match the nearest property boundary. Groundwater sources can exist both vertically and laterally. A 'stacked' aquifer policy is currently in preparation to better define the approach to managing layered systems. In many (particularly upland) fractured rock systems, where drainage to local creeks and rivers occurs, the systems are often disaggregated into small groundwater sources based on river sub-catchments. For systems with considerable geographic extent such as the large porous rock and fractured rock systems of the MDB, the groundwater sources are divided into zones to spread the extraction density. Surface water and groundwater are combined as single water sources in some areas, particularly where the groundwater is contained in narrow alluvial strips very close to the streams.

Absolutely accurate boundaries are difficult to define for groundwater, particularly where the groundwater source is sub-cropped, or thins out at the margins. In these circumstances, rather than defining the groundwater sources by way of (statutory) maps, they are defined in words with reference to particular geological structures.

## Defining consumptive pool/allocatable volumes

In NSW, the long-term average annual extraction limit (LTAAEL) of a groundwater source is set as a proportion of 'recharge' to the system. The recharge is determined via various means, ranging from relatively crude estimates of rainfall infiltration to the system, to more complex computer modelling of system inputs, including from rainfall, inflows from other aquifers, floods, the river and irrigation losses. Models are calibrated against historical groundwater level and extraction data.

In theory, the proportion of recharge that represents the LTAAEL for a groundwater source is determined taking into account the 'risks' posed to environmental values connected to groundwater from groundwater extraction. This theory has only applied in practice where the implementation of such an approach will not have any significant impact on the exercise of current groundwater extraction rights. However, in systems where a reduction in rights has been required to implement the approach, the allowable extraction tends to approach 100% of recharge.

The NSW extraction limit determinations are not discounted for water quality. They reflect groundwater 'availability' in quantity terms only, with the use to which the water can be put being considered a separately managed issue.

The approach to setting LTAAELs for the macro water sharing plan areas has been documented in a (yet to be made publicly available) manual.

The processes and circumstance in which LTAAELs can be amended are set out in the water sharing plans. Most of the major plans include provisions to amend these within certain limits at the mid-point of a 10 year plan without compensation. Beyond these provisions, any changes in management rules that result in a diminution of access are compensable under the Act, subject to some risk sharing arrangements, or unless the reduction 'is for the purpose of restoring water to the environment because of natural reductions in inflow to the water source, including but not limited to changes resulting from climate change, drought or bushfires' (s. 87AA(30(c))).

Further short term (seasonal) allocation limits may also be imposed if use exceeds the LTAAEL, or in response to local groundwater level drawdowns seen as 'unacceptable', or if local extraction is causing an 'unacceptable' deterioration in groundwater quality. The rules for triggering these short-term restrictions are contained in the relevant water sharing plans, although in many cases are left quite vague, and to the discretion of the Department.

## Restrictions on market participants

There are no restrictions on market participation in NSW.

### *Trading initiation*

## Triggers and prerequisites for trade

There are no statutory triggers for establishing groundwater trading in NSW. However, once a water sharing plan is made and all licences are converted to the Act (from the *Water Act 1912*), thereby being fully unbundled, there is nothing that precludes the operation of a trading regime in a groundwater source. Provisions are made for trading in all water sharing plans irrespective of their level of commitment at the time of making the plan. It is recognised

that there is unlikely to be much demand for trading in many of these areas, but also that it may be required in sub-areas where local impacts would preclude the issue of any new entitlements. It may also be administratively simpler for a proponent to use water allocation trades from time to time rather than undertake the more complex and time consuming process of applying for (permanent) additional entitlement from the Government.

As mentioned earlier, there are many areas in the state (albeit areas with low groundwater development potential) where new licences are available on application. The Government may also issue licences via 'controlled allocation' under s.65 of the Act, whereby the 'Minister may, by order published in the Gazette, declare that the right to apply for an access licence for a specified water management area or water source is to be acquired by auction, tender or other means specified in the order'. A controlled allocation policy for groundwater is currently under development.

## *Transaction processing*

### **Transaction impact assessment**

In general terms, all transactions that require Ministers consent, and are not prohibited by rules in the statewide Access Licence Dealing Principles or the relevant water sharing plan, must be consistent with general principles established in the Objects (s. 3) and Principles (s. 5) set out in the Act, and provisions developed from them set out in the Dealing Principles and the relevant plan.

These include the following (from s. 5):

- (a) water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded;
- (b) habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored;
- (c) the water quality of all water sources should be protected and, wherever possible, enhanced;
- (d) the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised;
- (e) geographical and other features of indigenous significance should be protected;
- (f) geographical and other features of major cultural, heritage or spiritual significance should be protected;
- (g) the social and economic benefits to the community should be maximised, and
- (h) the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

In practice it is reasonable to assume that water sharing plans address all these matters at the broader scale, through water source and zonal rules. These typically state the maximum entitlement/allocation that can be allowed within the zone/water source.

Further many of the local impacts are addressed through the process of issuing approvals for bores or for use of water on land. What remains are local cumulative impacts of extraction. To deal with this, groundwater plans commonly have concentration rules for access licence dealings, for example:

the dealing [must not result] in the total access licence share components, or credited water allocations authorised to be extracted through nominated works at a location, exceeding 600 ML/yr per square kilometre (Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003, cl. 45).

Additionally, under other provisions of the plans, local impact areas can be declared at any time by the Minister to address excessive local declines in water level, declines in water quality, or loss of aquifer integrity (thereby adversely affecting GDEs or other water users),

and dealings must not exacerbate or create any such local impacts. Such local impact areas have recently been established in the Lower Murrumbidgee Groundwater Sources.

## **Fees for transactions**

Transaction fees in NSW are set by the Independent Regulatory and Pricing Tribunal, which makes determinations every 5 years. Current fees are:

- Entitlement trades - \$370.69 + \$17.06/ML for transactions greater than 20ML and for more complex assessments where Site visits are required.
- Allocation trades - \$50 plus \$0.50 per megalitre traded (GST free) up to a maximum of \$150.00 applies for each application.

## **Trading rules**

The state-wide trading rules are contained in the Minister's access licence dealing principles order (extract attached). Dealing (trading) rules in water sharing plans follow a very standard form and generally include prohibitions on trades if:

- any of the access licences or water allocations are not within the plan area
- the trade would result in the total extraction under access licences through nominated works in the area, plus basic landholder rights extraction, causing adverse local impacts (as specified in the plan)
- the trade involves conversion of an access licence of one category to an access licence of another category
- the trade results in an interstate access licence or water allocation transfer into or out of the plan area.

The plans may prohibit or allow trade of water entitlements or allocations between separate water sources within the plan area but only if the total share components or use (in the case of allocation trades) of all access licences in the receiving groundwater source remains below the LTAAEL for that groundwater source.

The plans generally allow for trading across zones within a groundwater source, subject to any volumetric restrictions in the receiving water source, and to any local impact management restrictions.

## **Transaction processing efficiency**

Recent processing efficiency results are:

- 82.1% of all permanent trades 'processed' by the Department within 20 working days, and ~ 50% 'registered' with Department of Lands within a further 10 working days (2009–10).
- 92.6% of all water allocation assignments (groundwater & surface water) 'processed' by the Department within 5 working days (2009–10).

Local impact assessment of significant trades are the most expensive and take the longest time. Standardised guidelines for proponent studies, and/or Departmental local impact management assessment tools may improve processing times.

To expedite processing the Department has recently introduced a facility for on-line completion and lodgement of applications for Minister's consent.

## **Assessments of potential water level changes/drawdowns**

The Department is responsible for the assessment of trades. They may, however, require the proponent to undertake significant studies, including modelling and assessment of impacts on

dependent ecosystems and other users, thus furnishing them with sufficient information to make an informed decision.

Departmental assessment of water level changes associated with trades can range from very crude hand calculations, to the development and use of local impact assessment tools (usually simple MODFLOW models). Obviously the level of assessment will be commensurate with the perceived significance of the trade (for example its size, proximity to rivers and other GDEs and to other extraction points). Assessments of allocation trades that are consistent with relevant water sharing plan rules are minimal if they occur at all. There are no formal technical requirements/standards applied to assessments.

Both long term water level changes and the impacts of trades on seasonal drawdowns are assessed. In assessing 'permanent' trades, full development of existing entitlements is assumed, whereas allocation trade assessments assume continuation of current/recent use and water level behaviour.

While assessments of water level changes associated with trades are relatively robust, the next step of assessing the impacts of these water level changes on GDEs, surface water flows and rights to these, adjoining aquifers, and water quality is less rigorous. Economic and social impacts of trades are not assessed. 'Acceptable' impacts are not well defined, and it is often left to the hydrogeologist or other Department experts to make a professional judgement in respect to each trade.

## **Managing impacts of trade**

The impacts of trades are generally managed via:

- refusal of trades (where the impacts cannot be otherwise mitigated)
- imposition of conditions on the access licence
- local impact management and/or trading rules established in the plans with which assessments of trades must comply
- between-zone trading limits, maximum extraction densities, or extraction rate limits on bores
- distance rules between production bores, between production bores and stock and domestic bore, between bores streams and other GDEs, and between bores and contaminated sites or areas of poor quality (more saline) water.

## ***Facilitating groundwater trading***

### **Metering**

Meters are in place on production bores in the larger inland groundwater areas, but apart from a few scattered cases not elsewhere. To this point meters have been paid for and installed by water users.

The Australian Government has agreed in principle to funding the installation or replacement of meters in groundwater water sources in the Murray–Darling Basin as part of a \$221 million metering program (subject to due diligence assessment to be completed by mid 2010).

### **Access to market information**

The principal source of information is the NSW Office of Water (NOW) website, where the following information can be found:

- water sharing plans
- information on the types of transactions and processes

- application forms for transactions and guides
- a publicly accessible register of trades that have occurred (real time, not including any personal information, but including the price paid)
- a register of available water determinations
- summary statistics on trading by water source (updated in real time).

## Intermediaries

Because groundwater trading activity is relatively low and localised, activity by intermediaries is predominantly at the local level (e.g. stock and station agents). There is no regulation of intermediaries.

## Monitoring and compliance

### Monitoring and evaluation

As noted above, the Office of Water maintains systems that collate and report real time information on groundwater trading activity and processing times for several types of transactions on its website.

Assessment of cumulative impacts of trades is done at two levels: at the local level, as part of local impact assessment for individual transactions, and at the broad level through 10-yearly reviews of water sharing plans.

### Current trading statistics

Groundwater licence trading information for 2008–09 is shown in Table 24. The information was obtained from registers available on the NOW website.

**Table 24 NSW WSP areas – trading statistics for the 2008–09 water year**

| Water system                     | No. of temporary (allocation) trades | Volume of temporary (allocation) trades (ML) | No. of permanent (entitlement) trades | Volume of permanent (entitlement) trades (ML) |
|----------------------------------|--------------------------------------|----------------------------------------------|---------------------------------------|-----------------------------------------------|
| Alstonville Plateau Zone 1       | N/A                                  | N/A                                          | 2                                     | 81                                            |
| Alstonville Plateau Zone 2       | N/A                                  | N/A                                          | 1                                     | 3                                             |
| Alstonville Plateau Zone 3       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Alstonville Plateau Zone 4       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Alstonville Plateau Zone 5       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Alstonville Plateau Zone 6       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Dorrigo Basalt                   | N/A                                  | N/A                                          | 1                                     | 1                                             |
| Kulnura Mangrove Mountain Zone 1 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 2 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 3 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 4 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 5 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 6 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 7 | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Kulnura Mangrove Mountain Zone 8 | N/A                                  | N/A                                          | 1                                     | 5                                             |
| Lower Gwydir                     | 33                                   | 5393                                         | 5                                     | 878                                           |
| Lower Lachlan                    | 59                                   | 36445                                        | 7                                     | 9285                                          |
| Lower Macquarie Zone 1           | 4                                    | 2334                                         | 1                                     | 1229                                          |
| Lower Macquarie Zone 2           | 3                                    | 1272                                         | 0                                     | 0                                             |
| Lower Macquarie Zone 3           | 1                                    | 310                                          | 0                                     | 0                                             |
| Lower Macquarie Zone 4           | 1                                    | 1500                                         | 0                                     | 0                                             |
| Lower Macquarie Zone 5           | N/A                                  | N/A                                          | 1                                     | 100                                           |
| Lower Macquarie Zone 6           | N/A                                  | N/A                                          | 0                                     | 0                                             |

| Water system                        | No. of temporary (allocation) trades | Volume of temporary (allocation) trades (ML) | No. of permanent (entitlement) trades | Volume of permanent (entitlement) trades (ML) |
|-------------------------------------|--------------------------------------|----------------------------------------------|---------------------------------------|-----------------------------------------------|
| Lower Murray                        | 220                                  | 3065                                         | 25                                    | 6487                                          |
| Lower Murrumbidgee - Deep           | 291                                  | 101098                                       | 42                                    | 21840                                         |
| Lower Murrumbidgee - Shallow        | 8                                    | 1274                                         | 1                                     | 150                                           |
| NSW GAB - Surat                     | 0                                    | 0                                            | 4                                     | 1260                                          |
| NSW Great Artesian Basin - Warrego  | 0                                    | 0                                            | 0                                     | 0                                             |
| NSW GAB - Central                   | N/A                                  | N/A                                          | 0                                     | 0                                             |
| NSW GAB - Eastern Recharge          | N/A                                  | N/A                                          | 0                                     | 0                                             |
| NSW GAB - Southern recharge         | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Stuarts Point                       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Tomago Tomaree Stockton - Tomago    | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Tomago Tomaree Stockton - Tomaree   | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Tomago Tomaree Stockton - Stockton  | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Upper and Lower Namoi Zone 1        | 5                                    | 59                                           | 0                                     | 0                                             |
| Upper and Lower Namoi Zone 2        | 1                                    | 96                                           | 1                                     | 33                                            |
| Upper and Lower Namoi Zone 3        | 8                                    | 1488.2                                       | 4                                     | 515                                           |
| Upper and Lower Namoi Zone 4        | 6                                    | 817                                          | 14                                    | 2438                                          |
| Upper and Lower Namoi Zone 5        | 10                                   | 2021                                         | 1                                     | 187                                           |
| Upper and Lower Namoi Zone 6        | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Upper and Lower Namoi Zone 7        | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Upper and Lower Namoi Zone 8        | 1                                    | 54                                           | 3                                     | 289                                           |
| Upper and Lower Namoi Zone 9        | N/A                                  | N/A                                          | 2                                     | 660                                           |
| Upper and Lower Namoi Zone 10       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Upper and Lower Namoi Zone 11       | N/A                                  | N/A                                          | 0                                     | 0                                             |
| Upper and Lower Namoi Zone 12       | N/A                                  | N/A                                          | 1                                     | 100                                           |
| Upper and Lower Namoi - Lower Namoi | 24                                   | 5895                                         | 10                                    | 4798                                          |

## Enforcement/compliance

Apart from the general management of compliance with licences and approvals, there are no specific arrangements for compliance.

## **Attachment 1: Extracts from NSW Access Licence Dealing Principles Order 2004**

### **Part 2 – General principles**

#### **7 Impacts on water sources**

- (1) Dealings should not adversely affect environmental water and water dependent ecosystems as identified in any relevant management plan.
- (2) Dealings should be consistent with any strategies to maintain or enhance water quality identified in any relevant management plan.
- (3) In unregulated river water sources, dealings should not increase commitments to take water from water sources or parts of water sources identified in any relevant management plan as being of high conservation value.
- (4) In unregulated river water sources or a groundwater sources, dealings should not increase commitments to take water from water sources or parts of water sources above sustainable levels identified in any relevant management plan.
- (5) In regulated river water sources, dealings should not increase daily demand for water delivery at those locations and times where it is identified in any relevant management plan that demand exceeds delivery capacity.
- (6) In this clause, 'commitments to take water' refers, in relation to all access licences with nominated works in that water source or part of a water source, to:
  - (a) the total volume of water allocations in water allocation accounts, or
  - (b) where relevant, the sum of limits on rates of extraction in extraction components.

#### **8 Impacts on indigenous, cultural, heritage or spiritual matters**

- (1) Dealings should not adversely affect geographical and other features of indigenous significance.
- (2) Dealings should not adversely affect geographical and other features of major cultural, heritage or spiritual significance.

#### **9 Impacts on water users**

- (1) Dealings should not adversely affect the ability of a person to exercise their basic landholder rights.
- (2) Dealings should have no more than minimal effect on the ability of a person to take water using an existing approved water supply work and any associated access licences. This should be addressed by constraints on dealings established in access licence dealing rules in relevant management plans.

#### **10 Maximising social and economic benefits**

- (1) The objective of access licence dealings is to help to facilitate maximising social and economic benefits to the community of access licences as required under the objects of the Act. Dealings do this by:
  - (a) allowing water to move between alternative uses, and
  - (b) allowing the establishment of water markets that value the access licences, thereby encouraging investment in water efficient infrastructure, and
  - (c) allowing greater flexibility to access licence holders.
- (2) Subject to other principles in this Order, access licence dealing rules should allow maximum flexibility in dealings to promote the objectives set out in subclause (1).

### **Part 3 – Principles for specific types of access licence dealings**

#### **11 Conversion of access licence to new category**

- (1) This clause applies to access licence dealings under section 71O of the Act.
- (2) Dealings under section 71O are prohibited:
  - (a) if the licence is proposed to be converted to category regulated river (conveyance) or category estuarine or category coastal or category supplementary, or
  - (b) if the licence is suspended, or
  - (c) if the licence is a specific purpose access licence and there is provision in the regulations or the relevant water sharing plan for applications to be made

under section 61 of the Act for new licences of that category/subcategory in relation to the water source to which the licence relates, or  
(d) if the licence is a specific purpose access licence and that licence nominates a water supply work on land that gives rise to a domestic and stock right under section 52 of the Act.

(3) Dealings under section 71O are prohibited unless provisions of the relevant management plan:

- (a) protect environmental water from being affected by such dealings, and
- (b) protect basic landholder rights from being affected by such dealings, and
- (c) protect the available water under other access licences from being affected by such dealings.

(4) The share and extraction components of a new licence issued under a dealing under section 71O must comply with any requirements that are specified in the relevant management plan for a licence granted under section 63 of the Act for the new category.

(5) Except for where it is otherwise specified in access licence dealing rules in the relevant management plan water allocations remaining in the water allocation account of the cancelled licence are to be credited to the new licence provided there is a forfeiture of an amount that is equal to the difference between the share components of the cancelled licence and the new licence where the new share component is lower. The forfeiture of water from the water allocation account of the converted licence is required to minimise potential impacts on the reliability of water allocations to other licence holders in the following water year.

(6) The share component on a new access licence issued under a dealing under section 71O is to be of a quantity equal to the quantity on the cancelled licence multiplied by a conversion factor determined by the Minister in accordance with any rules set out in the relevant management plan.

(7) Conversion factor rules in management plans:

- (a) must be based on protecting environmental water and basic landholder rights as specified in the management plans, and maintaining available water to other access licences, and
- (b) are not to be set for the purpose of achieving a reduction in overall water extraction from water sources.

(8) Subject to (4), the extraction component and nominated water supply works on the new licence are to be the same as those that were on the cancelled licence.

(9) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

Under section 71O applications to convert local water utility access licences and supplementary access licences are prohibited, and licences granted are subject to the mandatory conditions applicable to the category or subcategory of licence to which it belongs. Also licences may only be granted in relation to the same water source or water management area as the cancelled licence.

## **12 Subdivision of access licences**

(1) This clause applies to subdivision dealings under section 71P of the Act.

(2) Dealings under section 71P are prohibited if the licence is suspended.

(3) The category or subcategory of the new licences is to be the same as the category or subcategory of the cancelled licence.

(4) Apart from the quantity of shares and any quantified rights in the extraction component, the share and extraction components and the nominated works specified in the new licences are to be the same as those that were on the cancelled licence.

(5) Water allocations remaining in the water allocation account of the cancelled licence are to be credited to the new licences so that the combined water allocations in the accounts of the new licences are no greater than the water allocations which remained in the account of the cancelled licence.

(6) Access licence dealing rules established by a management plan shall not regulate or prohibit subdivision dealings under section 71P of the Act.

As indicated in section 71P (3), the combined share components and combined extraction

components of the new licences are to be no greater than the share and extraction components of the cancelled licence, and conditions on the cancelled licence are to be carried over to the new licences.

### **13 Consolidation of access licences**

- (1) This clause applies to consolidation dealings under section 71P of the Act.
- (2) Consolidation dealings under section 71P are prohibited:
  - (a) if any of the licences are suspended, or
  - (b) if the share and extraction components and the nominated works specified in the licences are not the same, apart from the quantity of shares and any quantified rights in the extraction component.
- (3) The category or subcategory of the new licence is to be the same as the category or subcategory of the cancelled licences.
- (4) Apart from the quantity of shares and any quantified rights in the extraction component, the share and extraction components and the nominated works specified in the new licence are to be the same as those that were on the cancelled licences.
- (5) The quantity of shares and any quantified rights in the extraction component of the new licence is to be the sum of those on the cancelled licences.
- (6) Water allocations remaining in the water allocation accounts on the cancelled licences are to be credited to the new licence so that the water allocations in the account of the new licence is no greater than the sum of the water allocations remaining in the accounts of the cancelled licences.
- (7) Access licence dealing rules established by a management plan shall not regulate or prohibit consolidation dealings under section 71P of the Act.

as indicated in section 71P, the licences to be consolidated must be of the same category or subcategory, the combined share components and combined extraction components of the new licences are to be no greater than the share and extraction components of the cancelled licence, and conditions on the cancelled licences are to be carried over to the new licences.

### **14 Assignment of rights under access licences**

- (1) This clause applies to assignment of rights dealings under section 71Q of the Act.
- (2) Dealings under section 71Q are prohibited:
  - (a) if any of the licences are suspended, or
  - (b) if any of the licences is a specific purpose access licence.
- (3) Only share or extraction components, or parts thereof, that are numerically quantified may be assigned from one licence to another.
- (4) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this order.

As indicated in section 71Q, the licences which are involved in a dealing under section 71Q must be of the same category and have share components in the same water source or water management area. This dealing does not apply to local water utility access licences.

### **15 Change of water source**

- (1) This clause applies to amendment of share component dealings under section 71R of the Act.
- (2) Dealings under section 71R are prohibited:
  - (a) if the licence is suspended, or
  - (b) if the licence a specific purpose access licence, or
  - (c) from an unregulated river water source to a regulated river water source, or
  - (d) from a groundwater source to a regulated river or unregulated river water source, or vice versa, or
  - (e) if the licence is of category supplementary.
- (3) A dealing under section 71R is prohibited unless there is a hydrologic connection between the water sources of the cancelled and issued licences.
- (4) A dealing under section 71R is prohibited unless provisions of the relevant management plans:
  - (a) protect environmental water from being affected by such dealings, and
  - (b) protect basic landholder rights from being affected by such dealings, and

- (c) protect the available water under other access licences from being affected by such dealings.
- (5) The share and extraction components of a new licence issued under this dealing must comply with any requirements that are specified in the relevant management plan for a licence granted under section 63 of the Act.
- (6) The quantity of shares on the new access licence is to be of a quantity equal to the quantity on the cancelled licence multiplied by a conversion factor determined by the Minister in accordance with any rules set out in relevant management plans.
- (7) Conversion factors rules in management plans:
  - (a) must be based on protecting environmental water and basic landholder rights as specified in the management plans, and maintaining the available water to other access licences, and
  - (b) are not to be set for the purpose of achieving a reduction in overall water extraction from water sources.
- (8) No water allocations remaining in the water allocation account of the cancelled licence may be credited to the new licence.
- (9) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

As indicated in section 71R, the new licence arising from a dealing under section 71R is subject to the mandatory conditions relevant to its category or subcategory and water source. This dealing does not apply to local water utility access licences.

#### **16 Amendment of extraction component of access licence**

- (1) This clause applies to amendment of extraction component dealings under section 71S of the Act.
- (2) Dealings under section 71S are prohibited:
  - (a) if the licence is suspended, or
  - (b) if the licence is a specific purpose access licence, apart from local water utility access licences.
- (3) Amendment of the times, rates and circumstances part of the extraction component may only occur where:
  - (a) access licence dealing rules in the relevant plan make provision for it consistent with the principles in Part 2 of this Order, and
  - (b) those rules specifically indicate the nature of those amendments which are allowed.
- (4) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

As indicated in section 71S, the area or location arising from a variation of an access licence under this dealing must relate to the same water management area or water source as that to which the original area or location related.

#### **17 Assignment of water allocations between access licences**

- (1) This clause applies to assignment of water allocation dealings under section 71T of the Act.
- (2) Dealings under section 71T are prohibited:
  - (a) if the access licence from which water allocations are proposed to be assigned from is suspended, or
  - (b) if either of the access licences are specific purpose access licences, excepting:
    - (i) local water utility access licences and major water utility access licences and access licences of subcategory Aboriginal commercial, or
    - (ii) where one or both licences nominates a water supply work on land that does not give rise to a domestic and stock right under section 52 of the Act, and an order under section 60 (2) of the Act and a relevant order under section 323 of the Act is in force, or
  - (c) if a method of measurement of water extraction which is satisfactory to the Minister is not established for all nominated water supply works on both

- access licences, or
  - (d) if any of the access licences has a nominated work which is a runoff harvesting dam, or
  - (e) if any of the access licences is of category major utility, unless specific provision is made in access licence dealing rules to allow this, or
  - (f) from a supplementary water access licence to a licence of any other category.
- (3) Assignment of water allocations between access licences relating to different water sources is prohibited if:
- (a) either licence is of category supplementary, or
  - (b) there is no hydrologic connection between the water sources, or
  - (c) one water source is a regulated river and the other is an unregulated river, or
  - (d) one water source is a groundwater source and the other is a regulated river or unregulated river water source.
- (4) Assignment of water allocations between access licences relating to different water sources is prohibited unless provisions of the relevant management plans:
- (a) protect environmental water from being affected by such dealings, and
  - (b) protect basic landholder rights from being affected by such dealings, and
  - (c) protect the available water under other access licences from being affected by such dealings.
- (5) Assignment of water allocations from a local water utility access licence is prohibited unless:
- (a) the Minister has approved a demand management plan for all NSW town water supply schemes supplied under the local water utility access licence, and
  - (b) the Minister has approved a drought management plan for all NSW town water supply schemes supplied under the local water utility access licence, and
  - (c) the Minister is satisfied the assignment will not put the water supply for NSW towns supplied by the local water utility at risk.
- (6) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

## **18 Interstate transfer dealings**

- (1) This clause applies to dealings under section 71U of the Act.
- (2) Any dealings under section 71U must be consistent with the relevant inter-state agreement.
- (3) Dealings under section 71U are prohibited unless the waters for which the interstate access licence equivalent has or will have rights to are hydrologically connected to the water source in which to which the access licence to be issued or revoked relates.
- (4) Dealings under section 71U which revoke an access licence are prohibited:
  - (a) if there is an outstanding debt under the Act in respect of the licence, or
  - (b) if the licence is suspended, or
  - (c) if the licence is a specific purpose access licence.
- (5) The share and extraction components of a new licence issued under this dealing must comply with any requirements that are specified in the relevant management plan for a licence granted under section 63 of the Act.
- (6) Dealings under section 71U are prohibited unless arrangements are in place which:
  - (a) protect environmental water from being affected by such dealings, and
  - (b) protect basic landholder rights from being affected by such dealings, and
  - (c) protect the available water under other access licences from being affected by such dealings.
- (7) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

## **19 Interstate assignment of water allocations**

- (1) This clause applies to interstate assignment of water allocation dealings under section 71V of the Act.
- (2) Any dealings under section 71V must be consistent with the relevant inter-state agreement.
- (3) Dealings under section 71V are prohibited:
  - (a) if the access licence is suspended, or
  - (b) if the licence is a specific purpose access licence, apart from local water utility access licences, or
  - (c) if a method of measurement of water extraction which is satisfactory to the Minister is not established for all nominated water supply works on the access licence, or
  - (d) if the access licence is of category supplementary.
- (4) This dealing is prohibited unless arrangements are in place which:
  - (a) protect environmental water from being affected by the dealing, and
  - (b) protect basic landholder rights from being affected by the dealing, and
  - (c) protect the available water under other access licences from being affected by the dealing.
- (5) Interstate assignment of water allocations from a local water utility access licence is prohibited unless:
  - (a) the Minister has approved a demand management plan for all NSW town water supply schemes supplied under the local water utility access licence, and
  - (b) the Minister has approved a drought management plan for all NSW town water supply schemes supplied under the local water utility access licence, and
  - (c) the Minister is satisfied the assignment will not put the water supply for NSW towns supplied by the local water utility at risk.
- (6) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

## **20 Nomination of water supply works**

- (1) This clause applies to nomination of water supply works dealings under section 71W of the Act.
- (2) Dealings under section 71W are prohibited if the access licence is suspended.
- (3) Dealings under section 71W are prohibited if the access licence is a specific purpose access licence, with the following exceptions:
  - (a) if the licence is a local water utility access licence or a major water utility access licence, or
  - (b) if new or additional works are to be nominated, where those works supply the same property as the current nominated works, or a contiguous property to the property supplied by the current nominated works which is occupied by the same landholder.
- (4) Dealings under section 71W are prohibited if the access licence is of category local water utility, with the following exceptions:
  - (a) if new or additional works are to be nominated, that those works supply the same town water supply scheme as the current nominated works, or
  - (b) if a nominated work is withdrawn, that there remains at least one nominated work.
- (5) Nomination of a water supply work is prohibited if the access licence does not have an extraction component allowing taking of water at the location of the nominated work unless that nomination is for a water supply work in a NSW water tagging zone or an interstate water tagging zone.
- (6) Where a nominated water supply work is a runoff harvesting dam, the withdrawal of that nominated work may only be granted where arrangements are in place to ensure that the nominated work does not conserve any more water than is permitted pursuant to the exercise of basic landholder rights.
- (7) Where the application is to add a nominated water supply work that is a runoff harvesting dam, the application must be refused unless the runoff harvesting dam is

of no greater capacity than that which the Minister considers would conserve water consistent with the share component of the access licence.

(8) Withdrawal of nomination may not be prohibited by access licence dealing rules, except for as otherwise specified in this clause.

(9) Subject to the other parts of this clause, access licence dealing rules may prohibit or regulate these dealings provided this is done consistent with the principles in Part 2 of this Order.

(10) Dealings under section 71W which involve the nomination, or the withdrawal of any such nomination, of water supply works in a NSW water tagging zone or an interstate water tagging zone, except as provided by subclause (11), must be assessed in accordance with the rules applying from time to time under Schedule D of the Murray Darling Basin Agreement as set out in Schedule 1 of the Commonwealth Water Act 2007.

(11) Dealings under section 71W which involve the nomination, or the withdrawal of any such nomination, of water supply works in an interstate water tagging zone established for the Border Rivers Catchment must be assessed in accordance with the rules applying from time to time under Schedule E and its related Appendix E1 of the New South Wales-Queensland Border Rivers Intergovernmental Agreement 2008. The New South Wales-Queensland Border Rivers Intergovernmental Agreement 2008 relates to the Border Rivers Catchment. A map of the Border Rivers Catchment is shown in Schedule C to the Agreement.

## **21 Interstate and NSW tagging zones**

(1) The following interstate water tagging zones are established as interstate water tagging zones for the purposes of section 71W of the Act:

- (a) the interstate water tagging zones which are approved from time to time in the Protocols made under Schedule D of the Murray–Darling Basin Agreement as set out in Schedule 1 to the Commonwealth Water Act 2007,
- (b) the acceptable stream sections which are approved from time to time in Schedule E of the New South Wales-Queensland Border Rivers Intergovernmental Agreement 2008.

(2) The NSW water tagging zones specified in Schedule 1 are established as NSW water tagging zones for the purposes of section 71W of the Act.

## **Part 4 – Principles applicable to dealings in local management areas**

### **22 Lower Murrumbidgee Groundwater Sources**

The principles listed in Schedule 2 apply to any dealing in the local management areas specified in that schedule but do not apply to dealings by local water utilities.  
Schedule 2 Dealing Principles for the Lower Murrumbidgee Groundwater Sources Local Management Areas

#### **(1) Local Management Areas**

The local management areas referred to in this Schedule are Local Management Area 1 and Local Management Area 2 in the Deep Groundwater Source as defined in clause 4 (2) (b) of the Water Sharing Plan for the Lower Murrumbidgee Groundwater Sources 2003.

#### **(2) Principles for Dealings in the Local Management Areas**

The following principles apply:

(1) A licence created under section 71P is prohibited from:

- (a) nominating a water supply work or group of water supply works within Local Management Area 1 or Local Management Area 2 if a cancelled licence, at the time of its cancellation, nominated a water supply work or group of water supply works outside of Local Management Area 1 or Local Management Area 2, or
- (b) nominating a water supply work or group of water supply works located within Local Management Area 1 if a cancelled licence, at the time of its cancellation, nominated a water supply work or group of water supply works located in Local Management Area 2.

- (2) Dealings under section 71Q are prohibited if:
  - (a) the assignment of the share component is from a licence that nominates a water supply work located outside Local Management Area 1 or Local Management Area 2 to a licence that nominates a water supply work located within Local Management Area 1 or Local Management Area 2, or
  - (b) the assignment of the share component is from a licence that nominates a water supply work located in Local Management Area 2 to a licence that nominates a water supply work located in Local Management Area 1.
- (3) Dealings under section 71T are prohibited if:
  - (a) the assignment of the water allocation is from a licence that nominates a water supply work located outside of Local Management Area 1 or Local Management Area 2 to a licence that nominates a water supply work located within Local Management Area 1 and Local Management Area 2, or
  - (b) the assignment of the water allocation is from a licence that nominates a water supply work located in Local Management Area 2 to a licence that nominates a water supply work located in Local Management Area 1.
- (4) Dealings under section 71W are prohibited if:
  - (a) the nomination would result in a licence with a nominated water supply work or group of water supply works located outside Local Management Area 1 or Local Management Area 2 nominating an additional water supply work or group of water supply works located within Local Management Area 1 or Local Management Area 2, or
  - (b) the nomination would result in a licence with a nominated water supply work or group of water supply works located within Local Management Area 2 nominating an additional water supply work or group of water supply works located within Local Management Area 1.

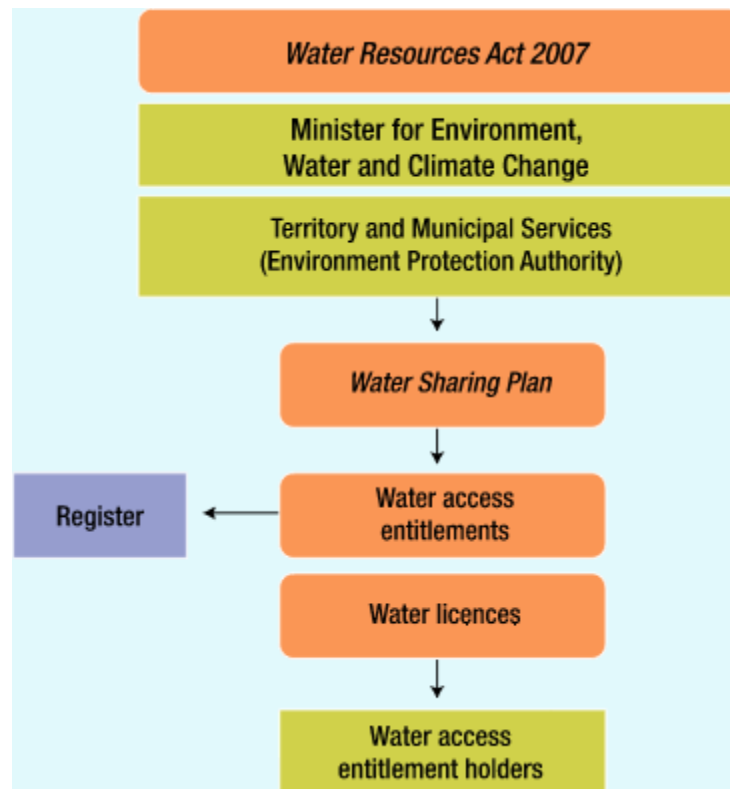
# Appendix E. Groundwater trading stocktake – ACT

## ***Governance and administrative framework***

### **Legislation**

The *Water Resources Act 2007* ensures efficient and equitable management of water resources in the ACT. The Act permits the permanent or temporary transfer of all or part of a water access entitlement, with the approval of the ACT Government's Environment Protection Authority. A broad overview of ACT water management arrangements is illustrated in Figure 11.

**Figure 11 Management arrangements for water in the ACT**



Source: NWC website

<http://www.nwc.gov.au/www/html/1118-australian-capital-territory.asp>

## **Institutional responsibilities**

In the Australian Capital Territory, water management responsibilities rest with various territory organisations.

The Department of the Environment, Climate Change, Energy and Water (DECCEW) is responsible for the management of the ACT's high-level strategic water policy, including the territory's national water reform agenda and national competition matters relating to water access, pricing and trading. It also regulates the ACT's water resources and monitors and reports on water quality.

The Minister for the Environment, Climate Change and Water determines the water management areas used for managing water resources in the ACT, as well as the sustainable yield of surface water and groundwater in each water management area.

The Environment Protection Authority (EPA) within DECCEW coordinates policies on water resource management, regulates the allocation of water from waterways, and compiles and maintains up-to-date information about the water resources of the ACT. The EPA maintains a register that includes details of water access entitlements granted, surviving allocations in force, licences issued and transfers made. The EPA reviews applications for water access entitlements and makes a recommendation for the minister to approve or reject an application. (AWMR 2009)

## Policies

The Environmental Flow Guidelines 2006 (ACT Government, 2006) are a requirement under the Water Resources Act 2007. The guidelines set out the groundwater extraction limits and surface water flows assessed to be necessary to maintain aquatic ecosystems in ACT waterways. They are used in water planning and in assessing applications for water licences. The guidelines were first prepared in 1999 and were revised in 2006. They are supported by an ongoing monitoring program.

