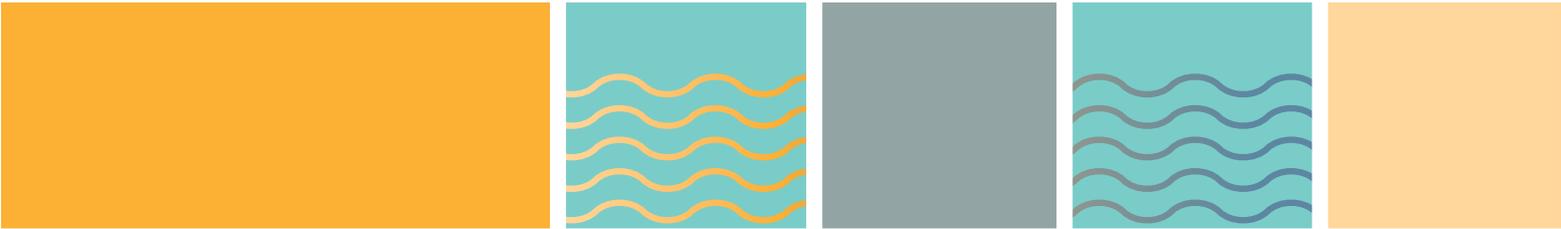


WATER SHARING PLAN

Bellinger River Area unregulated and alluvial water sources

Background document

August 2008



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Introduction

Water Sharing Plans are being progressively developed for rivers and groundwater systems across the State following the introduction of the *Water Management Act 2000*. A number of plans have already been completed. These plans protect the health of our rivers, while also providing water users with the greater certainty over future access to water and increased trading opportunities.

Water Sharing Plans for the majority of the State's unregulated rivers and groundwater systems are now being completed using a "macro" or broader-scale river catchment or aquifer system approach, although the principles, objectives and management arrangements remain the same as the plans developed for a smaller area or water source. Unregulated rivers are those which do not have their flows regulated by major state-administered dams. Most water users on unregulated rivers rely on natural flows for their water supply.

The Water Sharing Plan for the Bellinger River unregulated and alluvial area covers 11 water sources. The key rules in the Plan specify when licence holders can access water and how water can be traded.

This background document to the Bellinger WSP outlines:

- the purpose of the statutory Plan
- intended outcomes of the Plan
- a description of the Plan area
- the process of Plan development
- the use of adaptive management
- activities associated with implementation of the Plan.

This document is part of a range of material available specifically on the Bellinger River Area WSP including:

- the Water Sharing Plan for the Bellinger River Area Unregulated and Aquifer Water Sources 2007 (the legal plan written in its required statutory format)
- a guide to the Water Sharing Plan (a plain English version explaining the key Plan sections and rules)
- report cards for each water source detailing background information on the water sources classification and the proposed management rules.

In addition the following general information is also available on the macro planning process:

- The Community Manual *Macro water sharing plans: The approach for unregulated rivers. Report to assist community consultation* – explains the method used to classify and set water sharing rules for unregulated streams across the State
- *Guidelines for Surface Water Sharing Plan Report Cards*: explains the information presented in report cards
- *Setting the water sharing rules* – a one page brochure which outlines the key steps for developing the rules.

Purpose of the Plan

WHY ARE WATER SHARING PLANS (WSPS) BEING PREPARED

To provide certainty for the environment and water users

Continued expansion of water use across NSW has placed many water sources in the State at the limit of available water. This has seen increasing competition between water users, (towns, farmers, industries and irrigators) for access to water. In addition, this has placed pressure on the health and biological diversity of our rivers and aquifers.

Under the Water Management Act, the sharing of water must firstly protect the health of the water source and its dependent ecosystems, followed by basic landholder rights. Amongst licensed water users, priority is then given to water utilities and licensed stock and domestic use, ahead of commercial purposes such as irrigation and industry.

To facilitate water trading

WSPs set the rules by which irrigation licences can be traded. It is expected that over time, there will be an enhanced water market, where licences will be traded both permanently and temporarily.

There are also a number of macro water sharing plans currently being prepared for groundwater aquifer systems across the State. These include alluvial, coastal sand, fractured rock and porous rock aquifers. While these are separate WSPs, there will be instances where the two Plans must consider the inter-linkages of the water resources - eg in alluvial groundwater systems where the stream flow and groundwater are often closely linked.

WHY A MACRO APPROACH TO WATER PLANNING?

Macro water sharing plans (referred to hereafter as 'macro plans') are water sharing plans which apply to a number of water sources across catchments or different types of aquifers. In July 2004, 31 water sharing plans commenced in New South Wales, bringing these water sources and some 80 per cent of the water extracted in New South Wales under the management and licensing provisions of the Water Management Act.

The macro planning process is designed to develop broader-scale water sharing plans covering most of the remaining water sources in the State. Each macro plan covers a large river basin (not a single sub-catchment), or in the case of groundwater systems, cover a particular type of aquifer (eg fractured rock) across the State. These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water use.

Macro plans are being developed through a process involving technical assessments, classification and development of water sharing rules by regional panels and a state groundwater panel.

INTENDED OUTCOMES OF THE WSP

The objectives of the Bellinger River Area WSP are to:

- protect the important water dependent environmental, Aboriginal, cultural and heritage values
- protect basic landholder rights
- manage the river to ensure equitable sharing between users
- provide opportunities for market-based trading of licences and water allocations
- provide flexibility for licence users in how they can use their water
- allow for adaptive management, that is, to allow changes to be made when more information is available.

BENEFITS FOR WATER USERS

With the introduction of the WSP, a number of benefits flow to water users:

- Greater certainty for water users – the Plan sets out the water sharing arrangements for a 10 year period
- The Plan will facilitate trading of licences (and water allocations) – clear trading and access rules will help foster trading on unregulated rivers
- Commercial licences in the Plan area will automatically become perpetual access licences, meaning they do not have to be renewed. Approvals for the works used to extract water under these access licences will need to be reviewed.

The Plan recognises the economic benefits of commercial users such as irrigators and industry to the region. It sets rules that so that commercial users can continue to operate productively. Two of the water sources covered by the Plan were classified as having a high economic dependence on commercial extraction (see Table 1).

Table 1: Water sources with a high level of economic dependence

Water Source	Description
Bellinger River	Relatively high value of production from irrigation
Hydes Creek	Relatively high value of production from irrigation

ENVIRONMENTAL OUTCOMES

Water sharing plans are required to reserve water for the overall health of the river and to protect specific ecosystems that depend on river flows, such as wetlands, lakes, estuaries and floodplains. The share of water reserved for the environment is intended to sustain the aquatic fauna and flora.

Most of the flows in the Bellinger River Area unregulated rivers are protected from extraction. The total annual volume of water licensed for extraction in the Bellinger River Extraction Management Unit (EMU) is only 4,643 ML, compared to an annual average flow of 612 704 ML. In the Dalhousie Creek EMU, the total annual volume of water licensed for extraction is 191 ML, compared to an average annual flow of 1630 ML. The Plan also imposes new restrictions of access on days when flows are low to protect the environment. This is achieved by establishing “cease to pump” rules that describe when water must not be extracted, depending on the amount of flow in the river on any day.

Even though the total annual volume of water extracted in each EMU is relatively low compared to average annual flows, most of the demand for water from unregulated systems usually occurs at those times when stream flow is low. In order to protect a proportion of some of these very low flows for the environment, the Plan also imposes new restrictions on access on days when flows are low. This is achieved by establishing “cease to pump” rules that describe when water must not be extracted, depending on the amount of flow in the river on any day. Whilst there is only limited research on the importance of protecting very low flows, there is a body of evidence that suggests low flows are essential for maintaining water quality, allowing passage over riffles for fish and other fauna to pools used for drought refuge, and maintaining those parts of aquatic ecosystems that are most productive. For example, the faster flowing riffle areas between pools usually contain the highest abundance and diversity of aquatic fauna. Additionally, it should be noted that although many streams naturally stopped flowing in dry times, it is the increased frequency and duration of drying, as a result of extraction that has potential to impact on stream ecosystems.

