



## No. 8 Groundwater Quantity Management

Up until the 1980s, management of the State's groundwater was focused on its assessment and subsequent development. Although groundwater monitoring networks were established in the 1970s, little attention was paid to the impacts that extraction of groundwater might have on its continuing availability, and on surface water systems and dependent ecosystems. That only changed in the mid to late 1990s.

Users' rights in terms of their long-term access, and in relation to the rights of others, were poorly defined under previous legislation and management. Likewise users' obligations were not clearly articulated or understood. This led to the following consequences in some parts of the State:

- ◆ granting of entitlements from many aquifers consistent with a mining approach, resulting in licensed entitlements well above sustainable levels;
- ◆ extraction of groundwater approaching or exceeding natural recharge;
- ◆ degradation of groundwater dependent ecosystems – rivers, wetlands, vegetation, cave systems.
- ◆ inconsistent and often “band-aid” approaches to resolving problems;
- ◆ uncertainty for businesses;
- ◆ perceived inequities between users;
- ◆ uncertainty about the impacts of groundwater use on other values - environmental, social or economic.

Water Sharing Plans are one mechanism for resolving these issues. They will establish a management framework that aligns both entitlements and use with the sustainable yield of each groundwater system or zone, as well as ensuring that local impacts are minimised.

### Management Objectives

The objectives for managing groundwater quantity NSW are:

- ◆ to achieve the efficient, equitable and sustainable use of the state's groundwater;
- ◆ to prevent, halt, or reverse degradation of the State's groundwaters, and their dependent ecosystems;
- ◆ to provide opportunities for development which generate the most cultural, social and economic benefits to the community, region, State and nation, within the context of environmental sustainability; and
- ◆ to involve the community in the management of groundwater resources.

### Principle 1

**Total use of groundwater in a water source or zone will be managed within the sustainable yield, so that the groundwater is available for future generations, and dependent ecological processes remain viable.**

Sustainable yield is estimated as the long-term average amount of groundwater that will be available for extraction and use (including the access to basic rights) without compromising the integrity of the aquifer or the surface ecosystems that it supports.

The sustainable yield will be established based on the estimated long-term average yearly 'natural recharge' to the aquifer, less a portion set aside for environmental purposes. A technical report on the calculation of recharge for each aquifer is available to each groundwater management committee.

Strategies for managing use to within the sustainable yield are a key component of all water sharing plans for groundwater sources.

In some groundwater sources overall, or in some zones, current use is above the sustainable yield. In such cases, the water sharing plan must specify the mechanism for reducing over use to the sustainable yield by the end of the ten year planning period. Achieving this will inevitably mean that some licence holders who currently use up to their full licensed entitlements will be required to reduce that use (or secure additional entitlement through the transfer market).

Committees' strategies for reducing use to sustainable yield may include allowing licence holders with levels of use close to their current entitlements to phase down this use over the planning period. Any such phasing of reductions in use will be available only to those who have had a history of use greater than their long-term (reduced) entitlement.

## Principle 2

**Significant groundwater dependent ecosystems must be identified and protected.**

The Water Management Act 2000 requires specific environmental water provisions to be set for all the State's groundwater systems. This will be achieved by setting aside a part of the estimated long-term average yearly natural recharge to the aquifer.

The size of the environmental provision will vary according to the characteristics and dynamics of each system and the significance of any groundwater dependent ecosystems. It may vary from a very small proportion where the aquifer is deep and has little connection to the surface, to a significant proportion where the connection is strong or the aquifer is vulnerable to excessive extractions.

Groundwater management committees have been asked to recommend on this environmental proportion. Tools for protecting groundwater dependent ecosystems from localised pumping are also outlined in Principle 4 and *Advisory Note No. 9: Groundwater dependent ecosystems*.

## Principle 3

**Total licensed entitlements will not exceed 125% of the sustainable yield in currently over-allocated groundwater sources or zones.**

In many systems the current licensed entitlement is much more than the sustainable yield of the aquifer (or zone).

Adjusting total entitlements to the sustainable yield, or within 25% of this, will give licence holders a clear understanding of their tradeable "right" to a proportion of the sustainable yield.

*If adjustment of entitlements is required, all current licences, excluding those for domestic and stock and town purposes, will be adjusted proportionally, not distinguishing for history of use.*

While there can be some flexibility in the timing of entitlement adjustments over the planning period, it is recommended to groundwater management committees that action be taken sooner rather than later for the following reasons:

- ♦ licence holders will have a clear understanding of their long-term extractable rights, and unrealistic expectations matched by wasted investment will not be fostered,
- ♦ the groundwater transfer market will be more transparent for existing licence holders and also possible new entrants. In any event, transfers must be restricted to (foreshadowed) adjusted entitlements.