The 'Water Sharing Plan' has replaced the previous Water Resources Management Plan (Volume 3 of Think water, Act water), which has been repealed. The Water Sharing Plan includes two components:

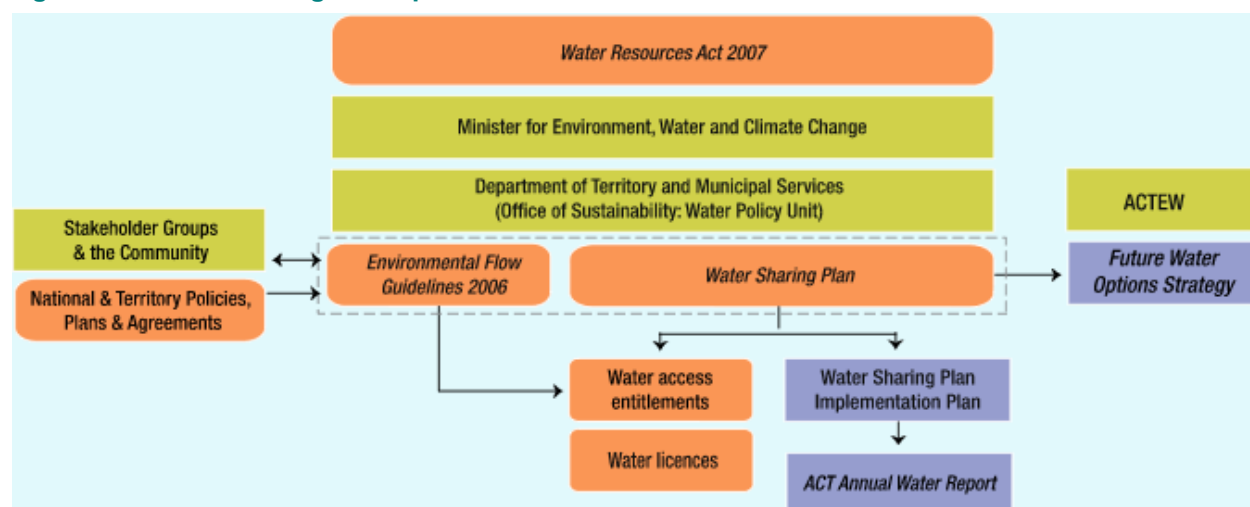
- DI 2007-193: water management areas
- DI 2007: volumes of water available.

Both are disallowable instruments under the *Water Resources Act 2007*. Parts 1 & 2 of Think water Act water remain as policy documents.

Water access entitlements and water licences are issued, transferred or amended consistent with the rules and requirements of the Water Sharing Plan and the Environmental Flow Guidelines.

Policy relationships are shown in Figure 12.

**Figure 12 Water management policies**



## Groundwater management units

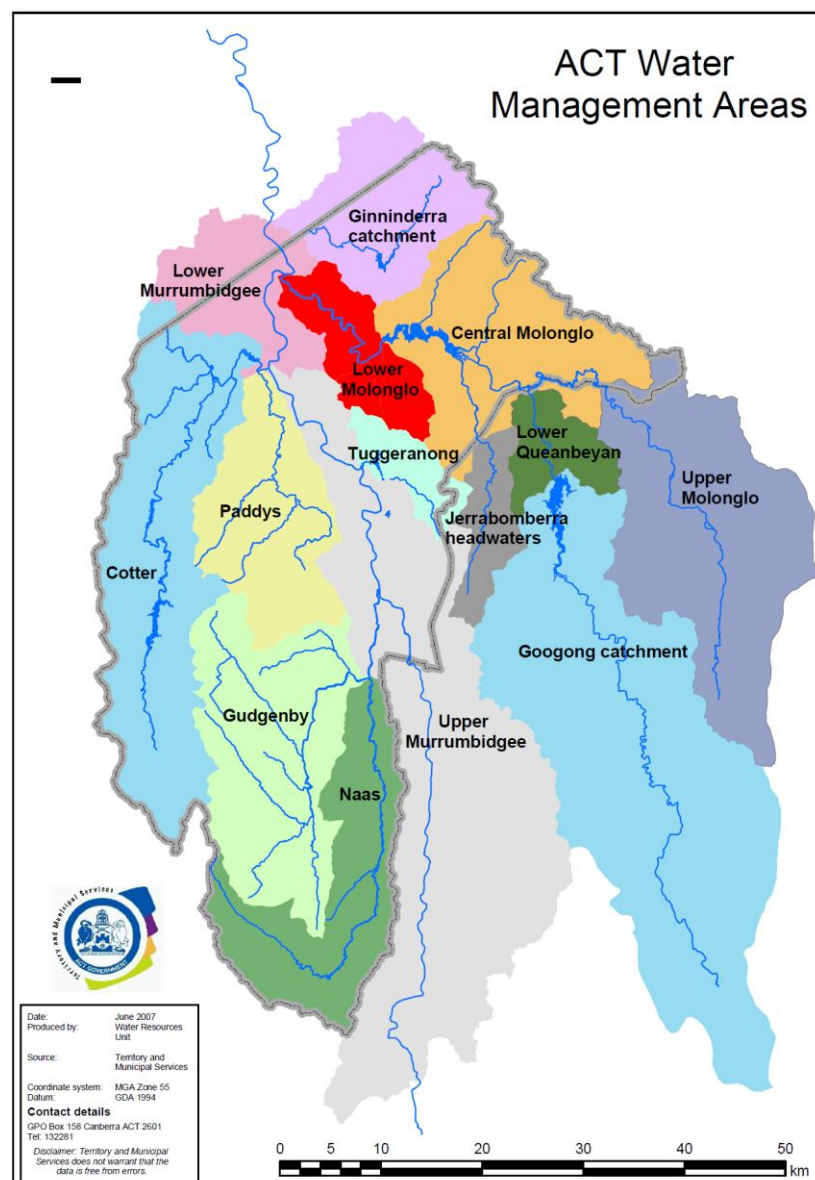
The ACT has 14 statutory water management areas (WMAs), each of which has specified volumes of water available for use and for environmental purposes. The water management areas comprise a number of grouped subcatchments or one larger subcatchment. In setting water management area boundaries, groundwater and surface water sources are considered as the same resource, but the sources are accounted for separately (AWMR, 2009). Water management areas are listed in Table 25 and shown spatially in Figure 13.

Groundwater policy is applied generically across all 14 WMAs. There are no individual water management plans that apply to individual WMAs.

**Table 25     ACT Water Management Areas**

|                                                                                                |                                                                                            |                                                          |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Upper Murrumbidgee<br>Central Molonglo<br>Lower Queanbeyan<br>Googong Catchment<br>Tuggeranong | Paddys<br>Cotter<br>Ginninderra Catchment<br>Upper Molonglo<br>Jerrabomberra<br>Headwaters | Lower Molonglo<br>Lower Murrumbidgee<br>Gudgenby<br>Naas |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------|

**Figure 13 Water Management Areas in the ACT**



Source: DECCEW website

[http://www.environment.act.gov.au/water/act\\_water\\_resources/act\\_water\\_resources\\_legislation\\_and\\_information\\_sheets](http://www.environment.act.gov.au/water/act_water_resources/act_water_resources_legislation_and_information_sheets)

## Groundwater licences and entitlements

Under the Act you are required to hold a Water Access Entitlement (WAE) before a Licence to take Water and Bore Work Licence can be issued. A WAE is a right to an amount of surface water or groundwater within a Water Management Area (WMA). A WAE only provides a right to a certain amount of water; it does not allow water to be taken from any particular location (DECCEW 2009d). A Licence to take Water is required to extract water authorised under a WAE. The Licence to take Water states the location from which water can be taken and used (DECCEW 2009a).

A licence to take water is required for every bore regardless of whether it is used for stock and domestic purposes only or not. Licences apply to both ACTEW (the water supply authority) and commercial and irrigation users. They provide the location from which water can be taken and used, and incorporate tradeable water allocations. A water access entitlement is a right to the amount of surface water or groundwater stated in the entitlement issued under the *Water Act 2007* (Cwth).

As a result of the *Water Resources Act 2007*, there are tradeable and non-tradeable water access entitlements. Water rights that have carried through from the former *Water Resources Act 1998* are known as 'surviving allocations' and are non-tradeable. The holder of a 'surviving allocation' can either:

- do nothing until such times as they want to deal with their water and/or land
- surrender the allocation in exchange for a non-tradeable water access entitlement
- surrender the allocation and buy a tradeable water access entitlement.

The *Water Resources Act 2007* allows for 'recharge' licences for adding water to an aquifer. However it is understood that there are currently no guidelines in place for establishing and authorising MAR schemes, and no formal facility for crediting of recharged volumes to water access entitlements.

Section 50 of the *Environmental Protection Regulation 2005* (made under the *Environment Protection Act 1997*) refers to the discharge of stormwater to groundwater and makes it an offence to discharge stormwater that has greater than 60 mg/L suspended solids. No other water quality guidelines for receiving groundwater are provided.

## Unlicensed groundwater rights

A licence to take water is required for every bore regardless of whether it is used for stock and domestic purposes only or not (DECCEW 2009a).

## Impacting activities outside of the groundwater management framework

All consumptive purposes require a licence and are accounted for within individual WMA limits. However, plantation forestry could impact on groundwater recharge and on stream flows (for which groundwater is conservatively managed to provide baseflows).

## Market regulation

No information was available on the powers to regulate the operation of the trading market.

## *Tradeable rights*

### Licences and entitlements

WAEs are able to be traded. Some WAEs may have a condition limiting their use to a particular location, but these will relate either to instances where the WAE was not purchased (e.g. it was converted from a 'surviving allocation' arising from the previous Act), or where the WAE was granted in relation to stock and domestic use at a specific location (DECCEW, 2009b).

A transfer of a water access entitlement may be absolute or for a limited period, and must be for units no smaller than 0.5 ML.

### Water allocations

There are no allocations that are separable from WAEs.

### Other tradeable rights

None.

## Entitlement statistics

Details are provided in Table 26.

**Table 26** Groundwater licensing statistics

| Water Management Area    | Extraction limits |                | GW entitlements 2008–09 |             |
|--------------------------|-------------------|----------------|-------------------------|-------------|
|                          | Sw + Gw (ML/yr)   | Max Gw (ML/yr) | No.                     | Volume (ML) |
| Upper Murrumbidgee       | 2517              | 640            | 22                      | 365         |
| Lower Murrumbidgee       | 29925             | 189            | 1                       | 10          |
| Naas                     | 2641              | 855            | 1                       | 2           |
| Gudgenby                 | 3558              | 1170           | 2                       | 21          |
| Cotter                   | 111408            | 2050           | 0                       | 0           |
| Paddys                   | 2905              | 909            | 4                       | 32          |
| Tuggeranong              | 1461              | 190            | 4                       | 48          |
| Upper Molonglo           | 102               | 24             | 1                       | 2           |
| Central Molonglo         | 7832              | 685            | 4                       | 684         |
| Lower Queanbeyan         | 7                 | 0              | 0                       | 0           |
| Jerrabomberra headwaters | 0                 | 0              | 0                       | 0           |
| Lower Molonglo           | 3304              | 297            | 14                      | 302         |
| Googong catchment        | 98914             | 0              | 0                       | 0           |
| Ginninderra catchment    | 5352              | 239            | 14                      | 212         |
| Totals                   | 272927            | 7248           | 67                      | 1678        |

Source: Water Resources (Water available from areas) Determination 2007 (No 1) Disallowable Instrument DI2007—191 made under the Water Resources Act 2007, Section 17 – Amounts of water available from areas

## Trade-related transactions

### Types of transactions

The holder of a WAE may, with the approval of the authority, transfer the whole or part of the entitlement to someone else, either permanently ‘absolute’) or temporarily. The authority must not approve the transfer of a water access entitlement unless satisfied that the intended use of the water and the place it is proposed to be used is consistent with the conditions of the entitlement and the territory plan.

Transfers take effect by amendment of WAEs, including cancellation (where an entire WAE amount is transferred on an absolute time basis), and suspension (where an entire WAE amount is transferred for a limited time period).

## ***Market and resource definition***

### **Scope of trading**

Trading can occur within and between WMAs, and between groundwater and surface. For trade to occur to another WMA or between water source types, there must be spare entitlement capacity in the receiving water source.

### **Establishing physical unit/zone boundaries**

WMA's are based on surface water catchments, and cater for both groundwater and surface water management.

### **Defining consumptive pool/allocatable volumes**

The 2006 Environmental Flow Guidelines (ACT Government, 2006) are a statutory instrument developed to support the former Water Resource Management Plan and in licensing the taking of water. Under the guidelines groundwater entitlements are limited to 10% of the estimated long term recharge for each WMA. The limited access to groundwater aims to protect baseflow in streams.

### **Restrictions on market participants**

There are no restrictions, apart from sellers having to hold a tradeable WAE.

### **Levels of trading**

The levels of trading are limited to transfer of the whole or part of a tradeable WAE to someone else, either permanently or temporarily.

## ***Trading initiation***

### **Triggers**

Groundwater trading has been made possible through the implementation of the Water Resources Act 2007, and associated administrative processes. In practice it can be expected that groundwater trading will be triggered by individual WMAs reaching full allocation levels.

In under allocated WMAs, additional WAE can be applied for and, if the application is successful, granted for a fee of \$587.95/ML (DECCEW, 2009a). While trading is legally possible in under-allocated systems, it is unlikely to be used.

### **Prerequisites**

The seller must hold a WAE.

### **Initiating groundwater trading in an area**

Trading has so far been very limited and only occurred as a change of owner. No information is available on the process for initiating trades, apart from the having the legislation in place (*Water Resources Act 2007*) and the seller holding a WAE.

## *Transaction processing*

### **Transaction impact assessment**

The only groundwater trades so far in the ACT have been for change of ownership, and no information was obtained on assessing the impacts that could arise from a change in extraction location.

### **Fees for transactions**

No information is available on fees for groundwater trades. Information on fees is available for other matters such as granting of WAE's and bore work licences.

### **Trading rules**

There are no documented trading rules for the ACT. However, DECCEW must not approve the transfer of a water access entitlement unless satisfied that the intended use of the water and the place it is proposed to be used is consistent with the conditions of the entitlement and the territory plan.

### **Transaction processing efficiency**

There is no information available on target processing times. As there have been very few trades (and change of owner trade only) there is no information available on actual processing times and issues.

## *Managing impacts of trade*

Total of entitlements for each GMU is relatively small, at 10% of long term recharge. This limits the risk of impacts occurring from trade.

## *Facilitating groundwater trading*

### **Metering**

Metering is required for some bores, but it is not clear under what conditions metering is and isn't required.

### **Access to market information**

Section 66 of the *Water Resources Act 2007* (the new Act) instructs the Environment Protection Authority (EPA) to create and maintain a register that includes details of the following:

- water access entitlements granted
- surviving allocations in force
- licences to take water issued
- driller's licences issued
- bore work licences issued
- waterway work licences issued
- recharge licences issued
- any transfers of water access entitlements.

The register may also include other information provided to, or collected by the EPA. The register is available for inspection by appointment, and is located at 12 Wattle Street, Lyneham ACT. EPA officers can make electronic searches of the register upon request; however fees are applicable for such searches (DECCEW 2009c)

## Monitoring and compliance

### Current trading statistics

| Water Management Area    | GW transfers 2008–09 |             |
|--------------------------|----------------------|-------------|
|                          | No.                  | Volume (ML) |
| Upper Murrumbidgee       | 0                    |             |
| Lower Murrumbidgee       | 0                    |             |
| Naas                     | 0                    |             |
| Gudgenby                 | 0                    |             |
| Cotter                   | 0                    |             |
| Paddys                   | 0                    |             |
| Tuggeranong              | 0                    |             |
| Upper Molonglo           | 0                    |             |
| Central Molonglo         | 211                  | 1.5         |
| Lower Queanbeyan         | 0                    |             |
| Jerrabomberra headwaters | 0                    |             |
| Lower Molonglo           | 0                    |             |
| Googong catchment        | 0                    |             |
| Ginninderra catchment    | 0                    |             |
| Totals                   | 2                    | 1.5         |

Source: National Water Commission (2009)

## References

National Water Commission 2009, *Australian Water Markets Report 2008–2009*, NWC, Canberra

<sup>11</sup> Identified trades were for change of ownership only

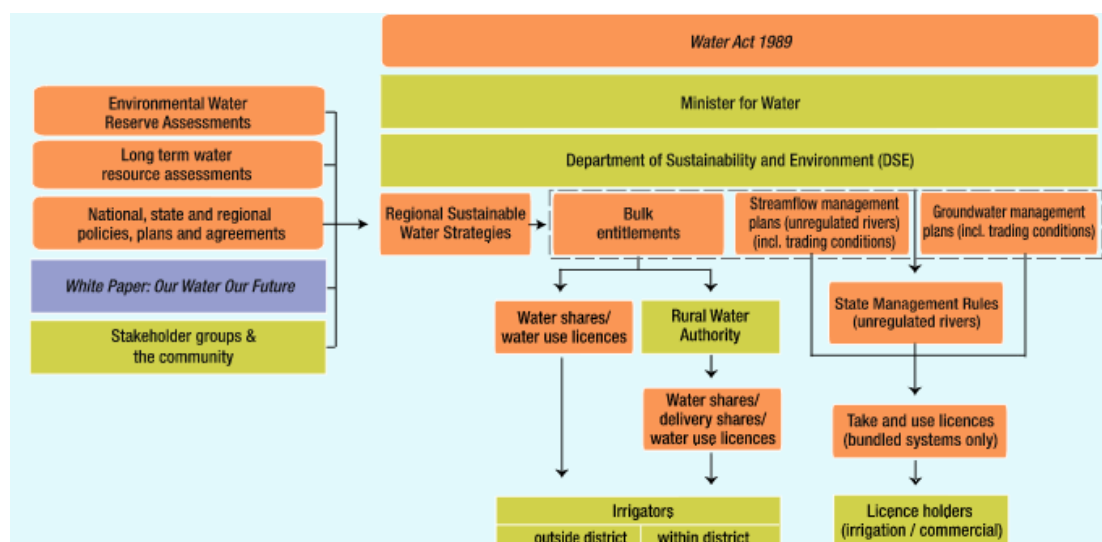
# Appendix F. Groundwater trading stocktake – Victoria

## Governance and administrative framework

### Legislation

The *Water Act 1989* (the Act) stipulates that the Crown has the right to the use, flow and control of all water in a waterway and all groundwater (s. 7). The Crown confers rights to water on water Authorities (through bulk entitlements), individuals (through licences, water shares and unlicensed rights) and the Environment Minister (environmental entitlements, referred to as the Environmental Water Reserve). A regime for regulation of conferred rights is set out which provides for rules and processes for their issue, trading and adjustment. Powers to enforce compliance with water entitlements, rights and obligations are provided.

**Figure 14 Management arrangements for water in Victoria**



Source: NWC website <http://www.nwc.gov.au/www/html/1957-water-markets.asp>

The Act defines groundwater as ‘any water occurring in or obtained from an aquifer and includes any matter dissolved or suspended in any such water’. Aquifer is defined as ‘a geological structure or formation or an artificial land fill permeated or capable of being permeated permanently or intermittently with water.’

Trading is enabled through specific provisions allowing for transfer of various types of water entitlements. There are no specific principles guiding water trading in the Act, other than the need for RWCs to consider relevant matters (s. 40) when assessing a trade application. This principle regulatory mechanism for groundwater is management of take and use licences and bore construction and operation licences:

- Applications for the issue, transfer and renewal of these licences are assessed by the relevant authority and may be refused or granted subject to conditions.
- Taking of water under these licences may be made dependent on determinations from time to time by authorities, where this is provided for in the conditions of the licence. For example licence conditions can simply state a maximum annual volume that can be taken (common for many licences) or can state the maximum annual volume, with the proviso

that it can be reduced in any twelve month period by determination of the authority (being progressively applied to licences in many areas).

Under s. 22A of the Act, the Minister has the power to set a permissible consumptive volume (PCV), which defines the maximum volume of water that can be taken from a defined water system or area over a specified period. Typically PCVs are set for management areas and specify a maximum volume per year. It is not required that PCVs be the same as the estimated sustainable yield (if it exists) and generally they are not.

In water supply protection areas (WSPAs), statutory groundwater management plans (GMPs) are required to be prepared by statutory consultative committees and approved by the Minister. In practice these have proven to be costly and difficult to develop, and so there are some WSPAs where this has not occurred. Development of GMPs is progressing, with the recent implementation of plans for the Warrion, KooWeeRup and Yarran WSPAs. Completion of plans for the Loddon Highlands and Lower Campaspe Valley WSPAs is anticipated for 2011 and 2012.

Introduction of management rules, and revocation of the WSPA status in some areas has also progressed. Rules for the Mid Loddon are complete, with the West Wimmera to follow shortly.

Where a GMP is in place, it can amongst other things, specify:

- restrictions or prohibitions on the issue of licences
- restrictions to be imposed on the taking of water
- conditions to be imposed on licences and on the transfer of licences.

More recently authorities have developed the concept of having Local Management Rules as a more practical administrative alternative to GMPs. These rules rely on conditions being imposed on licences when issued, renewed or transferred that enable authorities to apply reduced seasonal allocations, restrictions on extraction or other measures set out in the Rules. They are developed in consultation with local stakeholders and published, and can impose limits to extraction by either providing direction to a licence holder based on compliance with a licence condition, or by pursuing a water shortage declaration under s.233AAA of the *Water Act 1989*. They cannot impose restrictions or limits on existing licences to the extent that statutory GMPs can, but are otherwise similar in outcome.

## **Institutional responsibilities**

The main agencies for managing groundwater in Victoria are the Department of Sustainability and Environment (DSE) and the four rural water corporations (RWCs): Goulburn Murray Water (G-MW), Southern Rural Water (SRW), Grampians Wimmera Mallee Water and Lower Murray Water. Broadly, DSE has responsibility for state policy and state and regional strategies, while RWCs are responsible for groundwater licensing, trading, monitoring and compliance. Both DSE and RWCs are involved in resource assessment and the development of management plans.

## **Policies**

The Minister recently prepared a statutory instrument under the Act called *Policies for Managing Take and Use Licences* (Sep 2009). This instrument sets out requirements and guidelines that RWCs must comply with in administering take and use licences. It supersedes previously issued guidelines and includes, amongst other things:

- standard conditions to be applied when licences are issued, renewed or transferred
- guidelines relating to assessing impacts, and situations where applications should be refused

- that RWCs are to not issue new licences in an area if the sum of licence volumes and other authorisations to take water would exceed the PCV
- the requirements and obligations in relation to development and implementation of Local Management Rules by RWCs.
- DSE is currently preparing Managed Aquifer Recharge (MAR) guidelines.

Since *Policies for Managing Take and Use Licences* (Sep 2009) was released, the Minister has now approved policies for MAR. The DSE is also preparing guidelines to assist regional water authorities in developing Local Management Rules. These are expected to be released during 2010.

## Groundwater management units

The principal management unit for groundwater in Victoria is the groundwater management unit (GMU), the boundaries of which often fall across more than one river basin. A GMU can be a:

- *Groundwater management area (GMA)*: an area where groundwater has been intensively developed or has the potential to be. Statutory management plans are not required for GMAs, however, under s. 22A of the Act, the Minister has the power to set a Permissible Consumptive Volume (PCV), which defines the volume of water that can be used from the GMA over a specified period.
- *Water supply protection area (WSPA)*: an area declared under s. 27(1) of the Act to protect the groundwater or surface water resources there through the development of a management plan, typically needing a more intensive form of management due to declining aquifer quantity or quality, and/or risk of same. PCVs can also be set for WSPAs and this is normally the case.
- *Unincorporated area (UA)*: comprise those parts of the state not encompassed by GMAs or WSPAs, characterised as having limited groundwater development due to poor quality water, low yields, low economic potential or where development is constrained by statute (for example, in national parks). PCVs could potentially be set for UAs or any part thereof, but this has not been done.

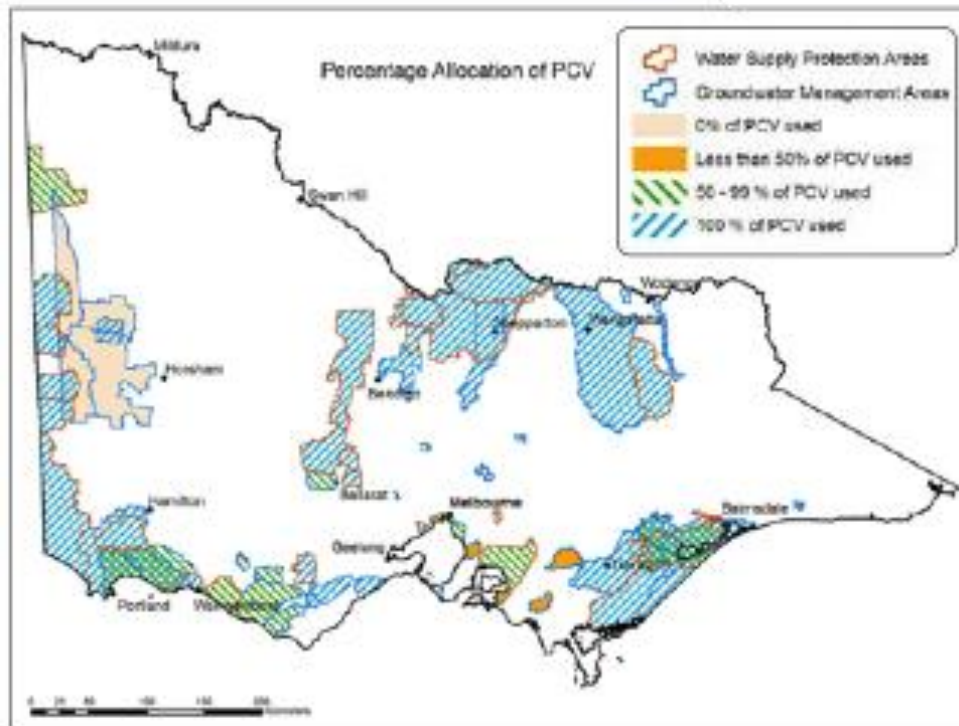
The GMUs can be defined both spatially and vertically and may be further broken down into zones.

Statutory management plans exist for a proportion of the WSPAs. Formal Local Management Rules (LMRs) have been issued for one GMA (more are in development). Apart from this, management of licences, including trade, is done on a case by case basis in accordance with the general provisions of the Act and the Minister's *Policies for Managing Take and Use Licences*. In some cases rules are established in an area because of a decision on an application being taken to the appeal court (Victorian Civil and Administrative Tribunal, or VCAT), with the court's decision setting a precedent that effectively becomes a rule in the relevant area.

Even though the Act mandates the development of statutory groundwater management plans in WSPAs, practical difficulties have hindered their development in many areas. Because a Groundwater Management Plan is required to be in place for 'permanent' trades to occur in WSPAs, trading has been significantly impaired in such areas. To get around this DSE and the RWCs are moving away from development of statutory management plans in many areas and instead developing formal Local Management Rules, which are adequate to set out rules for trade and licence issue generally. A case in point is the Mid Loddon, which was declared a WSPA in 2002, but no plan developed. Trading was thus heavily impaired. In 2006 G-MW commenced developing LMRs for the area, and in 2010 the WSPA declaration was revoked, the LMRs published, and trading opened up. As at March 2010, only the Loddon has formal LMRs, but more are in development.

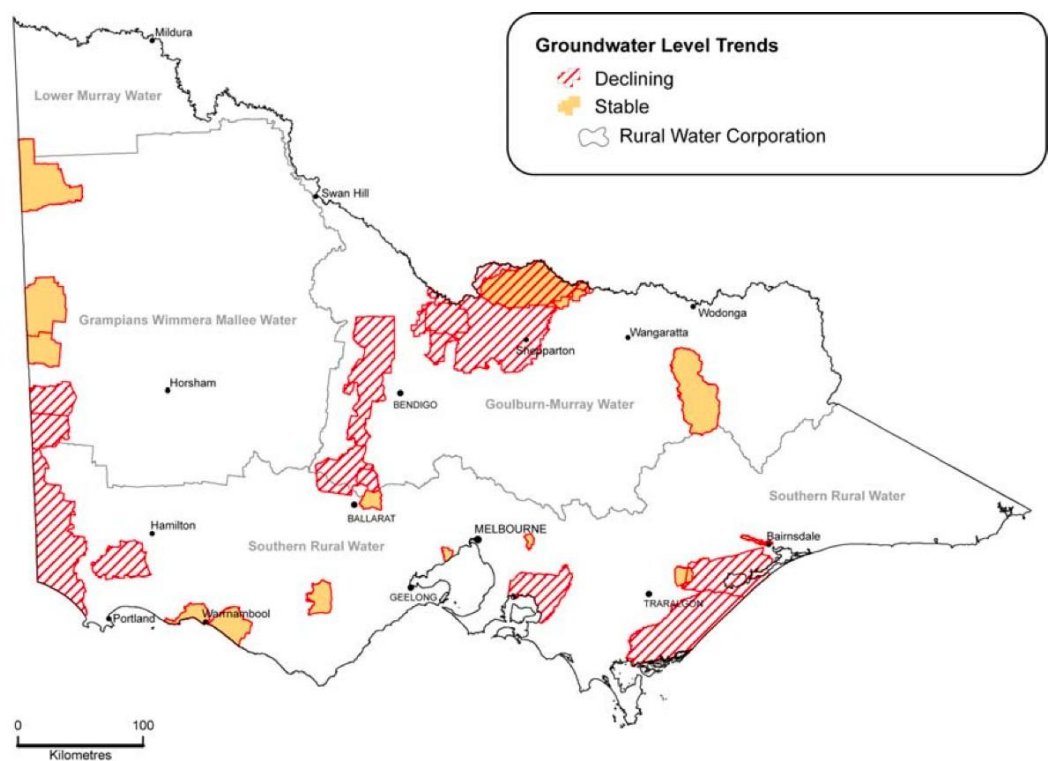
Existing GMAs and WSPAs are shown in Figure 15.

**Figure 15** GMAs and WSPAs in Victoria



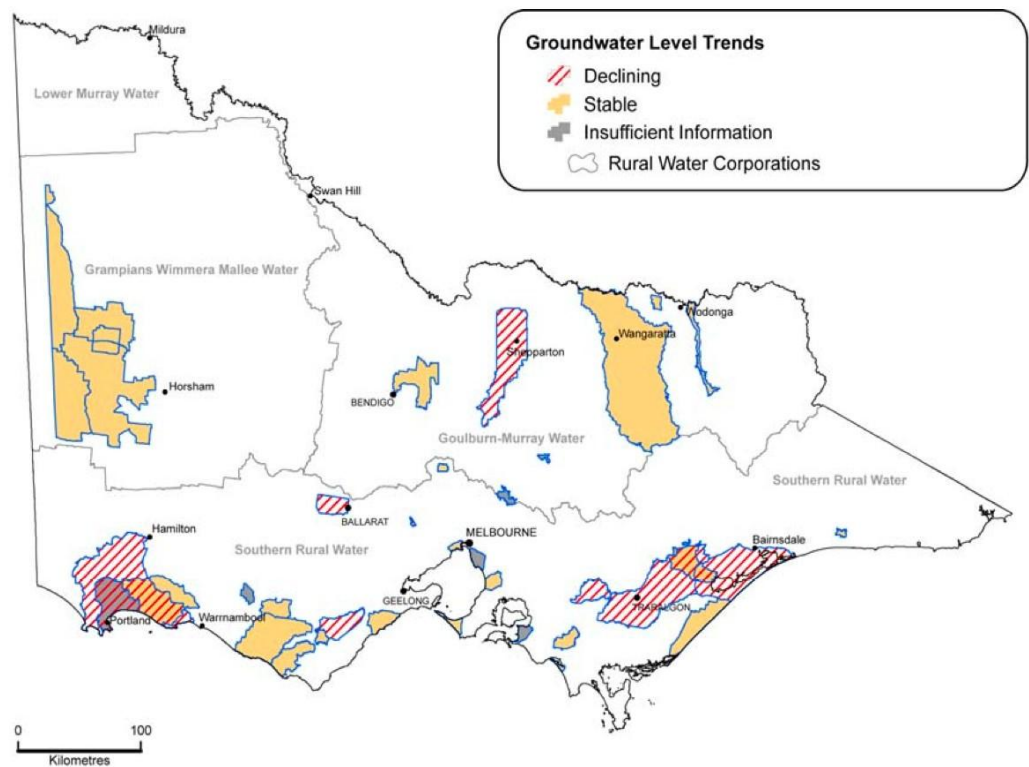
Source: DSE fact sheet *Groundwater licensing and trading in Victoria*, July 2009

Figure 16 WSPA trends in water level 2008



Source: Victorian Water Accounts 2007-2008

Figure 17 GMA trends in water level 2008



As at mid 2008, there were 66 GMUs in Victoria, of which 25 were WSPAs, 38 were GMAs and three were unincorporated areas. Management plans have, however, only been approved for eight of the 25 WSPAs. In addition to the management units, a groundwater sharing agreement is in place between South Australia and Victoria where aquifers straddle the state border. The designated area is a 40-kilometre-wide strip centred on the border and extending its full length. This area is managed under the *Groundwater (Border Agreement) Act 1985*.

'Development of the groundwater resource coupled with drought and climate change has led to declining groundwater levels across many of the groundwater management units... Compared to groundwater level trends in 2006–07, a larger number of management units are now showing a declining trend. Whilst this can be attributed to continuing demand for groundwater, external factors such as climate change and lack of recharge are also causing a decline in water levels and are outside of the groundwater management framework.' Refer to Figures 16 and 17 (Victorian Water Accounts 2008).

Where seasonal water allocations are announced it can be for all of a unit or any part of the unit. There is complete flexibility.

## **Groundwater licences and entitlements**

There are two types of groundwater entitlements: take and use licences held by individuals, and bulk entitlements held by authorities. It is possible under the Act to convert take and use licences to another type of entitlement called water shares, as has been done with regulated surface water, but there are no plans to do so.

For groundwater extraction for purposes other than domestic and stock use, an individual must hold a water licence under s. 51 of the Act, commonly known as a 'take and use licence'. To take the water the holder must also have a s. 67 licence to operate a bore at the specified location.

Section 36 bulk entitlements are effectively water licences for rural water authorities, urban water corporations or other specified bodies, such as electricity companies. The Act gives considerable flexibility in the nature of bulk entitlements. The first bulk entitlement for groundwater was issued in June 2009 to Barwon Water for urban water supply. No other groundwater bulk entitlements exist, but more are possible in the future. Other urban water authorities using groundwater have take and use licences. The conditions of this bulk entitlement prohibit the transfer of water.

Managed aquifer recharge (MAR) can occur. The Minister has approved policies for the licensing and approval of MAR under the Water Act 1989. The volumetric licensing process will operate on a 'net take' basis, with an approval for how much water can be recharged, and a licence to specify the volumes to be recovered.

## **Unlicensed groundwater rights**

Domestic and stock (D&S) use is defined under s. 3(1) of the Water Act 1989. Under section 8 of the Act, individuals may take groundwater for D&S purposes without a licence or entitlement, and without charge. However, all new D&S bores require a s. 67 bore construction licence. D&S bores are not metered, and there is no limit on the amount of water that may be extracted from a domestic and stock bore at any time, provided it is used only for domestic and stock purposes. This is the case even for stressed aquifers. The Minister has approved 'Reasonable domestic and stock guidelines' to be effective from January 2011.

## Impacting activities outside of the groundwater management framework

Groundwater PCVs in Victoria preclude any additional entitlements to extract of groundwater other than that for stock and domestic purposes. In these areas towns and mines can only gain additional access to groundwater by trading.

Effects that impact on groundwater recharge such as forestry are not regulated but are not generally considered to be significant. In the south-east, offshore oil and gas extraction may contribute to the depletion of onshore groundwater resources.

## Market regulation

Commonwealth Trade Practices legislation is applicable, but apart from this there are no specific powers. The whole issue is not considered significant because of the very small scale of groundwater trading.

## *Tradeable rights*

## Licences and entitlements

A take and use (s. 51) licence entitles the holder to take and use water subject to the conditions of the licence.

A take and use licence remains in force for the period specified in the license (not exceeding 15 years), unless sooner revoked or cancelled, and may be renewed on expiry. RWCs have discretion in determining these license durations. Most licenses are five years in duration. The RWC 'must renew the licence unless, in the opinion of the Minister [RWC as delegated], there are good reasons not to do so' (s. 58). Licence renewals are subject to the same licensing criteria as that for a new licence, i.e. s. 40(1) matters.

Conditions may be imposed when a licence is granted, and modified when it is renewed or transferred. Changes to conditions at other times can only be done pursuant to a statutory groundwater management plan.

The Act itself allows considerable administrative flexibility in specifying licences. In fact the conditions define the rights of the holder. In September 2009 the Minister issued a statutory statement called *Policies for Managing Take and Use Licences* (hereafter 2009 Policies) that RWCs are obliged to implement. In accordance with this, a set of standard licence conditions now applies. These standard conditions will be imposed on all new licences and on all existing licences when they are renewed or transferred. Standard conditions include:

- specification of how and where water may be taken
- specification of where and for what purpose water may be used
- an annual maximum volume that can be taken (1 July – 30 June)
- an annual use limit, being a maximum annual volume that can be applied to the nominated land
- an obligation to install a meter for all new licences for commercial and irrigation and for all existing licences if the annual maximum volume is 20 megalitres or greater
- the ability for the RWC to determine an annual water allocation less than 100% of the specified annual maximum volume (this condition is optional)
- the ability to carry over unused water allocation from one year to the next (this condition optional).