Four water sources were identified as having high instream value (see Table 2). For these water sources, water trading will be limited so that there is no increase in water entitlement, and in some cases trading rules aim to decrease entitlement. Where these values are at risk from extraction, the cease to pump rule tends to be quite stringent.

Table 2: Water sources with a high instream value (based on initial assessment)

Water Source	Description of instream value
Kalang River	7 threatened frog species 2 threatened bird species 1 other threatened fauna species minimal disturbance to in stream condition significant area of National Park
Never Never Creek	8 threatened frog species 1 threatened bird species 1 threatened wet flora species minimal disturbance to in stream condition high recreation value significant area of National Park
Rosewood Creek	8 threatened frog species 1 threatened bird species 1 threatened wet flora species minimal disturbance to in stream condition high diversity high recreation value significant area of National Park
Thora – North Arm	9 threatened frog species 3 threatened bird species 2 other threatened fauna 1 threatened wet flora species minimal disturbance to in stream condition high diversity significant area of National Park

At least three water sources in the Plan area had no existing cease to pump condition when flows are low. In others water sources, only a proportion of licenses were subject to access rules. When the Plan commences, all irrigation licences in all water sources will be subject to cease to pump rules.

Description of the plan area

DESCRIPTION

The Bellinger River WSP area is located 600 km north of Sydney on the mid north coast of NSW encompassing approximately 1000 square km. The two main rivers in the catchment are the Kalang and the Bellinger River. The Kalang River flows into the Bellinger just upstream of the river mouth at Urunga. They share a common entrance to the ocean. The tidal influence in the Kalang River extends for approximately 25 km upstream. For the Bellinger River, the tidal influence extends upstream for approximately 20 km to the township of Bellingen.

The Bellinger catchment is highly valued for its natural beauty and contains some regionally significant rainforest. It is rich in natural biodiversity with abundant aquatic and terrestrial ecosystems, famous for the Ringwood Tree and the vulnerable Bellinger River Freshwater Turtle (*Elseya georgesii*) which are only found locally.

Most of the catchment is mountainous with only small areas of flat land along with river and creek valleys and the coastal floodplain.

CLIMATE

The climate of the Bellingen valley and coastal areas is sub-tropical with warm, wet, humid summers and mild, dry winters. Bellingen township has a mean daily summer maximum temperature of 29 °C and a mean daily winter minimum temperature of 5°C. The proportion of rainfall is high compared with the rest of the state. Average annual rainfall for Bellingen is 1400mm/year with an overall average for the catchment of over 1500mm/year. The majority of rainfall occurs in the summer and autumn months (Bellinger Shire Council 2004).

LANDUSE HISTORY

Bellinger River lies within the territory of the Gumbaynggir Aboriginal people, which extends from Grafton in the north to the Nambucca River in the south and westward from the coast to the headwaters of the Nymboida River.

The land and waterways, and the plants and animals that live in them, feature in all facets of Aboriginal culture – including recreational, ceremonial, spiritual and as a main source of food and medicine. They are associated with dreaming stories and cultural learning that is still passed on today.

Europeans first came to the Bellinger Valley in 1841 with cedar cutters and graziers establishing in the area thereafter. At that time the area was covered with thick vegetation, and more than 80% of the catchment remains forested (HRC 2003). Dairying was introduced into the valley in the 1890s and many small holdings were developed at this time, although they tended to decline in the 1970s, similar to other coastal areas (Bellinger Shire Council 2004). Topography was a dominant factor influencing the development of the landscape, with steep slopes remaining forested while the narrow floodplain and nearby foothills have been cleared for grazing, cropping and other activities (DLWC 1999).

In the Bellinger-Kalang catchment, there is a dominance of bedrock control on most river styles and many river reaches have not experienced significant changes to the geomorphic structure of the river in the period since European settlement (Cohen et al 1998). In the Bellinger Valley, alluvial river reaches are more degraded than in the Kalang Valley and this reflects the greater degree of disturbance in the lower Bellinger River, resulting from clearance of riparian vegetation and gravel extraction (Cohen et al 1998). Downstream of Thora, the lower Bellinger River is particularly degraded with the channel width greatly enlarged, pools indistinct and the current river structure providing little aquatic and riparian habitat (Cohen et al 1998). The lower Kalang River is more stable and may be more representative of pre-European conditions (Cohen et al 1998).

INDUSTRY

Forestry operations are an important contributor to the local economy. Small land parcels are common in the catchment and the historical use of the land for dairying and beef production has changed to small-scale hobby farms and rural residential use (Bellinger Shire Council 2004). Produce includes limited dairy, beef, pork and crops such as maize, sorghum and vegetables.

Tourism is progressively overtaking agriculture as the largest contributor to the regional economy.

Plan development process

PROJECT GROUPS

Project Control Group

The Project Control Group (PCG) has overall responsibility for the strategic direction of the macro water sharing planning project, to make certain that adequate resources are available and to ensure that the varying policy and statutory requirements of the relevant NSW Government agencies are met. The PCG also has the role of making water sharing decisions in cases where the Regional Panel cannot reach agreement.

The PCG is chaired by the Department of Water and Energy (DWE). The group has representatives from the DWE, Departments of Environment and Climate Change (DECC), and Primary Industries (DPI). There are also three Catchment Management Authority (CMA) representatives. DWE is responsible for overall project management.

The Regional Panel

The Plan rules were initially developed by the North Coast Regional Panel. This is an inter-agency group consisting of representatives from DWE, DPI, DECC and the Northern Rivers CMA (as an observer). Appendix 1 lists the names of the North Coast Regional Panel representatives and their areas of expertise. The panel had access to staff from the agencies to provide technical and scientific information. The key roles of the panel were to:

- review the hydrological units or water sources
- assign economic, social and environmental values and undertake classification for each water source
- review the suitability of existing licence conditions
- make recommendations on the water access and trading rules for each water source
- assist CMAs with the public consultation on the proposed rules
- review submissions and make changes, where necessary to the draft water sharing rules.

An Independent Facilitator was engaged to chair the meetings and guide the decision-making process. The Regional Panel used a consensus decision-making approach and where agencies had particular issues those issues will be highlighted during the public consultation period for specific attention. An Independent Facilitator was not involved in the later Regional Panel meetings which were focused on the clarification and finalisation of draft Plan provisions.

THE POLICY CONTEXT

There are a number of policies and initiatives that impact on and direct the development of water sharing plans. Water sharing plans are required to be guided by the River Flow Objectives, as stated in the NSW State Water Management Outcomes Plan. In 1997, the NSW Government undertook a public process of developing water quality and river flow objectives for NSW unregulated river catchments. The relevant river flow objectives for the unregulated rivers for the Bellinger River Area WSP area aim to:

- protect natural low flows
- protect natural water levels in pools of creeks, rivers and wetlands during periods of no flow
- protect a proportion of moderate flows, “freshes” and high flows
- maintain or rehabilitate estuarine processes and habitats
- maintain groundwater within natural levels, and variability, critical to surface flows or ecosystems.

The rules in the Bellinger River Area WSP were developed based on these objectives (refer Appendix 5 for detail).

The macro plans are consistent with the **National Water Initiative** (see www.nwc.gov.au for details). This intergovernmental agreement includes provisions on water planning and specifies:

- recognises that settling the trade-offs between the competing outcomes of secure ecological and resource security outcomes will require best available science and socio-economic analysis, as well as community input
- ensures the achievement of the environmental and other public benefit outcomes, including arrangements necessary to sustain high conservation value rivers, reaches, and groundwater areas
- ensures that environmental and other public-benefit outcomes are achieved, including actions to sustain high-conservation value rivers, reaches, and groundwater areas.

The macro plans comply with the **NSW Natural Resource Commission (NRC) statewide standards** and contribute to the relevant statewide targets (see www.nrc.nsw.gov.au for details). The NRC was established in 2003 to develop statewide natural resource management standards and targets and to review the water sharing plans against these targets. As with the National Water Initiative, the state standards focus on the use of the best available knowledge, use of appropriate information management systems, delivery of integrated outcomes, engagement of the community and regular monitoring, measuring, evaluation and reporting.