## Example

Key overall aims of the plan are to achieve a reduction in the licenced entitlements closer to sustainable yield and to reduce overall water use to sustainable yield levels over the planning period.

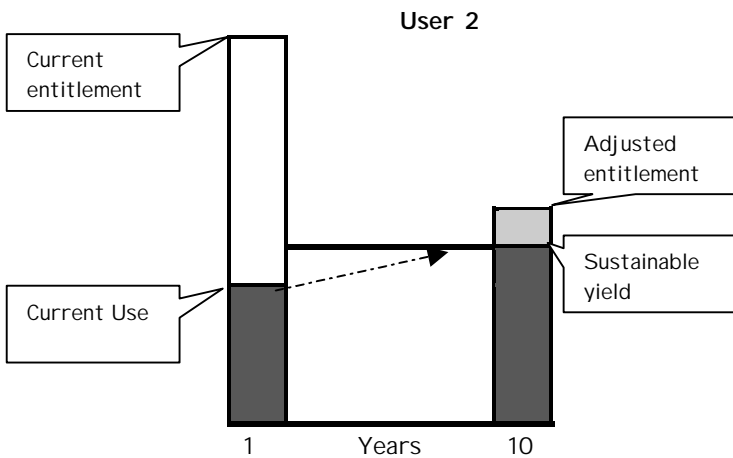
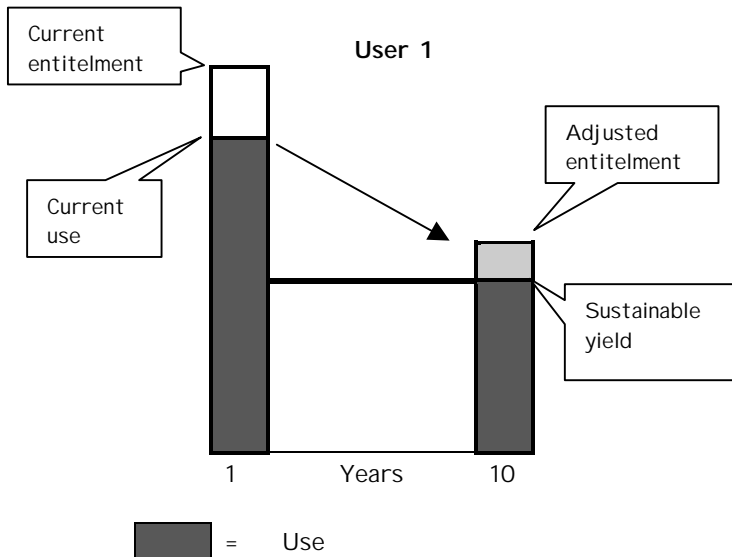
The example is for a system which has a sustainable yield less than existing use levels overall, and the long term use needs to be reduced to 50% of the current licenced entitlements. The committee has recommended that overall water use be phased down linearly over the term of the plan, and that all licenced entitlements be reduced to their long term levels at the commencement of the plan.

Consider the cases of two licence holders each having a current licensed entitlement of 1000 ML per year (see diagram below). At the start of the plan, User 1 has an adjusted licenced entitlement of 625 ML per year. This user has a history of use of 800 ML per year, and will be allowed to phase in the use adjustment over the planning period. Licence conditions would allow the licence holder to take additional water during the plan term – up to 780 ML in 1st year, 765 ML in the second, 745 in the third etc., down to 625 a year maximum in year 10.

User 2, however, has used only 425 ML of the licenced entitlement in the past, and would have use limited to the adjusted entitlement during the

planning period. That is, they could use up to 625 ML in any year.

Note that both users would have an expectation of long term use of 500 ML per year, but could use up to the 625 ML if overall use for the aquifer system remained below the sustainable yield level.



The actual pattern of the phasing process will be recommended by the relevant water management committee on a system-by-system basis, after consideration of the total level of over-use, and the risks to the resource of delaying action. This is a key issue for committee recommendation.

#### Principle 4

**Groundwater access must be managed in such a way that it does not cause unacceptable local impacts.**

Principles 1, 2 and 3 relate to the "macro" management of a groundwater system or zone. However, neither the quantity of groundwater nor its quality are consistent across an area. In addition, groundwater dependent ecosystems are not evenly distributed across an aquifer. Licensed groundwater pumping also tends to cluster, rather than be spread evenly across an aquifer.

Consequently, although from a whole of system perspective groundwater use may be sustainable, at a local level problems may emerge. These may include:

- ◆ aquifer compaction, reduced yields and even land subsidence resulting from a local concentration in pumping and water level declines,
- ◆ water quality decline resulting from concentrated pumping drawing in lower quality (usually saline) groundwater. This process is irreversible,
- ◆ degradation of groundwater dependent ecosystems from excessive pumping close by, and
- ◆ unacceptable local water level decline resulting in impacts between users.