A s. 51 licence is issued to a person or persons, and so does not transfer automatically if the land with which the licence is associated is transferred. It is associated with land through conditions on the licence that specify the location where water can be taken, and the land on which the water taken can be used. Under the 2009 Policies, licences can only be issued, renewed or transferred where the applicant owns or occupies the land where the water is to be taken and used, and the allowed take of water cannot extend to more than one groundwater management unit, or aquifer or trading zone. Nor can a single licence apply to both surface and groundwater.

To take the water the holder must also have a s. 67 licence to operate a bore at the specified location.

Take and use licences do not comply with the specification of a water access entitlement in the NWI. Specifically:

- there are not perpetual (cl. 28)
- they are not a share of the water in a specified consumptive pool (though licences are linked to a spatial location and the source specified as 'groundwater', and in many areas conditions are being progressively imposed to allow annual allocations – this is close to meeting this requirement)
- there are bundled with approvals regulating the use of water (cl 30)
- they are not mortgageable (cl 31).

## **Water allocations**

The entitlement on groundwater licences is a fixed annual maximum volume unless a condition applies allowing the RWC to determine an annual water allocation less than 100% of the specified annual maximum volume. This condition is being applied to most licences in GMAs and WSPAs.

Water allocations do not exist as entitlements separate to licences. However the specified maximum annual volume on a licence has a degree of independent existence, as it can be wholly or partially transferred to another person and location for a fixed period. See later comments on temporary trading.

Carryover of unused allocation has been implemented in some parts of Victoria, but is not common. An alternative arrangement that has been used in some areas is allowing allocations to be accessed on a 3-year rolling average basis.

## **Other tradeable rights**

None.

## Entitlement statistics

| GMU                | GMU Type | RWC   | No. of zones | No. of licences | Ent. volume (ML) | Est. use 08-09 (ML) | Use/ent. | Ent. limit (ML) |
|--------------------|----------|-------|--------------|-----------------|------------------|---------------------|----------|-----------------|
| Alexandra          | GMA      | G-MW  | 1            | 10              | 1,714            | 1,210               | 71%      | 1,937           |
| Barnawatha         | GMA      | G-MW  | 1            | 5               | 635              | 381                 | 60%      | 2,100           |
| Campaspe Deep Lead | WSPA     | G-MW  | 1            | 114             | 46,096           | 24,107              | 52%      | 47,252          |
| Katunga            | WSPA     | G-MW  | 1            | 190             | 59,539           | 32,849              | 55%      | 59,780          |
| Kinglake           | GMA      | G-MW  | 1            | 54              | 1,864            | 1,385               | 74%      | 2,015           |
| Lower Ovens        | GMA      | G-MW  | 1            | 253             | 17,062           | 6,825               | 40%      | 25,200          |
| Mid Goulburn       | GMA      | G-MW  | 2            | 61              | 12,330           | 4,566               | 37%      | 14,900          |
| Mid Loddon         | WSPA     | G-MW  | 1            | 97              | 34,014           | 19,422              | 57%      | 37,200          |
| Mullindolingong    | GMA      | G-MW  | 2            | 35              | 1,532            | 613                 | 40%      | 6,981           |
| Shepparton         | WSPA     | G-MW  | N/A          | 1445            | 241,033          | 57,154              | 24%      | 233,155         |
| S. Campaspe Plains | GMA      | G-MW  | 1            | 24              | 8,307            | 3,509               | 42%      | 8,850           |
| Spring Hill        | WSPA     | G-MW  | 1            | 55              | 4,909            | 2,041               | 42%      | 5,062           |
| Upper Loddon       | WSPA     | G-MW  | 1            | 115             | 13,264           | 5,066               | 38%      | 13,648          |
| Upper Ovens        | GMA      | G-MW  | 1            | 102             | 3,658            | 1,463               | 40%      | 4,010           |
| Apsley             | WSPA     | GWM W | 1            | 20              | 4,285            | 1,772               | 41%      | 4,285           |
| Avoca              | GMA      | GWM W | 1            | N/A             | 1,080            | N/A                 |          | 2,100           |
| Balrootan          | GMA      | GWM W | 1            | 13              | 1,522            | 413                 | 27%      | 1,522           |
| Goroke             | GMA      | GWM W | 1            | N/A             | N/A              | N/A                 |          | 2,200           |
| Gymbowen           | GMA      | GWM W | 1            | N/A             | N/A              | N/A                 |          | N/A             |
| Kaniva TCSA        | GMA      | GWM W | 1            | N/A             | N/A              | N/A                 |          | 1,100           |
| Little Desert      | GMA      | GWM W | 1            | N/A             | N/A              | N/A                 |          | 1,100           |
| Murrayville        | WSPA     | GWM W | 1            | 33              | 9,634            | 5,423               | 56%      | 10,883          |
| Neuarpur           | WSPA     | GWM W | 2            | 52              | 24,696           | 22,182              | 90%      | 24,750          |
| Nhill              | GMA      | GWM W | 1            | N/A             | N/A              | N/A                 |          | 1,200           |
| Telopea Downs      | WSPA     | GWM W | 1            | 10              | 7,482            | 2,300               | 31%      | 7,870           |
| SA/Vic Border      | WSPA     | N/A   | N/A          | N/A             | N/A              | N/A                 | N/A      | N/A             |
| Bungaree           | WSPA     | SRW   | 1            | 107             | 5,251            | 4,383               | 83%      | 5,273           |
| Cardigan           | GMA      | SRW   | 1            | 25              | 3,887            | 961                 | 25%      | 3,967           |
| Colongulac         | GMA      | SRW   | 1            | 44              | 3,840            | 792                 | 21%      | 4,695           |
| Condah             | WSPA     | SRW   | 1            | 39              | 7,436            | 3,162               | 43%      | 7,437           |
| Corinella          | GMA      | SRW   | 1            | 12              | 146              | 43                  | 29%      | 2,550           |
| Cut Paw Paw        | GMA      | SRW   | 1            | 8               | 710              | 68                  | 10%      | 3,650           |
| Denison            | WSPA     | SRW   | 1            | 125             | 17,743           | 8,370               | 47%      | 17,743          |
| Deutgam            | WSPA     | SRW   | 1            | 150             | 5,100            | 24                  | 0%       | 5,100           |
| Frankston          | GMA      | SRW   | 1            | 32              | 1,080            | 211                 | 20%      | 3,200           |

| GMU            | GMU Type | RWC | No. of zones | No. of licences | Ent. volume (ML) | Est. use 08–09 (ML) | Use/ent. | Ent. limit (ML) |
|----------------|----------|-----|--------------|-----------------|------------------|---------------------|----------|-----------------|
| Gellibrand     | GMA      | SRW | 1            | N/A             | N/A              | N/A                 |          | N/A             |
| Gerangamete    | GMA      | SRW | 1            | 1               | 8,000            | 12,438              | 155 %    | 20,000          |
| Giffard        | GMA      | SRW | 1            | 16              | 5,670            | 3,657               | 64%      | 5,665           |
| Glenelg        | WSPA     | SRW | 1            | 80              | 32,660           | 9,107               | 28%      | 32,660          |
| Glenormiston   | GMA      | SRW | 1            | 33              | 2,464            | 787                 | 32%      | 2,565           |
| Hawkesdale     | GMA      | SRW | 2            | 109             | 11,673           | 5,612               | 48%      | 16,161          |
| Heywood        | GMA      | SRW | 1            | 95              | 6,695            | 1,350               | 20%      | 8,500           |
| Jan Juc        | GMA      | SRW | 1            | 3               | 4,250            | 3,359               | 79%      | 4,250           |
| Kooweerup      | WSPA     | SRW | 8            | 386             | 12,826           | 5,036               | 39%      | 12,915          |
| Lancefield     | GMA      | SRW | 1            | 15              | 1,390            | 429                 | 31%      | 1,485           |
| Leongatha      | GMA      | SRW | 1            | 32              | 1,480            | 342                 | 23%      | 6,500           |
| Merrimu        | GMA      | SRW | 1            | 13              | 400              | 264                 | 66%      | 450             |
| Moe            | GMA      | SRW | 1            | 85              | 3,772            | 1,076               | 29%      | 8,200           |
| Moorabbin      | GMA      | SRW | 1            | 57              | 2,647            | 1,171               | 44%      | 2,700           |
| Nepean         | GMA      | SRW | 1            | 70              | 6,012            | 3,908               | 65%      | 6,013           |
| Newlingbrook   | GMA      | SRW | 1            | 5               | 1,947            | 558                 | 29%      | 1,977           |
| Nullawarre     | WSPA     | SRW | 1            | 212             | 21,280           | 13,536              | 64%      | 25,100          |
| Orbost         | GMA      | SRW | 1            | 5               | 1,201            | 578                 | 48%      | 1,200           |
| Paaratte       | GMA      | SRW | 1            | 8               | 3,193            | N/A                 | -        | 4,606           |
| Portland       | GMA      | SRW | 1            | 8               | 7,794            | N/A                 | -        | 4,600           |
| Rosedale       | GMA      | SRW | 3            | 52              | 22,233           | 6,891               | 31%      | 22,313          |
| Sale           | WSPA     | SRW | 1            | 109             | 21,062           | 11,160              | 53%      | 21,212          |
| Stratford      | GMA      | SRW | 2            | 8               | 27,645           | 88                  | 0%       | 27,643          |
| Tarwin         | GMA      | SRW | 1            | 2               | 37               | 6                   | 16%      | 1,300           |
| Wa De Lock     | GMA      | SRW | 3            | 242             | 28,458           | 9,512               | 33%      | 30,084          |
| Wandin Yallock | WSPA     | SRW | 1            | 187             | 2,939            | 565                 | 19%      | 2,924           |
| Warrion        | WSPA     | SRW | 1            | 131             | 13,835           | 3,943               | 29%      | 13,836          |
| Wy Yung        | WSPA     | SRW | 3            | 61              | 7,462            | 1,009               | 14%      | 7,426           |
| Yangery        | WSPA     | SRW | 1            | 164             | 14,103           | 4,812               | 34%      | 14,103          |
| Yarram         | WSPA     | SRW | 2            | 83              | 25,317           | 13,891              | 55%      | 25,317          |

(Source: 2008–09 annual reports for G-MW and SRW, and DSE website <http://groundwater.geomatic.com.au/Main.aspx>)

## Trade-related transactions

### Types of transactions

The Act (s. 62) allows the holder to apply for permanent and temporary transfer of a take and use licence 'to another person'. In approving such an application the Minister can add, amend or delete conditions. Thus the location of the licence can be moved, and the purpose or any other condition can be changed, as part of the transfer.

Permanent transfers can be:

- change of holder only—where the land is sold and the new landholder applies to transfer the existing licence associated with that land to the new landholder
- change of location (and perhaps purpose) are changed, but the holder is not
- change of location (and perhaps purpose) and holder
- partial transfer of volume, where the licence remains with the transferor (seller), but the volume is reduced by an amount, and the corresponding volume is issued to the transferee (buyer) as a new licence or a change to an existing licence.

The 2009 Policies give the RWC the option of effecting these by either cancelling and where necessary issuing new licences, or by modifying existing licences.

Temporary transfers are given effect by noting on the transferors licence that the volume is reduced for the specified period, and issuing the corresponding volume to the transferee as a new licence or a change to an existing licence for the same period.

## ***Market and resource definition***

### **Scope of trading**

Trade is not restricted to GMAs or WSPAs, but is less likely to occur outside of these areas. Individual trades are limited to within the respective groundwater system or management area, and frequently to within a zone (where these are in place).

It is theoretically possible to trade groundwater between Victoria and South Australia in the border agreement areas, but does not yet occur as South Australian licences are measured by area, not volume. Other than this there is no provision for cross state border trade of groundwater.

### **Establishing physical unit/zone boundaries**

Physical market boundaries are based on the GMA and WSPA boundaries. Many of these are administrative boundaries and are currently being reviewed to incorporate the latest hydrogeological information to more accurately reflect aquifer characteristics. GMAs are in process of being made to replace UAs (Northern Region Sustainable Water Strategy p 68).

In some cases, in areas of known high connectivity between groundwater and surface water, groundwater access has been granted via surface water licences, thus ensuring that groundwater access is managed according to surface water rules, and enabling trade between the linked resources. Such areas include parts of the Mitchell and Avoca rivers. A conjunctive groundwater–surface water plan is being developed for the Upper Ovens River, which may provide the opportunity for trading between groundwater and surface water.

There is no capacity to extend borders across state boundaries. The area covered by the Victoria – South Australia agreement, however, provides for cross border coordination of management of what is physically one aquifer system.

The geographical boundaries of many GMUs, especially those in northern Victoria, may not align with underlying groundwater systems. Boundaries have been developed on a needs basis with consideration to current hydrogeological understanding. In some cases this has made it difficult for regional water plans to properly quantify groundwater resources, including the entire extent of aquifers, its groundwater movement and interactions, and beneficial uses. The Groundwater SAFE (secure allocations, future entitlements) program commenced in 2009 (Commission funded) and will determine groundwater management boundaries that are aligned with surface water boundaries, taking into account those that currently exist. A permissible consumptive volume (PCV) or sustainable yield will be assessed for each groundwater-management area, taking into account water users, environmental water needs, and interactions between surface water and groundwater.

A stakeholder expressed concern with boundaries in fractured rock areas, as have been established largely around issues and do not reflect groundwater flow boundaries. For example, with the Mid to Upper Loddon boundary, the entitlement could not be transferred just across the boundary even though it was the same aquifer.

It was also noted that the quality of water can vary considerably in the same aquifer system. For example, Spring Hill – good quality, in basalts, but as move north into flatter areas, still basalts but less rain and salinity increases.

## **Defining consumptive pool/allocatable volumes**

Permissible consumptive volumes (PCVs) are caps that can be imposed by the Minister for Water to prevent the resource being depleted or adverse impacts such as declining groundwater levels, reduced base flows in rivers and streams, or changes to water quality. A PCV defines the maximum volume of water that can be allocated to / extracted from a Groundwater Management Area (GMA) or Water Supply Protection Areas (WSPA). The aquifer system they apply to is commonly defined in three dimensions (i.e. vertical as well as horizontal).

PCVs do not exist in Unincorporated Areas and many GMAs and WSPAs are already allocated to their PCV limit. In these areas, new licences cannot be issued and the only way to acquire new water is to purchase a licence from an existing groundwater entitlement holder. (source: <http://www.ourwater.vic.gov.au/environment/groundwater/management> accessed 11/03/2010).

PCVs are not, however, an extraction cap. They are a legal measure that prevents the issue of further water entitlement in an area. They have no direct effect on how much can be taken under already existing entitlements, and do not purport to prevent resource depletion, declining water levels and adverse impacts. Rather, it is other tools and mechanisms that achieve these things (e.g. extraction limits, pumping intensity rules, water level response triggers and individual pumping conditions). PCVs are frequently set at the sum of issued entitlements that are in place on the date of gazettal of the PCV. This can be more or less than a diversion limit that is assessed to be sustainable.

If there is a lack of knowledge, then a PCV can reflect a lower or higher volume than is necessary in the long term, but this cannot be confirmed until further studies are undertaken. Where such studies indicate more entitlement can be issued, then the PCV can be altered to allow for it. But the PCV is often higher than studies determine to be sustainable, in which case alternative action is needed.

Annual allocations are applied to licences in an area, whereby they are restricted to less than their entitlement volume. The method for determining these volumes varies, but is frequently linked to water level monitoring and hence they form a component of water level response management. Where statutory plans or formal local management rules apply, the method for determining such allocations is normally set out.

## **Restrictions on market participants**

Under the 2009 Policies, it is a requirement that the applicant for a new, renewed or transferred licence must own or occupy the land specified in the licence conditions where water can be taken and used. Some exemptions apply, for example for water carting (where the person extracting groundwater may not own or occupy the land overlying the aquifer). Additionally the applicant must be able to 'reasonably use that amount of water on the nominated land'.

These two requirements exclude non-water users from holding licences, and exclude water users from holding more than they can reasonably use.

## **Levels of trading**

As a transitional measure it is common to limit trade to temporary only while assessments are being done and management rules or plans are developed. Also, G-MW often encourages a

history of temporary trades as a preliminary step or part of supporting evidence for permanent trades.

The normal 'full' trading regime is for both temporary and permanent trading of licences.

There is potential in the Act to unbundle these licences into water shares and works and use licences, as has been done with surface water, but there are no plans to do so.

## *Trading initiation*

See sustainable water strategy documents for incentives for trade, auctions, trade between groundwater systems, reserve pricing.

### **Triggers**

Generally speaking, the Act allows persons to lodge applications for, and requires them to be assessed and determined by the government. In areas where the issue of new groundwater licences is still possible, there is little trade because there is a lack of drivers for it. Once issue of new licences in an area is prevented by a PCV, applications for temporary or permanent transfer of groundwater licences can be lodged and will be assessed in accordance with s40 of the Act.

However, if an area is declared to be a WSPA, permanent transfer is prevented until a statutory plan is made.

In Victoria town water has no special standing, so have to buy water like anyone else.

In areas where there is little demand for groundwater (e.g. in unincorporated areas, typically because it is physically difficult to find or access, or is of poor quality) issue of licences on application continues. In areas where demand is high and licences have stopped being issued, but as a result of studies it is determined that additional entitlement can be issued, then auctioning water is used. This was done a few years ago in the mid Loddon.

### **Prerequisites**

In Victoria groundwater licences are all volumetric and metered, at a minimum, in accordance with the Vic government Statewide Metering Policy. Extraction under groundwater entitlements of 20 ML or greater must be metered, and metering is a prerequisite of trade. Apart from the triggers for trading to occur described above, there are no additional prerequisites.

### **Initiating groundwater trading in an area**

Trading is always possible in Victoria, but once a PCV prevents issue of new entitlements, there is increased incentive for trade. Methods of informing water users vary from area to area.

## *Transaction processing*

### **Transaction processing steps**

The steps in trading transactions involving change of location (permanent or temporary) are as follows:

- Buyer and seller come into contact and agree on price.
- In the Goulburn Murray Water area, the applicants are required to advertise their intention for permanent transfers exceeding 19ML, and to notify all persons with properties within

one km of the bore where extraction will be increased. In Southern Rural Water advertising may be required.

- Application form is lodged with relevant RWC, signed by both buyer and seller.
- The applicant is commonly required by the RWC to commission studies into the possible impacts the transaction on the environment and other water users. The RWC provides guidance on the type of studies, which depend on the volume involved and the location.
- RWC assesses application, as per s40 of the Act, in consideration of applicant commissioned assessments, departmental assessments and lodged objections.
- The RWC grants or refuses the application. If granted, conditions may apply in order to address potential impacts. If the applicant is a town, it is referred to DSE to make the determination.

The applicant, or objectors, can appeal the RWC decision to VCAT.

## Transaction impact assessment

Transfers are to be assessed in consideration of all the matters to be considered in granting a new licence, including potential impacts on the environment and third parties associated with both the take and the use of water. These are set out in s. 40 of the Act, and include:

- the existing and projected availability of water in the area
- the existing and projected quality of water in the area
- any adverse effect that the allocation or use of water under the entitlement is likely to have on:
  - existing authorised uses of water; or
  - a waterway or an aquifer; or
  - the drainage regime
  - the maintenance of the environmental water reserve in accordance with the environmental water reserve objective
  - any water to which the applicant is already entitled
  - the need to protect the environment, including the riverine and riparian environment
  - government policies concerning the preferred allocation or use of water resources
  - whether the proposed source of water is within a heritage river area or natural catchment area, and whether there is any restriction on the use of the area.

In addition to the above, RWCs assess applications according to rules contained in Groundwater Management Plans and Local Management Rules.

RWCs vary in their approach to considering these matters. Applicants are commonly required to commission and submit studies into potential impacts, however these typically relate to applications for permanent transfer. The 2009 Policies require all applications for transfer for irrigation to prepare and irrigation and drainage management plan in accordance with specified guidelines. However these may be prepared and approved in advance of any application for transfer. An exemption applies for small licences (less than 20ML/year).

## Fees for transactions

Fees are set independently by each RWC. For Goulburn Murray Water (G-MW) and Southern Rural Water (SRW) some relevant fees are shown below.

| Transaction                                                       | G-MW                                                                                                                                                                                            | SRW                                                                                                                                                  |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| For a licence to construct a bore (should it be required)         | \$1217                                                                                                                                                                                          | \$1555                                                                                                                                               |
| For temporary transfer of licence entitlement                     | From \$246 for transfers within licence entitlement<br>To \$641 plus a varying volume per ML for volumes exceeding licence entitlement. E.g. for 60ML \$877, for 289ML \$2753, for 460ML \$5479 | \$235, plus, where required, an advertising fee of up to \$1910, and assessment fees of up to \$3515 and possibly more if there are sensitive issues |
| For permanent transfer of licence entitlement to another location | \$898 plus a varying volume per ML above 20ML (as per temporary transfers)                                                                                                                      | \$775, plus additional fees as above                                                                                                                 |

## Trading rules

Trading rules constrain the types of permanent and temporary transfers that may be approved by prohibiting the approval of certain types of applications. Applications that are not prohibited by trading rules may still be refused if impact assessment of the proposed transaction warrants it. The main rules are listed below.

### *State groundwater trading rules*

Under the Act:

Applications for permanent trade in WSPAs where a GMP has not been approved are to be deferred until the GMP is approved (s. 54). Does not apply to applications to change holder only when the associated land is transferred.

Under the 2009 Policies:

As mentioned previously, it is a requirement that the applicant for a transferred licence must own or occupy the land specified where the water is to be taken and used, and must be able to 'reasonably use that amount of water on the nominated land'.

A temporary transfer must conclude at the end of a water season.

A temporary transfer cannot exceed one water season, except in a WSPA where a GMP has not been approved, where the temporary transfer may be granted for up to five years.

Volumes temporary transferred may not be temporary transferred again.

The Water Act 1989 does not prevent a cross-boundary trade from being approved. However, trading rules generally prevent movement of licences or allocations across GMA and WSPA boundaries.

### *Local groundwater trading rules*

Campaspe Deep Lead Water Supply Protection Area (Groundwater) Management Plan 2003 (Note: This area has now been replaced with the Lower Campaspe Valley WSPA. The previous plan has been revoked and interim management rules are now in place):

- Permanent transfer for the purpose of irrigation is prohibited (does not apply to transfer of holder only when associated with transfer of land).
- Permanent and temporary transfer must be within the same Zone Group.
- Temporary transfer only allowed when seasonal allocation less than 100%.
- Permanent and temporary transfers only allowed if the relevant bores of the transferee (buyer) have sufficient capacity to take the water.

- Temporary transfers cannot go past the end of the current water year.

Katunga Water Supply Protection Area (Groundwater) Management Plan 2006:

- A temporary transferee may only transfer in the difference between the current restricted volume and 100% of the volume on their licence.
- In a permanent transfer of a licence which is not associated with the transfer or conveyance of land, the groundwater licence entitlement must be reduced by 20%.
- No permanent transfers to a location within two km of the River Murray

Permanent transfers prohibited if:

- the total groundwater licence entitlement from all licences authorised to be taken within a two km radius of the proposed extraction site exceeds 3700 ML/year or the approval of the application would lead to this volume being exceeded, or
- it would result in the total groundwater licence entitlement from all licences in Management Zone 1061 exceeding 6,500 ML/year, or the total groundwater licence entitlement from all licences in Management Zone 1063 exceeding 25,000 ML/year.

Shepparton Irrigation Region Water Supply Protection Area (Groundwater) Management Plan July 1997:

- No permanent or temporary transfers permitted.

Spring Hill Water Supply Protection Area (Groundwater) Management Plan 2001 (Note: This area has now been replaced with the Loddon Highlands WSPA. The previous plan has been revoked and interim management rules are now in place):

- Permanent transfers prohibited (does not apply to transfer of holder only when associated with transfer of land).
- Temporary transfers only permitted within the same zone, except for from the Forest Hill Zone or Blampied Zone to the Smeaton Zone or the Mollonghip Zone.
- Temporary transfer only permitted if the bore from which the entitlement is to be transferred is capable of producing that volume.
- Temporary transfers cannot exceed five years.

Mid-Loddon Groundwater Management Area Local Management Rules June 2009:

- A permanent or temporary transfer of groundwater licence entitlement within the management area may be approved provided the following conditions are also satisfied:
- The buyer has a bore with a metered diversion point;
- The approval of such a transfer would not cause the total licence entitlement in the Laanecoorie-Serpentine Zone to exceed 28,000 ML;
- The approval of the transfer would not cause the total licence entitlement in Jarklin Zone to be less than 3000 ML;
- The approval of the transfer would not cause the licence entitlement within a 5 km radius of the buyer's bore to exceed 5000 ML/yr, or 10% above the buyers licence entitlement as at 1 July 2009, where the total entitlement exceeds 5000 ML/yr.

A temporary transfer of licence may be permitted between bores up to a maximum of 5 km apart across management zone boundaries, even if this would result in the total licence entitlement in the Laanecoorie-Serpentine Zone exceeding 28,000 ML and the total licence entitlement in Jarklin Zone exceeding 3000 ML.

## Transaction processing efficiency

Describe typical and target processing times for different types of transactions in different areas. Use hard data if available.  
What aspects of transaction processing are the most expensive and take the longest time?  
What could be done to improve processing?

Typical processing times are two to three months. However there are cases where the applicant is required to commission field monitoring and studies that take months or years to complete, which hold up determination of the application.

Comments on transaction processing:

- Water user – up to 3 months assessment time for ‘temporary transfers’. Would like to see this reduced, especially for repeat trades. G-MW officer responded that they have improved on the process and most now take about 1 month.
- SRW looking at zoning and revised rules to enable more streamlined processing. For example, filtering applications according to distance (to nearest bore) and volume thresholds may negate some detailed assessment.
- Water user – groundwater trading is a complicated process technically and administratively. Technically, if you trade groundwater to a particular area, will you be able to extract it? Administratively, trade applications have to be submitted annually with G-MW (because the Upper Loddon Management Plan does not have local rules or a management plan).
- G-MW: In some areas (e.g. Spring Hill), assessments can be undertaken for temporary transfers for 5 years. This can save on a significant amount of application preparation and processing time and can provide greater periods of certainty for all parties. However, if new licences are activated in the area they must be assessed on the basis of the long term temp trade being in place and extraction occurring. Impact of extraction from new stock/domestic bores in the area does not get assessed.
- Water user – application forms are cumbersome, but a lot of forms are available online.
- Water user – before trade need to know the water is there. Significant cost in test drilling and assessments.
- Town water user – people who object to the town having the water can lodge an objection and slow things down.

## Assessments of potential water level changes/drawdowns

Impact assessment of applications is the responsibility of the RWCs, which have developed their own assessment processes based on complying with s. 40 of the Act. DSE has a role if the application relates to town water. Applicants are commonly required to commission technical impact assessment studies at their own expense. Such assessments by consultants typically cost in the order of \$20,000 to \$30,000.

SRW (and G-MW) have guidelines (see attachment) for the type of assessment needed based on volume, proximity to water features and other bores, purpose, and whether within or near a GMA or WSPA. Depending on which applies, three tiers of assessment are outlined in relation to conceptual hydrogeology, site testing, prediction of drawdowns and water quality. SRW uses a simple drawdown modelling tool, then advises applicant of what further work is required.

Comments:

Impact (i.e. predicted drawdown) is assessed against the 'available drawdown' in nearby bores. Hence, trade volumes can be limited due to the presence of nearby 'inefficient' bores. Trade limitations can be offset by compensatory actions, such as the proponent supplying water to the neighbour whose bore may be impacted.

G-MW: An acceptable impact is less than 20% of available head in a neighbours bore ('available head' is defined as the water level height above the pump, or the water level height above the bore bottom, less a 2 m allowance for the pump).

## *Managing impacts of trade*

### **System-wide drawdown effects**

(For example, on GDEs, surface water, adjoining aquifers, other bores, water quality etc; resulting from activation of sleepers).

PCVs, and annual allocations linked to monitoring are two mechanisms used.

In some areas trading rules have linked trade to historically used entitlement to prevent activation of sleepers by trade.

### **Local drawdown effects**

(For example, on GDEs, surface water, adjoining aquifers, other bores, water quality etc from allowing increased local concentrations of extraction).

Refusal of applications for bores/licences/transfers, or imposition of conditions requiring monitoring and responses.

There is concern in G-MW area of trading enabling migration of extraction to areas of better soil conditions, and these areas becoming locally over-allocated.

Biggest emphasis in assessment is on local drawdown effects – especially potential impacts on nearby bores.

### **Effects of use of water on land**

(For example, waterlogging, salinisation etc resulting from expanding irrigation)

Refusal or conditioning of applications for licences.

### **Effects of movement of economic activity**

(For example, loss of local community infrastructure through cumulative movements of water dependent economic activity out of an area)

Not a big consideration as groundwater in Victoria is a small part of water use and trade volumes are very low.

## *Facilitating groundwater trading*

### **Metering**

All licensed groundwater extraction is metered. Funded by the water user.

## Access to market information

G-MW: Annual reports in WSPAs with plans are sent to groundwater users in the management unit. These include information on trading activity.

RWC websites provide forms and information on how to lodge an application for a licence transfer.

G-MW staff are of the view that most groundwater users do not know/understand groundwater trading rules.

## Education and awareness

In northern Victoria water users are generally familiar with water trading and accept its legitimate role, but the same is not true in the south, where there is still considerable resistance to trading based on misconceptions.

## Intermediaries

Brokering of groundwater trades, where it occurs, is on an ad-hoc basis through local real estate agents. Because of the small scale and localised nature of groundwater markets there has been little need for anything more.

## *Monitoring and compliance*

## Monitoring and evaluation

Ministerial directions require reporting within the RWC Annual Reports on trade numbers and efficiency, and as required by DSE. Performance is also reported to the Essential Services Commission.

## Current trading statistics

Groundwater licence trading information for 2008–09 is shown in the following table. The information was obtained from various sources and may not be complete or accurate, but is indicative of the level of trading activity.

| GMU                          | RWC  | Temporary |             | Permanent |             |
|------------------------------|------|-----------|-------------|-----------|-------------|
|                              |      | No.       | Volume (ML) | No.       | Volume (ML) |
| Campaspe Deep Lead           | G-MW | 48        | 4,031       |           |             |
| Katunga                      | G-MW | 53        | 3,471       |           |             |
| Kinglake                     | G-MW | 2         | 33          |           |             |
| Lower Ovens                  | G-MW | 2         | 44          |           |             |
| Mid Goulburn                 | G-MW | 3         | 164         |           |             |
| Mid Loddon                   | G-MW | 21        | 3,235       |           |             |
| Shepparton Irrigation Region | G-MW | 1         | 108         |           |             |
| Spring Hill                  | G-MW | 13        | 325         |           |             |
| Upper Loddon                 | G-MW | 21        | 1,440       |           |             |
| Upper Ovens                  | G-MW | 1         | 5           |           |             |
| Murrayville                  | GWMW | 3         | 900         | 1         | 300         |
| Neuarpur                     | GWMW | 4         | 880         | 1         | 600         |
| Nullawarre                   | SRW  | 7         | 433         | 4         | 313         |
| Yangery                      | SRW  | 3         | 43          | 2         | 224         |

## **Enforcement/compliance**

RWCs have responsibility for ensuring water users comply with water access conditions.

### **Acknowledgements**

The following people are acknowledged for their contributions during the consultation phase of this project:

Jenny Egan, DSE

Gerry Egan, DSE

Patrick O'Halloran, DSE

Pat Russell, Central Highlands Water

Brendan Cossens, Goulburn-Murray Water

Terry Flynn, Southern Rural Water

Craig Parker, Southern Rural Water

# Attachment to Stocktake for Victoria: SRW Assessment Guidelines

## SRW Hydrogeological Assessment Guidelines for non-Urban Supply Groundwater Licence Applications

|                                                                                                                                                                                                                              | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 Is your property within a GMA or WSPA?                                                                                                                                                                                     | Proceed to Q2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Proceed to table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2 Have allocations been capped in that GMA/WSPA?                                                                                                                                                                             | No new licences available                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Proceed to table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Tier 1</b><br>Application volume <20ML<br>AND<br>Not within 1km of a surface waterway, wetland or known spring<br>AND<br>For irrigation or dairy use<br>AND<br>Not within a GMA/WSPA or within 5km of a GMA/WSPA boundary | <b>Tier 2</b><br>Application volume >20ML but <200ML<br>OR<br>Within 1km of a surface waterway, wetland or known spring<br>OR<br>For proposed commercial/industrial use or site remediation (exact use must be specified)<br>OR<br>Within a GMA/WSPA or within 5km of a GMA/WSPA boundary<br>OR<br>One or more registered bores (not owned by the applicant) within 1km radius                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Tier 3</b><br>Application volume >200ML<br>OR<br>Within 250m of a surface waterway, wetland or known spring<br>OR<br>Two or more registered bores (not owned by the applicant) within 1km<br>OR<br>Within 10km of a GMA/WSPA boundary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Conceptual hydrogeology</b>                                                                                                                                                                                               | Describe the conceptual hydrogeology from available site observations and/or desktop study inc transmissivity, flow direction, depth to water, stratigraphy, bore yields in local area, confined/unconfined aquifer<br><br>Identify and summarise the available data from all bores within 1km of the proposed extraction from GMS search<br><br>Identify and summarise the available data from the nearest SOBN bore(s)<br><br>Identify the nearest surface water feature, wetland etc believed to be "downgradient" from the proposed bore<br><br>Identify any nearby areas of known gw-sw interaction<br><br>Identify nearest likely recharge area(s) & mechanism(s)<br><br>If estimating recharge from rainfall (optional), use 10 driest consecutive years from nearest weather station<br><br>Specify target aquifer, bore depth, construction details | Describe the conceptual hydrogeology from available site observations and/or desktop study inc transmissivity, flow direction, depth to water, stratigraphy, bore yields in local area, confined/unconfined aquifer<br><br>Identify and summarise the available data from all bores within 2km of the proposed extraction from GMS search<br><br>Identify and summarise the available data from the nearest SOBN bore(s)<br><br>Identify all surface water features, wetlands etc within 1 km<br><br>Identify the nearest surface water feature, wetland etc<br><br>Describe sw/gw interaction from avail data<br><br>Identify nearest likely recharge area(s) & mechanism(s)<br><br>If estimating recharge from rainfall (optional), use 10 driest consecutive years from nearest weather station<br><br>Estimate extraction as a fraction of groundwater throughflow across the property using site-specific aquifer parameters<br><br>Specify target aquifer, bore depth, construction details |
| <b>Site Testing</b><br>If multiple extraction wells are proposed, the testing guidelines should be applied to the well field as a whole, not to each individual bore                                                         | Conduct site inspection - Confirm and provide details of all bores on site inc wl, construction, yield/specific capacity, total depth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Conduct site inspection - Confirm and provide details of all bores on site inc wl, construction, yield/specific capacity, total depth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Step testing may not be practical or necessary in all circumstances but must be conducted for extraction bores without existing pump/headworks infrastructure                                                                | Step test - at least 4 steps 50-100 mins each + recovery to determine appropriate extraction rate<br><br>Constant rate pumping test - at rates consistent with proposed pumping regime<br>Constant drawdown tests may be conducted in place of constant rate tests, if appropriate at least 48 hrs duration + recovery<br><br>Water levels - observations from pumping well at minimum, with at least 1 dedicated obs well (in same aquifer) preferred. Recovery tests MUST be completed and analysed appropriately if there are NO appropriate observation bores in the same aquifer OR if no response is detected in the observation wells                                                                                                                                                                                                                 | Step test - at least 4 steps 50-100 mins each + recovery to determine appropriate extraction rate<br><br>Constant rate pumping test - at rates consistent with proposed pumping regime<br>Constant drawdown tests may be conducted in place of constant rate tests, if appropriate at least 4 days duration + 4 days recovery at least 7 days duration + 7 days recovery if application > 1000ML<br><br>Water levels - observations from pumping well and at least 1 dedicated obs well in same aquifer + other aquifers as practical. Recovery tests MUST be completed and analysed appropriately if there are NO appropriate observation bores in the same aquifer OR if no response is detected in the observation wells                                                                                                                                                                                                                                                                       |