Table 3: Contribution of the Bellinger River Area WSP to the NRC statewide targets.

Relevant statewide target	Contribution by Bellinger River Area WSP
By 2015 there is an improvement in the condition of riverine ecosystems	<ul style="list-style-type: none"> - set a defined share of water for riverine ecosystems - protection of very low flows - trading rules to maintain or reduce entitlement in high value streams - adaptive management, giving the ability to adjust rules once information becomes available
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained	<ul style="list-style-type: none"> - trading rules to maintain or reduce entitlement in high-value coastal water sources
By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems	<ul style="list-style-type: none"> - rules to be developed for tidal pool areas based on the environmental requirements of estuaries - commence to flow rules introduced to protect first flush to estuaries
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being	<ul style="list-style-type: none"> - plans provide a defined share to water and defined security of access - water markets encourage movement of water licenses to high-value uses - rules developed which consider community dependence on water extraction
By 2015 there is an increase in the recovery of threatened species populations and ecological communities	<ul style="list-style-type: none"> - some access and trading rules were developed to protect water dependent threatened species where these were identified and the risk to these from extraction was high

This Plan is consistent with and contributes to the Northern Rivers **Catchment Action Plan** (2006, Catchment Action Plan, Northern Rivers CMA).

Policies specific to water sharing plans

Aboriginal Community Development Access Licences

Many of our rivers already have a high number of irrigation licences, and are generally judged to be ‘stressed’, particularly during dry times when, for example, river flows are low. This effectively prevents the issuing of any new water licences on these “stressed” rivers. However in some of our coastal rivers, higher and more reliable flows are common and provide an opportunity for licences to be granted for Aboriginal Community Development activities, provided this additional extraction would not negatively impact on ecological values that are dependent on high flows. In these coastal catchments, Aboriginal Community Development licences¹ may be issued which allow water to be pumped from rivers during the

¹ The NSW Government has amended the Water Management Regulation 2004 in order to delete the Aboriginal Commercial sub-category and create a new sub-category of unregulated river and aquifer access licences called “Aboriginal Community Development.” This new category of licences is not fully commercial. While they may be temporarily traded, they cannot be subject to permanent trade and as such will remain in the Aboriginal community for the life of the licence. Aboriginal communities, enterprises and individuals are encouraged to seek financial assistance from funding bodies such as the Aboriginal Water Trust to purchase fully commercial licences.

higher flows, and stored in farm dams or tanks, to be used as needed. It is important to note that higher flows are not just peak or flood flows but also include flows that occur for 50 percent of the time.

Since granting these Aboriginal Community Development licences would mean less water remains in the river to meet environmental needs, it will be necessary to limit the total volume that can be extracted for Aboriginal commercial purposes. The limit would be a proportion of the river flow, and would never exceed 500ML/yr per water source. The government does not propose to limit the volume assigned to each individual Aboriginal Community Development licence, only the total volume per water source.

High Flow Conversion

Many of our coastal unregulated rivers suffer severe competition for water during dry spells. These extended periods of low flow tend to be when water users compete most strongly for access to dwindling flows and pools. Instream values can also be stressed during these low flow periods as wildlife is concentrated and water quality can deteriorate. Therefore, there is merit in incentive schemes that attempt to move extraction out of the low flows and into the higher flows, as an attempt to improve environmental conditions.

By changing water use from periods of low flow to periods of relatively higher flow, over time, streams may be de-stressed and river conditions may improve. An incentive is required though, as low flow extraction is cheap and convenient – water users simply pump the water when it's available. To utilise higher flows, generally it would be necessary to construct on-farm storage. Water could then be pumped during periods of higher flow and stored and used at a later time. This is a much more expensive approach to irrigation but can provide enhanced security for water users.

The proposed incentive through the draft plan is to allow those pumpers that convert to higher flows to be granted additional volumes of water. In the Bellinger River Area WSP it is proposed that for every 1 unit of an unrestricted licence surrendered, 2.5 units of higher flow entitlement will be granted.

Given that the purpose of the higher flow conversions is to “de-stress” low flows in our coastal river systems, a detailed assessment was undertaken to ensure that there is an overall environmental benefit achieved.

The conversion has been recommended in specified water sources only if the following criteria are met:

- The water source is classified as having important instream values at high risk from extraction or in water sources having high hydrological stress.
- There are adequate mechanisms in place to ensure the surrendered low flow is reserved for the environment.
- There is no highly sensitive estuary (for example an ICOLL) or other identified high flow sensitive feature such as a wetland within the Extraction Management Unit.
- There is no existing high flow stress (ie significant extraction already in the high flows).
- The conversion would not significantly impact on tidal pool users or Town Water Supplies.

Through this process, conversions are capped at the extraction management unit by either an increase of 20% of the existing annual entitlement, or 10% extraction of the daily 30th percentile converted to an annual limit based on a half year growing season, whichever is the lesser.

Further assessment would be required before additional conversions (up to a maximum of 30% of the 30thtile x 110) would be within a sustainable framework.

Trading of higher flow entitlements is possible, but constrained as follows:

- Within water source trades will generally be permissible;
- Cease and commence to pump levels at the new location will generally be the 50thtile;
- As long as the proposed location meets the eligibility criteria explained above, trades between water sources would generally be permissible.

CLASSIFICATION METHOD

The Regional Panel classified each water source as high, medium or low on the basis of its instream and economic values, and the risks to these values. Two matrices were developed – the first being the “value matrix” which rated a water source’s instream value against its hydrologic stress. The second was the “risk matrix” which rated the risk to instream values against community dependence.

This classification method took into account:

- the amount of water licensed for extraction
- the impact of extraction on rivers and estuaries
- the associated uses from this extraction
- the social and economic impacts of restricting extraction.

Specifically the classification process involved assessment of factors, including:

- instream values; for example, threatened fish that are likely to be affected by extraction
- the risk to instream values posed by the existing or increased extraction
- the hydrologic stress, which is the amount of water licensed for extraction relative to river flow
- the extraction value, which is the economic value of the water licensed for extraction
- the economic dependence of the local community on activities dependent on licensed water extraction
- the sensitivity of estuaries to the removal of freshwater inflows
- basic landholder rights and town water supplies
- whether the existing water sharing rules are adequate to manage the risk to instream values and basic landholder rights
- NSW Government policy.

A large range of reference material was used in addition to the general knowledge of Regional Panel members and technical support staff. The reference material is listed in Appendix 2.

The classification assisted in determining the optimal balance between extraction and retention of water instream for each water source. These broad-scale relative assessments showed where water sharing rules needed to strongly protect valuable natural assets by limiting extraction or to provide for extraction by water users where there is significant community dependence on extraction. Generic indicative rules were developed for each classification for each matrix to expedite the development of the water sharing plans by the

panels. Where necessary, the panels refined these indicative rules to reflect local circumstances. The “value” matrix was used to develop trading rules and the “risk” matrix used to develop the water access rules. The final classifications determined by the Regional Panel for all water sources (both value and risk matrices) have been summarised in Appendix 3.

It is important to note that the matrix approach was used as an ‘indicative tool’ to develop initial classifications. While these classifications guided the water sharing rules, a major role of the Regional Panel was to use the local knowledge of panel members to check whether the final classifications were realistic. Amendments to both the classifications and the management rules by the Regional Panel were based on local and technical knowledge of the water sources. In addition, the approach did not include some information which was added by the Regional Panel, such as extraction for town water supplies and the economic values of water extraction that were not considered in the classification process.

For full details about the classification method, see the document *Macro water sharing plans. The approach for unregulated rivers. Report to assist community consultation* which is available on the department’s website.

Aboriginal values

Aboriginal cultural values could be affected by water extraction from rivers. Most information about flow-related Aboriginal values resides in Indigenous communities. These communities will be targeted during the public exhibition period, to determine whether the proposed water sharing rules adequately protect Aboriginal cultural values. For more information see the fact sheet *Macro water sharing plans. Information for Aboriginal water users*, available on the department’s website.