Tools for minimising local impacts between users include:

- ◆ ensuring high yield pumping bores are a minimum distance apart;
- ◆ refining these distance criteria according to the annual volume extracted, and characteristics of the system;
- ◆ setting maximum annual volumes that can be extracted in relation to land size;
- ◆ limiting the water level draw down on neighbouring bores to a percentage of the saturated thickness of the aquifer; and
- ◆ limiting the water level draw down caused by extractions on a specified monitoring bore.

Tools to protect against water quality decline include:

- ◆ setting distance limits from the place where lower quality groundwater occurs so the water is not drawn into higher quality groundwater areas;
- ◆ setting groundwater quality criteria which, when approached, trigger a change in pumping regime for licence holders; and
- ◆ limiting water level draw down to prevent poor water quality inflow.

Tools to protect dependent ecosystems include:

- ◆ setting critical water levels close to dependent ecosystems which, when approached, trigger a change in pumping regime for nearby licence holders
- ◆ ensuring high yield pumping bores are at least a certain distance from dependent ecosystems;
- ◆ further refining these distance criteria according to the annual volume extracted;

The local impact (micro) management described above will apply to all groundwater systems, and will take precedence over any macro management tools. This approach is particularly important in shallow aquifer systems where the volume of water in storage is relatively small. Although the sustainable yield for all systems is derived using long term average climatic condition, in shallow groundwater systems, the sustainable yield is likely to be available in average to wet years only. In dry or drought years, when the recharge is less than the average, the system will quickly be depleted, and extraction up to the full sustainable yield will not be possible.

In shallow systems, a combination of sustainable yield (to determine annual extractable volumes), and water level triggers (to determine daily or weekly access to manage local impacts) will be the key to successful and sustainable groundwater management.

### Principle 5

**Artificial recharge of groundwater will be strictly controlled.**

The concept of artificial recharge of an aquifer is at times put forward to increase yield. This involves the enhanced recharge of an aquifer by an injection well or bore, or by spreading and holding water over the aquifer's recharge areas. However, either of these processes can harm the aquifer. Therefore, artificial recharge schemes will be strictly controlled to protect the intrinsic water quality of the aquifer and maintain aquifer permeability.

### Principle 6

**Landholders overlying an aquifer will have a basic right to access groundwater for domestic and stock purposes.**

The *Water Management Act 2000* recognises a basic right of landholders overlying an aquifer to access groundwater for domestic and stock watering purposes. An access licence is not required to extract water to satisfy a landholder's basic right.

However, the bore, well, or spearpoint will require a water management work approval.

In special circumstances, the Minister may limit the exercise of basic rights. This is only likely if the cumulative impact of sometimes hundreds of small domestic bores is likely to have an unacceptable impact on groundwater levels, which may in turn jeopardise the quality or quantity of the resource or dependent ecosystems in the medium to longer term. It may also be necessary if there is contamination of the aquifer making it a health risk for people to use the water.

### Principle 7

**Access to groundwater will be managed according to an established priority of use.**

The *Water Management Act 2000* establishes a priority of access to the water that is available for extraction, after environmental water is provided. The State-wide priority is to satisfy, in order:

- ◆ basic rights, including domestic and stock requirements first; then
- ◆ local water utility and major water utility water needs; and then
- ◆ all other irrigation and industry needs.

If groundwater access has to be diminished, the access of a higher priority will be diminished at a lesser rate than the access of a lower priority.

While protecting domestic and stock (D&S) water is a key requirement, it should not unnecessarily compromise future supply for other uses. With regard to stock and domestic bores, the following options should be evaluated and a preferred approach recommended in draft water sharing plans:

- ◆ drilling new D&S bores to sufficient depth (below the level of water level fluctuation due to irrigation pumping) to maintain their long-term access to the resource for the life of the bore;
- ◆ deepening existing affected D&S bores or drilling new, deeper bores to maintain access to the resource in all but exceptional (drought) circumstances. The financial (cost sharing) arrangements for this need to be specified in the draft water sharing plans;
- ◆ providing the supply of D&S water from other sources, such as a neighbouring irrigation bore, during critical times.

## Principle 8

**All rights (excepting basic rights) to access and extract groundwater must be licensed and metered.**

Under the *Water Management Act 2000*, any person or entity wanting to access groundwater for any purpose other than to satisfy a basic right, will require a water access licence, and extractions must be metered.

In some areas, even domestic and stock groundwater extractions will require metering and the Minister will declare these areas or circumstances. This is likely to be in areas where the cumulative impact of these small extractions is significant.