## SRW Hydrogeological Assessment Guidelines for non-Urban Supply Groundwater Licence Applications

|                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site Testing (cont'd)</b>                                                                                                                       |                                                                                                                                                                                                                                                                                                                     | <b>Flow rate</b>                                                                                                                                                                                                                                                                                                    | <b>Flow rate</b>                                                                                                                                                                                                                                                                                                    |
| Stream flow reduction can be estimated as "% of average annual flow", "%instantaneous flow reduction" or "%baselflow reduction", as appropriate    |                                                                                                                                                                                                                                                                                                                     | Monitor surface water conditions and/or water table fluctuations during pumping test to enable estimation of stream flow reduction                                                                                                                                                                                  | Monitor surface water conditions and/or water table fluctuations during pumping test to enable estimation of stream flow reduction                                                                                                                                                                                  |
|                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                     | Groundwater chemistry - drifter-collected/lab analysed EC sample from any new bores (as per BCL conditions), otherwise EC sample to be collected in accordance with EPA VIC Pub #669 for lab analysis from all bores on site                                                                                        | Groundwater chemistry - at least one sample to be collected in accordance with EPA VIC Pub#669 for lab analysis of major cations and anions, TDS, EC and pH from all bores on site                                                                                                                                  |
|                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                     | Monitoring of EC in all wells during pumping test (data logger preferred)                                                                                                                                                                                                                                           | Monitoring of temp and EC in all wells during pumping test (data logger preferred)                                                                                                                                                                                                                                  |
| Discharge approval may be required from the EPA, other Water Authorities or Catchment Management Authorities                                       |                                                                                                                                                                                                                                                                                                                     | Fate of discharged water and discharge location relative to pumping and obs wells and water bodies                                                                                                                                                                                                                  | Fate of discharged water and discharge location relative to pumping and obs wells and water bodies                                                                                                                                                                                                                  |
| <b>Test Data</b>                                                                                                                                   | Provide raw data from any on site testing conducted                                                                                                                                                                                                                                                                 | All raw data from aquifer testing and monitoring to be provided in graphical form                                                                                                                                                                                                                                   | All raw data from aquifer testing and monitoring to be provided in graphical form                                                                                                                                                                                                                                   |
|                                                                                                                                                    | Any data analysis (eg slug test calculations etc) to be presented using the appropriate methods and fully referenced                                                                                                                                                                                                | All data analysis to be presented. Appropriate methods MUST be used (dependent on the aquifer type, boundary conditions etc) and presented for review                                                                                                                                                               | All data analysis to be presented. Appropriate methods MUST be used (dependent on the aquifer type, boundary conditions etc) and presented for review                                                                                                                                                               |
| <b>Prediction of Drawdown Impacts</b><br>"Likely" and "Worst" case scenarios to be presented for all applications.                                 | Drawdown assessment - simple Theis analysis to be completed using likely T, S values +/- 1 order of magnitude over 1 year, to estimate drawdown impacts/bore interference                                                                                                                                           | Drawdown assessment - simple Theis analysis to be completed using likely T, S values +/- 100% (based on lit & site data) over 1 year/extraction season, to estimate drawdown impacts/bore interference. Numerical modelling may be appropriate for complex cases.                                                   | Drawdown assessment - simple Theis analysis to be completed using site T, S values +/- 50% over 1 year/extraction season to estimate drawdown impacts/bore interference. Numerical modelling may be appropriate for complex cases.                                                                                  |
|                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                     | Use likely T&S values +/- 1 order of magnitude if in fractured rock                                                                                                                                                                                                                                                 | Use site T&S values +/- 1 order of magnitude if in fractured rock                                                                                                                                                                                                                                                   |
| All assessments must include ALL water use on the subject property, including existing extraction licences, as well as any additional applications | "Likely" case should assess the proposed pumping regime (proposed pumping rate for standard extraction period) eg 0.5L/s for 8 hours. "Worst" case should assume entire application volume is extracted in one pumping period at twice the proposed extraction rate                                                 | "Likely" case should assess the proposed pumping regime (proposed pumping rate for standard extraction period) eg 0.5L/s for 8 hours. "Worst" case should assume entire application volume is extracted in one pumping period at twice the proposed extraction rate                                                 | "Likely" case should assess the proposed pumping regime (proposed pumping rate for standard extraction period) eg 0.5L/s for 8 hours. "Worst" case should assume entire application volume is extracted in one pumping period at twice the proposed extraction rate                                                 |
|                                                                                                                                                    | Complete combined drawdown assessment assuming all identified neighbouring bores pumping simultaneously over 1 year/extraction season (current licensing info to be obtained from SRW records via info statement). Use Principle of Superimposition to add individual drawdown impacts from multiple pumping bores. | Complete combined drawdown assessment assuming all identified neighbouring bores pumping simultaneously over 1 year/extraction season (current licensing info to be obtained from SRW records via info statement). Use Principle of Superimposition to add individual drawdown impacts from multiple pumping bores. | Complete combined drawdown assessment assuming all identified neighbouring bores pumping simultaneously over 1 year/extraction season (current licensing info to be obtained from SRW records via info statement). Use Principle of Superimposition to add individual drawdown impacts from multiple pumping bores. |
| <b>Groundwater Quality</b>                                                                                                                         | Identify any risks to gw quality associated with proposed extraction                                                                                                                                                                                                                                                | Identify any risks to gw quality associated with proposed extraction                                                                                                                                                                                                                                                | Identify any risks to gw quality associated with proposed extraction                                                                                                                                                                                                                                                |
|                                                                                                                                                    | Discuss likely salinity/groundwater chemistry and potential impacts on soil, surface water etc                                                                                                                                                                                                                      | Discuss any SOBN or site quality data                                                                                                                                                                                                                                                                               | Discuss any SOBN or site quality data                                                                                                                                                                                                                                                                               |
|                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                     | Discuss likely salinity/groundwater chemistry and potential impacts on soil, surface water etc                                                                                                                                                                                                                      | Discuss likely salinity/groundwater chemistry and potential impacts on soil, surface water etc                                                                                                                                                                                                                      |
| <b>Proposed pumping regime and monitoring</b>                                                                                                      | Proposed pumping regime and monitoring program                                                                                                                                                                                                                                                                      | Proposed pumping regime and monitoring program                                                                                                                                                                                                                                                                      | Proposed pumping regime and monitoring program                                                                                                                                                                                                                                                                      |

### NOTE TO CONSULTANTS:

1. All testing, assessment, data analysis and reporting is to be conducted by appropriately qualified hydrogeologists
2. All pumping tests to be conducted in accordance with AS2368-1990
3. The results of the site-specific assessment must be presented to SRW in a technical report
4. This document provides guidelines only. All assessments should be tailored to the needs and constraints of the specific project. However, the reasons for any deviations from the assessment methodology above must be documented in the hydrogeological assessment report
5. Technical queries should be addressed to Elissa McNamara on 03 9974 4752 or elissam@srw.com.au
6. Submitted hydrogeological reports are in the public domain and may be reviewed by third party hydrogeologists, regulators and groundwater users.
7. All submitted reports should be accompanied by an Executive Summary (3 pages max) suitable for distribution to non-technical stakeholders

# Appendix G. Groundwater trading stocktake – Tasmania

## *Governance and administrative framework*

### **Legislation**

The *Water Management Act 1999* provides the statutory basis for management of groundwater in Tasmania. Section 7 stipulates that all rights for the taking of water from any water resource, including groundwater, are vested in the Crown, except insofar as that right is conferred through other provisions of the Act. The Act confers rights to take water on individuals and authorities through licences and specified unlicensed rights.

An owner or occupier of land may take any volume of groundwater for any purpose without a licence, subject only to a general obligation not to cause material or serious environmental harm (ss. 48, 51), unless:

- a water management plan stipulates that a licence is required (s. 50), or
- a groundwater area is declared (s. 124A) and the order states a licence is required.

In either case the requirement for a licence can apply generally or for specified classes of persons, volumes, purposes or other criteria.

At the time of writing (May 2010) there are no requirements established under either of these mechanisms for the holding of a licence for groundwater, though plans are underway for this to be done for the first time in the near future.

Since 1 September 2009 a Well Works Permit (s. 135) is required for the construction of any well to be used for taking water.

A water licence is an authority to take water from a watercourse, lake or well. Licences are endorsed with water allocations. A Tasmanian water allocation specifies the quantity of water that a licensee is entitled to take and use from a specified water resource. It is a fixed volume that can be taken in any year, and is not varied through seasonal allocation announcements. A water licence may include one or multiple water allocations of different types. A 'blank' licence may be issued, onto which water allocations may be transferred.

Division 4, Part 6 of the Act provides the statutory arrangements for transfers of licences and water allocations. Transfers of licences and water allocations can be permanent ('absolute') or for a limited period (through a lease arrangement for a stated period).

### **Institutional responsibilities**

The Department of Primary Industries, Parks, Water and Environment (DPIPWE) is responsible for administering the Act, including managing licences and permits and development of water management plans.

### **Policies**

DPIPWE has published the document *Guiding Principles for Water Trading in Tasmania*<sup>12</sup>. The document is intended to 'clarify and provide certainty on the Department's position on the interpretation of the relevant provisions of the Act' and 'apply to the assessment of all

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<sup>12</sup> Water Resources Policy #2003/2, *Guiding Principles For Water Trading In Tasmania*, Water Resources Division, Department of Primary Industries, Water and Environment Tasmania, July 2004

applications for transfers of water licences and water allocations under Part 6 of the *Water Management Act 1999*.’ (p 0, 1).

## Groundwater management units

Two statutory mechanisms are available for defining groundwater management units:

1. declared groundwater management areas (s. 124A)
2. groundwater resources specified in a water management plan.

There is complete flexibility in how these management units are defined. At the time of writing no statutory groundwater units are in place under either mechanism.

Recently groundwater conceptual models<sup>13</sup> were developed for each of 19 ‘priority’ groundwater management units in Tasmania to aid in resource assessment for planning and management of groundwater. They cover aquifers considered to be priority areas due to actual or potential demand for water or sensitive GDEs. These management units were defined based on geology. Boundaries are defined in two dimensions spatially and include all aquifers within the spatial boundaries. Aquifers within the unit are differentiated within the models.

The policy document *Guiding Principles for Water Trading in Tasmania* specifies that:

*Trading zones can be established to facilitate trade within and between geographic areas (eg. sub-catchments). Within a trading zone, the exchange rate for transfers is 1.0 and between zones the exchange rate is less than 1.0. That is, a trading zone is the geographical area within which it is assumed that water transfer losses and changes in water surety are negligible.*

There is no mechanism for seasonal water allocation declarations.

## Groundwater licences and entitlements

Water licences, and water allocations stipulated on those licences, are the only legal tradeable groundwater rights.

The Act makes some provision for MAR through its definition of groundwater:

1. water occurring naturally below ground level; or
2. water pumped, diverted or released into a well for storage underground.

Thus there is the theoretical capacity to issue water licences in relation to the taking of water placed in the ground, though it would necessary to exclude this from other licences.

## Unlicensed groundwater rights

Any taking of groundwater is currently unlicensed. Groundwater extraction that will require a licence will be specified in groundwater management area declarations and/or water management plans. Thus any types, purposes etc of extraction not specified will continue to not require a licence.

## Impacting activities outside of the groundwater management framework

None considered significant.

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<sup>13</sup> DPIW 2008, *Development of Models for Tasmanian Groundwater Resources - Conceptual Model Report for Cam-Emu-Blyth*, Prepared for DPIW Tasmania, November 2008, available at DPIPWE website <http://www.dpiw.tas.gov.au/internnsf/WebPages/RPIO-4Y47M4?open> accessed 16 Dec 2009.

## Market regulation

None specific to Tasmania. There is a reliance on the Commonwealth Trade Practices legislation.

## Tradeable rights

### Licences and entitlements

According to the DPIPWE website:

*A water licence specifies where you are allowed to take water. This includes any river, stream, creek or in-stream dam within your property boundary that connects to other watercourses in the catchment [and presumably in the future aquifers]. You must have a water licence to take, trap or store water for the use of watering stock for commercial sale or for crop irrigation.*

*A water allocation states how much water can be taken in a given time period. You must also have a water allocation (specific megalitre limit stated on your licence) if you are intending to draw water from any water body other than an isolated land based dam for commercial farming purposes. Under Section 59 of the Water Management Act 1999, conditions on a water allocation may relate to the area that the water is able to be taken from, the area the water is to be used on, the specific purpose for which the water may be used and/or that the water is only to be taken to fill a specific dam. A water allocation can be obtained through application to the Minister, or by transferring water from another licence. You can hold a water licence without necessarily having a water allocation but you cannot have a water allocation without holding a water licence.*

There are currently no licences on issue for taking of groundwater. Once issued, the licences will have the following attributes (ss. 56, 83):

- is to specify the name and address of the licensee
- may specify the water resource from which the water is to be taken
- may be endorsed with a water allocation or water allocations expressed by specifying the volume of water that may be taken and used or by reference to the purpose for which the water may be taken and used or in any other manner
- may, where the Minister considers it to be appropriate, specify the surety with which a water allocation can be expected to be available for taking
- may specify conditions under which the licensee may take water or the licence or a water allocation of the licence may be transferred
- may specify conditions under which the licensee may undertake well works
- may specify when the Minister may vary the conditions of the licence
- may specify such other conditions and matters as the Minister thinks fit.

Where a licence is endorsed with more than one water allocation, these attributes may apply in respect of each allocation separately.

In addition, a water allocation on a licence may be specified to apply to water:

- (a) taken from, or used on, only a specified area of land; or
- (b) used only for a specified purpose.

Water licences continue until the date specified on the licence. There is no maximum period for this specified in the Act. According to DPIPWE website water licences are issued for a period of 40 years with provision made for reassessment of licence conditions every five years.

Water licences are designated as being personal property, and thus have all the characteristics of property as an asset.

There does not appear to be any restriction on who can hold a licence. While it is customary for a licence to have the location where water is to be taken shown, and therefore for the holder to have demonstrated that they are authorised to use the location, it does not appear to be a requirement of legislation.

Water licences do not totally comply with the specification of a water access entitlement in the NWI. Specifically:

- They are not perpetual.
- They are not a share of the water in a specified consumptive pool (though it is possible that this could be contrived through the provisions of a plan and the use of restriction notices).
- They are able to be used as security, and financial interests in a licence are required to be recorded on the licence register, and have the right of veto on transfer. However they do not have all the legal benefits associated with mortgages over land, such as statutory rights to take possession on default.
- There is no requirement for the holding of any sort of approval for the use of water on land or use of water supply works, thus it is expected that conditions on the licence will relate to how the water is taken and used on land so as to minimise risk of environmental impacts, since there are no alternative mechanisms to address these risks. So, the licence is not unbundled from regulation of use of water.

## Water allocations

Water allocations as defined in the Tasmanian Act do not comply with the NWI definition. They are an ongoing right to a fixed maximum volume that can be taken in any year, rather than the volume of water arising from such a right after annual or seasonal allocation announcements. They are effectively the same as the specified share of the water resource on water access entitlements in other states, and are more analogous to an NWI water access entitlement than an NWI water allocation.

Effectively the volume of water that can be taken in any one year (the equivalent of the NWI water allocation) is 100% of the water allocation, unless reduced by the Minister through a restriction notice under s 92. Thus if a water allocation is transferred for the remainder of the current year only, it is the same effect as an NWI water allocation transfer.

## Other tradable rights

None.

## Entitlement statistics

There are no groundwater licences in Tasmania as at May 2010.

## *Trade-related transactions*

### Types of transactions

1. Absolute transfer of a licence to another person associated with the sale of land (s. 95). This involves simply the change of the name of the holder.
2. Transfer of a licence to another person for use at another location (s. 95). This:
  - can be absolute (permanent) or for a fixed period

- incorporates an application to vary the licence (s. 69) so as to change of location where the water may be taken.
3. Transfer of a water allocation, or part of a water allocation, on a licence to another person (s. 95). This:
    - can be absolute (permanent) or for a fixed period
    - requires the transferee to first hold a licence, onto which the transferred allocation can be endorsed
    - implicitly includes change of location, as the receiving licence is generally at a different location.
  4. A temporary transfer (s. 103), which is the short term movement (max 21 days) of the right to take water from an allocation to a person who does not hold a licence. In this lease arrangement the water entitlement is retained by the seller and a temporary transfer to a person (who does not require a licence) is permitted to overcome a significant water shortage.

## **Market and resource definition**

### **Scope of trading**

Trading can only occur in areas where licences are issued. According to the *Guiding Principles for Water Trading*:

*Trading zones can be established to facilitate trade within and between geographic areas (e.g. sub-catchments). Within a trading zone, the exchange rate for transfers is 1.0 and between zones the exchange rate is less than 1.0. That is, a trading zone is the geographical area within which it is assumed that water transfer losses and changes in water surety are negligible.*

*Within a trading zone, transfers of water allocations will be permitted with an exchange rate of 1.0 (i.e. the transferred water allocation will not be reduced in volume or reliability to address transfer losses) unless specific local circumstances such as the presence of karst or underground flows result in less water being physically available at the post-transfer extraction point.*

### **Establishing physical unit/zone boundaries**

None are defined as yet.

### **Defining consumptive pool/allocatable volumes**

Not currently done.

### **Restrictions on market participants**

With the exception of the short term 'temporary transfers' designed for emergency situations, a person must hold a licence to participate in the market. There does not however appear to be any restrictions on who can hold a licence. While in practice licences to now have always included a location where water is to be taken, and required the holder to have access to that location, it is theoretically possible to have a licence with no location specified, i.e. just a water resource.

### **Levels of trading**

Trading is either allowed or not. There is only one scheme.

## *Trading initiation*

### **Triggers**

It is intended that groundwater trading will be possible immediately groundwater licences and allocations have been issued.

There are no current plans for issue of licences by auction of similar rather than simply by application. Thus while trading is legally possible in under-allocated systems it is unlikely to be used.

### **Prerequisites**

Only the issue of licences. Though there will be no demand for trading until the government determines that no further new licences are to be issued.

### **Initiating groundwater trading in an area**

Trading is automatically available once licences are issued.

## *Transaction processing*

### **Transaction processing steps**

The steps in trading transactions involving change of location (permanent or temporary) are as follows:

- Buyer and seller come into contact and agree on price
- Application form is lodged with DPIPWE, signed by both buyer and seller. Consent of registered financial interests must be included.
- DPIPWE may require the applicant to supply additional information in order to assess the application.
- DPIPWE assesses application, as per ss. 97 and 99 of the Act.
- DPIPWE grants or refuses the application. If granted, conditions may apply or the licence or allocations may be varied in order to address potential impacts. The transaction is effective when granted. Applicants notified of decision with 7 days of decision.
- DPIPWE records any changes to licences / allocations in the register.
- The applicant can request a review of the decision and/or can appeal the decision to the Tasmanian Resource Management Planning and Appeal Tribunal.

### **Transaction impact assessment**

No Departmental procedures for assessing groundwater trades are available. However under the Act the decision to refuse or grant a transfer application is based on the following (s. 97, 98):

- consistent with the objectives of the Act and any relevant water management plan
- whether it could reasonably be expected to lead to material environmental harm or serious environmental harm
- whether it will have a significant adverse impact on other persons taking water from the relevant water resource.

## Fees for transactions

The following fees apply to surface water transfers. No fees for groundwater transfers have been set.

|                                                                                                                             |          |
|-----------------------------------------------------------------------------------------------------------------------------|----------|
| Absolute transfer with sale of land                                                                                         | \$36.17  |
| Upstream transfer within a trading zone                                                                                     | \$130.73 |
| Upstream transfer between a trading zone                                                                                    | \$261.34 |
| Limited period upstream transfer between trading zones (where a similar transfer has been approved and assessed previously) | \$130.73 |
| Downstream transfer                                                                                                         | \$130.73 |

## Trading rules

The document *Guiding Principles for Water Trading in Tasmania* mostly sets out principles to be considered in assessing applications for transfers. It includes one rule:

*Transfers of water allocations will not be permitted where the existing and proposed extraction points are not hydrologically connected.*

Water management plans can set out rules, but there are currently no provisions for groundwater in plans.

## Transaction processing efficiency

No groundwater trades currently occur.

However approval times for surface water trades are reporting as varying widely from a few days to over 6 months<sup>14</sup>.

## Assessments of potential water level changes/drawdowns

In general, DPIPWE will be responsible for assessing the potential impacts of trades on groundwater levels. The full policy and methodology for assessment has not been specifically determined at this stage, but will range from simple desktop analyses to detailed modelling, depending on factors such as the assessed level of risk the use of the groundwater is likely to entail, the aquifer type, the presence of other nearby groundwater users or sensitive environmental values, or the amount of water to be taken, for example.

DPIPWE has the power (s. 86(1)) to direct a proponent to carry out an assessment of the effect of allocating the water.

## Managing impacts of trade

The Well Works Permit system currently uses buffer zones around proposed wells to set minimum distances from other wells and from watercourses. The buffers are 50m and 250m respectively, depending on whether it is a well to be used for stock and domestic or commercial purposes. This would also apply if a new well was being installed following a trade of a groundwater allocation.

DPIPWE may also require the proponent to carry out detailed hydrogeological investigations and/or modelling if the use of the water from a potential trade is considered to be high risk.

<sup>14</sup> National Water Commission, *Australian Water Markets Report 2008-09*

## *Facilitating groundwater trading*

### **Metering**

Metering is almost non-existent for groundwater. However the intention is that all groundwater allocations above a yet to be approved threshold (probably 10ML/annum) will be metered.

### **Access to market information**

DPIPWE website contains general information on licences and trading, water plans and application forms. The Water Information System of Tasmania provides limited information on entitlements and allocations for no charge online.

There is no reporting mechanism for trading activity.

### **Intermediaries**

Generally water trading in Tasmania is limited. There are no arrangements to manage intermediaries.

There is evidence that intermediaries are active.

## *Monitoring and compliance*

### **Monitoring and evaluation**

None.

### **Current trading statistics**

Nil.

### **Enforcement/compliance**

Nil.

## *Acknowledgements*

Ludovic Schmidt, DPIPWE, is acknowledged for his contributions during the consultation phase of this project:

# Appendix H. Groundwater trading stocktake – South Australia

## *Governance and administrative framework*

### **Legislation**

Chapter 7 of the *South Australian Natural Resources Management Act 2004* governs the management and protection of water resources. Along part of the SA/Vic border, groundwater is also managed under the *Groundwater (Border Agreement Act) 1985*, which has higher authority than the *Natural Resources Management Act 2004* (the Act).

The Act provides for the declaration of defined water resources (water courses, surface water, lakes or underground water taken via wells) to be 'prescribed water resources' (s. 125).

The prescription of a water source triggers a series of actions leading to the regulation of water extraction by a licensing regime and the development and implementation of a Water Allocation Plan (WAP). A WAP is prepared by a Natural Resources Management (NRM) board under Chapter 4 Part 2 of the Act and adopted by the Minister consistent with Division 2 (or Schedule 4 of Transitional Provisions). It sets out how the prescribed water resources will be managed. Water licensing (including trading) must be administered in accordance with WAPs.

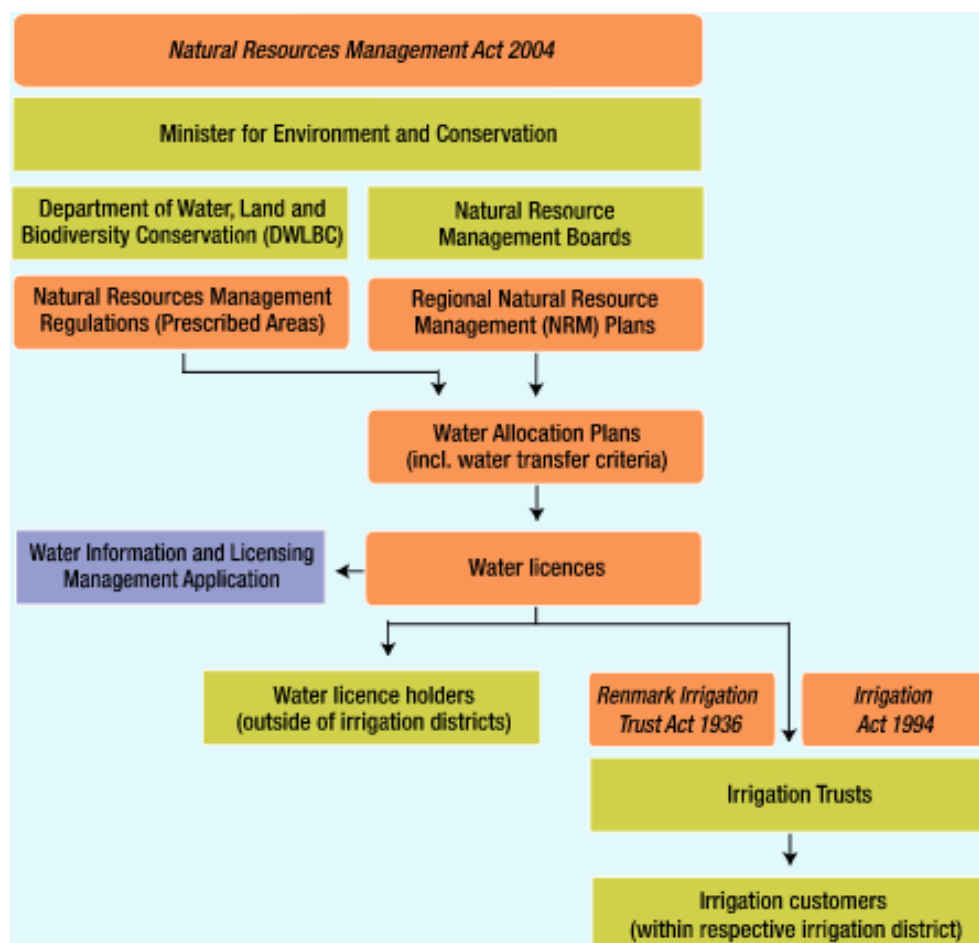
Historically, licenses have been ongoing rights to water in a designated water source with specified works and a purpose based description. Water allocations were normally specified in terms of annual volume and purpose. Under recent legislative amendments South Australia has commenced a phased process of unbundling pre-existing water licences into separate water licences (which incorporate water access entitlements, each of which represents an ongoing share of defined consumptive pool), water allocations, site water use approvals and water resource works approvals. Water access entitlements and water allocations under the new provisions are broadly consistent with the NWI definitions.

At the time of writing most ground water licences in South Australia are still in their old form.

NRM Plans manage some aspects of water interception / extraction via the water affecting activity (WAA) permit policy section. In particular, a WAA permit is required to construct or enlarge a dam or other water diverting structure, to drill a well and in future to plant commercial plantation forestry. NRM Plans apply across whole NRM Board region, and thereby provide some management of these activities in areas that are not prescribed. The controls provided by WAA permits are limited as the permit is only required for the activity of dam or well construction (or forest planting), and so can't directly control the volume taken. However, the permit can:

- Set rules on where a well can be drilled – allows things like buffer zones to avoid interference to GDEs including watercourses that interact with groundwater.
- Set rules on area and location of commercial plantation forestry that recognise impact on runoff and recharge (e.g. determine volumetric equivalent of forest on runoff and recharge, and only allow forest if there is room in the diversion limit).

**Figure 18 Management arrangements for water in South Australia**



Source: NWC website <http://www.nwc.gov.au/www/html/1768-water-markets.asp>

The Act speaks of regulating access to ‘underground water’ through managing the taking of water through wells, where a well is defined as:

- an opening in the ground excavated for the purpose of obtaining access to underground water
- an opening in the ground excavated for some other purpose but that gives access to underground water
- a natural opening in the ground that gives access to underground water.

Trading is enabled through specific provisions allowing for transfer of various types of water entitlements. There are no specific principles guiding water trading in the Act.

Subject to the provisions of the relevant water allocation plan a water licence may be transferred (s. 150) to another person, and a water access entitlement, or part of a water entitlement under the licence, may be transferred to another person.

The transfer can be perpetual or for a limited term, and must be approved by the Minister. Similarly, subject to the provisions of the relevant water allocation plan, a water allocation may be transferred (s. 157).

The Minister may also:

- allow the transfer of a delivery capacity entitlement (if or when they are issued)
- enable inter-state trade by entering into an agreement with the Minister of another State or Territory for the conversion of licences from one jurisdiction to another
- promote the transfer or surrender certain entitlements in the Murray–Darling Basin
- dispose of, through auction, tender or private sale, a licence that was forfeited.

This principle regulatory mechanism for groundwater is management of licences, allocations and approvals for water resource works (principally wells for groundwater) through:

- granting, subject to conditions, or refusing applications for the issue, transfer and variation of these licences and approvals
- determination of annual water allocations to holders of water access entitlements on water licences
- making of WAPs specifying rules that must be complied with in making the above decisions and determinations.

## **Institutional responsibilities**

The main agencies for managing groundwater in South Australia are the Department of Water Land and Biodiversity Conservation (DWLBC) and regional natural resource management (NRM) boards.

DWLBC has responsibility for state policy and administration of water licences, approvals and trading applications.

NRM Boards are responsible for preparing WAPs that are consistent with the State Natural Resources Management Plan (s. 76 NRM Act 2004), with input from DWLBC.

## **Policies**

The State Natural Resource Management Plan sets broad policies for groundwater trading, with implementation occurring through WAPs.

WAPs must 'ensure water trading rules are economically effective while being socially and environmentally responsible.'

The State Natural Resources Management Plan adopts the guidelines from the State Water Plan 2000. The Water Allocation and Management Guidelines (Appendix B of the Plan) includes a rule that 'transfers of water access entitlements between groundwater basins are not supported due to the potential negative social and environmental impacts. However, transport of water between groundwater basins is supported if it is within the ecological limits of the taking and receiving environments.'

In addition to state-wide provisions the Ground Water Border Sharing Arrangement between South Australia and Victoria limits extractions from shared groundwater to permissible annual volumes.

The Plan notes that the single greatest threat to groundwater quality is salinity.

## **Groundwater management units**

Prescribed areas are the primary basis for water planning and management in South Australia.

The boundaries for prescribed areas are set two-dimensionally, and have typically been some combination of catchment and administrative boundaries, but are increasingly based on the former, to coincide with NRM Board regions.

Within the defined boundary of a prescribed water source, an 'order' specifies the waters to which it relates. The prescription may be placed on surface water (i.e. harvesting of runoff), groundwater (bores and wells) or watercourses (stream and rivers) or a combination of types.

Prescribed Water Areas can include vertical zoning (according to aquifer types, such as unconfined or confined aquifers) and lateral zoning (which often reflects variations in water demand/usage). The rules applicable to overlying or adjacent aquifers may differ where circumstances dictate.

Trade within some prescribed areas in the South East is managed partially through rules applied to 'management areas', the boundaries of which often coincide with those of 'Hundreds', which are traditional jurisdictional areas (similar in form to a 'Parish').

Not all groundwater sources have been prescribed and therefore do not have a relevant WAP through which trade is enabled. Trade is therefore not enabled in groundwater sources that are not under management pressure.

Existing prescribed areas incorporating management of underground water, and associated plans are listed in Table 27 and illustrated in Figure 19.

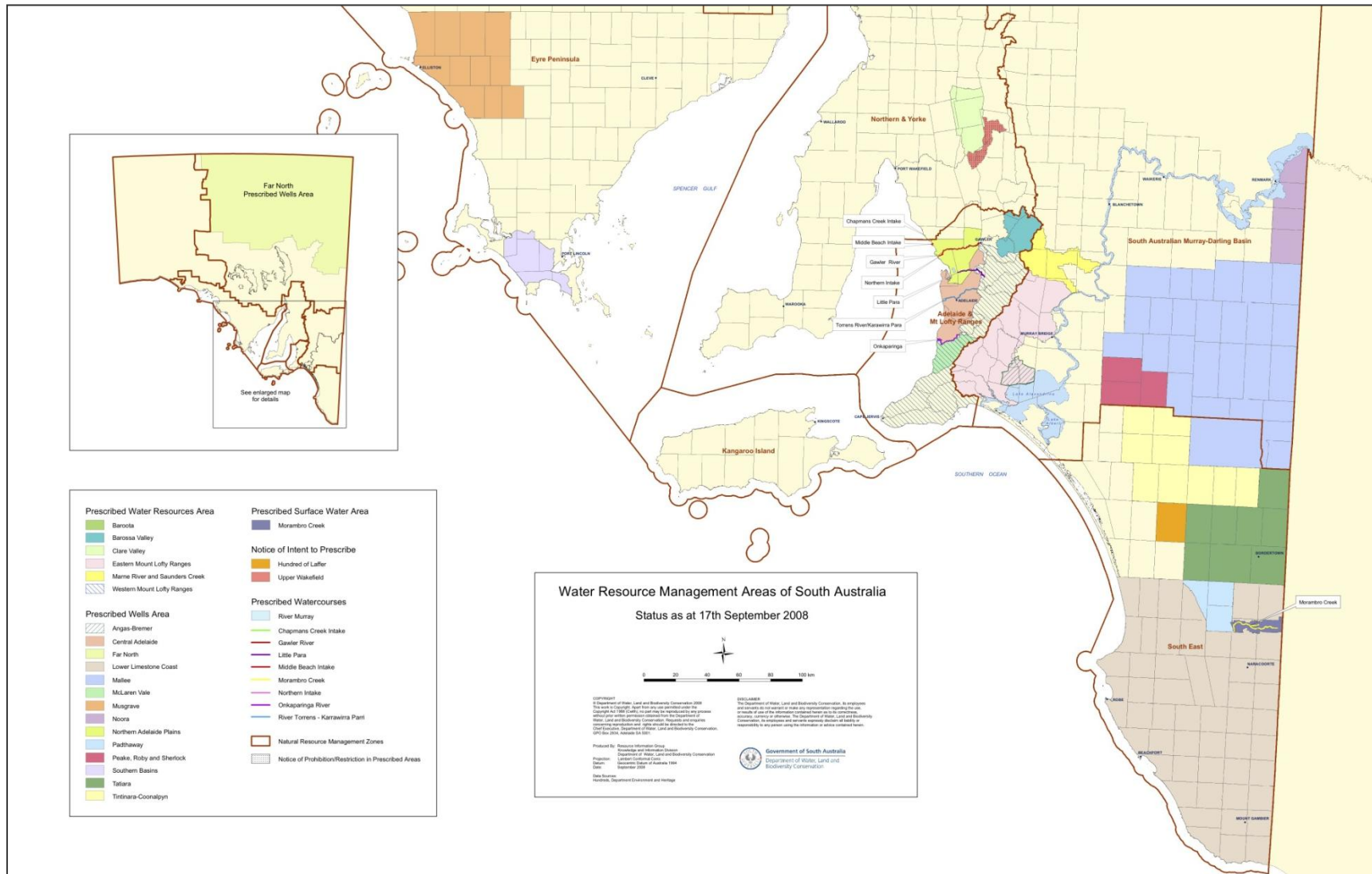
**Table 27 Prescribed areas incorporating underground water in South Australia**

| <b>NRM region</b>            | <b>Prescribed area</b>                         | <b>Resources prescribed</b>                  | <b>WAP in place?</b> |
|------------------------------|------------------------------------------------|----------------------------------------------|----------------------|
| Adelaide and Mt Lofty Ranges | Barossa Prescribed Water Resources Area        | Groundwater<br>Watercourses<br>Surface Water | Yes                  |
|                              | Central Adelaide Prescribed Wells Area         | Groundwater                                  | Under preparation    |
|                              | Dry Creek Prescribed Wells Area                | Groundwater                                  | No                   |
|                              | McLaren Vale Prescribed Wells Area             | Groundwater                                  | Yes                  |
|                              | Northern Adelaide Plains Prescribed Wells Area | Groundwater                                  | Yes                  |
|                              | Western Mount Lofty Ranges                     | Groundwater<br>Watercourses<br>Surface Water | Under preparation    |
| Eyre Peninsula               | Musgrave Prescribed Wells Area                 | Groundwater                                  | Yes                  |
|                              | Southern Basins Prescribed Wells Area          | Groundwater                                  | Yes                  |
| Northern and Yorke           | Baroota Prescribed Water Resources Area        | Groundwater<br>Watercourses<br>Surface Water | No                   |
|                              | Clare Valley Prescribed Water                  | Groundwater                                  | Yes                  |

| <b>NRM region</b>       | <b>Prescribed area</b>                         | <b>Resources prescribed</b>                  | <b>WAP in place?</b> |
|-------------------------|------------------------------------------------|----------------------------------------------|----------------------|
|                         | Resources Area                                 | Watercourses<br>Surface Water                |                      |
| SA Arid Lands           | Far North Prescribed Wells Area                | Groundwater                                  | Yes                  |
| SA Murray-Darling Basin | Angas Bremer Prescribed Wells Area             | Groundwater                                  | Yes                  |
|                         | Mallee Prescribed Wells Area                   | Groundwater                                  | Yes                  |
|                         | Noora Prescribed Wells Area                    | Groundwater                                  | Yes                  |
|                         | Peake, Roby and Sherlock Prescribed Wells Area | Groundwater                                  | Under preparation    |
|                         | Marne Saunders Prescribed Water Resources Area | Groundwater<br>Watercourses<br>Surface Water | Yes                  |
|                         | Eastern Mount Lofty Ranges                     | Groundwater<br>Watercourses<br>Surface Water | Under preparation    |
| South East              | Padthaway Prescribed Wells Area                | Groundwater                                  | Yes                  |
|                         | Tatiara Prescribed Wells Area                  | Groundwater                                  | Yes                  |
|                         | Tintinara Coonalpyn Prescribed Wells Area      | Groundwater                                  | Yes                  |
|                         | Lower Limestone Coast Prescribed Wells Area    | Groundwater                                  | Yes                  |

Source: DWLBC 2010

**Figure 19 Prescribed areas in South Australia**



Source: DWLBC website: [http://www.dwlbc.sa.gov.au/assets/files/groundwater\\_resource\\_map.pdf](http://www.dwlbc.sa.gov.au/assets/files/groundwater_resource_map.pdf)

## Designated water resources

Each water access entitlement relates to (i.e. is a share of) a specified consumptive pool, where a consumptive pool means the water that will from time to time be taken to constitute the resource within a particular part of a prescribed water resource defined in a WAP. These defined consumptive pools are thus 'designated water resources'. There can be one or more consumptive pools in a prescribed water resource, but they are all defined in the relevant WAP. Water allocation determinations are made for each consumptive pool and for each class of water access entitlements in that pool. They apply uniformly to all water access entitlements of the class in the specified consumptive pool.

## Groundwater licences and entitlements

Under current arrangements, a groundwater licence authorises a licence holder to 'take' or trade an allocation or to 'hold' and trade a water allocation. The more general 'take' licence caters for the:

- Works (bores) and their locations permitted to be used in taking water;
- Volumetric or area-based allocation, and
- Use of the groundwater for a particular purpose (such as irrigation)

The licence must specify the basis on which the water access entitlement is to apply (s. 148(b)) and the licence takes effect from the time of registration in the Water Register.