The initial consultation sessions have provided some insights into Aboriginal cultural values on Bellinger unregulated rivers. Aboriginal communities have indicated that water sharing rules should protect natural instream values. Whilst Aboriginal groups acknowledge the rights of commercial water users, they believe that this should not be at the expense of the environment. In their view, the priority for Water Sharing Plans should be to provide for natural flowing rivers with healthy aquatic biodiversity.

Exceptions to the generic classification approach

As mentioned a major role of the Regional Panel was to use the local knowledge of panel members to check whether the final classifications were realistic. Table 4 lists the changes to classifications made by the Panel.

Table 4: Refined Classifications based on Regional Panel Knowledge (refer to Appendix 3)

Water source	Change to Classification	Justification
Never Never Creek	Risk classification changed from E - C	Panel revised the economic dependence from medium to high due to the number of licenses and a large dairy farm operating in the water source. The Panel also revised the risk to instream values from medium to high based on the number of threatened species and the amount of water being taken out of the system.
Rosewood Creek	Risk classification changed from H - G	The Regional Panel revised the economic dependence from medium to low as a large proportion of the water source is National Park and there are a relative small number of licenses.

OTHER CONSIDERATION

Estuaries

Estuarine values can be threatened by water extraction. Some estuaries are highly sensitive to freshwater inflows, whilst others are quite resilient to changed inflows. The size and shape of estuaries vary and this, combined with the amount of freshwater inflows, determines the estuaries overall sensitivity to freshwater extraction. Where possible, extractions will be tightly capped in estuaries found to be highly sensitive to freshwater inflows.

An analysis was undertaken by a DWE expert panel to determine how sensitive each of the states estuaries are to changes to freshwater inflows. Table 5 summarises the inflow sensitivities for the Bellinger area estuaries.

Table 5: Inflow sensitivities for the Bellinger area estuaries

Name	Inflow sensitivity - low flows	Inflow sensitivity - high flows
Coastal Bellinger	Low	Low
Coastal Kalang	Low	Low
Dalhousie Creek	High	High

Water interception activities

Changed land-use activities can intercept significant quantities of water. Examples of this are an increased farm dam capacity in a catchment or significant areas of new forestry plantations. Under the National Water Initiative, significant interception activities will require a water access licence.

The Bellinger catchment is considered an area in which there are no significant water interception activities anticipated within the life of the plan. There are large areas of the catchment covered by State Forests, including some areas of hardwood plantation. The majority of the State Forests within the catchment are managed with selective logging technique, resulting in minimal change to catchment hydrology. However, in the lower reaches of the catchment, there are some hardwood plantations but these are only modest in scale and not considered to have a significant impact on river flow at the water source or catchment level.

Plantation developments are controlled in NSW under the Plantations Afforestation Act and will be monitored in the Bellinger catchments, and assessed to determine if water access licences are required for new plantations.

Farm dams require an access licence only when:

- they are located on a 3rd-order (or greater) river, irrespective of the dam capacity or purpose
- if they exceed the maximum harvestable right for the property, which is equivalent to 10% of the mean annual runoff
- if they are on a permanent (spring fed) 1st and 2nd order streams.

The provisions relating to harvestable rights are unaffected by any of the rules identified in a macro water sharing plan. The volume of licensed farm dams was considered in determining hydrologic stress and access rules.

Surface water – Groundwater interactions

Groundwater and surface waters are inextricably linked. The actual connections between surface and groundwater systems vary significantly between systems. For example, surface waters recharging alluvial aquifers may emerge again at a discharge point in the river within hours. Water recharging aquifers of the Great Artesian Basin, however may not discharge for some tens of thousands of years. The connection characteristics need to be considered in linking surface water and groundwater planning, because in some cases, the same resource is being accessed.

For the purposes of water sharing, aquifer types have been grouped into 4 basic categories:

- porous rock aquifers found in rock formations such as sandstone or limestone. Groundwater occurs within the pore space in the rock matrix
- fractured rock aquifers found in rock formations such as granite or basalt. Groundwater in these rocks occurs mainly within the fractures and joints
- coastal sand aquifers, where groundwater is contained in the pore spaces in the unconsolidated sand sediments
- alluvial aquifers, where groundwater is contained in the pore spaces in the unconsolidated floodplain material.

The level of connectivity, the relative level of impact and the timing of connection have been considered in developing both the unregulated river and the associated groundwater sharing plans for the Bellinger area. One of the key factors in determining the sustainable yield for various aquifers is the downstream values in associated streams.

The aquifer types and groundwater sources that occur within the Bellinger water sharing plan and their connectivity characteristics are given in Table 9. It is based on principles and recommendations in *Towards a National Framework for Managing the Impacts of Groundwater and Surface Water Interaction in Australia* by Sinclair Knight Merz (2006).

Table 6: Connectivity between aquifer types and surface water

Aquifer type	Water Sources	Level of Connection between surface & groundwater -	Level of impact on instream values	Estimated travel time between groundwater and unregulated river
Coastal sands	Bellinger Coastal Sands	Significant (tidal section only)	Low due to connection with saline water	Days to months
Up-river Alluvial	All unregulated rivers	Significant	High due to impact on base flows	Day to months
Coastal Floodplain Alluvial	Bellinger Coastal Floodplain	Low - Moderate (tidal section only)	Low since not major contributor and low level of connection	Season
Fractured rock	New England Fold Belt	Low - Moderate	Low since not major contributor	Years to Decades

Alluvial aquifers

The alluvial aquifers can have a significant connection to their parent streams, depending on the type of alluvial material. For example, where alluvial aquifers are found in upriver situations and are made from coarse material such as sands and gravels, groundwater and surface waters interact significantly. However, in the lower catchment areas, where alluvial materials tend to be finer, there is generally only moderate inter-play between groundwater and the river. Therefore, the alluvial aquifers in the Bellinger River water sharing plan area have been grouped into 2 categories;

- The shallow “upriver” alluvial aquifers are characterised by coarse materials and relatively short travel times between ground and surface waters. These aquifers are considered to be “highly connected” to their parent streams. The water sharing rules for the upriver alluvial aquifers are covered in the Bellinger river unregulated and alluvial WSP.
- The coastal floodplain alluvial aquifers tend to have relatively fine materials, often interspersed with silt and clay layers, with only a small amount of inter-change between the surface and groundwater. Since the alluvial aquifers that occur on the coastal floodplains (ie those downstream of the tidal limit) of the Bellinger are low to moderately connected to their parent streams, it is not necessary to fully integrate the surface water and groundwater sharing rules for these systems. The coastal floodplain aquifers will be managed through the “Coastal Alluvium Macro Groundwater Sharing Plan” which will include water sharing rules for all of the states coastal floodplain aquifers. It will be important in that WSP to protect against saltwater intrusion and to properly consider the impact of groundwater extraction on estuary values.

The tidal limit is a useful boundary between the coastal and upriver alluvial systems in the Bellinger macro Water Sharing Plan area. In the Bellinger River water source, the tidal limit is a gravel bar 1.6 km upstream from the Bellinger town Bridge. In the Kalang River, the tidal limit is a small rise in the river 700 m upstream from the bridge at Brierfield. In the Hydes Creek water source the river separates into two tributaries. The tidal limit in the northern arm is 900 m upstream from Slarkes Bridge, and in the western arm, 150 m upstream from Constable Bridge.

The proposed water sharing rules for the highly connected upriver alluvial systems will be based on the following principles:

- Manage to a single long term annual extraction limit for the unregulated surface water and up-river shallow alluvial groundwater. This would be based on the sum of existing unregulated and alluvial groundwater entitlement, plus basic landholder rights, plus exemptions such as Aboriginal commercial or town water purposes (where these apply).
- Manage growth in use through a common set of available water determinations for both surface and groundwater users.
- Permit within water source licence conversion, assignment or allocation of surface to groundwater licences but not the reverse (ie one way only).
- Manage the trade of alluvial groundwater licences with the same trading rules as the adjoining surface water. In effect, this would prohibit trading into areas identified as having high instream values, or are characterised as high hydrological stress. Trade, where permitted between water sources, would only be from a river alluvial area to another river alluvial area.
- Manage existing bores located within 40m of an unregulated river to surface water daily access rules, (from year 6 of the plan), except access licences for stock and domestic, local water utilities, food safety or essential dairy care.