## Principle 9

**In systems that are not subject to a licence embargo or a Ministerial order, groundwater access licences will be issued on the basis of demonstrated need, within the sustainable yield.**

Some aquifers may be subject to a Ministerial order controlling how access licences are to be allocated – by auction, tender or other form. Outside these areas anyone may apply for an access licence in an area not embargoed.

Applicants for a groundwater licence will need to assess their groundwater requirements and demonstrate both a bonafide need for the resource, and the likely impacts of the proposed pumping on the sustainability of aquifer. The level of information required will depend on the size of the proposed development.

The DLWC will advise whether the volume of groundwater sought is within the sustainable yield for the aquifer and management zone, and whether there are likely to be any unacceptable impacts on dependent ecosystems, existing users, or water quality. There will be upper limits on the amount of groundwater that can be obtained based on local sustainability criteria. Final conditions (including the entitlement) will be determined after the bore is constructed and actual yield information is available.

## Principle 10

**Groundwater access licence holders have resource stewardship obligations, and are required to abide by the conditions of their licence.**

The right to access groundwater will be conditional on the resource itself remaining sustainable,

dependent ecosystems being protected, and local impacts between users being minimised. Licence holders will be required to abide by the rules established in the water management plans, and any other conditions on individual licences, including the condition to meter extractions.

## Principle 11

**Permanent and temporary transfer of groundwater access will be permitted within sustainable yield constraints, if the transfer does not cause unacceptable impacts on other users, water quality or dependent ecosystems. Inter-aquifer transfers will not be permitted.**

There are natural limits on the amount of access that can be transferred from one area to another within an aquifer system because of hydrogeological constraints on the movement of groundwater. It is also important that groundwater transfers do not have adverse environmental impacts, or unacceptable impacts on other users.

Water management plans will specify local transfer rules in the water source, consistent with State-wide principles – see *Advisory Note No. 15: Water transfers*. Given the myriad of possible very localised impacts of groundwater transfers, each proposed transfer (particularly permanent transfers) will also require assessment and approval by the DLWC.

## Principle 12

**Within environmental and interference constraints, the management of groundwater access should provide business flexibility for existing users through carryover and borrowing provisions on annual entitlements.**

Carryover is a management tool that encourages efficiency and discourages wastage. This allows water users to accumulate a part of their annual or announced allocation not used in any one year, for use in following years. Carryover will not be permitted if flow meters are not installed.

A water user may also be able to borrow a small percentage of their forthcoming year's annual allocation to complete seasonal requirements. The following year's allocation will be reduced by at least the borrowed amount.

## Principle 13

**Approvals must be obtained before any groundwater access licence can be activated at a particular location.**

To activate an access licence, the following approvals are required:

- ◆ a water supply works approval to construct the bore, using a licensed bore driller; and
- ◆ a water use approval to use water on land for a particular purpose.

### Principle 14

**All activities or works that intersect an aquifer, and are not for the primary purpose of extracting groundwater, need an aquifer interference approval.**

Examples of possible aquifer interference include mining or road building, and monitoring bores. If the activity or work causes a decline in groundwater quantity, an access licence will be required as well as the aquifer interference approval.

### Government Role

To assist the Committees in developing their recommendations on the water sharing rules the DLWC will provide the committee with:

- ◆ the established average yearly recharge estimates for the management area and specific zones, and the basis for their calculation calculation - *"Recharge Assessment for Priority Groundwater Systems within NSW", DLWC Sept 01;*
- ◆ information on groundwater dependent ecosystems and their degree of dependence;
- ◆ use adjustment options for over-used systems;
- ◆ entitlement adjustment options for systems which are overallocated;
- ◆ options for protecting basic rights;
- ◆ options for managing local impacts on groundwater dependent ecosystems;
- ◆ options for managing the water quality impacts of pumping;
- ◆ options for minimising local interference effects between users;
- ◆ options to protect aquifer structure;
- ◆ account management options (carryover and borrowing provisions); and
- ◆ State water transfer principles.

### Committee Role

In developing their draft water sharing plans, Committees will need to:

- ◆ recommend the proportion of recharge to be retained as a global environmental provision, thus establishing the sustainable yield for the system;
- ◆ recommend a strategy for use adjustment in over-used systems;
- ◆ recommend a strategy for entitlement adjustment in systems which are overallocated;
- ◆ recommend rules or strategies for protecting basic rights;
- ◆ recommend rules or strategies for managing local impacts on groundwater dependent ecosystems;
- ◆ recommend rules or strategies for managing the water quality impacts of pumping;
- ◆ recommend rules for minimising local interference effects between users;
- ◆ recommend rules to protect aquifer structure;
- ◆ recommend account management rules (carryover and borrowing provisions); and
- ◆ recommend local transfer rules.