On the declaration of a water source a licence holder may apply for a water access entitlement to meet their reasonable requirements. This establishes the primary distribution of tradeable entitlements.

Under the new licensing system currently being phased in, there are:

- Water Access Entitlements – the ongoing right to a specified share of the water resource, expressed on a water licence.
- Water Allocations – the right to take a specific volume of water for a given period of time, not exceeding 12 months, based on the volume of water available for allocation in that period. It can be obtained as a result of a Water Access Entitlement, water allocation carry over, water allocation trade or an interstate water entitlements trading scheme.
- Water delivery capacity entitlements – the right to receive a specific volume of water where the ability to deliver water is limited.
- Water Resource Works Approval – the permission to construct, operate and maintain works for the purpose of taking water from a prescribed resource at a particular location and in a particular manner.
- Site Use Approval – the permission to use water, taken from a prescribed resource at a particular site and in a particular manner.

The first two of these are tradeable property rights; the last two are non-tradeable approvals or permissions.

The Minister determines the volume of water that can be made available for allocation to each class of water access entitlement in each prescribed water resource.

To take and use water a person must hold a water resource works approval, a site use approval and a water allocation relating to the consumptive pool where the water is to be taken.

Managed aquifer recharge is allowed. A licence or permit is needed to drain water into a well (for the injection component of the ASR project). Currently the type of approval required depends on the catchment area for the source water to be drained into the well. In order to recover the water that has been injected into the aquifer, a 'recharge allocation' is also required. The recharge allocation is issued as a groundwater licence from the Department for Water, Land and Biodiversity Conservation. The volume of recharge water allocated is a percentage (up to 100%) of the water that was injected in the previous year (1 July–30 June). Depending on the individual WAP, unused recharge allocations can be carried over for use in following years, but transfer of recharge allocations is only allowed under the McLaren Vale WAP.

## Unlicensed groundwater rights

Outside of prescribed areas and within prescribed areas that do not prescribe underground water, groundwater may lawfully be taken without a licence.

Within prescribed underground water areas, under s 124 (4) of the Act an occupier of land may take water from a well on their land for domestic or stock purposes, though this right can be removed for any prescribed area by regulation.

Unlicensed domestic and stock bores are not metered.

## Impacting activities outside of the groundwater management framework

Certain 'water affecting activities' which include new plantation forestry, mining and urban expansion must meet water requirements from within the applicable consumptive pool. In Prescribed Water Areas where licensed allocation can no longer be granted, this may mean having to purchase existing groundwater allocation. However, these licences or approvals may require more complex definition to take account of different levels of interference over time and their relationship with groundwater resources, recharge and run-off.

## Market regulation

The *Water Act 2007* (Cwth) makes the Australian Competition and Consumer Commission responsible for providing the Minister for Climate Change and Water with advice on water market rules and water charge rules, monitoring and enforcing those rules, and providing advice to the Murray–Darling Basin Authority on water trading rules for use in the Basin Plan

Water brokers undertake a commercial activity that is covered by the provisions of the *Trade Practices Act 1974*. The Act requires that brokers (and businesses in general) do not engage in false or misleading conduct, make false or misleading claims, accept payment in the knowledge they cannot deliver the contracted goods or services, or engage in unconscionable, harassing or coercive conduct. The Commission has produced guides to assist irrigators, brokers and other market participants in these matters. These include (<http://www.accc.gov.au/content/index.phtml/itemId/862697>):

- Water trading – an overview of your fair trading rights when using brokers and exchanges.
- Water brokers and exchanges – your fair trading obligations.
- Water trading – a guide to your fair trading rights when using brokers and exchanges.

These guides relate general laws concerning fiduciary duties and good ethical practices to water trading in particular. They are not limited to application in water trading.

## *Tradeable rights*

### **Licences and entitlements**

Under current arrangements, a groundwater licence authorises a licence holder to take or to hold water allocation, and caters for:

- the works (bores) and their locations
- volumetric or area-based allocation
- the purpose, or the use of the groundwater (such as irrigation).

With no separation of licensed 'entitlements' from 'annual allocations', groundwater trading is limited to transfer of licences to other parties upon sale of land to which a licence applies, and the administrative transfer (cancellation of the sellers' licence component and creation of the buyers licence component) of allocation volume (for annual or longer periods, including permanent).

In the proposed unbundled situation, a water licence is the 'container' for water access entitlements. As described earlier, they are unbundled from approvals for works and use of water on land. A water licence specifies:

- name of holder and contact details
- the water resource
- the date of issue and expiry (if relevant)
- history of transactions on the licence
- whole of licence temporary transfers, including:
  - the person to whom the licence will return at the end of the transfer period;
  - the reversion date
- Water Access Entitlements:
  - number of unit shares
  - from which consumptive pool
  - which class of licence
- temporary transfers of water access entitlements including:
  - the person/licence from which the WAE comes from and will revert to
  - number of unit shares and their class
  - date of return of any temporarily transferred entitlements
- conditions – some classes of entitlements may have specific conditions, for example the class of entitlements relating to Environmental Land Management Allocations will specify that allocations arising from these entitlements can only be used on specified land at a specified rate.

Water licences are generally issued in perpetuity, although they may be issued for a fixed period. They can be cancelled by the Minister for failure to pay fees or comply with conditions. Cancelled licences may be redistributed by the Minister using market mechanisms (auction, tender or private agreement) where appropriate.

Water licences can be held by any legal entity, and are classed as personal property. Water access entitlements generally comply with the specification of a water access entitlement in the NWI.

### **Water allocations**

Groundwater allocations are not separated from licences.

In the proposed unbundled situation, water allocations may arise from water allocation determinations for consumptive pools. They are issued to the holders of water access entitlements. Every share on a water access entitlement within a specific class is entitled to obtain an equal share of the volume made available for allocation to that class and the holder of the water licence will obtain their respective share as a water allocation. This is then entered on each person's water account as a volume of water.

Water allocations, once created, are property-independent of the water access entitlement from which they arose. That is, once issued, water allocations are not discriminated by the class of the water access entitlement from which they arose - they are just a volume of water that can be taken from the specified water resource. However they expire if not used by the end of the allocation period (i.e. the water year).

To take and use water a person must hold a water resource works approval, a site use approval and a water allocation relating to the consumptive pool where the water is to be taken.

## Other tradeable rights

There are currently no other tradeable rights to groundwater. Some types of water licences (such as delivery rights or water interference activities) are enabled under the Act but have not yet been issued.

## Entitlement statistics

| PWA / PWRA                   | Licensed 'entitlement' volume (ML) |
|------------------------------|------------------------------------|
| Barossa PWRA                 | 7,147                              |
| McLaren Vale PWA             | 7,715                              |
| Northern Adelaide Plains PWA | 27,516                             |
| Musgrave PWA                 | 2,325                              |
| Southern Basins PWA          | 8,887                              |
| Baroota PWRA PWA             | n/a                                |
| Clare Valley PWRA            | 3,050                              |
| Far North PWA                | 12,841                             |
| Angas Bremer PWA             | 11,817                             |
| Mallee PWA                   | 2,023                              |
| Noora PWA                    | 2,144                              |
| Marne Saunders PWRA          | n/a                                |
| Padthaway PWA                | 86,709                             |
| Tatiara PWA                  | 192,648                            |
| Tintinara Coonapyn PWA       | 81,036                             |
| Lower Limestone Coast PWA    | 755,035                            |

Source: NWC 2009 and individual WAPs

Note: In the SE region (Padthaway, Tatiara, Tintinara-Coonapyn, Lower Limestone Coast PWAs), entitlement volumes include those to arise from volumetric conversions, but do not include possible volumes arising from licensing of plantation forestry water interception.

## *Trade-related transactions*

### **Types of transactions**

Under the current bundled licence situation, with no separation of licensed ‘entitlements’ from ‘annual allocations’, groundwater trading involves the transfer of licence ownership. This may occur through a change in the ownership or control of the land to which the licence applies. Alternatively, with no transfer of land, the seller’s licence may be cancelled and an equivalent licence established for the buyer at a different location.

The transfer can be absolute (through a permanent cancellation) or for a limited period (through a temporary suspension). In the case of a suspension the effect is equivalent to the transfer out of annual allocations accruing to the licence during the period of the transfer.

Where a licence is separated into a distinct water access entitlement and separate allocations, the ownership of the entitlement may change without reference to particular works or approvals and the ownership of allocations may change without reference to the entitlement from which the allocations were derived.

In executing a water licence or water access entitlement transfer, the Minister can vary the conditions of the water access entitlement.

### **Transaction processing**

Applications for transfers of water licences or water allocations are accepted and processed by DWLBC. They are not normally advertised, however, under the McLaren Vale WAP advertising of transfer applications is required.

Technical assessments are undertaken by the proponent, relevant NRM Board officers and/or the Department.

In considering the granting or refusal of an application to transfer a water entitlement, water allocation or water delivery capacity the Minister is required to take into consideration matters specified in the relevant WAP as well as other, more general, factors such as the public interest and the risk of affecting third parties..

### **Market and resource definition**

#### **Scope of trading**

Groundwater trading can only occur within, and not between, individual Prescribed Water Areas. Subject to WAP rules, trading may be further limited to within individual zones (or Hundreds), or to only one direction between zones.

Zones are commonly established to reflect parameters such as groundwater demand and groundwater quality. WAP rules often prevent trading to:

- zones of greater demand or drawdown stress
- zones of lower groundwater salinity
- defined distances from other bores, or from GDEs.

#### **Establishing physical unit/zone boundaries**

WAP boundaries are generally based either on catchments, or on boundaries of groupings of ‘Hundreds’ that have been selected to represent particular groundwater flow systems or areas of significant groundwater demand.

Internal zone boundaries frequently reflect local parameters such as groundwater demand and groundwater quality, and vertical changes from unconfined to confined groundwater flow. In the south-east region, individual 'management areas' within PWAs often correspond with individual 'Hundreds', and may extend across PWA boundaries.

## **Defining consumptive pool – allocation volumes**

A WAP must include an assessment of the water required by the environment and an assessment of whether the taking or use of water from the resource will have a detrimental effect on the quality or quantity of water that is available from any other water resource. It must also determine or provide a mechanism for determining, from time to time, a consumptive pool or pools and set out principles for determining water access entitlements and for the taking and use of water (so that an equitable balance is achieved between environmental, social and economic needs for the water and the rate of taking and use of water is sustainable). In doing this the present and future needs of the occupiers of land, and the effect on the value of the land must be considered, as well as the capacity of the resource to meet those needs on a continuing basis, and the need for monitoring.

## **Restrictions on market participants**

Generally there are no constraints, although the Minister can refuse applications for transfer to persons who have breached the Act or not paid fees.

## **Levels of trading**

There are no different levels implemented or envisioned in the legislation. However, in practice, on the conversion of water districts to trusts, the Trusts (and now NRM Boards) became responsible for trade within their areas of operation.

### ***Trading initiation***

#### **Triggers**

There are no specific triggers for groundwater trading, apart from development of a WAP, which itself is triggered by management need.

Provision has been made for auctioning groundwater. No cross-PWA trading has occurred nor is envisaged.

#### **Prerequisites**

Trading can occur with allocations quantified either volumetrically (in ML) or by irrigated areas (in ha). Metering is required where volumetric allocations are to be traded between licences.

## **Initiating groundwater trading in an area**

Trading is initiated through commencement of a WAP.

### ***Transaction processing***

#### **Transaction impact assessment**

Transfers are required to be consistent with the relevant WAP. Matters to be considered mainly relate to groundwater level drawdown and include:

- impacts on other groundwater users

- impacts on groundwater quality
- impacts on GDE's (including baseflow to streams)
- potential changes to aquifer status, from confined to unconfined.

## Fees for transactions

A fee of \$349 is charged for a transfer in ownership where there is no movement in location of the associated extraction point.

A fee of \$583 is charged for the movement of a point of extraction. A further \$154 is charged for the required assessment.

## Trading rules

In granting or refusing the transfer of either a licence (s.150) or an allocation (s. 157) the Minister's decision must be consistent with the relevant water access plan, must be made in the public interest, must be consistent with the Murray–Darling Basin Agreement (where relevant) and be consistent with (if any) prescribed regulations.

In making those decisions the Minister may vary the entitlement and any conditions to ensure consistency with relevant plans and agreements. This includes situations where the location of the water to be taken moves and may in the future impact on other water users by exceeding the availability of water, or there is a change in evaporation losses.

Rules are specified in individual WAPs, and generally aim to:

- prevent detrimental effects on the ability of other persons to taking groundwater
- prevent detrimental impacts on GDEs.

Various types of rules are used to achieve the above aims, including those that:

- ensure new points of taking meet particular distance criteria from other bores or GDEs, including meeting the requirements of the '16 km<sup>2</sup> circle test' (which sets drawdown limits at a 2.25 km radius from the proposed point of groundwater extraction)
- prevent increased extraction in stressed areas (as defined by recent drawdown, or by zoning e.g. trading may only occur into other zones or management areas if it will not result in over-allocation)
- prevent increased extraction in zoned areas of lower salinity (to prevent continual migration to the low salinity zone, and maintain groundwater levels and quality in the low salinity zone)
- prevent increased extraction in areas that may cause an aquifer status to change from confined to unconfined.

The only example of transfer rules for unbundled entitlements in a WAP are those in the River Murray WAP, which do not apply to groundwater transfers. These rules are few:

- Water access entitlements from the River Murray consumptive pool may be transferred to another person where it remains of the same class for which it was issued. The exception is that entitlements of classes 3a and 3b, may be converted from one to the other upon a transfer and class 6 water access entitlements may not be transferred.

- Except for water allocations obtained on account of a class 6 water access entitlement, water allocations may be transferred to another person.
- Water allocations obtained on account of a class 8 entitlement may be transferred but remain subject to the conditions set out in principles 33, 34 and 35 (relating to use of the water in a particular area). Water allocations obtained on account of a class 9 entitlement may be transferred but remain subject to the conditions set out in Section 5.3 (only to be used for the benefit of wetlands).

## Transaction processing efficiency

Service standards are set at:<sup>15</sup>

- Intra-state allocation trades – 90% within 10 business days
- Inter-state allocation trade – 90% within 20 business days
- River Murray Only - Intra and Inter-State entitlement trade to approval – 90% within 20 business days
- River Murray Only - Intra and Inter-State entitlement trade to registration – 90% within 10 business days.

For non River Murray entitlement trades DWLBC aims to make approvals within 20 days unless technical assessment is required, in which case the target is 30 days.

## Stamp duty

The transfer of a water licence or part of a water access entitlement is not chargeable with duty (see s. 150(17) of the Act).

## Assessments of potential water level changes/drawdowns

Assessment is undertaken by DWLBC. Methods may vary according to the situation, and for transfers that are not prohibited by the WAP rules, assessment options may include:

- evaluating resultant allocation intensity (e.g. as ML/ha) using GIS methods
- subjective judgement on drawdown and salinity in the context of the intent of the WAP rules, and using the Theis equation to predict potential drawdown impacts.

Assessment is undertaken on the assumption of users in the assessed area extracting full licensed volume.

DWLBC is occasionally faced with enquiries on 'allowable' volume for trade following refusal of a particular transfer application. In such cases, DWLBC will advise of an acceptable volume if possible.

<sup>15</sup> <http://e-nrims.dwlbc.sa.gov.au/wtr/ProcessingTimes.aspx> as at 20 June 2010

## *Managing impacts of trade*

### **System-wide drawdown effects**

Total extraction is kept to required levels as per specified 'safe yield' estimates or other extraction limits, and groundwater levels and quality are monitored. Trading is not allowed between PWAs.

Both extraction and ground water-affecting land uses are potentially assessed for system wide impacts.

In the South East, where drawdown risks are identified there is no trade allowed into the management area (typically a Hundred) that is jeopardised.

### **Local drawdown effects**

Various types of rules are used to prevent or minimise local drawdown effects, including those that:

- ensure new points of taking meet particular distance criteria from other bores or GDEs
- prevent increased extraction in stressed areas (as defined by recent drawdown, or by zoning)
- prevent increased extraction in zoned areas of lower salinity (to prevent continual migration to the low salinity zone, and maintain groundwater levels and quality in the low salinity zone)
- prevent increased extraction in areas that may cause an aquifer status to change from confined to unconfined.

### **Effects of use of water on land**

Information provided on an application form includes, for both the transferor and transferee:

- recent (less than one year old) salinity sampling from each well;
- crop type, crop area, and volume for each well;
- the location – section number, allotment number, Hundred, and plan number;
- a map of the transferees property including the area to be irrigated, irrigation main lines, location of buildings, location of irrigation water sources (storages/wells), and proposed meter locations.

### **Effects of movement of economic activity**

WAP's can include minimum levels of allocations to maintain critical social and economic conditions.

## Facilitating groundwater trading

### Metering

Metering is required for all bores in PWAs, except for those bores that are limited to stock and domestic use. A parallel National Water Commission project is considering groundwater metering policy issues.

### Access to market information

The Department's web site provides information on water trading activity, service standards, WAPs, and application forms.

A water trade reporting web site (<http://e-nrims.dwlbc.sa.gov.au/wtr>) lists every approved trade in the current year and historical summaries since 2000–01. The information is updated daily. The information provided includes the date of transfer, the term, the quantity (volumetric or other), the allocation type (taking or holding), the return date (for temporary and term transfers) and the cost of the trade (although virtually no trades provided declared prices).

Secure trade applications forms specific to each PWRA but covering both surface and groundwater are available at <http://www.dwlbc.sa.gov.au/licensing/forms/index.html>.

### Intermediaries

Intermediaries operate as unregulated private entities. They include a wide range of businesses including land brokers, lawyers, water brokers and water trading exchanges. Intermediaries are subject to the same codes of conduct as other businesses under the *Trade Practices Act 1974*.

## Monitoring and compliance

### Monitoring and evaluation

The Department's web site includes water trading statistics and reports on compliance with administrative service standards.

### Recent trading statistics 2008–09

| PWA / PWRA                   | No. of annual allocation trades | Annual allocation trade volume (ML) | No. of entitlement trades | Entitlement trade volume (ML) |
|------------------------------|---------------------------------|-------------------------------------|---------------------------|-------------------------------|
| Barossa PWRA                 | 6                               | 49                                  | 3                         | 21                            |
| McLaren Vale PWA             | 22                              | 161                                 | 3                         | 19                            |
| Northern Adelaide Plains PWA | 33                              | 1052                                | 13                        | 295                           |
| Musgrave PWA                 |                                 |                                     |                           |                               |
| Southern Basins PWA          | 1                               | 3                                   |                           |                               |
| Baroota PWRA PWA             |                                 |                                     |                           |                               |

|                           |    |      |    |      |
|---------------------------|----|------|----|------|
| Clare Valley PWRA         |    |      |    |      |
| Far North PWA             | 2  | 2044 | 2  | 47   |
| Angas Bremer PWA          | 39 | 1450 | 2  | 100  |
| Mallee PWA                | 1  | 55   | 6  | 142  |
| Noora PWA                 |    |      |    |      |
| Marne Saunders PWRA       |    |      |    |      |
| Padthaway PWA             | 4  | 708  | 5  | 1643 |
| Tatiara PWA               | 3  | 14   | 1  | 8    |
| Tintinara Coonalpyn PWA   | 7  | 2153 | 5  | 79   |
| Lower Limestone Coast PWA | 1  | 87   | 11 | 1323 |

Source: NWC 2009

## Enforcement/compliance

There is no requirement to declare all associated interests held in water entitlements nor process for monitoring those positions.

Compliance actions for breaches in fiduciary duties and other trade practices by intermediaries and other participants in water trade is dependent on complaints by consumers.

## References

National Water Commission 2009, *Australian Water Markets Report 2008–2009*, NWC, Canberra

## Acknowledgements

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# Appendix I. Groundwater trading stocktake – Western Australia

## Governance and administrative framework

### Legislation

The *Rights in Water and Irrigation Act 1914* (RIWI Act) currently provides the framework for water management in Western Australia. The Act is less prescriptive and detailed in relation to water entitlements and their management than the legislation in most other states. The Western Australian government intends to replace the Act with a new Water Resources Management Act that will more closely reflect the requirements of the National Water Initiative. The new Act will result in major changes to water entitlements, and how they are specified and managed.

The RIWI Act vests the right to use, flow and control of water in ‘any watercourse, wetlands or underground water source’ in the Crown (s. 5A). The Crown then may confer the rights on other entities through licences, permits or other unlicensed rights. A regime for regulation of conferred rights is set out which provides for rules and processes for their issue, trading and adjustment. Powers to enforce compliance with water entitlements, rights and obligations are provided. The principal regulatory mechanisms for groundwater are s. 5C take licences, and s. 26D well construction licences.

Both a s. 5C licence to ‘take’ groundwater, and a s. 26D licence to construct (deepen, alter, etc) a well are required in any artesian groundwater area, or for non-artesian groundwater that is in an area that is proclaimed or prescribed, unless:

- the well is constructed in and/or water taken from a non-artesian groundwater area for domestic and stock (and other limited) purposes only
- the taking of such water is permitted by way of exemption by an Order under s. 26C, or through a local by-laws made by the Minister under s. 26L of the Act
- the taking of such water is permitted by another written law (e.g. Commonwealth legislation).

Water can be taken, and wells constructed, in other (non-prescribed or proclaimed) non-artesian groundwater areas without a s. 5C or s. 26D licence. The prescribed areas in WA are shown in Figure 20.

Licences to take water usually specify the conditions, length of tenure, and the volume of water that may be taken. This volume is referred to as the ‘water entitlement’.

Clause 29 of Schedule 1 to the *Rights in Water and Irrigation Act 1914* allows water entitlements to be permanently relinquished to another person who is eligible to hold a water licence, under section 5C, as a means for reallocating the water in a fully allocated area.

Clause 30 allows for the temporary movement of water entitlements, by providing that a licensee may enter into an agreement allowing a third party to take water under the licence for a limited period of time<sup>16</sup>.

Permanent trades between existing licence holders are achieved via amendments to the ‘entitlements’ associated with both licences. For a trade to a new licence holder, a new

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<sup>16</sup> <http://www.water.wa.gov.au/PublicationStore/first/92868.pdf>, p.4

licence must be granted and the transferors licence 'entitlement' amended. 'Agreements' must be between existing licence holders, and again require amendments to both licences.

'Under the RIWI Act, 'the department must assess all applications to trade, transfer or form an agreement to allow another person to take the water. All trades, transfers or agreements require the approval of the department. Before determining these applications, the department may, under Clause 33 of Schedule 1 of the *Rights in Water and Irrigation Act 1914*, direct the applicant to produce an assessment of the impacts of granting the application.'<sup>17</sup>

The Act itself contains general objects that the Minister (and other persons to the extent that they have relevant functions) are to 'seek to ensure ... are achieved'. These include:

- (a) *to provide for the management of water resources, and in particular —*
  - i. *for their sustainable use and development to meet the needs of current and future users; and*
  - ii. *for the protection of their ecosystems and the environment in which water resources are situated, including by the regulation of activities detrimental*
- (b) *to promote the orderly, equitable and efficient use of water resources;*
- (c) *to foster consultation with members of local communities in the local administration of this Part, and to enable them to participate in that administration; and*
- (d) *to assist the integration of the management of water resources with the management of other natural resources.*

In deciding an application, including for a trade, the Minister must have regard to whether the proposed taking and use of water (Schedule 1, cl.7):

- (a) *are in the public interest;*
- (b) *are ecologically sustainable;*
- (c) *are environmentally acceptable;*
- (d) *may prejudice other current and future needs for water;*
- (e) *would, in the opinion of the Minister, have a detrimental effect on another person;*
- (f) *could be provided for by another source;*
- (g) *are in keeping with —*
  - i. *local practices;*
  - ii. *a relevant local by-law;*
  - iii. *a plan approved under Part III Division 3D Subdivision 2; or*
  - iv. *relevant previous decisions of the Minister;*
- or*
- (h) *are consistent with —*
  - i. *land use planning instruments;*
  - ii. *the requirements and policies of other government agencies; or*
  - iii. *any intergovernmental agreement or arrangement.*

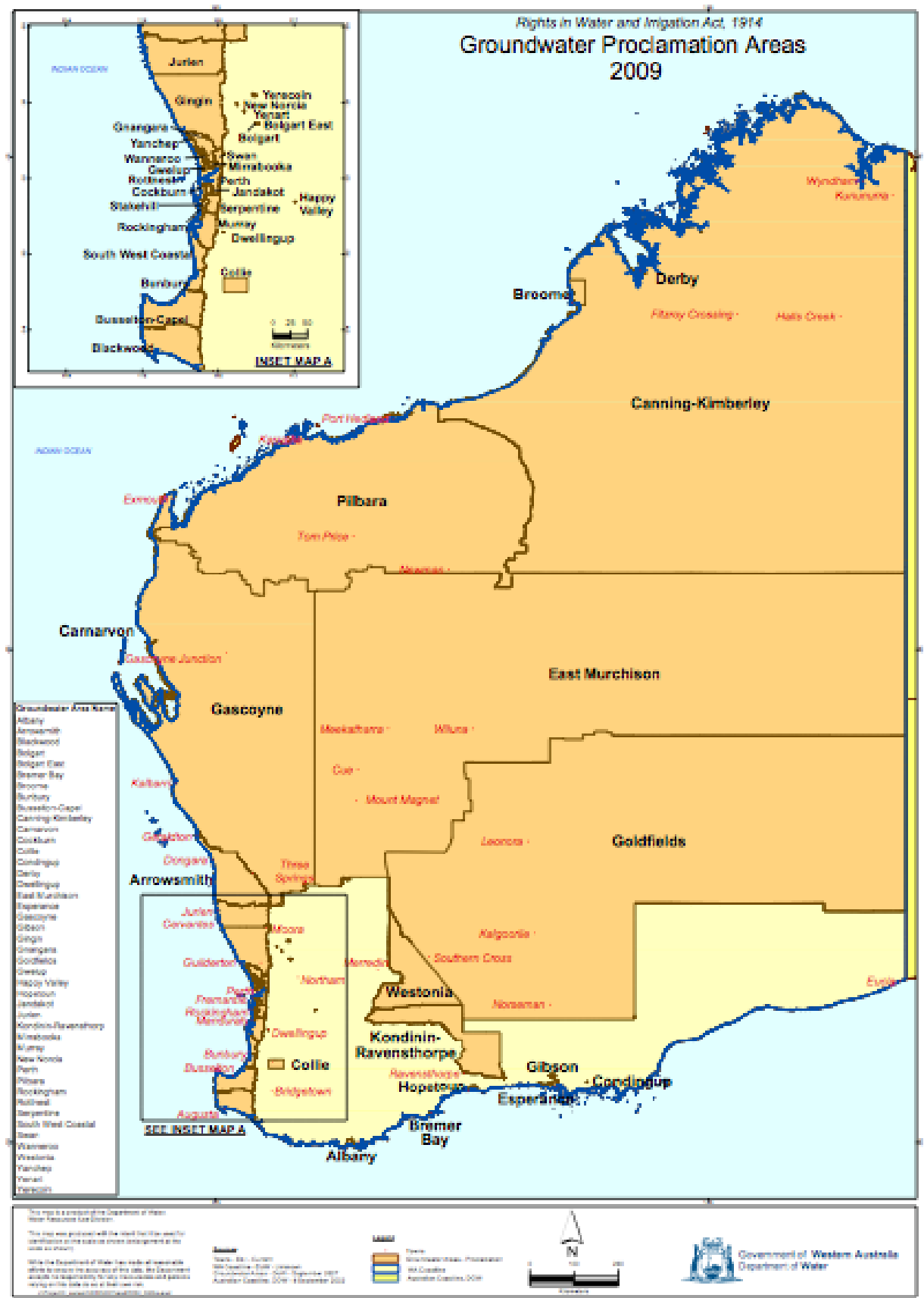
The Act also enables Statutory Plans (and local by-laws) to include 'matters that are to guide the management by the Minister...' of water resources in the sub-region to which a sub-regional management plan applies, including 'applications for the Minister's approval of transfers of licences and water entitlements, and of agreements, made under Division 7' of Schedule 1 to the Act. Note that none of the current water allocation plans in WA are

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<sup>17</sup> Ibid, p.5

'statutory' plans under the Act. The non-statutory plans do, however, a form of 'government policy' with which decisions under the Act should be, and generally are, consistent.

**Figure 20** WA groundwater areas proclaimed under the Act



## Institutional responsibilities

The main agency for managing groundwater in Western Australia is the Department of Water, responsible for discharging the specific water resource management powers and functions set out in the RIWI Act. Broadly, DoW has responsibility for state water policy, and state and regional water strategies, for developing water allocation plans, and for administering groundwater licensing, trading, monitoring and compliance.

## Policies

Trading in WA is governed by the provisions of the RIWI Act (as outlined above), and is further guided by the provisions of (non-statutory) Water Allocation Plans, and by *Operational policy 5.13: Water entitlement transactions for Western Australia, 2010*<sup>18</sup>. Briefly, this policy 'provides guidance to Department of Water officers when processing proposals to transact water entitlements and informs water users of their responsibilities. Major issues detailed in this document include the rules for transacting water entitlements such as'. It includes:

- Eligibility – An eligible transferee must have legal access to the land from which the water is to be taken. Special measures can be put in place if the subject land is in the process of changing ownership.
- Which water entitlements can be transacted – Licence exempt uses cannot be traded (fire fighting purposes; watering cattle or other stock, other than those being raised under intensive conditions; domestic garden and lawn irrigation (not exceeding 0.2 ha); short term dewatering activities taking small volumes of groundwater from the water table aquifer). In addition, licences or entitlements cannot be traded or subjected to agreement if:
  - the water licence has expired
  - there are any outstanding fees associated with the licence
  - the water entitlement (or part of) that has not been regularly utilised and/or is not likely to be utilised in the future (except where this unused water has resulted from water savings measures)
  - the unused water entitlement that is part of a staged development and the purchaser is not continuing with the original intent of the total development
  - the licence has been granted with conditions that restrict it from being transacted (e.g. licence for dewatering). These licences are granted only to that particular licensee.
- Other prerequisites – To be traded a water entitlement must be specified as a volume or shares in an allocation limit. Accurate measurement of use is a pre-requisite for water transactions. This will usually involve the use of a calibrated cumulative flow meter (exceptions include small volume transactions <5ML). Both the vendor and purchaser are to have accurate measurement of water use, in accordance with the department's policy on measurement of use (Strategic policy 5.03 Metering the taking of water, Department of Water 2009). Normally several years of metered water use data should be provided in support of an application to transact water.
- Where transactions can occur – Transactions are restricted to within a WRMU and within a groundwater sub-area and aquifer.
- Tenure of trades – The licence associated with a permanent trade will be valid for the remainder of the permanently traded entitlement. Temporary trades (agreements) are generally for a year or more, with special arrangements required for transaction of less than a year.
- Matters for consideration – In addition to grounds provided by the statutory matters for consideration outlined in the previous section, the department may refuse water entitlement transactions in order to:

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<sup>18</sup> <http://www.water.wa.gov.au/PublicationStore/first/92868.pdf>

- protect the environment and other users from unacceptable impacts
- ensure that outcomes continue to be beneficial to the state
- prevent non-efficient uses and monopolies in water
- meet policy objectives
- protect the water market from distortion.
- How speculation and market manipulation issues are addressed – The policy discourages speculation by:
  - scrutinising any transaction that will result in a single licensee gaining access to more than 50 per cent of the total water availability in a WRMU.
  - allowing for recouping and re-allocation unused water entitlements. Recouping may occur: Upon the application to transact water; upon the expiry of a development condition; when a licence is cancelled; upon renewal of a licence, or; following a departmental survey of use in an area. The re-allocation of any water recouped will be at the discretion of the department consistent with approved policy.
- Transaction between industry sectors – The policy allows transactions between sectors.
- Security interests - Where a person is noted on the (s. 26GZI) register as having a security interest (as defined in Part III Division 3E) in a licence, the Minister must not approve the transfer of the licence or the water entitlement under the licence, or of an 'agreement', without the written consent of that person.
- Brokering and information disclosure – The Department will not stand as a broker, and the policy encourages ethical behaviour of private brokers. General pricing information is available to the public upon request to the Department. General information on licences and entitlements is made available on request to the Department. The release of information will be in accordance with Department's policies and legislative requirements. Licensing data is also subject to the requirements of the Freedom of Information Act 1982.
- How the Department of Water will assess trade applications - Applications must be made in the prescribed form (available on the Department's website), and will be assessed in accordance with the objectives of water management in s. 4(1) of the RIWI Act and specific matters for consideration including those set out in clause 7(2) of Schedule 1 to the Act and s. 35(2) of the Rights in Water and Irrigation Regulations 2000. Upon application for a transaction the Department undertakes a preliminary review, and notifies the applicant of further information requirements. Information requirements/applicant assessment requirements generally increase with increasing volume of trade, the level of commitment of the resource, level of knowledge of the resource, and risk to other uses and environmental values.
- The role of water allocation plans - Transactions must be consistent with any department-approved plan for managing the water resources and environmental water provisions that apply to the water resource management unit (WRMU) in question. Plans (and/or by-laws) may specify area-specific trading rules (consistent with the state-wide policy and the Act). Water entitlement transactions generally operate where groundwater WRMU's allocation limits are established and all available water has been allocated. The policy sounds a precautionary note regarding the potential for allocation limits to change into the future based on a reassessment of environmentally sustainable levels of extraction.

## Groundwater management units

The principal management unit for groundwater in WA is the Water Resource Management Unit (WRMU). In theory, WRMU areas are based on hydrogeological units. In practice, however, the larger WRMUs have been proclaimed based on a combination of hydrogeology and administrative boundaries. These WRMUs are often subdivided into smaller sub-areas which, are more closely aligned to the hydrogeology. These in turn are further subdivided into individual layered aquifers, for which allocation limits are set. In some cases, contiguous aquifers (hydrogeological units) span sub-areas, particularly if the unit covers a large area, such as the confined Yarragadee aquifer. While the broader WRMUs are proclaimed

statutorily, the sub-areas and aquifers are established (at this stage non-statutory) via water allocation plans.

The groundwater WRMUs of WA are shown in Figure 21, and the WRMUs for which allocation plans are in place are shown in Figure 22. The allocation category (C1-C4) represents an increasing level of allocation compared with the allocation limits for the unit. The management response category (R1-R4) represents the current level of management response. If the R value is less than the C value, the current level of management is considered inadequate. This system is a 'first-pass' indication of allocation status.