- Prohibit new bores within 40m of 1st & 2nd order streams unless:
 - they are drilled into the underlying parent material, and the slotted intervals of the production bore commences deeper than 30 metres, and
 - the applicant can demonstrate that the bore will have minimal impact on base flows in the stream.
- Apply the standard local impact rules for alluvial groundwater and the standard provisions for newly identified Groundwater Dependent Ecosystems.

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and natural ecological processes determined to some extent by the availability of groundwater.

The Bellinger River Area unregulated and alluvial water sources Water Sharing Plan includes water sharing rules for the highly connected alluvial groundwater. An initial assessment has been undertaken to determine whether there are any significant GDEs reliant on the alluvial groundwater. Possible GDEs in alluvial groundwater include:

- cave systems
- wetlands
- endangered ecological communities

Caves

Caves ecosystems are below the ground surface and at groundwater discharge areas and as such tend to be totally dependent on groundwater. Groundwater dependent cave ecosystems are typically associated with limestone and support an abundant variety of fauna such as crustacea and macro-invertebrates. Entire families of creatures are known to exist in these systems, some of which have been extinct from the surface for millennia. These caves are rich in biodiversity and it is important to ensure that groundwater extraction doesn't impact on that biodiversity.

The initial assessment found no caves in the Bellinger WSP area that are considered to be highly dependent on groundwater.

Wetlands

Groundwater dependent wetland ecosystems are typically areas where the water table is at the surface, or periodically at the surface. While the degree of groundwater dependency is variable, groundwater plays a critical role in wetlands found on alluvial floodplains. Many wetlands are extremely species rich with a mixture of plants and animals and are often considered to have high conservation value.

The initial assessment found no groundwater dependent wetlands on the alluvial floodplains in the Bellinger WSP area.

Endangered Ecological Communities

An endangered ecological community (EEC) is an assembly of species occupying a particular area (plant or animal communities) that is in danger of becoming extinct. These EECs are listed in schedules to the *Threatened Species Conservation Act (1995)*. In the case of plant communities, where these forests/woodlands occur on alluvial floodplains, it is possible that the vegetation relies to some extent on groundwater to sustain transpiration and growth. Groundwater extraction can effectively lower the water table, having a negative impact on the vegetation community.

The initial assessment found no groundwater dependent EECs for the Bellinger WSP area.

Water Sharing Rules for GDEs

GDE identification and assessment is an ongoing process. In the event that new significant GDEs are found in the Bellinger WSP area, consideration will be given to adding these during the life of the WSP. In this event, new or replacement bores will not be permitted within a buffer zone around the new GDE. Existing bores are not affected by the buffer zones and are able to continue operating (ie within the existing conditions of their access licences).

WATER SHARING RULES

Water sharing rules that the classification process focused on consist of:

- Access rules – which determine at what flow levels extraction is allowed
- Dealing rules – which control:
 - the trade of water, both transfer of access licence and assignment of water allocation between access licences
 - change of water sources, and
 - the location for extraction.

Other management rules are considered in the development of the plan such as:

- Extraction limits – which set the total volume of water that can be extracted annually from the water source or water management zone,
- Rules for granting new entitlement – what types of access licences may be granted,
- Rules for granting works approvals – what types of set back conditions are required,
- System operation rules – what types of rules are required for major storages (where relevant).

For details about the proposed water sharing rules for each water source covered by the draft Plan, refer to the Water Source Report Cards, available on the www.dwe.nsw.gov.au.

Developing the Access and Dealings Rules

The Regional Panel used local knowledge and expertise in applying the water sharing rules. For example:

- Existing local water sharing rules were examined to determine whether they achieved the required level of environmental protection and provided for basic rights.
- Local studies or information from regional staff in areas such as irrigation (DPI) or aquatic ecology (DWE) were included.
- Extractions patterns by local water and major utilities were examined.
- Consideration was given to see if the estuary at the end of the system necessitated additional catchment-wide protection.

In some instances, indicative rules were further refined if site-specific information was available.

The Regional Panel also considered the ability to manage and monitor flow in a water source. For example, where there was no flow gauging station they assessed the risks to the water source, and either:

- recommended new gauges be installed for high-risk or highly stressed water sources, or
- looked at alternatives such as “staff” gauges (which measure river height but not flow) or visible flow references where the risk to instream values was low.

They also considered any known specific requirements of threatened species in relation to key reproductive needs, migration or other particular ecological activities.

The Panel recommended a staged approach to change, so as to limit adverse social and economic impacts. In essence, this proposes that water users be given time to adapt to new rules. Where the existing rules were not consistent with the Panel’s recommended rules, the degree of immediate change (and hence the effect on extractors) was limited to the next higher level of rule in the first instance, unless a higher level of protection could be achieved with minimal socio-economic impact. The Panel then determined a timeframe and the further steps required to achieve the recommended rules during the life of the Plan.

Once the proposed water sharing rules were determined, a check was done to ensure that the rules integrate well and are practical across the catchment.

In some water sources, local water users have daily and hourly pumping restrictions or other arrangements to conserve water during dry times. While these have often been very effective in sharing water between license holders, they have not been enforceable via licence conditions. During targeted consultation, there was support by water users to continue using these arrangements in the majority of water sources, and as a result these were incorporated into the access rules of the draft WSP where possible.

Granting Aboriginal Community Development Licences

A detailed assessment was undertaken to determine where it may be appropriate to grant Aboriginal Community Development licences. It was decided that no new licences would be granted in water sources with high instream value or in areas that could not support any high flow licences. For the Bellinger River WSP area, applications for Aboriginal Community Development licences will be considered by the DWE in the following water sources:

- Bellinger River
- Boggy Creek
- Coastal Bellinger
- Coastal Kalang
- Hydes Creek
- Spicketts Creek

High Flow Conversions

Water sources in the Bellinger River Area WSP where applications for high flow conversions will be considered by the DWE are Never Never Creek and Hydes Creek.

Exceptions to the generic rule approach

In reviewing the indicative rules proposed for each water source, the Regional Panel used their local knowledge to refine access and trading rules where appropriate. Amendments made were based on factors such as:

- available infrastructure (eg river gauges)
- available management systems (eg ability to manage the rules)
- existing management rules (eg existing licence conditions or Water Users' Association management rules)
- whether the highly variable nature of the water source required differing management rules within it.

It was recognised that local interpretation of the indicative water sharing rules was very important. For example, the rule of 'no pumping from pools when pool drops to a specified height' was regarded as inappropriate in these systems due to small pool sizes and the numerous numbers of pools, and was not consistent with River Flow Objectives (pools need to be maintained for drought refuge). In these instances the Regional Panel adopted a rule of 'no pumping from pools where there is no visible inflow and outflow'.

In water sources where the existing access rule was more stringent than the indicative rule, generally the existing access rule was adopted, given that there should be no adverse social or economic impact as there would be no change to current operations. In these circumstances the Panel acknowledged that many of the rules had been negotiated by water users, had been in place for a period of time and seemed to be adequately protecting values while providing certainty for water users.

For several water sources no rule other than cease to pump when there is no visible flow could be recommended due to the absence of gauging stations. However in many cases visible flow approximates the level which the indicative rule was trying to achieve.

Table 7 outlines the changes made to the initial access and trading rules by the Regional Panel.

Table 7: Water Sharing Rules based on Regional Panel Knowledge

Water source	Change to water sharing rules	Justification
Kalang River	The access rule identified through the classification process was CTP when no visible flow at end of water source. The Panel recommended the CTP be set at 4 ML/day but not before year 6.	The Panel considered the economic dependence rating to be lower than indicated by the classification process. Given this and the high instream value of the area the panel recommended the access rule that would of applied if the water source had a low economic dependence rating.