Figure 21 Groundwater WRMUs of WA

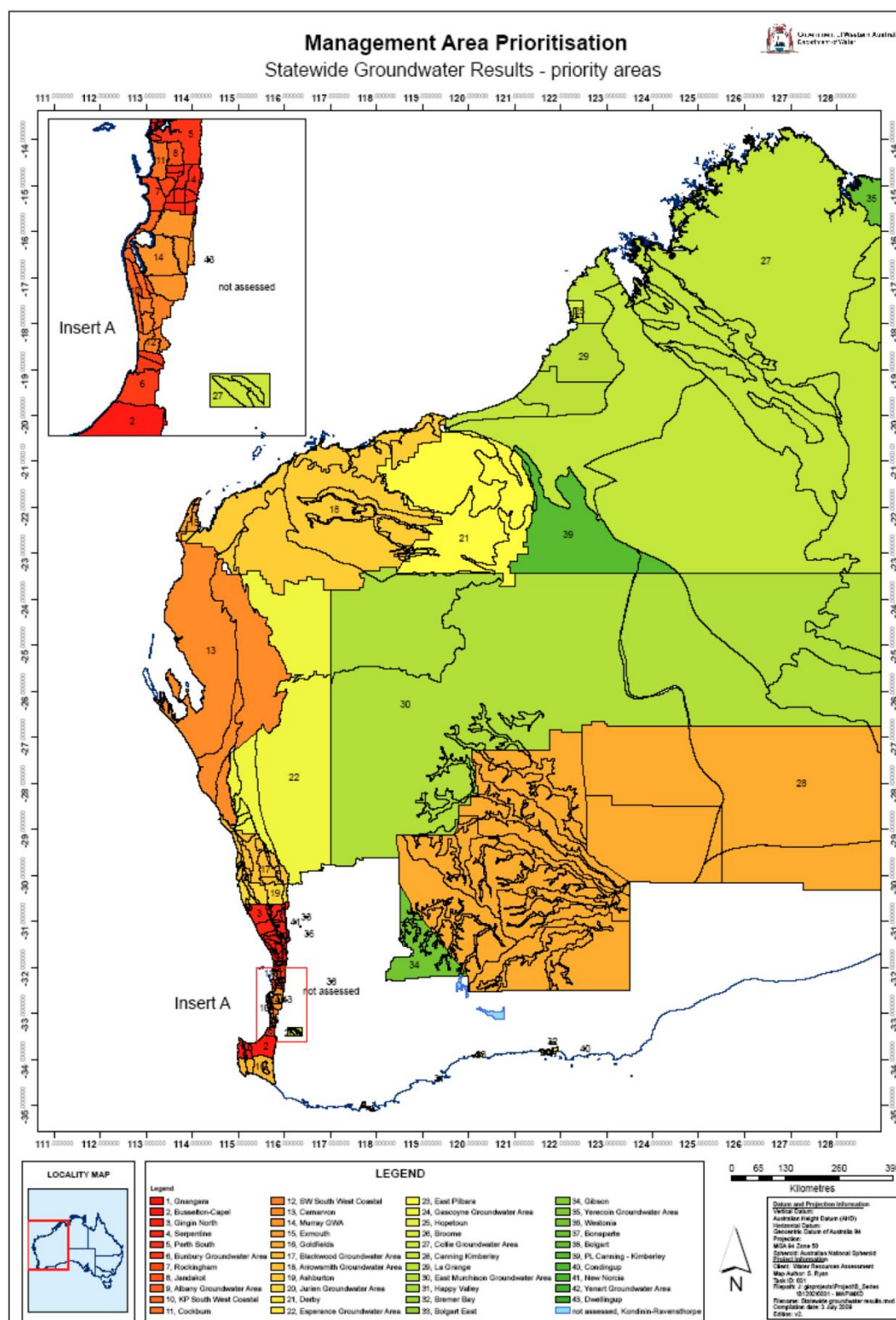


Figure 22 WA groundwater allocation plan areas

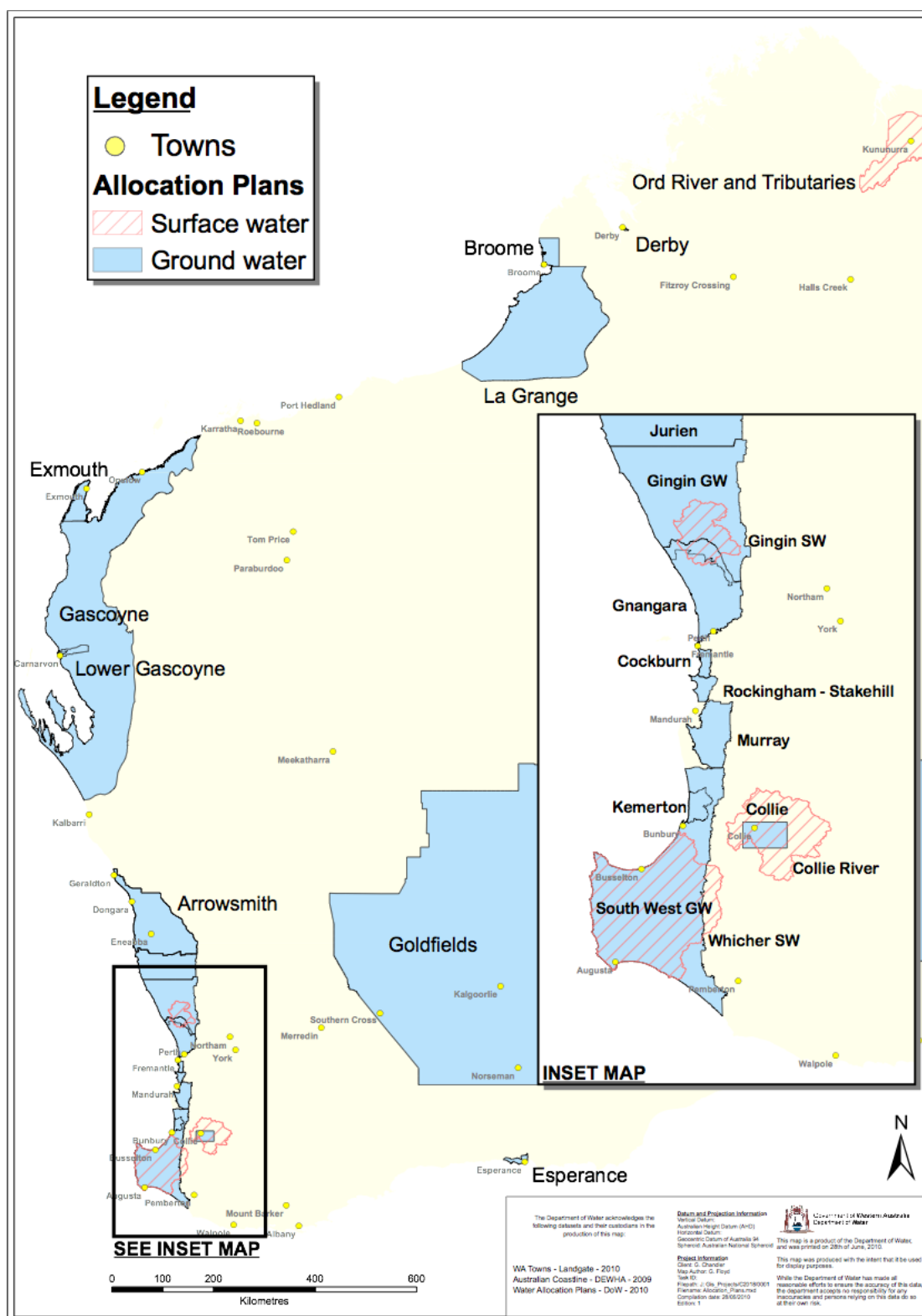


**Table 28 Administrative regions, groundwater areas and sub-areas in WA - allocation, management and plan status**

| Region  | Management Unit or Groundwater Area (no. sub-areas /no separate allocation limits for stacked aquifers) | Use <sup>19</sup> | Class | Response | Plan                                                                       | Allocation limits last updated (if no plan) | Historical plans/date for management area |
|---------|---------------------------------------------------------------------------------------------------------|-------------------|-------|----------|----------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------|
|         | La Grange (2/2)                                                                                         | 12%               | C1    | R2       | La Grange WAP, 2010                                                        |                                             |                                           |
|         | Canning-Kimberley                                                                                       | 18%               | C1    | R1       |                                                                            | Allocation Limits reviewed 2005-06          |                                           |
|         | Derby                                                                                                   | 35%               | C2    | R1       |                                                                            | Allocation Limits reviewed 2006             |                                           |
| Pilbara | Pilbara - Ashburton Groundwater Subarea                                                                 | 61%               | C2    | R1       |                                                                            | Allocation Limits reviewed 2005             |                                           |
|         | Pilbara - East Pilbara Groundwater Subarea                                                              | 65%               | C2    | R1       |                                                                            | Allocation Limits reviewed 2005             |                                           |
| Midwest | Carnarvon (1/2)                                                                                         | 96%               | C4    | R3       | Groundwater Management Strategy: Managing the Groundwater Resources of the |                                             |                                           |

<sup>19</sup> Note that 'use' is not actual use, but entitlements granted.

| Region            | Management Unit or Groundwater Area (no. sub-areas /no separate allocation limits for stacked aquifers) | Use <sup>19</sup> | Class | Response | Plan                                         | Allocation limits last updated (if no plan) | Historical plans/date for management area                                                                                                                                       |
|-------------------|---------------------------------------------------------------------------------------------------------|-------------------|-------|----------|----------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gascoyne          |                                                                                                         |                   |       |          | Lower Gascoyne River (Carnarvon), 2004       |                                             |                                                                                                                                                                                 |
|                   | East Murchison                                                                                          | 21%               | C1    |          |                                              |                                             |                                                                                                                                                                                 |
|                   | Gascoyne (2)                                                                                            | 17%               | C1    | R2       | CAB GW 2007/Exmouth GW 1999                  |                                             |                                                                                                                                                                                 |
| North Perth Basin |                                                                                                         |                   |       |          | Arrowsmith GW (North Perth Basin draft 2009) |                                             | Managing the water resources of the Arrowsmith Groundwater Area - Interim sub-regional allocation plan/ <b>2002</b><br>Arrowsmith Groundwater Area Management Plan/ <b>1995</b> |
|                   | Arrowsmith (8/35)                                                                                       | 27%               | C2    | R2       |                                              |                                             |                                                                                                                                                                                 |
|                   | Gingin (22)                                                                                             | 39%               | C2    | R2       | Gingin GW (North Perth Basin draft 2009)     |                                             | Managing the water resources of the Gingin Groundwater Area - Interim sub-regional allocation plan/ <b>2002</b><br>Gingin Groundwater Area Management Plan/ <b>1993</b>         |

| Region     | Management Unit or Groundwater Area (no. sub-areas /no separate allocation limits for stacked aquifers) | Use <sup>19</sup> | Class | Response | Plan                                         | Allocation limits last updated (if no plan) | Historical plans/date for management area                                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------|-------------------|-------|----------|----------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Jurien (5)                                                                                              | 20%               | C1    | R2       | Jurien GW (North Perth Basin draft 2009)     |                                             | Managing the water resources of the Jurien Groundwater Area - Interim sub-regional allocation plan/ <b>2002</b><br>Jurien Groundwater Area Management Plan/ <b>1995</b> |
|            | New Norcia                                                                                              | 36%               | C3    | R2       | New Norcia GW (North Perth Basin draft 2009) |                                             |                                                                                                                                                                         |
| Goldfields | Bolgart                                                                                                 | 0%                | C2    |          |                                              |                                             |                                                                                                                                                                         |
|            | Bolgart East                                                                                            | 133%              | C1    |          |                                              |                                             |                                                                                                                                                                         |
|            | Goldfields                                                                                              | 26%               | C1    |          |                                              |                                             |                                                                                                                                                                         |
|            | Happy Valley                                                                                            | 43%               | C2    |          |                                              |                                             |                                                                                                                                                                         |
|            | Yenart                                                                                                  | 65%               | C2    |          |                                              |                                             |                                                                                                                                                                         |
|            | Yerecoin                                                                                                | 43%               | C3    |          |                                              |                                             |                                                                                                                                                                         |
| Swan Avon  | Gingin (6)                                                                                              | 101%              | C2    | R3       | Gnangara GW 2009                             |                                             |                                                                                                                                                                         |
|            | Gnangara (4)                                                                                            | 98%               | C4    | R3       | Gnangara GW 2009                             |                                             |                                                                                                                                                                         |

| Region                | Management Unit or Groundwater Area (no. sub-areas /no separate allocation limits for stacked aquifers) | Use <sup>19</sup> | Class | Response | Plan               | Allocation limits last updated (if no plan)           | Historical plans/date for management area                                  |
|-----------------------|---------------------------------------------------------------------------------------------------------|-------------------|-------|----------|--------------------|-------------------------------------------------------|----------------------------------------------------------------------------|
|                       | Gwelup (2)                                                                                              | 115%              | C4    | R3       | Gnangara GW 2009   |                                                       |                                                                            |
|                       | Jandakot                                                                                                | 73%               | C3    | R1       |                    | Allocation Limits for Perth GWA (South) reviewed 2005 | Jandakot Groundwater Schemes Stage 2 Public Environmental Review Vol 1 & 2 |
|                       | Mirrabooka (14)                                                                                         | 82%               | C3    | R3       | Gnangara GW 2009   |                                                       |                                                                            |
|                       | Perth (23)                                                                                              | 78%               | C3    | R3       | Gnangara GW 2009   |                                                       |                                                                            |
|                       | Swan (16)                                                                                               | 113%              | C4    | R3       | Gnangara GW 2009   |                                                       | Swan groundwater allocation plan/ <b>1997</b>                              |
|                       | Wanneroo (12)                                                                                           | 118%              | C4    | R3       | Gnangara GW 2009   |                                                       | Wanneroo groundwater allocation plan/ <b>1993</b>                          |
|                       | Yanchep (3)                                                                                             | 22%               | C1    | R3       | Gnangara GW 2009   |                                                       |                                                                            |
| Kwinana Peel - Harvey | Cockburn (4)                                                                                            | 84%               | C3    | R2       | Cockburn GW 2007   |                                                       | Cockburn Groundwater Allocation Plan/ <b>1993</b>                          |
|                       | Dwellingup                                                                                              | 15%               | C1    |          |                    |                                                       |                                                                            |
|                       | Murray (4/15)                                                                                           | 18%               | C1    | R1       |                    |                                                       | Murray groundwater allocation plan/ <b>1993</b>                            |
|                       | Rockingham (11)                                                                                         | 64%               | C2    | R2       | Rockingham GW 2008 |                                                       |                                                                            |
|                       | Serpentine                                                                                              | 32%               | C2    |          |                    |                                                       |                                                                            |

| Region      | Management Unit or Groundwater Area (no. sub-areas /no separate allocation limits for stacked aquifers) | Use <sup>19</sup> | Class | Response | Plan                                                     | Allocation limits last updated (if no plan) | Historical plans/date for management area                     |
|-------------|---------------------------------------------------------------------------------------------------------|-------------------|-------|----------|----------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------|
|             | South West Coastal (5)                                                                                  | 45%               | C2    | R2       | Kemerton groundwater subareas water management plan 2007 | Allocation Limits reviewed 2005             |                                                               |
|             | Stakehill                                                                                               |                   | C3    |          |                                                          |                                             |                                                               |
| South West  | Blackwood (23)                                                                                          | 44%               | C2    | R3       | South West GW 2009                                       |                                             |                                                               |
|             | Bunbury (13)                                                                                            | 75%               | C3    | R3       | South West GW 2009                                       |                                             | Bunbury Groundwater Area Management Plan/ <b>1993</b>         |
|             | Busselton-Capel (20)                                                                                    | 86%               | C3    | R3       | South West GW 2009                                       |                                             | Busselton-Capel Groundwater Area Management Plan/ <b>1995</b> |
|             | Collie (2)                                                                                              | 310%              | C4    | R4       | Collie SW/GW 2009                                        |                                             |                                                               |
|             | South West Coastal (9)                                                                                  | 2%                | C1    | R3       | South West GW 2009                                       |                                             |                                                               |
| South Coast | Albany                                                                                                  | 115%              | C4    |          |                                                          |                                             |                                                               |
|             | Bremer Bay                                                                                              | 59%               | C3    |          |                                                          |                                             |                                                               |
|             | Condingup                                                                                               | 29%               | C2    |          |                                                          |                                             |                                                               |
|             | Esperance (4)                                                                                           | 42%               | C2    | R2       | Esperance GWA 2007                                       |                                             |                                                               |

| Region | Management Unit or Groundwater Area (no. sub-areas /no separate allocation limits for stacked aquifers) | Use <sup>19</sup> | Class | Response | Plan | Allocation limits last updated (if no plan) | Historical plans/date for management area |
|--------|---------------------------------------------------------------------------------------------------------|-------------------|-------|----------|------|---------------------------------------------|-------------------------------------------|
|        | Gibson                                                                                                  | 33%               | C3    |          |      |                                             |                                           |
|        | Hopetoun                                                                                                | 82%               | C3    |          |      |                                             |                                           |
|        | Kondinin-Ravensthorpe                                                                                   | 11%               | C1    |          |      |                                             |                                           |
|        | Westonia                                                                                                | 13%               | C2    | R1       |      | Allocation Limits reviewed 2005             |                                           |

Individual aquifers within groundwater sub-areas and WRMUs most closely resemble the NWI 'designated water resources'. In all cases, 'allocation limits' are set for each of the 'stacked' aquifers in a sub-area and WRMU. Trades between these designated water resources may or may not be permitted by the relevant Plan.

There are no 'seasonal water allocations' applied. WA systems are managed as high reliability systems within the allocation limits, so this is not at this stage seen as necessary.

## Groundwater licences and entitlements and MAR

As discussed, there are two licences required to extract groundwater – a section S.5C 'take' licence, and a S.26D licence to construct and use a 'work'. These may be contained within the same instrument. An 'entitlement' in relation to a [5C] licence, means 'the quantity of water that the licensee is entitled to take under the licence, and includes part of a water entitlement'. In effect, the rights to take water from a specified work or works, and use it for a specified purpose are bundled up in these licences.

Suitable managed aquifer recharge (MAR) activities are encouraged in WA and the Water Corporation is currently undertaking trials. Their management is guided by *Strategic policy 1.01 — Managed aquifer recharge in Western Australia* (Draft for public comment, Oct 2009)<sup>20</sup>:

*'Under the Rights in Water and Irrigation Act, water that is infiltrated or injected into the natural groundwater system is vested in the Crown. Proponents of MAR schemes have the same rights as other licence holders and must apply for a licence [5C and 26D] to extract water. However, the department wishes to encourage higher value uses of water, and will consider applications for abstraction of recharge water favourably through the normal licensing process under the Act, provided that departmental requirements are met. Abstraction will be allowed only when recharge water is available and water quality requirements are met.*

- The permanent transfer of water entitlements granted for MAR schemes will not be allowed; however, the operator of the MAR scheme may lease the allocation to a third party. The parties must reach an agreement to take water under the existing 5C licence, ensuring that recharge will continue for the period of the agreement.*
- The impacts of abstraction should be offset by the impacts of recharging the aquifer. Recharge and recovery operations must therefore take place within the same groundwater system (in some cases, this may cover more than one groundwater management area). If recharge and recovery are to take place in different groundwater systems, they will be treated as separate operations, not MAR. In these cases, applications for abstraction will be assessed through the normal licensing process.*
- The abstraction volume should be less than or equal to the recharge volume. The department will assign appropriate recovery figures based upon estimates from the hydrogeological assessment. There may be cases where additional groundwater can be abstracted without unacceptable impacts; however, proponents will be required to demonstrate the sustainability of any additional abstraction.*
- The department will support banking or storage of the recharge water within the aquifer over a short period, provided that the proponent demonstrates that the water will be available for use when required, and the impacts of abstraction will be acceptable. The period of banking of the recharge water that will be allowed will be determined by the department on a case-by-case basis, based on hydrogeological assessment and groundwater modelling undertaken by the proponent.'*

The allocation limit for a WRMU is not amended to reflect MAR recharge and recovery volumes. MAR volumes are recorded separately to allow transparency and simplify administration. MAR volumes may be reported in allocation plans, where appropriate.

<sup>20</sup> <http://www.water.wa.gov.au/PublicationStore/first/89851.pdf>

## Unlicensed groundwater rights and impacting activities outside of the groundwater management framework

Exemptions to licensing requirements have been outlined in the 'legislation' section above.

## Impacting activities outside of the groundwater management framework

Other than stock and domestic use, activities outside the regulatory regime are limited to plantation forestry and other land use changes. Mining, oil and gas and geothermal activities are generally captured under the legislation (dewatering licences, take licences if required), and are in any event generally occurring in areas where there is little competition for groundwater resources and therefore demand for a trading market. Plantation forestry is being proposed in areas of higher competition for groundwater. A licensing policy has been developed to manage the impact of interception on the consumptive pool (or available groundwater resource) where there is a need to do so. Mechanisms exist in the Act to manage stock and domestic groundwater use, and a detailed policy on this has been developed (Strategic Policy 2.03 – Managing unlicensed groundwater use<sup>21</sup>, 2009).

## Market regulation

There are no powers in the WA legislation to regulate the operation of the trading market (e.g. behaviour of market intermediaries, price manipulation etc).

## *Tradeable rights*

## Licences and entitlements

A s. 5C licence entitles the holder to take and use water subject to the conditions of the licence. The licence may be granted or renewed for a fixed period; or an indefinite duration, as stated in the licence or the renewal. In general, licences are granted/renewed for 10 years. As a matter of policy, there are no 'indefinite period' licences. However, the Act provide for these to remain in force until terminated because the licence holder becomes 'ineligible' to hold a licence (for example if they no longer have legal access to the land), is suspended or cancelled for various reasons outline in clause 25 of Schedule 1 to the Act (including an inconsistency between the exercise of the licence and the operation of an approved plan), or is surrendered under clause 27 (cl. 24, Sch 1).

A s.5C licence states the licensee name, the annual water entitlement, a description of the water resource (the groundwater area and aquifer name, or the surface water area and river name to which the licence relates), the location of the water source where the water will be taken, the authorised activities (including the location and purpose) for which water may be taken, the duration of the licence, licence conditions, the existence of any agreements where relevant (undertaken under clause 30 of schedule 1 to the RIWI Act ) and the instrument (licence) number. The licence links to a proclaimed groundwater area, an aquifer name and a specified lot number (location).

Conditions may be imposed when a licence is granted, and modified when it is renewed or transferred. The Minister may also amend a licence at any time to vary the duration of a licence, or vary, add to or remove any term, condition or restriction included in the licence, or include any new term, condition or restriction in the licence. Such an action can be taken at any time, and for any number of reasons (cl. 24(2) of Sch. 1), including to give effect to a trade, or if:

*b) in the opinion of the Minister, the exercise of the power is necessary or desirable —*

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<sup>21</sup> <http://www.water.wa.gov.au/PublicationStore/first/88666.pdf>

- (i) *due to the detrimental effect of actions authorised by the licence on another person;*
- (ii) *to protect the water resource to which the licence relates from unacceptable damage; or*
- (iii) *to protect the associated environment from unacceptable damage;*
- d) *in the opinion of the Minister, the quantity of water that may be taken under the licence has consistently not been taken;*
- e) *in the opinion of the Minister, the exercise of the power is necessary or desirable —*
  - (i) *in the public interest;*
  - (ii) *because the water resource to which the licence relates is insufficient to meet demand or expected demand; or*
  - (iii) *otherwise to more effectively regulate the use of that water resource;*
- f) *in the opinion of the Minister, the exercise of the power is necessary to prevent a serious inconsistency arising as a result of —*
  - (i) *the approval of a plan, or the alteration, revocation or substitution of a plan, under Part III Division 3D Subdivision 2; or*
  - (ii) *the making, amendment or repeal of relevant local by-laws;*

Except in certain circumstances, the Minister must notify a licence holder before taking action to alter a licence, and the licence holder must be given an opportunity to make a written submission to which the Minister must have regard prior to making a final decision.

The Appendix to Schedule 1 of the Act outlines the ‘matters to which licence terms, conditions or restrictions may relate’. These powers are quite broad, and include any conditions or restrictions relating to:

- the use, management, protection and enhancement of any water resource and its ecosystem, or the environment in which the water resource is situated
- the amendment, renewal or surrender of a licence (as above)
- transfers of licences or entitlements, and agreements, including any prohibition or restriction on any such
- the removal, construction, alteration, maintenance or operation of works, structures and equipment
- the monitoring of any water resource and its ecosystem, or the environment in which the water resource is situated
- the provision of information to the Commission.

A s. 5C licence is issued to a person or persons, and so does not transfer automatically if the land with which the licence is associated is transferred. In practice, and under the trading policy, and also under *Operation policy 5.05: Giving an undertaking to grant a licence or a permit*, ‘if the purchaser has met all the legal and the department’s criteria for holding a licence, the department can undertake to agree to approve the water transaction once the property is purchased’. The legal requirements include those required for the ‘granting’ of a new licence. The licence does not automatically transfer, and new conditions or (entitlement) volumes may be applied commensurate with the proposed use of the land and water, and any other policies and plans in place at the time of the application. The exception to this rule is in the event of the death of the licence holder. If a licence holder dies, the Department may retain the licence for a certain period, generally one year, to allow the executor of the estate to apply to transfer the licence to the family, but again that transfer is not automatic.

Section 5C take licences do not strictly comply with the specification of a water access entitlement in the NWI. Specifically:

- They are not perpetual (cl. 28).
- They are not a share of the water in a specified consumptive pool (though licences are

linked to a spatial location corresponding to a 'water resource' or 'source' which in turn has a global allocation 'limit'. Conditions can also in theory be placed on licences allowing for annual allocations to be imposed, although the Department has not yet considered this as a management option.

- A 'use it or lose it' policy applies, and 'like' licences in a water source can be treated differently.
- They are bundled with approvals regulating the use of water (cl. 30).
- They are not mortgageable (cl. 31).

The chief executive officer (of the department) must keep a register of instruments (including licences), which must set out the following details (s. 26GZJ):

- the nature of the instrument and the provision or provisions of this Act under which it has effect
- the period for which it is in force
- the name and business address in the case of a licence under section 5C, of the person who for the time being holds the licence
- a description of the water resource to which the instrument relates, including the locality in which, and a legal description of the land on which, it is situated
- in the case of a licence, details relating to any security interest in the licence that the CEO is required to note on the register under section 26GZM
- details of any conviction of a person for an offence against this Act
- where relevant, the volume of water that may be taken under the licence
- details of an 'agreement' approved in relation to the licence (including name and address of person with whom agreement is made, and term of agreement)
- whether the licence is currently subject to an undertaking by the Minister to approve a transfer or agreement, but that this has not yet been approved.

## Water allocations and other tradable rights

The entitlement on groundwater licences is a fixed annual maximum volume. Water allocations (under the NWI definition) do not exist as entitlements separate to licences. No conditions apply allowing the DoW to determine an annual water allocation less than 100% of the specified annual maximum volume. Some Plans specify a reduction in 'take' in response to water level triggers. However, to affect this reduction, DoW amends individual licences if the water level trigger is met. In practice, only major licences (e.g. urban water licences) are affected.

In effect, water allocations can be wholly or partially transferred to another person and location for a fixed period via 'agreements' under the Act.

There are no other tradable rights relevant to groundwater in WA

## Entitlement statistics

Data not obtained.

## *Trade-related transactions*

### Types of transactions and transaction processing

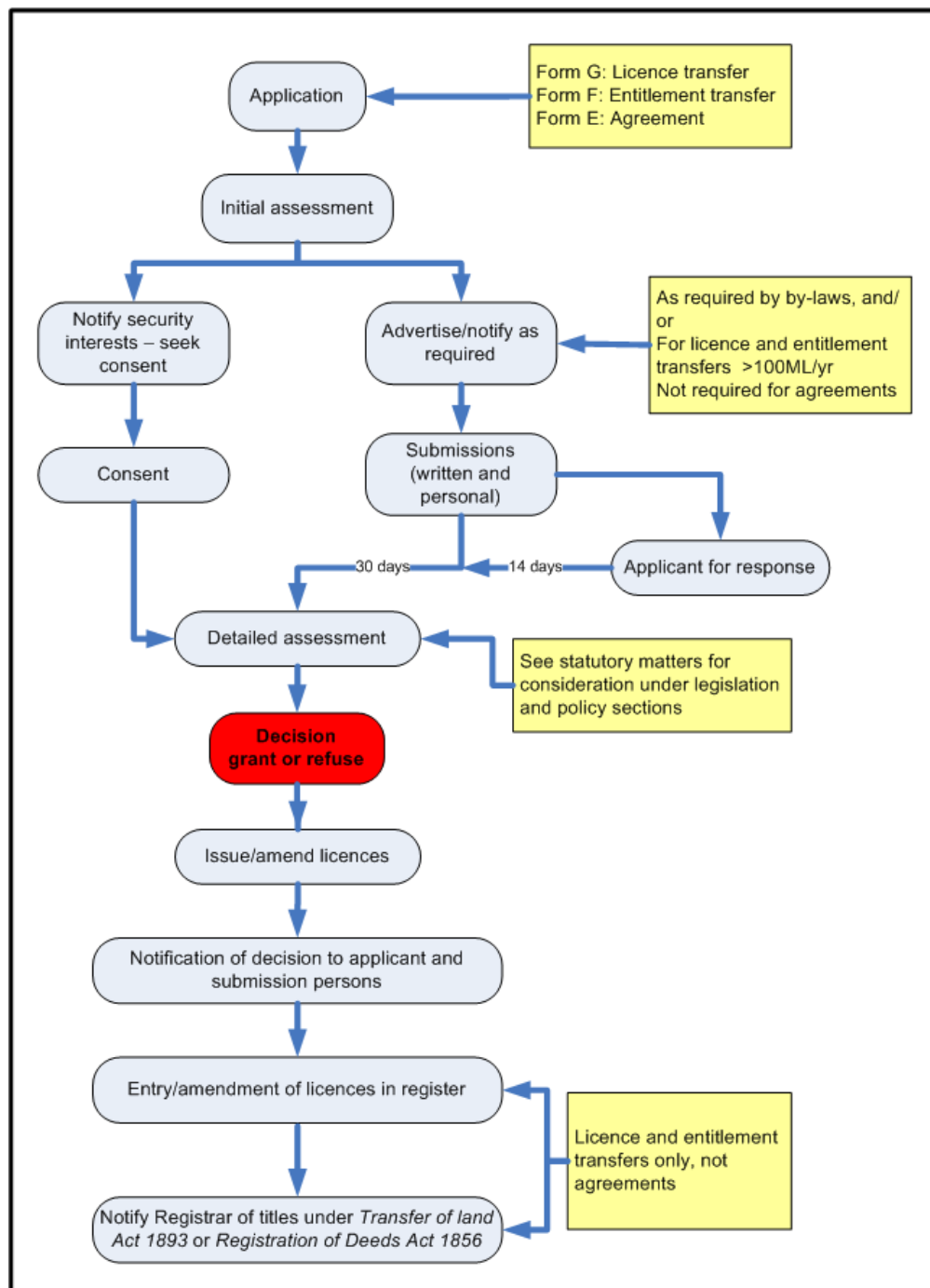
The trade-related transactions for licences/entitlements and water allocations – legislative provision, policies and administrative practices, and how these are given effect have been outlined in the previous sections on 'legislation' and 'policies'.

There are essentially three transaction types:

1. Transfer of licence in its entirety.
2. Transfer of entitlement (effectively part of a licence) to a new licence holder.
3. Agreement (temporary) between existing licence holders.

The statutory steps for processing applications are shown in Figure 23<sup>22</sup>.

**Figure 23 Trade transaction process in WA**



<sup>22</sup> See <http://www.water.wa.gov.au/Doing+business+with+us/Water+licensing/Licensing+publications+and+forms/default.aspx> for application forms

## Market and resource definition

### Scope of trading

'A water transaction must remain within a water resource management unit (WRMU) (i.e. same ... groundwater subarea and aquifer)<sup>23</sup>'. Generally they only occur in aquifers that are fully allocated. In over-allocated systems, actions are taken to reduce entitlements to within the allocation limits prior to allowing trades. There is no trading between hydrologically 'disconnected' systems, nor between groundwater and surface water units.

### Establishing physical unit/zone boundaries

Allocation plans are developed for proclaimed groundwater areas.. Groundwater areas boundaries are proclaimed in legislation. Groundwater area boundaries can be based on administrative areas, or hydrogeological boundaries. Sub-area boundaries, which are not proclaimed, are based on hydrogeological information where possible, such as fault lines or major aquifer features. Allocation limits are set for individual (stacked or layered) aquifers within sub-areas.

There are no 'combined' surface water and groundwater management units in WA.

### Defining allocatable volumes

Allocation limits are caps that are imposed by the Minister prevent the resource being depleted or adverse impacts such as declining groundwater levels, reduced base flows in rivers and streams, unacceptable impacts on groundwater dependent ecosystems, or changes to water quality. An allocation limit defines the maximum volume of water that can be allocated to licence holders in A WRMU. In some areas, total entitlements exceed the allocation limits. In such areas, actions are being taken to reduce the total allocations to within these limits (see Statewide Policy No.11 Management of Unused Licensed water Entitlements, 2003<sup>24</sup>).

There are 728 individual groundwater resources (aquifers) in WA, approximately 40% of which have allocation limits calculated on the basis of recharge or through-flow. Translating the recharge or through-flow to an allocation limit is done on percentage basis - i.e. a percentage is retained in-situ to maintain a salt-water interface and/or GDEs. The percentage equates to the importance of the GDE (based on professional opinion) The allocation limits are always less than recharge/through-flow. In only about 2% of cases models are used for setting the allocation limit on a groundwater management unit basis, providing GDE and management of the salt water interface. In a further 40% of GMUs, where use is very low and there is no foreseeable demand pressure, the allocation limit is set at current licensed allocation. In these areas the department is working through a process of migrating these across to the recharge/through-flow approach to setting allocation limits starting with GMUs where it foresees potential future demand for water. In the remaining 18% there is no abstraction or a few artesian licences within an unproclaimed area.

The department's general principles for allocating water are:

- *to recognise the rights of existing water users and account for this when considering any changes to the allocation limits*
- *to consider the in situ social, cultural and ecological water requirements of an aquifer when determining the allocation limits*
- *to recognise that climate variation must be considered in making decisions about water availability in order to ensure that the productive base of the resource is maintained.'*

<sup>23</sup> Operational policy 5.13 Water entitlement transactions for Western Australia

<sup>24</sup> <http://www.water.wa.gov.au/PublicationStore/first/41089.pdf>

A precautionary, or 'low risk', approach is taken where information for a particular water resource is limited.

WA does not use seasonal allocation limits. In very limited cases (e.g. Gnangara), water levels may trigger a change in access to groundwater, but access changes are restricted to the water Corporation extraction, and if such limitations are triggered, the licence is amended.

WA is becoming increasingly more rigorous and transparent in its approaches to setting allocation limits. In the contemporary water allocation planning process, *water allocation decisions*<sup>25</sup> are published with any draft or final water allocation plan. These decisions outline any previous allocation limits, the principles and processes for setting limits, and the outcome of the application of those, being the final allocation limits.

## Restrictions on market participants

Under the policy, an eligible transferee must have legal access to the land from which the water is to be taken. Additionally the applicant must be able to reasonably use that amount of water on the land, or for the specified purpose. These two requirements exclude non-water users from holding licences, and exclude water users from holding more than they can reasonably use.

## Trading initiation

### Triggers and prerequisites

Triggers for establishing groundwater trading in WA are not specified, but are clearly based on entitlements plus an estimate of unlicensed water use reaching full allocation (that is, the defined allocation limit). There is no provision to effect a moratorium on the issue of licences. Licence applications must be accepted and either approved or rejected.

Provisions exist in the Act for allowing trading by the Minister, including in management units which are under-allocated, for example by auctioning/tender of entitlements. These provisions have not been used, and there is no detailed policy in relation to this.

The sections on 'legislation' and 'policies' outlined the prerequisites for establishing groundwater trade, and for individual participation in a market (including the requirement for entitlements to be specified volumetrically (or as shares) and use quantified prior to transactions occurring.

There are no formal processes or legislative requirements to initiate trade in an area.

## Transaction processing

### Transaction impact assessment

A general description of the matters to be considered when assessing the impacts of applications for transactions that are not prohibited by rules has been provided in the 'legislation' and 'policy' sections. All transactions require assessment as per the Act. A person must have legal access to the land that the water is taken from to be eligible to hold a water licence. If the licence is only changing ownership then legal access to the land is the primary assessment, together with whether the licensee has abided by the terms and conditions of the licence. If the new owner also wishes to change the purpose the water is to be used for this also has to be assessed, with respect to the possible impacts.

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<sup>25</sup> For an example, see <http://www.water.wa.gov.au/PublicationStore/first/92756.pdf> for the Murray decision.

## Fees for transactions

A fee of \$200 applies for all transactions. Proponents are required to provide sufficient information to allow the Department to make an informed decision, irrespective of cost. Where transactions involve anything but insignificant amounts of water, or have insignificant impacts on environmental values or other uses, Department costs associated with assessment of information provided by applicants are unlikely to be recovered.

## Trading rules

Statutory constraints and matters for consideration when processing trade transactions have been outlined in the 'legislation' and 'policy' sections. Under the State-wide policy<sup>26</sup>:

*'The factors common to all transactions include:*

- both parties are within the same water management unit*
- both parties will draw the water from the same aquifer or water course*
- the applicant has legal access to the land for development*
- there is no local policy from a water management (allocation) plan (if existing) that would prevent transaction*
- the vendor's licence is current and has been compliant with the terms and conditions of the licence and has no outstanding breaches*
- the purchaser's licence (if applicable) is current and has been compliant with the terms and conditions of the licence*
- the water to be transacted has been used in the past*
- measurement of water use (for example metering) is accurate*
- other demands for water do not prevent transaction*
- there are no environmental concerns or contentious issues*
- there are no public objections to the transaction*
- have water use efficiency measures been adopted and water savings demonstrated.*

*If there is non-agreement with any of the above factors, further investigation will be necessary. The transaction applicant may be required to do further work (at their cost) in support of the application (for example monitoring (metering) report, hydrogeological investigation, operating strategy, water use efficiency plan). However, the Department of Water may still refuse the application for a water entitlement transfer if the investigation supports the refusal of the application.'*

The above constraints/considerations apply to all transactions. In additions, an applicant for a licence transfer must apply for the water transfer within 30 days of purchase of property.

Water allocation plans do not generally add much to the state-wide trading policy, except of course to delineate the sub-areas and aquifers within which trading can occur. In some instances, where there are over-allocated or fully allocated sub-areas or aquifers, the plans may specify if and how can occur, and any potential restrictions on these (for example in the Murray plan, 'trades must result in 'the movement of a drawpoint to a location further away from a groundwater-dependent ecosystem or environmentally sensitive area'.

## Transaction processing efficiency

Initial assessment of transactions is undertaken by the department within 60 days. Processing times for detailed assessments are dependent on level of complexity of assessment, volumes involved, sensitivity of the system and dependent ecosystems, the time taken for proponents to provide information required by the Department, and . No statistics kept on processing times, but the department reports anything from a couple of weeks to more than 12 months in complex cases.

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<sup>26</sup> Operational policy 5.13 Water entitlement transactions for Western Australia

## Assessments of potential water level changes/drawdowns

'Under clause 4(2), Schedule 1 of the *Rights in Water and Irrigation Act 1914*, the department may require applicants for the grant, amendment, transfer or agreement to temporarily transfer a licence under s. 5C of the Act, to undertake a hydrogeological assessment in support of their application.

These assessments should address the potential impacts of the proposed groundwater abstraction on the water resource, the environment and on other water users. The department may use these assessments, together with other information that it holds, to determine whether it considers the proposed abstraction to be acceptable. The department will determine the level of assessment that is required ...[which may include a]:

- H1 – desktop hydrogeological assessment
- H2 – basic hydrogeological assessment including drilling and test pumping
- H3 – detailed hydrogeological assessment including drilling, test pumping and a groundwater model.<sup>27</sup>

The level of assessment required is a function of the volume of water involved in the transaction, the level of knowledge regarding the state of the groundwater source, the demand for accessing a particular groundwater resource, and/or the potential impacts of taking the water. *Operational policy no. 5.12 – Hydrogeological reporting associated with a groundwater well licence* outlines the decision criteria triggering different levels of assessment, the assessment requirements and standards (including if and when a model needs to be developed), and the assessment processes and timeframes for submission of information by applicants.

Where impacts are likely or the entitlement volume is large, the applicant will be required to prepare an operating strategy to indicate and mitigate the impacts of their activities due to the taking and use of water. This is assessed and approved by the department. The approved strategy becomes part of the licensing conditions, and the licensee would be required to comply with the agreed operating strategy.

For all assessment levels, the policy requires proponents to describe whether the impacts of taking the water are assessed to be acceptable, manageable or unacceptable. It gives no guidance, however, on what is acceptable or unacceptable. It is assumed that the relevant management (allocation) plan or other state-wide policies provide such guidance. 'Some areas (such as Gngangara and Jandakot) have more stringent criteria than other areas, based on the value of the water resource to the community and the presence of groundwater dependent ecosystems (GDEs). Water level criteria are set to support compliance with Ministerial conditions set on the Gngangara and Jandakot mounds. A key objective for all systems is to minimise impacts on water resources and GDEs from the taking of water, such that licence applications to take water do not cause additional declines in water levels at environmentally sensitive locations', (DoW, pers. comm., July 2010).

## Managing impacts of trade

At this stage, allocation limits associated with individual (in some cases layered) aquifers are the primary tool to manage the impacts of trades, with limited, if any, allowance for transactions between aquifers. In addition, as a result of a trade assessment, the following restrictions may also be applied to the traded licence or entitlement:

- Restrictions on volume traded to a location
- Extraction regime restrictions
- Location (from which traded water may be pumped) restrictions
- Bore construction conditions (e.g. screening requirements)

<sup>27</sup> Operational policy no. 5.12 – Hydrogeological reporting associated with a groundwater well licence, <http://www.water.wa.gov.au/PublicationStore/first/89953.pdf>

In addition and as mentioned, in undertaking required trade assessments, the applicants 'must describe whether the impacts of taking the water are assessed to be acceptable, manageable or unacceptable. If the impacts are identified as manageable, the applicant should describe how the taking of the water will be managed to reduce the potential impacts.' Other management techniques can, therefore, be proposed by the applicant for departmental consideration.

The allocation limits, and these potential conditions on transactions are used to manage both system wide and local drawdown effects on GDEs, surface water resources, adjoining aquifers, other bores, water quality, and other groundwater users. Applicants are also required to assess the impacts of the transaction on likely future uses.

## ***Facilitating groundwater trading***

### **Metering**

Currently, metering of groundwater abstractions in WA is very limited. There are, however, significant plans to expand metering, consistent with the NWI directions and the WA government's Blueprint for Water Reform, and contained in Strategic policy 5.03 – Metering the taking of water<sup>28</sup>.

### **Access to market information**

The following market information is readily available of the DoW website:

- Water allocation plans and allocation decisions – including trading rules, allocation limits and start of plan commitments.
- State-wide policies specifically on, and that may affect, trading.
- Transaction application forms.
- Information on fees and charges.

Other market information is available 'on request' from the Department.

The statutory register of 'instruments' (see previous section on 'licences and entitlements') is not currently public.

### **Intermediaries**

Water Market intermediaries are not directly regulated in WA. Departmental officers reported no knowledge of intermediaries operating in WA, and suggest that the markets may be too small to warrant such intermediary activity.

## ***Monitoring and compliance***

### **Monitoring and evaluation and statistics**

There is no systematic monitoring of, or reporting on groundwater trading in WA, although the DoW obviously records having received an application to trade GW.

### **Enforcement/compliance**

There is no systematic enforcement or compliance activities in relation to groundwater trading in WA, although the normal licence compliance activities apply equally to traded entitlements or 'agreements'.

## ***Acknowledgements***

Phillip Kalaitzis, DoW, is acknowledged for his contributions during the consultation phase of this project.

# Appendix J. Groundwater trading stocktake – Northern Territory

## *Governance and administrative framework*

### **Legislation**

The *Water Act 1992* (the Act) provides for the investigation, allocation, use, control, protection, management and administration of water resources in the Northern Territory. The Minister for Natural Resources, Environment and Heritage and the Controller of Water Resources are the consent authorities under the Act (NWC 2006). The Minister appoints the Controller of Water Resources under the Act, and the Minister and Controller may delegate their powers under the Act (apart from the power to delegate) to other persons. The Department of Natural Resources, Environment and the Arts (the Department) manages the day to day operational aspects of the Act, including conducting water resource investigations, monitoring compliance, preparing water allocation plans, and administering licences and permits. Powers to enforce compliance with water entitlements, rights and obligations are provided under the Act. The Minister has the power to regulate and restrict water extraction under emergency powers, and also to declare, by notice in the Gazette, a part of the Territory to be a *water control district*, and assign a name to that district (s. 22). The purpose of the declaration is specified in the notice, and may include the purpose of preparation of a water allocation plan. Permits to construct bores (s. 57) and licences to extract groundwater (s. 60) are generally required in water control districts (unless exempt by order).

There are no specific heads of power in the Act relating to trading of groundwater, except in relation to the transfer of a groundwater extraction licence with a property transfer (s. 92). It is within the provisions relating to water allocation plans that a water trading regime is inferred. Section 22B(5) of the Act specifies that 'a water allocation plan is to ensure in the water control district that:...

*(c) the right to take or use water under a licence granted under section 45 or 60 is able to be traded (in part or in full); ...'*

In practice, no water trading has yet occurred in the NT, and the only place in which it has been practically enabled is the Katherine Tindall Limestone Aquifer. Trading will be achieved by the amendment of existing licences, and/or the cancellation/surrender and granting of new licences using existing provisions of the Act (s. 60 granting, ss. 93 and 94 amendment and surrender).

The Act defines groundwater as 'water occurring or obtained from below the surface of the ground (other than water contained in works, not being a bore, for the distribution, reticulation, transportation, storage or treatment of water or waste) and includes water occurring in or obtained from a bore or aquifer.' Aquifer is defined as 'a geological structure or formation, or an artificial land-fill, permeated or capable of being permeated permanently or intermittently with water.'

### **Institutional responsibilities**

The Minister for Natural Resources, Environment and the Arts (NRETA) and the Controller of Water Resources (a public servant) are the consent authorities under the Act (NWC 2006). The Minister appoints the Controller of Water Resources under the Act, and they may both delegate their powers under the Act (apart from the power to delegate) to other persons. NRETA manages the day to day operational aspects of the Act, including conducting water resource investigations, monitoring compliance, preparing water allocation plans, and administering licences and permits. The Minister has the power to regulate and restrict water

extraction under emergency powers, and has wide discretion in relation to the making, format and content of water allocation plans (WAPs) (NWC 2006). NRETA addition has responsibility for Territory policy and Territory and regional strategies.

## **Groundwater management units**

The principal management unit for groundwater in the NT is the water control district shown in Figure 24, or aquifers, or parts thereof, (contemporarily called 'water sources') within water control districts. The water sources are generally constructed around areas of higher demand and where possible align with hydrogeological units. The water source may be further broken down into 'zones' for entitlement or trade management, however it is the specified aquifers in the water control districts that most closely resemble the NWI 'designated water resources'.

Figure 24 NT Water Control Districts



Plans have been completed for Alice Springs and Ti Tree (Water Resource Strategies), and for the Katherine Tindal Limestone Aquifer (WAP). Plans for the Ooloo aquifer in the Daly and the Tindal aquifer at Mataranka are being developed and are expected to be completed in 2010. Tiwi Islands and priority Darwin Rural regions planning processes have commenced and are expected to be completed by the end of 2011 and 2012 respectively' ([http://www.nwc.gov.au/resources/documents/2009\\_BA\\_chapter\\_1\\_water\\_planning.pdf](http://www.nwc.gov.au/resources/documents/2009_BA_chapter_1_water_planning.pdf)). A WAP for the Western Davenport region is also underway. Beyond those planning processes it is proposed that over the next 5 years other areas, listed in Table 29, will have water allocation plans developed.

Beyond 2014 other planning processes are scheduled including ones for the Darwin Rural Area (outside areas covered by a specific WAP); Darwin and Palmerston cities; Cox

Peninsula and Dundee; and Indigenous lands in support of the Territory Growth Towns policy. However these new plans will have a longer developmental timeframe as earlier Water Allocation Plans reach their review or end date and Departmental resources need to be assigned to those (older) plans.

**Table 29 Proposed NT water allocation planning**

| Plan area              | Target completion year | Comments                                                          |
|------------------------|------------------------|-------------------------------------------------------------------|
| Great Artesian Basin   | 2010                   | NT portion only                                                   |
| Berry Springs          | 2011                   | declaration most likely after Howard East Aquifer WAP is declared |
| Alice Springs          | 2011                   | Review                                                            |
| Yulara                 | 2012                   |                                                                   |
| Ti-Tree                | 2012                   | Re-written                                                        |
| Howard East Aquifer    | 2012                   | Declaration                                                       |
| Wadeye                 | 2013                   |                                                                   |
| Overarching Daly Basin | 2013                   |                                                                   |
| Tennant Creek          | 2014                   |                                                                   |
| Acacia Hills Area      | 2014                   |                                                                   |
| Gove Peninsula         | 2014                   |                                                                   |
| Katherine Tindall      | 2014                   | Review                                                            |

## Groundwater licences, entitlements and allocations

To extract and use groundwater in water control districts both a permit to construct a bore (s. 57) and a s. 60 licence to take (or extract) water are required. The extraction licences, or entitlements associated with these are potentially tradeable and have a term not exceeding 10 years. The holder of a licence must be the owner or occupier of land to which the licence relates. Use rights are bundled with the extraction entitlements and are tied to the land, as the licence is one to take a specified amount of water for a specified purpose at a specified location.

The entitlement on groundwater licences is a fixed annual maximum volume unless a s. 70 direction is given by the Controller to determine an annual water allocation less than 100% of the specified annual maximum volume, as is planned for in the Katherine WAP. Water allocations do not exist as entitlements separate to licences. However the specified maximum annual volume on a licence has a degree of independent existence, as it can be wholly or partially transferred to another person and location for a fixed period.

Licence conditions and entitlements can be changed at any time. The Katherine Plan allows for amendment of licensed entitlements (included any traded entitlements) at the 5 and 10 yearly plan reviews in response to changed understanding of water requirements to achieve environmental, Indigenous cultural, and other instream public benefit outcomes, and consequent changed water availability. Entitlements can be amended differentially based on level of development of existing entitlements.

## Unlicensed groundwater rights and impacting activities outside of the groundwater management framework

S.14 of the Act confers a right of owners of overlying land to take and use ground water for domestic and stock purposes without a s. 60 extraction licence. Domestic and stock includes

domestic purposes, wandering stock, and for domestic gardens of up to 0.5 hectares. Bore construction permits are, however, required if the stock and domestic use is within a water control district. The Act (s. 96) includes emergency powers to limit any stock and domestic rights to take water. Domestic and stock bores are not metered.

Extraction outside of declared water control districts is not licensed for other purposes where the take is up to a maximum pumping rate of 15 L/sec, and bore permits are also not required. Within water control districts, the Minister may exempt certain extraction from the requirement to obtain an access licence. In the Katherine plan, for example, all extraction of less than 5 ML/yr is exempt. Take and use by activities under the Mining or Petroleum Acts are also exempt from licensing requirements.

Forestry and other land use change impacts on groundwater resources also lie outside the regulatory environment.

## Instruments for regulating groundwater extraction

The principal regulatory mechanism for managing groundwater extraction is management of extraction licences and bore construction permits. Applications for the issue, trade and renewal of licences are assessed by NRETA and may be refused or granted subject to conditions. Licence conditions may be varied at any time (s. 93), and directions may be served on landholders in respect of their take and use of groundwater. This power is used in the Katherine Plan to apply annual announced allocations of less than 100% of licensed entitlement.

The Act allows the Minister to declare, name, and describe a purpose for a *water control district* by notice in the Gazette (s. 22.). The purpose may include preparation of a water allocation plan.

The Act specifies the outputs and outcomes of the plan but no objects, principles or procedures to guide development. Section 22B(5) specifies that 'a water allocation plan is to ensure in the water control district that:

- a) water is allocated within the estimated sustainable yield to beneficial uses
- b) the total water use for all beneficial uses (including those provided through rural stock and domestic use and licences granted under ss. 45 and 60) is less than the sum of the allocations to each beneficial use
- c) the right to take or use water under a licence granted under ss. 45 or 60 is able to be traded (in part or in full)
- d) as far as possible - the full cost for water resources management is to be recovered through administrative charges to licensees and operational contributions from licensees.

The Act is unclear as to whether the statutory WAP binds the actions of the administrators of the Act. Section 22B(4) indicates that it does, with 'Water resource management ...*to be in accordance with*' the WAP. However, s. 90 (1)(ab) provides more latitude to the Controller who *must take into account* any WAP in deciding whether to grant, amend or modify a licence under ss. 45 or 60. In practice, however, the WAPs form the operating rules for management of groundwater extraction at the water source level.

While the Act does not specifically require WAPs to be consistent with inter-state agreements, it does prohibit the granting of any licences 'contrary to an agreement about water sharing made by the Territory with a State or the Commonwealth' (s. 91). It is presumed that, in practice, this would extend to a WAP, if that plan directed the granting of licences. The same would apply to the requirement to *take into account* any 'relevant land use objectives under the [NT] Planning Act (s. 90(1)(j)).

While not required by the statute, WAPs in the Northern Territory are also guided by the *Integrated Natural Resource Management (INRM) Plan for the Northern Territory: Sustaining Our Resources – People, Country and Enterprises*, (Northern Territory Government, 2005). It was prepared by the NT Landcare Council for the whole of the NT which is different from Regional NRM Plans in other states which are usually developed by catchment-specific

groups. Amongst other natural resource elements, the INRM Plan includes the following natural resource management targets for inland waters:

- Long term aspirational targets (50 years)
- Specific and measurable resource condition targets (10-20 years), and
- Short term management action targets (1-5 years).

The INRM Plan is built around the principles of ESD, the precautionary principle, and adaptive management, and includes specific targets and actions relating to water allocation.

## ***Managed aquifer recharge***

Managed aquifer recharge is enabled under s. 67 of the Act via the recharge licences.

### **Defining consumptive pools**

As a matter of policy, the NT government has adopted the following framework in relation to *sustainable yield*, articulated in the INRM Plan:

All available scientific research directly related to environmental and cultural water requirements for the water resource will be applied in setting non-consumptive water provisions as the first priority, with allocations for consumptive use made subsequently within the remaining available water resource. In the absence of scientific research directly related to environmental and cultural water requirements, the following contingent allocations are made:

For aquifers:

- In the northern third of the Territory, at least 80% of annual recharge is allocated for environmental and cultural water provisions, and annual extraction will be equivalent to no more than 20% of annual recharge.
- In the southern two thirds of the Territory there will be no deleterious change in groundwater discharges to wetlands, and total extraction over a period of not less than 100 years will not exceed 80% of aquifer storage at start of extraction.

In the event that current and/or projected consumptive use exceeds the 20% threshold levels, new groundwater licences will not be granted unless supported either by directly related scientific research into the groundwater dependent ecosystems and/or cultural water requirements, or hydrologic modelling confirming that groundwater discharge is reduced by no more than 20%. In the event that current and/or projected consumptive use exceeds the threshold levels of 80% for aquifer storage, or groundwater discharges to wetlands are impacted, then new groundwater licences will not be granted unless supported by directly related scientific research into the groundwater dependent ecosystems and/or cultural water requirements.

In practice, the above policy sets the starting point for development of aquifer-specific water allocation plans that may themselves vary the policy at the operational level. The Katherine plan is a case in point where much more sophisticated approaches to allocation management have been adopted.

### **Entitlement statistics**

Details not available

## Trade-related transactions and operation

### Types of transactions

The only specific trading provision in the Act is a s. 93 transfer of permit or licence. This provision relates solely to the transfer of ownership of a licence (and not to change in location at which the licence can be used). 'Where a licence is granted to a person in relation to the person's use of land and, during the period of the licence, the person's interest in the land is transferred to another person, the licence shall be deemed to have also been transferred to the other person at the time of the transfer of the interest in the land and shall continue in force accordingly as if originally granted to that other person.'

Other permanent and temporary trades that result in a change in location at which the licence entitlement, or part thereof, can be extracted are achieved administratively, by amending or cancelling the seller's licence and granting or amending the purchaser's licence.

Water trading procedures are outlined on the NRETA website:

*'Purchaser seeks out suitable seller. This can be achieved by contacting licensees via the contact details provided on the licence register, or placing a tender document or similar in the local paper.'*

*An agreement is made between the two parties and generally includes:*

- Purchase price (overall amount or \$/ML) - Note: NRETA will not offer any advice on the price at which traders should offer to sell or buy water.
- Duration of the trade (Although a temporary trade may only be on an annual basis, an agreement may be made for a longer period, but would remain subject to the relevant WAP rules).

*Trading application forms are completed by both the seller and purchaser and can be submitted to NRETAS via email, post, fax or in person. Assessment Criteria includes:*

- Any infrastructure used to extract traded water must be compliant before a trade will be allowed by the Department;
- The appropriate trading zones are taken into account;
- Water is traded for a price determined by the market, as such, trades do not require a property development plan to be submitted.'

Statutory processes relating to granting or amending licences must be followed. Sections 71B to 71E set out the procedural tasks that must be followed, including:

- Advertising (at the proponent's expense) of a notice of intention to make a water extraction licence decision including: whether the application is for the grant, amendment or modification of a water extraction licence, the means of extraction; the name of the water resource; the location of the bore from which the water will be taken; a description of the areas of land on which the bore is located and on which the water will be used; the proposed beneficial uses of the water, and the maximum quantity of water in megalitres proposed to be taken annually for each beneficial use, any other information, available to the Controller about the relevant water resource, that the Controller considers relevant to the application, including: the total quantity of water that currently may be taken from the water resource under water extraction licences; the total quantity of water that currently is taken from the water resource under water extraction licences; the estimated total sustainable yield of water of the water resource.
- Notification of neighbours
- Seeking of written comments
- A requirement for the Controller to take into account any submissions, and to publish the decision including reasons for the decision, addressing of submissions, and importantly the s. 90(1) 'factors to be considered'.

## Fees for transactions

Not available.

## Trading rules

There are no Territory-wide policies or rules on water trading. Trading rules have only been developed for the Katherine-Tindall Limestone Aquifer. Rules in that plan include:

- volumetric limitations on trade (both temporary and permanent) between management zones. These are designed to minimise the impacts of trades on connected river flows.
- trade of 'developed' or 'used' water only. Unused portions of entitlements cannot be traded. This restricts trade to entitlement or allocation no longer required because of (demonstrated and approved) enterprise efficiency measures or short term circumstance resulting in under-use of entitlement.

## Transaction impact assessment

Transfers are to be assessed in consideration of all the matters to be considered in granting or amending a licence.

The s. 90(1) 'factors to be considered' include:

- (a) *the availability of water in the area in question;*
- (ab) *any water allocation plan applying to the area in question;*
- (b) *the existing and likely future demand for water for domestic purposes in the area in question;*
- (c) *any adverse effects likely to be created as a result of activities under the permit, licence or consent on the supply of water to which any person other than the applicant is entitled under this Act;*
- (d) *the quantity or quality of water to which the applicant is or may be entitled from other sources;*
- (e) *the designated beneficial uses of the water and the quality criteria pertaining to the beneficial uses;*
- (f) *the provisions of any agreement made by or on behalf of the Territory with a State of the Commonwealth concerning the sharing of water;*
- (g) *existing or proposed facilities on, or in the area of, the land in question for the retention, recovery or release of drainage water, whether surface or sub-surface drainage water;*
- (h) *the adverse effects, if any, likely to be created by such drainage water resulting from activities under the licence on the quality of any other water or on the use or potential use of any other land;*
- (j) *the provisions under the Planning Act relating to the development or use of land in the area in question;*
- (k) *other factors the Controller considers should be taken into account or that the Controller is required to take into account under any other law in force in the Territory.*

In practice, in addition to, and/or in support of the above factors, where a hydrogeological model has been developed (such as in the Katherine-Tindall aquifer), this will be used as a tool to predict the water level and flux impacts of trade, and the qualitative (and, where possible, quantitative) impacts of these on plan outcomes will be assessed.

## Prerequisites for trading and initiating groundwater trading in an area

There are no Territory-wide prerequisites for trade, nor any standard or documented process for initiating trade. As a matter of practice, however, a water allocation plan would generally be in place before trading commences. There is very little demand for trade in the NT and as such little development of standardised policies and approaches.

## *Facilitating groundwater trading*

### **Current trading statistics and transaction processing efficiency**

No trades have been undertaken in the NT to date.

### **Metering**

No details available.

### **Access to market information**

A water allocation plan groundwater licence register is available publically on the NRETA website ([http://www.nt.gov.au/nreta/water/manage/register/pdf/wapgwel\\_register.pdf](http://www.nt.gov.au/nreta/water/manage/register/pdf/wapgwel_register.pdf)). The register contain information on access licences based on region, aquifer, water district and water trading zone, and contains the following information (where it exists):

- Name and address
- Expiry date
- Whether trading is available
- Location
- Primary entitlement, its security and whether this can trade
- Secondary entitlement, its security and whether this can trade

The groundwater licence register contains similar information.

### **Intermediaries**

Being very little demand for or interest in trading in the NT, there are no market intermediaries, and no mechanisms to monitor or regulate these. There is also no monitoring for market manipulation (e.g. price fixing). However the risk and consequences of this is are considered negligible at present.

## *Monitoring and reporting*

### **Monitoring of markets and monitoring and regulating inappropriate market behaviour**

Given the lack of trading in the NT, there are understandably no arrangements in place to regularly monitor and report on groundwater trading activity, the efficiency in processing of transactions, or the cumulative impacts of trades.

## *Acknowledgements*

The following people are acknowledged for their contributions during the consultation phase of this project:

Diana Leeder, NRETA

Ian Lancaster, NRETA

## Appendix K. Tables of groundwater trading stocktakes

Enabling environment – legislation and policy

Operating environment – prerequisites to a market

Operation of groundwater trading markets

Trade facilitation and monitoring

## Enabling environment – legislation and policy

### Governance and administrative framework

| Enabling environment:<br>Governance                                                    | Qld                                                                                                                                                          | NSW                                                                                                                          | Vic                                                                                                                                                                                                                                                                       | SA                                                                                                                                             | Tas                                                                                                                                                                                                      | WA                                                                                                                                                                                                                         | NT                                                                                                                                    | ACT                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relevant Act/s                                                                         | Water Act 2000                                                                                                                                               | Water Management Act 200029                                                                                                  | Water Act 1989                                                                                                                                                                                                                                                            | Natural Resources Management Act 2004; Groundwater (Border Agreement) Act 1985                                                                 | Water Management Act 1999                                                                                                                                                                                | Rights in Water and Irrigation Act 1914 (RIWI)                                                                                                                                                                             | Water Act 1992                                                                                                                        | The Water Resources Act 2007                                                                                                                                                         |
| Administering authority(s)                                                             | Dept of Environment and Resource Management (DERM)                                                                                                           | NSW Office of Water (NoW)                                                                                                    | Rural Water Authorities (4), Dept of Sustainability and Environment (DSE)                                                                                                                                                                                                 | Dept of Water, Land, Biodiversity and Conservation (DWLBC)                                                                                     | Dept of Primary Industries, Parks, Water and Environment (DPIPWE)                                                                                                                                        | WA Dept of Water (DoW)                                                                                                                                                                                                     | Controller of Water Resources within Dept of Natural Resources, Environment, The Arts and Sport (NRETAS)                              | Environment Protection Authority (EPA) within the Dept of the Environment, Climate Change, Energy and Water (DECCEW).                                                                |
| Does the Act include:                                                                  |                                                                                                                                                              |                                                                                                                              |                                                                                                                                                                                                                                                                           |                                                                                                                                                |                                                                                                                                                                                                          |                                                                                                                                                                                                                            |                                                                                                                                       |                                                                                                                                                                                      |
| Principles or guidelines for establishing or managing trading                          | General objectives and principles for water management (Ch 2)                                                                                                | General objectives and principles for water management (s. 3, 5)                                                             | Only general water management purposes (s. 1)                                                                                                                                                                                                                             | Only refers to the State Natural Resources Management Plan                                                                                     | Only general objectives for water management (s. 6)                                                                                                                                                      | Only general objectives for water management (s4)                                                                                                                                                                          | Only an enabling statement (s. 22B)                                                                                                   | Transfers must be consistent with conditions of the WAE and the Territory plan (s. 26).                                                                                              |
| Ability to create policies, rules guidelines etc for trading that have statutory force | The Act refers to content of ROPs, which may limit the volume of water that may be transferred between different locations or for different purposes (s. 98) | The Act enables orders for access licence dealing principles to be made (s. 71Z), and rules in statutory water sharing plans | The Act enables policies and guidelines that RWCs must comply with in assessing applications (s. 53) – expressed as state policy for managing take and use licences, and local management rules.<br><br>Also rules in management plans for water supply protection areas. | The Act requires the preparation of a Water Allocation Plan with trade provisions and enables the preparation of regulations specific to trade | The Act enables rules in statutory plans.<br><br>Guiding Principles for Water Trading have also been published, that set out how the Department interprets and applies the Act in assessing applications | The Act enables plans to include ‘matters that are to guide the management by the Minister...’ of water resources including for approval of transfers of licences and water entitlements, and of agreements. <sup>30</sup> | No specific statutory power, but the Controller has ultimate flexibility to create and apply policies and guidelines as they see fit. | The Act enables preparation and approval of Environmental Flow Guidelines (EFG) to meet aquatic ecosystem needs, and which must consider environmental, economic and social impacts. |
| Matters for consideration when processing trades, including:                           | s127C, s128, s128A, s128B, s129, s129A, s130, s131, s134, s135, s148, and s150                                                                               | s 71Y                                                                                                                        | s 53 and 40                                                                                                                                                                                                                                                               | s 150 and 157                                                                                                                                  | s 97                                                                                                                                                                                                     | Schedule 1, cl.7                                                                                                                                                                                                           |                                                                                                                                       | s 26                                                                                                                                                                                 |
| WAP or local rules                                                                     | Yes                                                                                                                                                          | Yes                                                                                                                          | Yes                                                                                                                                                                                                                                                                       | Yes                                                                                                                                            | Yes                                                                                                                                                                                                      | Yes                                                                                                                                                                                                                        | Implied by S.22B(4), but unclear                                                                                                      | No                                                                                                                                                                                   |
| Environmental impacts                                                                  | Yes                                                                                                                                                          | Yes                                                                                                                          | Yes                                                                                                                                                                                                                                                                       | Yes                                                                                                                                            | Yes                                                                                                                                                                                                      | Yes                                                                                                                                                                                                                        | No                                                                                                                                    | No                                                                                                                                                                                   |

<sup>29</sup> Note that some groundwater in NSW is still managed under the *Water act 1912*. Both temporary and permanent transfers are possible under that legislation. It is expect that all groundwater take will be managed under the *Water Management Act 2000* within a few years. Discussion in the report is limited to trading under the *Water Management Act 2000*.

<sup>30</sup> Note that none of the current water allocation plans in WA are ‘statutory’ plans under the Act. The non-statutory plans are, however, a form of ‘Government policy’ with which decisions under the Act should be consistent.

| Enabling environment:<br>Governance | Qld | NSW  | Vic                               | SA                                                                                                                                            | Tas | WA                                                                                                                                                      | NT                                                  | ACT                                                                                   |
|-------------------------------------|-----|------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------|
| Other third-party impacts           | Yes | Yes  | Yes                               | Yes                                                                                                                                           | Yes | Yes                                                                                                                                                     | Must consider any submissions made to advertisement | No                                                                                    |
| Other (specify)                     | n/a | n/a. | Statutory state policies and PCVs | Where a WAP does not exist then provisions of a plan that provides for the adequate protection of the resource.<br><br>Inter-state agreements | n/a | Public interest<br>Other state policies and plans <sup>31</sup><br>Lack of financial resources of proponent<br>If convicted of an offence under the Act | As above.                                           | Transfers of WAE must be consistent with conditions of the WAE and the Territory plan |

## Products (potentially tradeable)

| Enabling environment:<br>Products                                        | Qld                                                                                                                    | NSW                                                                                                                                                    | Vic                                                                                                                            | SA                                                                                               | Tas                                                                                                                                                                                      | WA                                                                                                                                                                                | NT                                                                                                                   | ACT                                                                                                                                                                   |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Types of groundwater rights that are potentially tradeable under the Act | 'Annual entitlements' accruing to licences<br><br>Water allocations (do not yet apply to groundwater)                  | Aquifer access licences (entitlements)<br><br>GW 'allocations' accruing to licences<br><br>Extraction rights                                           | Take and use licences                                                                                                          | Take licences.                                                                                   | Licences, and water allocations (=entitlement) on licences.                                                                                                                              | s 5C 'take' licence                                                                                                                                                               | S.60 extraction licence                                                                                              | Tradeable Water Access Entitlements (WAEs).<br><br>Tradeable water allocations incorporated in a 'Licence to take Water'.                                             |
| Non-tradeable GW rights                                                  | 'Nominal entitlements' on licences<br><br>Stock and domestic rights, and any groundwater that is not subject to a WRP. | 'Basic rights' (D&S and native title). Town water licences can temp trade, and then only in some cases. Supplementary water licences are non-tradeable | D&Sk                                                                                                                           | Hold licences<br><br>D&S                                                                         | Any person can take groundwater without a licence except for types and purposes specified in declared areas or in statutory plans. As at May 2010, no licences required anywhere in Tas. | Domestic and stock<br><br>Other licence 'exempt' rights<br><br>TWS in some circumstances<br><br>Environmental water<br><br>Return flows<br><br>'Unused' portions of entitlements. | Stock and domestic<br><br>Other non-licensed extraction.<br><br>'Unused' portions of entitlements (Katherine policy) | Stock and domestic rights, 'surviving allocations' from the former Water Resources Act 1998, and non-tradeable WAEs arising from conversion of surviving allocations. |
| Extent to which tradeable groundwater rights are 'unbundled'             | Not yet, but will occur in individual ROP areas under conversion from water licences to water allocations.             | Fully unbundled. Separated from use rights and works. Not attached to specific parcel of land (but works through which water is taken are              | Bundled and linked to a property, but held by a person (licence ownership does not automatically transfer with land transfer). | Bundled with allocations implicitly linked as an assigned yield from the underlying entitlement. | Bundled and linked to a property, but held by a person (licence ownership does not automatically transfer with land transfer).                                                           | Bundled and linked to a property, but held by a person (licence ownership does not automatically transfer with land transfer).                                                    | Bundled and linked to a property, but held by a person. Licence ownership transfers with land transfer (S.92).       | Partially unbundled – separated from land and use rights. To take and use water, a 'Licence to take Water' is required.                                               |

<sup>31</sup> including *Operational policy 5.13: Water entitlement transactions for Western Australia, 2010*)

| Enabling environment:<br>Products                                                                                                            | Qld                                                                                                                            | NSW                                                                                                                                                                                                                                   | Vic                                                                                                                                     | SA                        | Tas                                                                                                              | WA                                                                                                                                                                                                                                                 | NT                                                                                                                                                                                                              | ACT                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
|                                                                                                                                              |                                                                                                                                | nominated on the licence).                                                                                                                                                                                                            |                                                                                                                                         |                           |                                                                                                                  |                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                 |                                             |
| Are tradeable groundwater rights linked (by condition or entitlement specification) to a specific GMU or zone (not just a property or bore)? | Not determined                                                                                                                 | Yes. Groundwater source (GMU) and zones are specified in water sharing plans.                                                                                                                                                         | No                                                                                                                                      | Not determined            | Yes, but will include link to specific location also.                                                            | Licence specifies the 'water resource'<br><br>Will also link to specific location (via 26D licence to construct)                                                                                                                                   | Not specified, but licence conditions specify water control district and 'location', which may relate to a specific groundwater source.                                                                         | Yes – management area is stated on the WAE. |
| Are there any restrictions on ownership of tradeable GW rights?                                                                              | For water licences, holder must be the owner or occupier of the land.<br><br>For tradeable water allocations, no restrictions. | No                                                                                                                                                                                                                                    | Holder must occupy the land, and be able to reasonably use that amount of water on the land. Also must hold a s 67 licence for bore(s). | No                        | Theoretically no. However in practice the licence holder has been required to occupy land and use the water.     | Holder must be owner or occupier of land to which licence relates, or be authorised under agreement to use the land, or be a public utility, and be authorised to undertake proposed water using activity.                                         | Holder must be owner or legal occupier of land to which licence relates.                                                                                                                                        | No                                          |
| Do tradeable groundwater rights meet the requirements of cl.31 of the NWI?                                                                   | For water licences - no. Not perpetual, and are bundled with use.<br><br>For proposed groundwater allocations – yes.           | Yes                                                                                                                                                                                                                                   | No – not perpetual, bundled with use, not defined as a share of water in a specified consumptive pool.                                  | Only in the Murray River. | No – not perpetual, bundled with works and use, not defined as a share of water in a specified consumptive pool. | No – not perpetual, bundled with works and use, not defined as a share of water in a specified consumptive pool.                                                                                                                                   | No – not perpetual, bundled with use, not defined as a share of water in a specified consumptive pool.                                                                                                          | Yes                                         |
| Groundwater extraction or interference that is outside the regulatory framework?                                                             | Mining<br><br>Natural gas (including coal seam gas) extraction<br><br>D&S                                                      | All take of water (including mine de-watering) requires a licence, except D&S and activities in clause 18 of the Water Management (General) Regulation 2004. Forestry/ other land use change impacts on GW not managed under the Act. | All take of water is subject to licence except for D&S. Forestry, oil and gas, mining impact indirectly.                                | D&S                       | All take of water except what may be declared to require a licence.                                              | All non-artesian S&D. All non-artesian GW use outside prescribed areas.<br><br>Ss 26C and 26L exempt take.<br><br>Take of water permitted by another written law (e.g. Commonwealth legislation)<br><br>Forestry and land use change impacts on GW | Any extraction outside of declared water control districts, and exempt extraction within these.<br><br>Use by activities under the Mining or Petroleum Acts.<br><br>Forestry and land use change impacts on GW. | No                                          |

## Trade-related transactions

| Enabling environment:<br>Transactions                                                                     | Qld                                                                                                                                                          | NSW                                                                                        | Vic                                                                 | SA                                                                  | Tas                                                                      | WA                                                                 | NT                                                                | ACT                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Are the following transactions enabled under the relevant Act:                                            |                                                                                                                                                              |                                                                                            |                                                                     |                                                                     |                                                                          |                                                                    | Trading achieved administratively in NT. Very few Act provisions. |                                                                                                                                                      |
| Change in ownership only of entitlement – permanently or for a fixed period – without change in location. | Yes, but for water licences must be landholder at that location. Unrestricted for proposed water allocations.                                                | Yes. Unrestricted. Lease available by 'term transfer'.                                     | Yes – to successor in land occupancy.                               | Yes to owner of land to which approval relates.                     | Yes, but must be landholder at that location                             | Yes, but must be landholder at that location. Schedule 1,          | Yes, S.92 with transfer of land to new owner.                     | Yes, unrestricted. Can be absolute or for a limited period.                                                                                          |
| Permanent change in location of all or part of an entitlement.                                            | For groundwater licences, only in the GAB. Will apply in other ROP areas upon conversion to water allocations                                                | Yes – can be local, between zones, and between some water sources within the 1 WSP.        | Yes – permanent transfer.                                           | Yes.                                                                | Transfer of licence, or water allocation (=entitlement) to new location. | Yes – Schedule 1 cl.29A 'transfer of licences and entitlements'.   | No                                                                | Yes                                                                                                                                                  |
| Temporary change in location of all or part of an entitlement                                             | For groundwater licences – no. For proposed Qld water allocations – a specific volume of water may be assigned to a different location on a temporary basis. | Yes – term transfer as above, combined with nomination of works at the different location. | Yes – temporary transfer.                                           | Yes. Unbundled allocation trade given effect through this.          | Transfer (as above) can be for any fixed period.                         | Yes – 'agreements with licensees to take water' (Schedule 1 cl.30) | No                                                                | Yes                                                                                                                                                  |
| Trade in water allocations (Note this refers to water allocation as per NWI defn)                         | Yes – can trade 'annual entitlements' arising from water licences. Upon conversion to water allocations, can undertake 'seasonal water assignments'.         | Yes – assignment of water allocations from one licence to another.                         | Effectively done by temporary transfer for remainder of water year. | No. Effectively done through temporary reassignment of entitlement. | Could be effected by fixed period transfer for remainder of water year.  | Could be done under 'agreement' above.                             | No                                                                | Not exactly, as water 'allocations' have not been applied to groundwater. Can effectively be done by temporary transfer for remainder of water year. |
| Trade in water entitlements interstate                                                                    | Yes                                                                                                                                                          | Yes                                                                                        | Yes                                                                 | Yes under an agreement with corresponding Minister.                 | No                                                                       | No                                                                 | No                                                                | Yes but not in practice for groundwater.                                                                                                             |
| Trade in water allocations interstate                                                                     | Yes                                                                                                                                                          | Yes                                                                                        | Yes                                                                 | Yes                                                                 | No                                                                       | No                                                                 | No                                                                | No, as water 'allocations' have not been applied to groundwater.                                                                                     |
| Trade in extraction rights?                                                                               | No                                                                                                                                                           | Yes (if they are created)                                                                  | No                                                                  | No                                                                  | No                                                                       | No                                                                 | No                                                                | No                                                                                                                                                   |

| <b>Enabling environment:<br/>Transactions</b>                                            | <b>Qld</b>                                                                                                                                                                                                                               | <b>NSW</b>                                                                                                                                                                               | <b>Vic</b>                                                      | <b>SA</b>                                                                          | <b>Tas</b>                                                | <b>WA</b>                                                                                                           | <b>NT</b>                                                                                                       | <b>ACT</b>                                      |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Is statutory consent required for all transactions?                                      | Required for changes, subdivisions and amalgamations (not for leases and transfers)                                                                                                                                                      | For all except change in ownership.                                                                                                                                                      | Yes                                                             | Yes                                                                                | Yes                                                       | Yes                                                                                                                 | Not specified in Act, but achieved via licence granting/ amendment which requires statutory consent.            | Yes                                             |
| For which transactions are technical assessments required?                               | Generally not required for seasonal trade of annual entitlement.<br><br>For water allocations, will be required for 'changes' that are not mentioned in ROPs (s. 130)                                                                    | Most that result in a change in the approved point of extraction.<br><br>Using a risk management approach small volumes in some water sources are approved without technical assessment. | All except transfer to new occupier of same land.               | All trades must take into account the public interest.                             | All except transfer to new occupier of same land.         | All.                                                                                                                | All                                                                                                             | Not yet determined.                             |
| Which transactions require advertising?                                                  | Not required for seasonal trade of annual entitlement.<br><br>For water allocations, will be required for 'changes' that are not mentioned in ROPs, and which require further information (s. 130 applications; see also s 131 and 132). | None (however, advertising is required for 'approvals' for bores)                                                                                                                        | RWCs have discretion. Generally for permanent transfers >19 ML. | Generally, no advertising required, except for trades within the McLaren Vale PWA. | None                                                      | Transfers (but not agreements) > 100 ML/yr, or if required by by-laws, or if Minister sees fit.                     | All (S.71B)                                                                                                     | Advertising is not mentioned in the Act or EFG. |
| Who has standing to object?                                                              | Anyone                                                                                                                                                                                                                                   | Anyone                                                                                                                                                                                   | Anyone                                                          | Anyone                                                                             | N/A                                                       | Anyone or as specified in the by-laws                                                                               | Anyone                                                                                                          | Not determined                                  |
| How are objections ultimately handled under the statute?                                 | Not determined                                                                                                                                                                                                                           | Mediation, then by appeal to Land and Environment Court (s. 368).                                                                                                                        | Mediation, then court of appeal.                                | Representation to the authority then mediation then ERD Court                      | N/A                                                       | Written submissions<br><br>Opportunity to be heard personally<br><br>State administrative tribunal                  | Written submissions<br><br>Ministerial review with advice from statutory Review Panel if requested by Minister. | Not determined                                  |
| For which transactions are the consent of security interests in an entitlement required? | Leases and transfers, when applicable. Also, to relocate a GAB water licence requires 'notification' to mortgagees (and for this to be confirmed via a statutory declaration provided to DERM).                                          | All except trade of water allocations                                                                                                                                                    | Not required, but may be done to some extent administratively   | All changes to the register                                                        | All, but only for those interested noted on the register. | All – licence transfer, entitlement transfer, and/or agreement but only for those interested noted on the register. | Not specified. No provision for security interests in NT Act.                                                   | Not determined                                  |