CONSULTATION

The classifications and the Regional Panel's recommended rules underwent targeted consultation with water users and specific interest groups ² before the Plan was drafted. Formal public exhibition³ of the draft Plan ensured a wider level of public consultation.

While developing the macro plans, the participating agencies (DWE, DPI, DEC and the CMAs) have identified areas where better data is needed for making future water planning decisions. Similarly, the community might suggest areas where further analysis or data gathering is required. This local input is essential in the finalisation of the draft Plans.

CMAs will manage the consultation process throughout the State, and will ensure that all stakeholders and interested parties have an opportunity to examine and comment on the proposed water sharing rules. In particular, the Northern Rivers CMA will be looking for stakeholders to provide:

- local knowledge and expertise – for example, there may be natural or socio-economic values that may be more apparent to locals
- feedback on the practical elements of the proposed water sharing rules, to make certain they are easily implemented
- check that there are no unintended outcomes from the plans – local stakeholders have the expertise to advise on how these rules will work on-ground – it is essential that this is given due consideration before the Plans are finalised.

Targeted consultation on the draft rules

Targeted consultation on the proposed rules for the Bellinger River Area WSP began in late 2005 and finished in mid 2006 (Table 8). The objectives of this consultation were:

- to provide background as to why the macro plans were being developed, how they were developed, what rules were proposed in the various areas and how stakeholders could provide feedback; and
- to provide a 'first opportunity' to informally consult with key stakeholders to test the suitability of the proposed water sources and management zones, flow reference points and access and trading rules.

² Targeted consultation refers to informal consultation held with key stakeholders to test the suitability of the proposed water sharing rules and provide feedback on the rules potential impacts.

³ Public exhibition is the formal exhibition of the draft Plan where the Minister invites submissions on the draft Plans and in particular will seek comment on a range of key issues.

Table 8: Key groups consulted

Date	Group	Location
Jan 2006	Representatives from key interest group including water uses, industry, environmental and Aboriginal organisations,	Coffs Harbour
Feb 2006	Town Water Supply –, North Coast Water, Coffs Harbour, Clarence, Bellingen and Armidale Councils	Coffs Harbour
Mar 2006	License holders and general public	Coffs Harbour
May 2006	Aboriginal Community Support Officers (CMA) and representatives from Aboriginal communities	Nambucca

The Northern Rivers CMA encouraged stakeholders to submit their comments in writing. A total of three submissions were received as a result of the targeted consultation in the Bellinger area. These were reviewed by the Regional Panel and changes were made to information where appropriate.

Refining water sharing rules as a result of targeted consultation

The Regional Panel reviewed the submissions as well as matters raised at the meetings and as a result made some changes to the initial rules. During this review process if more update flow data and water use data was available it was incorporated into the assessment process. Table 9 outlines the changes to the proposed rules as a result of the consultation or new data. Table 6 outlines the changes to the proposed rules as a result of the consultation.

So that individuals and groups can see how the key issues raised during consultation were dealt with by the Regional Panel, a section titled "Matters Raised During Targeted Consultation" has been added to the report card for each water source.

Table 9: Changes to water sharing rules as a result of targeted consultation

Water source	Change to water sharing rules	Justification
Never Never Creek	No change to rules but the risk classification was changed from C - E	Based on information received during consultation it was suggested that 5 dairies farms had ceased operations. This was later confirmed by DWE licensing. In light of this information the Panel reversed its original decision and changed both economic dependence and the risk to instream value to medium which was the initial classification.

Public exhibition of the draft rules

Public exhibition of the proposed rules was held in the Bellinger River Area WSP during March – April 2008. The objectives of this consultation were:

- to provide background to stakeholders as to why the macro plans were being developed, how they were developed, what rules were proposed in the various areas and how stakeholders could provide feedback; and
- to formally consult with a broad range of stakeholders to test the suitability of the proposed water sources and management zones, flow reference points and access and trading rules.

One public meeting was held at Bellingen during the public exhibition period. Briefings with environmental interest groups. Aboriginal stakeholders and Local Government were also undertaken during public exhibition.

A total of five submissions were received as a result of the public exhibition.

Refining water sharing rules as a result of public exhibition

The Regional Panel reviewed all submissions as well as matters raised at the meetings and as a result made some changes to the rules. Table 10 outlines the changes to the proposed rules as a result of the consultation.

Table 10: Changes to water sharing rules as a result of public exhibition

Water source	Change to water sharing rules	Justification
Bellinger River	The original trading rule of allowing trades in remains however the volume has been reduced	The Panel agreed to adjust the boundary for the highly connected alluvial aquifers downstream to include the Bellingen TWS borefields. The entitlement for TWS was included in the peak daily demand calculations and as a result the 'trade in' volume was reduced from 308 ML to 54ML.

Adaptive management

Adaptive management is an important part of a water sharing plan. The term refers to making provision within the plan to change the access or trading rules in response to new information obtained during the 10 year life of the plan. Adaptive management is a requirement of both the Water Management Act and the National Water Initiative.

HOW THE RULES MIGHT CHANGE

In five water sources, there was a lack of adequate information or infrastructure to develop the final water sharing rules which could fully manage the risk to instream values and/or protect community dependencies. In these cases, further analysis or data collection will be undertaken during the life of the Plan (see Table 11). These include additional monitoring or studies on surface water flows and tidal pool behaviour, salinity levels and estuarine water requirements.

Table 11: Water sources where adaptive management applies

Water Source	Adaptive Management
Access Rules	
Boggy Creek	If the 95th %ile at the Bellinger River gauge at Thora is found from a hydrologic study to be less than visible flow at the end of the water source, then the CTP will change to visible flow at the pump site.
Bellinger River, Rosewood Creek, Boggy Creek, and Never Never Creek	If a suitable gauge is installed near the junction of the Bellinger River and Roses Creek and sufficient data is obtained to enable determination of a cease to pump level at the flow reference point at or below the equivalent to the 95th percentile flow at the end of the system in the relevant water source.

RESEARCH OPPORTUNITIES

The planning process has identified a number of areas for research opportunities both at a state and regional level. In order to better assess trade-offs, integrated hydrological/ecological studies and socio-economic models are required. Also assessing Aboriginal cultural values and an investigation into the Bellinger River estuary including economic valuation and hydraulic behaviour (in response to freshwater inflows) are examples of research opportunities.

It is intended that a statewide research prospectus be developed that reflects research needs and knowledge gaps across all macro plans once they have been drafted. Opportunities for a collaborative approach to research with organisations such as universities and co-operative research centres will be explored.

Monitoring and review

MONITORING

The Plan includes a number of performance indicators that will be monitored over the 10 year life of the Plan.

DWE is currently developing a Monitoring Evaluation Reporting (MER) Framework. This framework will be developed in collaboration with key stakeholders, and be consistent with the MER needs of the Natural Resource Commission and the National Water Commission. The intention is that the framework can be applied to existing water sharing plans and macro water sharing plans to enable the development of a specific MER plan.

It is not practicable to monitor all issues in all water sources. The performance indicators identify that monitoring will be undertaken for specific issues in key water sources. A risk assessment approach will be used to identify specific issues and high risk water sources where detailed MER needs to occur.

An Implementation Program is to be established that sets out the means by which the provisions of this Plan are to be achieved. The monitoring of the performance indicators will be detailed in the Implementation Program.

PLAN REVIEW

The Natural Resources Commission will undertake a review of this Plan prior to any decision to extend its term or to make a new plan.

The MER framework developed will consider the statutory requirements for the different types of evaluation:

- The Plan will be audited at intervals of no more than five years, for the purpose of ascertaining whether its provisions are effective. This audit is to be carried out by an audit panel appointed by the Minister (for Natural Resources).
- The Plan will be audited by the Natural Resource Commission to assess to what extent the water sharing provisions have contributed to the relevant state wide targets, and natural resource standards and targets in the relevant catchment management area. The Natural Resource Commission will call for public submissions when undertaking its review.
- Annual review of Implementation Programs.
- In addition, information from the relevant monitoring and evaluation programs should inform progress against the relevant statewide targets and requirements of the National Water Commission under the National Water Initiative.