## Operating environment – prerequisites to a market

### Market and resource definition

| Operating environment:<br>Market definition                                                           | Qld                                                                                                      | NSW                                                                                                                                                                            | Vic                                                                                                         | SA                                                                                           | Tas                                      | WA                                                                                                                                            | NT                                                                                                                                                  | ACT                                                                                 |
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| On what basis are GMUs delineated                                                                     | Contiguous hydrogeological units, with GMU boundaries defined at the fine scale by cadastral boundaries. | 1. Some administrative boundaries (e.g. coastal)<br>2. Hydrogeology (including aquifer geometry and water quality)<br>3. Surface catchments<br>4. Level/density of development | Historically by drawing convenient boundaries around areas of high demand. Moving to hydrogeological units. | Catchment based planning. GMUs managed as tiered hydro. units.                               | None as yet defined.                     | Contiguous hydrogeological units.                                                                                                             | Historically by drawing convenient boundaries around areas of high demand. Moving to hydrogeological units or units within a catchment (Katherine). | Surface flow catchment boundaries are used to define (WMAs), which also act as GMUs |
| Are there, or can there be, trading 'zones' within GMUs. On what basis' are they delineated?          | Yes. Various basis, including hydrogeological properties and numerical model cells                       | Yes. Generally subcatchments or based on WQ differences, or water level/pressure drawdown.                                                                                     | Yes. Basis as above.                                                                                        | Yes. Through the provisions of the WAP. On hydro. and geographic area ('hundred').           | Plans can establish zones.               | Generally hydrogeological basis.                                                                                                              | Yes. (In Katherine) based on proximity to connected river.                                                                                          | There are no 'zones' for groundwater management within GMUs                         |
| Is trading between GMUs possible, and if so does it happen in practice?                               | Yes. But not in practice yet.                                                                            | Legally possible but not in water sharing plans yet.                                                                                                                           | Not allowed.                                                                                                | Yes, contingent on consistency with WAP rules. Trade out of pressured hundreds occurs in SE. | Could be enabled but not yet determined. | Trades between GMUs (aquifers) are permitted only within sub-areas and where demand in the receiving GMU will remain below sustainable yield. | No, but not precluded by legislation.                                                                                                               | Is possible but has not occurred in practice.                                       |
| Is trading between zones possible, and if so does it happen in practice?                              | Yes. In practice subject to plan rules.                                                                  | Yes. In practice subject to plan rules.                                                                                                                                        | Yes                                                                                                         | Yes – if consistent with WAP and State Policies                                              | Could be enabled but not yet determined. | As above. Not happening in practice.                                                                                                          | Yes (Katherine) allows for (within limits). Not yet happening in practice.                                                                          | No, as there are no groundwater zones within GMUs.                                  |
| Can local areas (sub-zonal) be created that further restrict trade? If so, how and on what basis/why? | No provisions for this.                                                                                  | Yes through dealings principles order or order under s. 324 e.g. if impacts on other users or GDEs are considered unacceptable.                                                | No provisions for this.                                                                                     | Yes. SE region uses geographic area blocks (hundreds)                                        | Could be enabled but not yet determined. | Local impacts managed through transfer application process, and assessment thereof. Proponent to provide information.                         | Not provided for in plans, but S.93 powers to amend licences (for any reason) can be used.                                                          | No provisions for this.                                                             |

| Operating environment:<br>Market definition                                                                                                              | Qld                                                                                                                                                                                                                                                                                        | NSW                                                                                                          | Vic                                                                                                                                                                           | SA                                                                                                                                     | Tas | WA                                                                                                   | NT                                                                                                                                                                                                                                            | ACT                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Is the approach used to set limits to entitlements and extraction on a long-term basis objective, repeatable and transparently documented?               | Limits are mainly set by either numerical modelling of groundwater flows, analytical water balance assessment or acceptance of current entitlement levels (in which case no extraction limit is specified, and sustainable extraction is achieved through annual 'announced entitlements'. | Yes in WSPs, background document for each plan and draft report on macro planning process for groundwater.   | PCVs define the limit on issuing entitlements – generally published and basis stated.<br><br>Water management plans can do the same. Extraction limits generally not defined. | Processes are not clearly documented.                                                                                                  | N/A | Yes. Methodology made public with 'allocation decision'.<br><br>Departmental methodology documented. | Territory INRM policy (subject to WAP): in the north, 20% of recharge allowed for extraction, or in the south use of 80% storage over >100 year period.<br><br>WAP extraction limits more complex and tailored to hydrogeological conditions. | Yes. Entitlements and extraction are limited to 10% or estimated recharge in each WMA, as specified in the Environmental Flow Guidelines. |
| Is the approach used to set limits to short term (e.g. seasonal) allocations or limits to extraction objective, repeatable and transparently documented? | Yes, as described for 'announced entitlements' in 'water sharing rules' policy documents.                                                                                                                                                                                                  | Yes WSP's set trigger for AWDs.<br><br>Local impact management (s. 324) orders.<br><br>Operational policies, | Where this is done it is normally explained, but no formal requirements for documentation.                                                                                    | Partially. Process uses both technical inputs and 'community knowledge.' Repetition is dependent on documentation of community issues. | N/A | Yes, in WAPs where such limits are applied.                                                          | Yes (in case of Katherine).                                                                                                                                                                                                                   | No approach defined or undertaken.                                                                                                        |
| What is the process to change such limits or approaches once set, and are these transparently documented?                                                | Not determined                                                                                                                                                                                                                                                                             | Yes, listed in each WSP. Statutory process for other changes to WSP, including compensation.                 | Statutory plans (which are few) state rules and PCVs authorised by the Minister. Others are done administratively                                                             | WAPs review within 5 years.<br><br>Minister can also take back in public interest.                                                     | N/A | Revision of WAPs (timeframes unspecified).                                                           | Overall limits: WAP reviews every five years<br><br>Short term limits: triggered by plan, and triggers reviewed at 5 yrs.                                                                                                                     | Not determined                                                                                                                            |

## Trade initiation and other prerequisites

| Operating environment:<br>Trade initiation                  | Qld                                                         | NSW                                                                                                                                | Vic                                                                                                                                                                    | SA                                                                                                                                | Tas                                                                                     | WA                                                                                                                                                             | NT                                                  | ACT                                                                                                      |
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| What are the triggers for establishing groundwater trading? | Declaration of a WRP area and a moratorium on new licences. | Statutory WSP with trading rules.<br><br>Where no WSP, can be triggered by demand and implemented under Water Act 1912 and policy. | Trading always available, but in practice triggered by stopping issuing new licences through PCV or plan.<br><br>If WSPA declared, no perm trading until plan is made. | Prescription of a water source enables the issuance of a licence which is private property (s146(8)) and can therefore be traded. | First require licences to take groundwater.<br><br>Then transfers are legally possible. | Usually only if no further licences are being granted, or if granting new licences would cause unacceptable impacts.<br><br>Generally a plan will be in place. | Not specified. In practice enabled by approved WAP. | First require a tradeable WAE, then transfers are legally possible. These must be purchased from DECCEW. |

| Operating environment:<br>Trade initiation                      | Qld                                                                                                                                                                                                  | NSW                                                                                                                                                            | Vic                                                                                 | SA                                                     | Tas                                                                     | WA                                                                                                                                  | NT                                                                                                                       | ACT                                                                                                                             |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Can trading commence in GMUs which are under-allocated?         | Statutorily, no impediment. In practice does not occur                                                                                                                                               | Yes. WSPs not yet made for under-allocated systems, but trading possible under Inland GW Transfers Policy, 2009.                                               | Yes, if PCV set at a low level because of uncertainty.                              | Theoretically possible.                                | Theoretically possible.                                                 | Theoretically possible. Would only occur if granting of new licence would cause unacceptable local impacts.                         | Theoretically possible, but not yet considered.                                                                          | Theoretically possible.                                                                                                         |
| What other elements must be in place before trade can commence? | Quantified entitlements. Meters for seasonal water assignments. Conversion to unbundled entitlements ('tradeable allocation') required for NWI entitlement trade except for GAB and change of owner. | Volumetric entitlements. Can occur under Water Act 1912 (bundled) or Water Mngt Act 2000 (fully unbundled). Meters required for water allocation (temp) trade. | All licences volumetric. Meters required for temp trade, but coverage is very high. | Metering is required for volumetric trade.             | N/A                                                                     | Sustainable allocation limits established. Total GMU entitlements are 'within' these limits. Entitlement volumetrically quantified. | Not specified, but in practice: Volumetric entitlements; WAP with entitlement or use limit; history of use <sup>32</sup> | N/A                                                                                                                             |
| What is the process to initiate trading in a GMU?               | Commence a WRP and ROP. For NWI 'entitlement' trading, require conversion of licences to tradeable 'allocations'.                                                                                    | Commencement of a plan (including trading rules) under the Water Mngt Act 2000. Declaration under WA 1912 – all inland NSW is declared.                        | Triggered by PCV declaration. Opens up when local rules or plan made.               | Prescribe water source – establish WAP – trade enabled | Generally commence a plan, then issue licences to existing water users. | None specified.                                                                                                                     | None specified.                                                                                                          | The one plan covers all management units of the ACT, and trading was made possible once the Water Resources Act 2007 commenced. |

## Operation of groundwater trading markets

### Transaction processing

| Market operation:<br>Transaction processing  | Qld                                                    | NSW                                  | Vic                                                | SA                            | Tas                                          | WA                  | NT                | ACT                                |
|----------------------------------------------|--------------------------------------------------------|--------------------------------------|----------------------------------------------------|-------------------------------|----------------------------------------------|---------------------|-------------------|------------------------------------|
| Who determines applications?                 | DERM                                                   | NSW Office of Water                  | Rural water authorities (4)<br>DSE for town water. | DWLBC                         | DPIPWE                                       | Dept of Water       | NRETAS            | DECCEW                             |
| Typical processing times – 'permanent' trade | Only implemented for GAB. No indication of timeframes. | Generally 2 weeks but up to 3 months | Can be years                                       | 20-30 days service commitment | For surface water, from days to many months. | No 'typical' times. | No trades to date | Insufficient trades to gauge this. |

<sup>32</sup> The Katherine Plan only allows for trade of developed (or used) entitlement 'freed up' via efficiency measures.

| <b>Market operation:<br/>Transaction processing</b>    | <b>Qld</b>                                                                                                | <b>NSW</b>                                                                                                  | <b>Vic</b>                                                                    | <b>SA</b>                                                      | <b>Tas</b>                                           | <b>WA</b>                                                                                                                                       | <b>NT</b>                                                                                | <b>ACT</b>                                       |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------|
| Typical processing times – ‘temporary’ trade           | Unsupplemented seasonal water assignments - 81% processed within 5 business days                          | 1 day to 1 week                                                                                             | 1-3 months                                                                    | 10-20 days commitment                                          | N/A                                                  | As above                                                                                                                                        | No trades to date                                                                        | Insufficient trades to gauge this                |
| Typical fees – ‘permanent’ trade                       | \$282.30                                                                                                  | \$370.69 + \$17.06/ML greater than 20 ML for more complex assessments where site visits are required.       | From \$775 to several thousand dollars depending on volume and other factors. | \$583 + \$154 for assessment<br>\$361 if no change in location | For surface water, fees range from \$36 to \$261     | \$200                                                                                                                                           | Not determined                                                                           | n/a                                              |
| Typical fees – ‘temporary’ trade                       | \$128.30                                                                                                  | \$50 + \$0.50/ML traded, up to \$150                                                                        | From \$235 to several thousand dollars depending on volume and other factors. | \$583 + \$154 for assessment<br>\$361 if no change in location | N/A                                                  | \$200                                                                                                                                           | Not determined                                                                           | N/A                                              |
| Who undertakes impact assessments?                     | DERM                                                                                                      | Generally the Office. Can request any information from applicant.                                           | Applicants                                                                    | DWLBC                                                          | DPIPWE, who may require the applicant to do studies. | Applicants required to assess. DoW assesses these and can request more information/ studies, including an ‘operating plan’ to mitigate impacts. | NRETA, who may require the applicant to do studies or provide further information (S.75) | DECCEW                                           |
| Indicative current transaction numbers for whole state | 73 seasonal water assignments in 2008-09.                                                                 | 764 temporary transfers (210GL) and 170 permanent transfers (83GL) for 2008-09 includes change of ownership | Approx 182 temporary, 8 permanent for 2008-09                                 | 49 volumetric licence trades and 48 area-based for 2008-09     | Nil                                                  | 64 licence transfers for 2008-09                                                                                                                | Nil                                                                                      | 2 for 2008-09, and for change in ownership only. |
| Main factors affecting processing times                | For proposed tradeable allocations, expected to be specifying and obtaining information, and advertising. | Level of assessment required<br>Trade water volume involved<br>Season or time of year                       | Required assessments, can take several months or more to complete.            | Permanent – assessment<br>Temporary - processing               | N/A                                                  | Depends on complexity of assessment, information requirements, and assessment requirements (including by other agencies – EPA)                  | N/A                                                                                      | Insufficient trades to gauge this                |

### Assessment and mitigation of third-party impacts

| <b>Market operation:<br/>Impact management</b> | <b>Qld</b> | <b>NSW</b> | <b>Vic</b> | <b>SA</b> | <b>Tas</b> | <b>WA</b> | <b>NT</b> | <b>ACT</b> |
|------------------------------------------------|------------|------------|------------|-----------|------------|-----------|-----------|------------|
| <b>Permanent trades:</b>                       |            |            |            |           |            |           |           |            |

| <b>Market operation:<br/>Impact management</b>                                                   | <b>Qld</b>                                                                                          | <b>NSW</b>                                                                                                                                          | <b>Vic</b>                                                                                  | <b>SA</b>                                                                                                                                | <b>Tas</b>                                                                                                                      | <b>WA</b>                                                                                                                                                                                                                                                                                                                  | <b>NT</b>                                                                         | <b>ACT</b> |
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| How are groundwater hydrological changes (water levels, etc) resulting from extraction assessed? | Little or no assessment and largely dealt with at the planning level. Permanent trades in GAB only. | By hydrogeologist. Simple hand calculations, simple local impact model, or more complex analytical (hot spots) model.                               | Typically a simple drawdown model, informed by site pump tests and a site conceptual model. | Drawdown analysis using Theis equation                                                                                                   | Method for assessment not yet determined, but will range from simple desktop analyses to detailed modelling, depending on risk. | Methods not specified. If detailed assessment required by applicant, then modelling required. Pump tests may be required.                                                                                                                                                                                                  | Methods not specified. Katherine area, existing model would be used.              | N/A        |
| How are effects of those hydrological changes on other bores assessed?                           | As above                                                                                            | Other bores identified from database. Simple model or calculations used to estimate drawdown.                                                       | Other bores identified by consultation with neighbours. Model used to estimate drawdown.    | Apply drawdown analysis to the '16 km <sup>2</sup> test' and pre-determined impact threshold.                                            | As above                                                                                                                        | Applicants submit hydrogeological assessment report, assessing impacts of the proposed abstraction on the GW resource, existing users, GDEs, GW-SW interactions and water quality.<br><br>Level of assessment determined by DoW and the report prepared in accordance with the Dept's policy on hydrogeological reporting. | As above                                                                          | N/A        |
| How are effects of those hydrological changes on GDEs assessed?                                  | As above                                                                                            | Only impacts on GDEs 'identified' in plans assessed. Exclusion zones specified in some WSPs Simple model or calculations used to estimate drawdown. | GDEs identified by site assessment. Model used to estimate drawdown.                        | Apply drawdown analysis to the '16 km <sup>2</sup> test' and pre-determined acceptable threshold for outer edge of Env Protection Zones. | As above                                                                                                                        |                                                                                                                                                                                                                                                                                                                            | As above                                                                          | N/A        |
| How are effects of GW hydrological changes on surface water flows assessed?                      | As above                                                                                            | Not assessed specifically. Addressed through distance conditions in WSPs.                                                                           | Not determined                                                                              | Adherence to distance conditions negates the need for assessment.                                                                        | As above                                                                                                                        |                                                                                                                                                                                                                                                                                                                            | As above                                                                          | N/A        |
| How are effects of those hydrological changes on groundwater quality assessed?                   | As above                                                                                            | Not determined                                                                                                                                      | Not determined                                                                              | Zoning and adherence to interzonal trading rules negates the need for assessment                                                         | As above                                                                                                                        |                                                                                                                                                                                                                                                                                                                            | Not yet encountered.                                                              | N/A        |
| How are impacts of water use on land (e.g. irrigation) assessed ?                                | As above                                                                                            | Not assessed for trades. Unbundled rights. Assessment of water use 'approval' is where this occurs.                                                 | Typically an irrigation and drainage plan is required.                                      | Dealt with at the planning level.                                                                                                        | As above                                                                                                                        | Not specifically assessed for trades, but may be included in 'operating strategy' for larger developments.                                                                                                                                                                                                                 | As part of new licence/ licence amendment assessment process.                     | N/A        |
| How are socio economic impacts of changes in water use location considered?                      | As above                                                                                            | Extensive stakeholder consultation in development of WSPs<br><br>Assessment of impacts on existing users                                            | Advertising for larger trades, then addressing objections.                                  | Dealt with at the planning level.                                                                                                        | N/A                                                                                                                             | Applicants required to assess impacts on current and future water use, but not broader socio-economic impacts. Note granting of licence considered future activity under Native Title legislation.                                                                                                                         | As part of WAP development process. Also through advertising/ objections process. | N/A        |

| Market operation:<br>Impact management                                                                                                             | Qld                                                                                                                                                    | NSW                                                                                                                                                                                                                    | Vic                                                                                                           | SA                                                                                      | Tas             | WA                                                                                                             | NT                                                                       | ACT                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| What is different for temporary trades?                                                                                                            | Again, largely dealt with by rules established at the planning level, with numerical model output (where available) providing guidance.                | Same as for permanent trades<br><br>Risk assessment triaging using zones and volume thresholds<br><br>Assessment of impacts on existing users                                                                          | Generally same but less rigour required.                                                                      |                                                                                         | N/A             | No real difference with respect to assessment.                                                                 | Not specified.                                                           | N/A                                                                                                                                         |
| What criteria are there for deciding on acceptable levels of impact (e.g. acceptable drawdowns)?                                                   | Not determined.                                                                                                                                        | General State-wide criteria<br><br>Some water sources have specific criteria depending on level of development and impact                                                                                              | Vary with RWC. Internal 'rules of thumb'.                                                                     |                                                                                         | None determined | State-wide policies or WAP provisions (generally quite broad, but some water level criteria in limited plans). | Not specified. Considered on a case by case basis as part of assessment. | N/A                                                                                                                                         |
| What measures may be used to mitigate impacts (apart from refusal of the application)?                                                             | Not determined                                                                                                                                         | Licence conditions – distance, pumping rates, annual bore extraction limits, monitoring requirements etc.<br><br>Water level triggers for pumping shut-off<br><br>Mitigation plans<br><br>Management using trade areas | Negotiation and compensation to affected parties, licence conditions such as linking extraction to monitoring | Consideration of reduced volume of trade that would not result in unacceptable impacts. | None determined | Licence conditions. Approved 'operating strategies' may become licence conditions.                             | Licence conditions.                                                      | Total of entitlements for each GMU is relatively small, at 10% of long term recharge. This limits the risk of impacts occurring from trade. |
| Are required impact assessments standardised and documented?                                                                                       | No                                                                                                                                                     | Yes for stressed water sources                                                                                                                                                                                         | RWCs have some public and internal guidelines                                                                 | No                                                                                      | Not yet.        | To some extent (Operational Policy no. 5.12).                                                                  | No.                                                                      | Not determined, and there have been insufficient trades to gauge this.                                                                      |
| To what extent are case by case impact assessments reduced by rules (e.g. minimum distances, maximum extraction densities, establishment of zones) | To a large extent. Rules are used to govern the movement of water rights between zones, and also within zones (directional constraints wrt coastline). | To a large extent. Given current resources, heavy (perhaps too heavy) reliance on plans rules alone.                                                                                                                   | Guidelines specify that assessments vary according to various criteria such as distance, volume.              | To a large extent – documented and enforced rules negates much individual assessment.   | Not determined  | Not really in WAPs, but state-wide policies provide guidance to DoW.                                           | Katherine WAP: Trading zones; Some generic distance conditions.          | There have been insufficient trades to gauge this.                                                                                          |

## Trade facilitation and monitoring

### Facilitation, monitoring and reporting for groundwater trade

| Trade facilitation and monitoring                             | Qld                                                                                                                       | NSW                                                                                                                          | Vic                                                                                                    | SA                               | Tas                               | WA                                                                                                                                       | NT                                                       | ACT                         |
|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------|
| Extent of metering                                            | Limited – in WRP areas only                                                                                               | ~35% of 10,000 high yield bores currently metered. Most major systems are fully metered.                                     | Comprehensive                                                                                          | Limited – in PWA and PWRA only   | None                              | Very limited at present.                                                                                                                 | Extremely limited.                                       | Not determined              |
| Plans to expand upon metering                                 | Not determined                                                                                                            | <i>NSW Water Extraction Monitoring Policy</i> (Aug 2007). Metering in all stressed and HCV systems, 'measurement' in others. | N/A                                                                                                    | Not determined                   | Proposed once licensing commences | Strategic Policy 5.03: Metering the take of water, 2009.<br><br>Expansion proposed. Intend to require meters for extraction of >50 ML/yr | Slowly introducing in WAP areas if considered necessary. | Not determined              |
| Public access to information on products and processes        | DERM website. In the future (following unbundling), information will also be available on the Water Allocations Register. | NOW website                                                                                                                  | Forms and guides on water authority websites                                                           | DWLBC website                    | None                              | Processes and policies on licensing and trading on DoW website                                                                           | NRETAS website                                           | DECCEW website              |
| Public access to information on market activity and prices    | Little available                                                                                                          | Trading statistics and application fees are available on NOW website.                                                        | Transaction info (except prices) provided in annual reports to water users in WSPAs. Otherwise minimal | Little available for groundwater | Nil as no trading occurring       | Not publicly available                                                                                                                   |                                                          | Nil as no trading occurring |
| Monitoring and reporting of transaction processing efficiency | Limited information available                                                                                             | Processing efficiency statistics available on NOW website.                                                                   | None                                                                                                   | No information available         | Nil as no trading occurring       | Not undertaken                                                                                                                           |                                                          | Nil as no trading occurring |
| Activity by intermediaries                                    | Nil or minor for groundwater                                                                                              | Intermediaries active in major systems – Namoi, Gwydir, Murrumbidgee and Murray.                                             | Some activity by real estate agents.                                                                   | Not determined                   | Nil as no trading occurring       | Nil or minor for groundwater                                                                                                             |                                                          | Nil as no trading occurring |

## Appendix L. Terminology and commonality

## Jurisdictional terminology

Water rights, planning and trading terminology varies considerably between Australian jurisdictions. A selected range of 'benchmark' general terms relevant to groundwater trading are provided below, with NWI definitions provided where available, and informal definitions provided for the remainder. Jurisdictional terms are listed against the benchmark terms in the table below. The jurisdictional terms are the best match equivalents of the benchmark terms, but their alignment with the benchmark terms will vary considerably. For Queensland and New South Wales, there is transition underway with water legislation that affects the terminology applied to groundwater licensing, planning and trading, and terms have been provided for both old and new situations.

## Benchmark terms and definitions

### *Groundwater rights*

Water licence (informal term and definition) – an instrument that may define a range of conditions of water access, including water entitlements and allocations, and possibly including linked parcels of land, and approvals for works and use.

Water access entitlement (NWI term and recommended national definition) - entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water plan

Announced allocation (informal term and definition) – a proportion, percentage or share value that is announced by a regulating authority and applied to an individual licensed entitlement to determine the seasonal water allocation.

Water allocation (NWI term and recommended national definition) - the specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan

### *Groundwater planning*

Water system (NWI term and definition) – a system that is hydrologically connected and described at the level desired for management purposes (e.g. sub-catchment, catchment, basin or drainage division and/or groundwater management unit, sub-aquifer, aquifer, groundwater basin).

Trading zones (NWI term and definition) – zones established to simplify administration of a trade by setting out the known supply source or management arrangements and the physical realities of relevant supply systems within the zone. Trade can occur within and between zones without first having to investigate and establish the details and rules of the system in each zone.

Water plan (NWI term and definition) – statutory plans for surface and/or ground water systems, consistent with the Regional Natural Resource Management Plans, developed in consultation with all relevant stakeholders on the basis of best scientific and socio-economic assessment, to provide secure ecological outcomes and resource security for users.

Sustainable yield (National Groundwater Committee term and definition) – for an individual groundwater system, the groundwater extraction regime, measured over a specified planning timeframe, that allows acceptable levels of stress and protects dependent economic, social, and environmental values (see Appendix M).

Extraction limit (informal term and definition) – for an individual groundwater system, a volumetric limit on groundwater extraction, within a specified timeframe.

Entitlement limit (informal term and definition) – for an individual groundwater system, a volumetric limit on licensed entitlements that can be on issue.

Entitlement level (informal term and definition) - for an individual groundwater system, the volumetric level of licensed entitlements at commencement of a water plan.

***Groundwater trading transactions***

Change of ownership (informal term and definition) – permanent change to ownership of a water licence; occurs to ‘bundled’ licences concurrently with property transaction.

Permanent trade (informal term and definition) – permanent transfer of licensed entitlement from one licence to another, or change in location of water extraction under a licensed entitlement.

Temporary trade (informal term and definition) – seasonal transfer of licensed entitlement (or linked annual allocation) from one licence to another, or transfer of fully ‘unbundled’ water allocation between individual accounts.

## Comparison of terminology for groundwater rights, planning and trading

| Benchmark term           | Qld                                                             | NSW                                                                                                                                | ACT                                                           | Vic                                                                       | Tas                                                           | SA                                                                                                     | WA                                                                            | NT                                                                               |
|--------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Water rights             |                                                                 |                                                                                                                                    |                                                               |                                                                           |                                                               |                                                                                                        |                                                                               |                                                                                  |
| Water licence            | Licence                                                         | Bore licence (old);<br>Access licence (new – various categories incl ‘zero’ share access licence);<br>Work and Use approvals (new) | Licence to Take Water;<br>Bore Work Licence                   | s.51 water licence<br>(‘Take and use’ licence)                            | Water licence                                                 | Take licence;<br>Hold licence (for trading allocations only)                                           | Licence to take water;<br>Licence to construct a well                         | Extraction licence (various reliability categories);<br>Bore construction permit |
| Water access entitlement | Nominal entitlement (old);<br>Water allocation (new)            | Entitlement (old);<br>Share component (new)                                                                                        | Surviving allocation (old);<br>Water Access Entitlement (new) | Entitlement                                                               | Water allocation                                              | Water (taking) allocation;<br>Water (holding) allocation                                               | Water entitlement                                                             | Entitlement;<br>Annual licensed volume                                           |
| Announced allocation     | Announced entitlement (old);<br>(new – not known)               | Announced allocation (old);<br>Available Water Determination (new)                                                                 | Not applicable                                                | Annual allocation                                                         | Not applicable                                                | Not applicable                                                                                         | Not applicable                                                                | Announced allocation                                                             |
| Water allocation         | Annual entitlement (old);<br>(new – not known)                  | Allocation                                                                                                                         | Not applicable                                                | Annual allocation volume                                                  | Not applicable                                                | Not applicable                                                                                         | Not applicable                                                                | Announced allocation                                                             |
| Planning                 |                                                                 |                                                                                                                                    |                                                               |                                                                           |                                                               |                                                                                                        |                                                                               |                                                                                  |
| Water system             | Groundwater management area (GMA);<br>Declared subartesian area | Groundwater management area (GMA – general term);<br>Water source (new)                                                            | Water management area (WMA)                                   | Groundwater management area (GMA);<br>Water supply protection area (WSPA) | Groundwater area;<br>Groundwater resources specified in a WMP | Prescribed wells area (PWA);<br>Groundwater resource within a ‘Prescribed water resources area’ (PWRA) | Proclaimed groundwater areas;<br>Water resource management unit (WRMU)        | Water control district;<br>Aquifers, or Water sources                            |
| Trading zones            | Zones                                                           | Zones (old and new);<br>Local impact management areas (new)                                                                        | Not applicable                                                | Zones                                                                     | Trading zones                                                 | Zones                                                                                                  | Sub-areas                                                                     | Zones                                                                            |
| Water plan               | Water Resource Plan (WRP);<br>Resource Operations Plan (ROP)    | Water Sharing Plan (WSP - new)                                                                                                     | Environmental Flow Guidelines                                 | Local management rules (LMR);<br>Groundwater management plan (GMP)        | Water management plan                                         | Water allocation plan (WAP)                                                                            | Groundwater allocation plan (GAP);<br>Groundwater area management plan (GAMP) | Water allocation plan (WAP)                                                      |
| Sustainable yield        | n/a                                                             | n/a                                                                                                                                | n/a                                                           | Sustainable yield                                                         | n/a                                                           | n/a                                                                                                    | n/a                                                                           | n/a                                                                              |
| Extraction limit         | n/a                                                             | Long term average extraction limit                                                                                                 | Groundwater abstraction limit                                 | PCV                                                                       | n/a                                                           | n/a                                                                                                    | n/a                                                                           | n/a                                                                              |

| Benchmark term     | Qld                                                                                       | NSW                                                                                                             | ACT                                                             | Vic                          | Tas                                                                                                                   | SA                               | WA                   | NT                            |
|--------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------|-------------------------------|
| Entitlement limit  | n/a                                                                                       | n/a                                                                                                             | n/a                                                             | n/a (often set at PCV level) | n/a                                                                                                                   | n/a                              | n/a                  | n/a                           |
| Entitlement level  | n/a                                                                                       | Requirements of water under access licences                                                                     | n/a                                                             | n/a                          | n/a                                                                                                                   | n/a                              | n/a                  | n/a                           |
| Transactions       |                                                                                           |                                                                                                                 |                                                                 |                              |                                                                                                                       |                                  |                      |                               |
| Change of owner    | Water licence transfer (old);<br>Water allocation transfer (new)                          | Transfer of ownership (new)                                                                                     | Permanent ('absolute')                                          | Permanent transfer           | Transfer of water allocation ('Absolute' transfer)                                                                    | Transfer of licence              | Licence transfer     | Transfer of permit or licence |
| Permanent transfer | Water licence relocation (old);<br>Subdivision or Change of water allocation (new);       | Permanent transfer (old);<br>Assignment of rights (new);<br>Access licence to nominate water supply works (new) | Permanent (incl 'absolute' transfer if entire volume is traded) | Permanent transfer           | Transfer of water allocation (incl 'absolute' transfer if entire volume is traded);<br>Vary licence (change location) | Permanent transfer of allocation | Entitlement transfer | Permanent trade               |
| Temporary transfer | Licence seasonal water assignment (old);<br>Seasonal water assignment of allocation (new) | Temporary transfer (old);<br>Assignment of water allocation (new)                                               | Temporary                                                       | Temporary transfer           | Transfer of water allocation ('fixed period');<br>Temporary transfer (max 21 days)                                    | Temporary transfer of allocation | Agreement            | Temporary trade               |

## Appendix M. National definition for sustainable yield

(as agreed by the National Groundwater Committee, 2004<sup>33</sup>)

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<sup>33</sup> National Groundwater Committee, Department of Environment and Heritage, 2004, *Definition and approach to sustainable groundwater yield Annex A*, Department of Sustainability, Environment, Water, Population and Communities, viewed 7 June 2011 < <http://www.environment.gov.au/water/publications/environmental/groundwater/annex-a.html> >

### **Definition and approach to sustainable groundwater yield:**

Sustainable groundwater yield is defined as:

*'The groundwater extraction regime, measured over a specified planning timeframe, that allows acceptable levels of stress and protects dependent economic, social, and environmental values.'*

This definition is based on adopting the following approach to its implementation:

#### **Extraction regime**

It is recognised that sustainable groundwater yield should be expressed in the form of an extraction regime, not just an extraction volume. The concept is that a regime is a set of management practices that are defined within a specified time (or planning period) and space. Extraction limits may be expressed in volumetric quantity terms and may further specify the extraction or withdrawal regime by way of accounting rules and/or rates of extraction over a given period and/or impact, water level or quality trigger rules. The limits may be probabilistic and/or conditional.

An often-used means of defining the extraction regime has been by way of a maximum volume that may be taken in any single year. In some cases, where draw beyond the rate of recharge may be acceptable, it may be only for a specified period, after which time the rate may be less than the rate of recharge to compensate. In some cases and under specific circumstances (for example, high or low rainfall years) the amount of water that may be taken may be greater or less than the longer-term value and the conditions for this can be specified.

#### **Acceptable levels of stress**

The approach recognises that any extraction of groundwater will result in some level of stress or impact on the total system, including groundwater dependent ecosystems. The concept of acceptable levels of stress as the determining factor for sustainable yield embodies recognition of the need for trade-offs to determine what is acceptable. How trade-offs are made is a case and site-specific issue and a matter for the individual States to administer. The trade-offs will often involve balancing between environmental, social and economic needs. In some cases, the stress may be temporary as the system adjusts to a new equilibrium.

The definition should be applied in recognition of the total system. That is, it should recognise the interactions between aquifers and between surface and groundwater systems and associated water dependent ecosystems. The definition implies that integrated management decisions must be taken to fully satisfy its spirit. In calculating sustainable yield, a precautionary approach must be taken with estimates being lower where there is limited knowledge. Application of the calculated sustainable yield as a limit on extractions must be applied through a process of adaptive management involving monitoring impacts of extraction. Sustainable yields should be regularly reassessed and may be adjusted in accordance with a specified planning framework to take account of any new information, including improved valuations of dependent ecosystems.

#### **Storage depletion**

The approach recognises that extraction of groundwater over any timeframe will result in some depletion of groundwater storage (reflected in a lowering of water levels or potentiometric head). It also recognises that extracting groundwater in a way that results in any unacceptable depletion of storage lies outside the definition of sustainable groundwater yield.

Where depletion is expected to continue beyond the specified planning timeframe, an assessment needs to be made of the likely acceptability of that continuation and whether intervention action might be necessary to reduce extraction. If intervention is likely to be necessary, then planning for that action should be undertaken so that it can be implemented at the end of the specified time-frame.

Major considerations in determining the acceptability of any specific level of storage depletion should be 'inter-generational equity', and a balance between environmental matters identified in the National Principles for Provision of Water for Ecosystems, social and economic values.

### **Protecting dependent economic, social and environmental values**

The definition recognises that groundwater resources have multiple values, some of which are extractive while others are in-situ (e.g. associated water-dependent ecosystems) and all have a legitimate claim on the water resource.

In considering trade-offs in resource values, due recognition should be given to environmental dependencies, the risk of irreversible impacts and any decisions shall be made in accordance with the principles of ecological sustainable development.