Implementation

IMPLEMENTATION PROGRAMS

An Implementation Program is to be established that sets out the means by which the provisions of this Plan are to be achieved. The process for monitoring of the performance indicators will be outlined in the Implementation Program. An annual review of the Implementation Program will be conducted to determine whether the program is being effective in implementing the water sharing provisions. The results of this review will be included in DWE's Annual Report.

MONITORING WATER EXTRACTIONS

Each water sharing plan indicates the relevant mandatory conditions for extraction, including that all licences undertake measurement of use. DWE will develop a measurement of use strategy to meet the objectives of the NSW Water Extraction Monitoring Policy.

Measurement of use may be via meters or other forms of monitoring devices fitted to approved works, or via alternative monitoring systems, in order to provide water extraction estimates.

In relation to monitoring devices, different types of devices will be required depending on the nature of the water supply work installation, the size of the work, and the effect that the operation of the work may have on the water source and other water users.

It is anticipated that assessment of water sources will be undertaken across the State to identify priority areas of measurement of use and to determine the most suitable measurement options. It is likely that this will be implemented in high priority areas initially, with roll out to all water sources over time, as appropriate.

Note: Decisions regarding the timetable for introduction of measurement of use are still under consideration. In the interim, water users are encouraged to use other forms of self-measurement to assist them to extract water in line with Plan provisions.

COMPLIANCE

DWE will undertake compliance activities as necessary to enforce the provisions of the Plan once it is implemented. Some reliance is placed on local water users to identify inappropriate or unlawful behaviour and report this to the Department.

Appendices

APPENDIX 1: NORTH COAST REGIONAL PANEL - MEMBERSHIP AND EXPERTISE

Name	Agency	Role	Expertise
Regional Panel			
Jeremy Black	DNR	agency representative	GIS technology, spatial analysis and modelling, Remote sensing and aerial photographic interpretation, Stream flow Simulation Modelling, Soil conservation and land rehabilitation.
John Williams	NSW DPI	agency representative	Regional experience in water reform programs, water quality problems especially acid drainage, coastal agricultural industries, catchment management and interagency coordination.
Adrienne Farago	DEC	agency representative	Regional input to water reforms, catchment plans and investments, biodiversity and threatened species management planning.
Ian Simpson	NRCMA	CMA observer	Catchment management, program development and implementation, project management, soil conservation, land management and riparian restoration. Community liaison and engagement.
Support Staff			
Richard Swinton	NSW DPI	Technical support/ alternative representative	Resource management, water policy development, farm systems and enterprises, farm management and economics, irrigation systems and management, extension and communications, water sharing plan development and implementation
Marcus Riches	NSW DPI	Technical support	Fisheries management and conservation issues, threatened species, biological/environmental research, local knowledge of flow behaviour of catchments, WSP development and implementation.
Roland Bow	DECC	Technical support/ alternative representative	Technical and management expertise in research, aquaculture, commercial fisheries, compliance and conservation, fisheries management and aquaculture.
Peter Lloyd Jones	DECC	Technical support/alternative representative	Measuring ecological response of environmental flows, regional input and delivery of water reforms/ water sharing plan development, input into State water policy development.
Michael Healey	DNR	Technical support/ Acting macro coordinator	Aquatic ecologist, knowledge of flow requirements for freshwater biota, regional knowledge of flow dependent biota, water sharing plan development and implementation.
Peter Hackett	DNR	Technical Support (licensing)	Licensing officer, local knowledge of water users, WUAs, local access arrangements and reference points.
Nicky Smith	DNR	Macro coordinator	Water policy and planning, WSP development and implementation, facilitation and project management.
Neil Dufty		Independent Facilitator	Qualified educator and earth scientist, experienced facilitator in NRM planning, former chair of water management committees.

APPENDIX 2: REFERENCE MATERIAL USED BY THE NORTH COAST REGIONAL PANEL

- Licensing Administrator System (LAS). DWE state-wide database holding the licence details including volume of entitlement, location details and stream orders.
- Hydsys – Hydsys is a DWE state-wide database that holds all flow record data. Flow records are available for most water sources in the Northern Rivers area.
- Regional Groundwater Monitoring Network – DWE is developing a regional groundwater monitoring network to be used to monitor alluvial groundwater levels and assess stream / surface water connectivity.
- Volumetric Conversion Database (VOLCON) – used to help determine the Peak Daily Demand (PDD) for each water source.
- Regional Geographic Information Systems. DWE Land use and topographic information.

Central Data sets

- Stressed rivers reports – used as the basis for identifying where there are instream barriers.
- Threatened species – fish. Data supplied by DPI.
- Threatened species – other. Data supplied by DECC.
- Index of Social Disadvantage – Australian Bureau of Statistics.
- Employment in Agriculture - Australian Bureau of Statistics
- Roy et al. 2001. Structure and Function of South-eastern Australian estuaries.

Other Agency Data

National Parks and Wildlife (DECC) state-wide atlas. State-wide flora and fauna database

NSW Fisheries (DPI) modelled data sets (Fish Community Index, Fish Community Vulnerability).

NSW Fisheries (DPI) freshwater and saltwater recreational fishing database.

Other projects/reference material

Australian Greenhouse Office (March 2004 version). *NSW Forest Extent 1972-2002*. Australian Greenhouse Office, Canberra. Data set used to determine % cover and width of riparian zones.

Boulton, A., Smolders, K, Turner, B. and Bell, D.(2003). *Land-use, drought, and river condition in the Bellinger and Nambucca catchments, northern NSW Final Report*. Ecosystem Management and Botany, University of New England Armidale NSW.

Harris, J. H. and Gehrke, P. C. (eds) (1997). *Fish and Rivers in Stress: The NSW Fish Survey*. NSW Fisheries, Cronulla, Sydney.

National Heritage Trust (2002). *Australian Catchment, River and Estuary Assessment 2002, Volumes 1 & 2*. National Land and Water resources Audit, Canberra. Data used included aquatic biota (macroinvertebrate/AUSRIVAS) index.

- NSW DPI Agriculture web site for crop gross margins: www.agric.nsw.gov.au/reader/budget.
- Pierson WL, Bishop K, Van Senden D, Horton PR, Adamantilis CA. 2002. *Environmental Water Requirements to Maintain Estuarine Processes. Environmental Flows Initiative Technical Report Number 3*. National Heritage Trust, Canberra.
- Roy PS et al. 2001. *Structure and Function of South-eastern Australian Estuaries*. Estuarine, Coastal and Shelf Science 53: 351–384.
- Trewin, D. (2001), *Census of Population and Housing: Socio-Economic Indexes for Area's (SEIFA)*. Australian Bureau of Statistics, Canberra.

Some Key References cited (indicative only)

- Bellinger Shire Council (2004). 2002-2003 *State of Environment Report: Bellinger LGA*. Bellinger Shire Council.
- Cohen, T., Reinfelds, I. and Brierley, G.J. (1998). *River styles in Bellinger-Kalang catchment*. Report completed for N.S.W. Department of Land and Water Conservation on behalf of Macquarie Research Limited.
- DLWC (1999). *Bellinger Catchment Stressed Rivers Report*. NSW Department of Land and Water Conservation, Sydney.
- HRC, (2003). *Independent Inquiry into North Coast Rivers Final Report*. Healthy Rivers Commission, Sydney.

APPENDIX 3: CLASSIFICATION SUMMARY

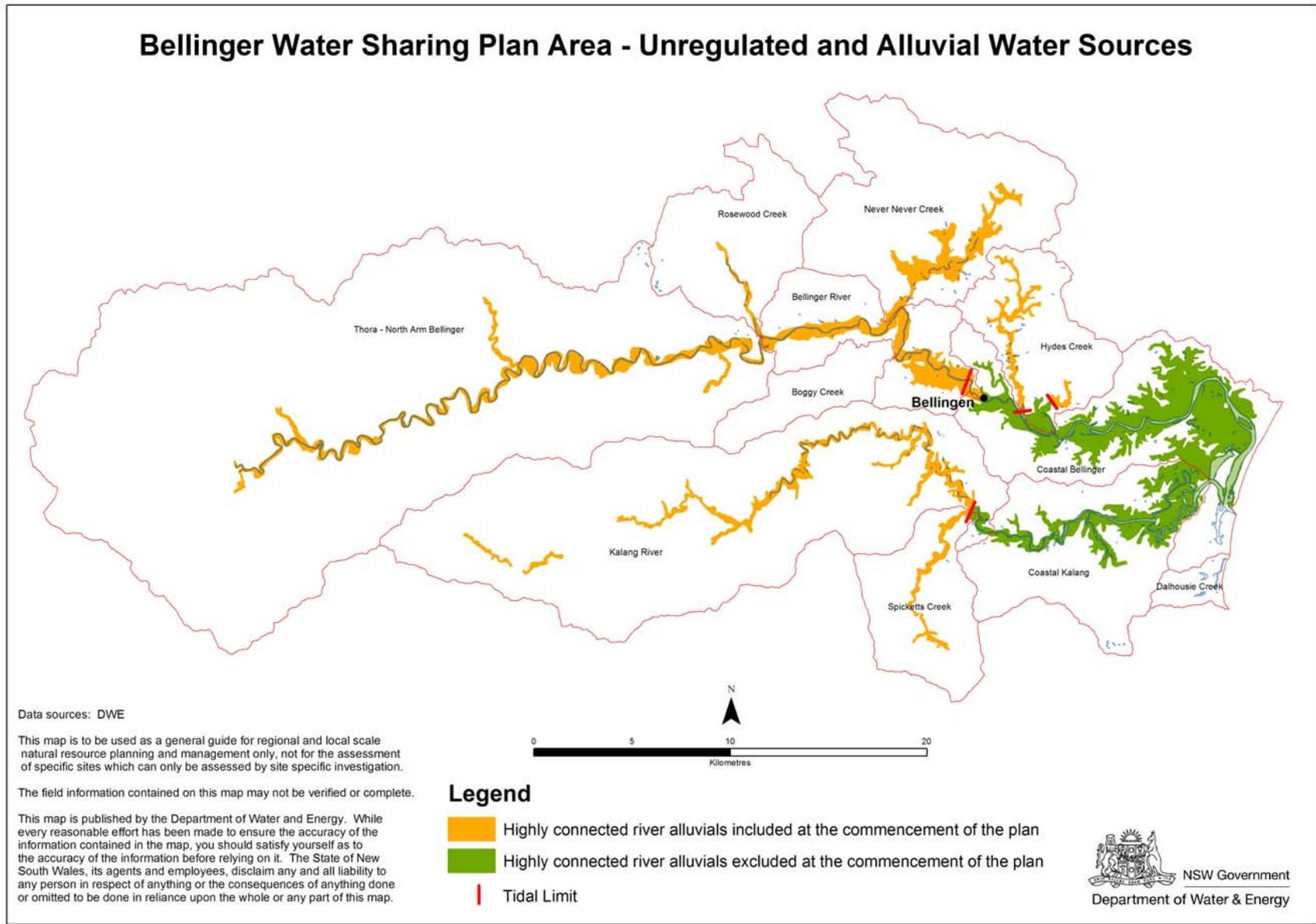
Value Matrix

High Instream Values	<p>A</p> <p>Kalang River, Rosewood Creek, Thora – North Arm Bellinger</p>	<p>B</p> <p>Never Never Creek</p>	<p>C</p>
Medium Instream Values	<p>D</p> <p>Bellinger River, Boggy Creek, Spicketts Creek, Coastal Kalang</p>	<p>E</p> <p>Coastal Bellinger,</p>	<p>F</p> <p>Hydes Creek,</p>
Low Instream Values	<p>G</p>	<p>H</p>	<p>I</p>
	<p>Low hydrologic stress of hydrologic risk</p>	<p>Medium hydrologic stress of hydrologic risk</p>	<p>High hydrologic stress of hydrologic risk</p>

Risk Matrix

High Risk to Instream Values	A	B	C
Medium Risk to Instream Values	D	E Never Never Creek	F Hydes Creek
Low Risk to Instream Values	G Coastal Bellinger, Rosewood Creek, Spicketts Creek, Thora – North Arm Bellinger	H Boggy Creek, Kalang River, Coastal Kalang	I Bellinger River
	Low dependence on extraction	Medium dependence on extraction	High dependence on extraction

APPENDIX 4: WATER SHARING PLAN AREA MAP



APPENDIX 5: CONTRIBUTION TO THE RIVER FLOW OBJECTIVES

Levels of assessed contribution:

FULL – contributes to objective in full

HIGH - while not fully contributing to objective is considered a good level of contribution

PARTIAL - goes some way to contributing to the objective

LOW - only small degree of contribution to the objective

Note that for some systems while there may be no specific rule for each river flow objective the extent to which the rules, annual extraction limits and the risk to values contributed to the objectives was considered, and a specific rule developed only where necessary.

(*) Note that for the tidal pool water source although rules have not yet been developed the following assessment is based on the intent of the rules. Tidal pool is assessed against the RFOs based on rules intended to maintain natural variability of salinity levels, and protect from significant salt water intrusion.

Water source	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Bellinger River	HIGH	PARTIAL	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Boggy Creek	HIGH	PARTIAL	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Coastal Bellinger	HIGH	PARTIAL	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Coastal Kalang	HIGH	PARTIAL	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Dalhousie Creek	HIGH	FULL	FULL	FULL	N/A	FULL	FULL	PARTIAL	N/A	N/A	N/A	FULL
Hydes Creek	PARTIAL	PARTIAL	HIGH	HIGH	N/A	PARTIAL	PARTIAL	PARTIAL	N/A	N/A	N/A	LOW
Kalang River	HIGH	HIGH	FULL	FULL	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Never Never Creek	PARTIAL	PARTIAL	HIGH	HIGH	N/A	PARTIAL	PARTIAL	PARTIAL	N/A	N/A	N/A	LOW
Rosewood Creek	HIGH	HIGH	FULL	FULL	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Spicketts Creek	PARTIAL	HIGH	HIGH	HIGH	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH
Thora – North Arm Bellinger	PARTIAL	HIGH	FULL	FULL	N/A	HIGH	HIGH	PARTIAL	N/A	N/A	N/A	HIGH

APPENDIX 6: IDENTIFIED THREATENED SPECIES

It is important to note that the macro water sharing plan process is concerned with protecting in stream water values that relate to extraction. Therefore, only threatened species that are likely to be sensitive to extraction have been considered when assessing the water source values.

Threatened Species	Bellingen River	Boggy Creek	Coastal Bellinger	Coastal Kalang	Dalhousie Creek	Hydes Creek	Kalang River	Never Never Creek	Rosewood Creek	Spicketts Creek	Thora – North Arm Bellinger
Frogs											
Borrorlong Frog	E						E	E	K		K
Giant Barred Frog	K	K	K	E	E	E	K	K	E	K	K
Glandular Frog	E						E	E	K		K
Green and Golden Bell Frog			K	E							
Green-thighed Frog	K	E	E	E	E		E	E	E	E	E
Pouched Frog	E							E	K		E
Red-crowned Toadlet											K
Sphagnum Frog							K	K	K		K
Stuttering Frog	E	E					E	K	K	E	K
Wallum Froglet	E		K	E	E	E	E	E	E	E	E
Birds											
Beach Stone-curlew			K	K	K						
Black Bittern	E	E	K	E	E	K	E	E	K	E	E
Black-necked Stork	K		K	K	E	K	E			E	K
Blue-billed Duck			K		K						
Comb-crested Jacana			K	K	K						
Osprey			K	K	K						K
Other Fauna											
Bellingen River Turtle											K
Large-footed Myotis							K				K
Wet Flora species											
Ravine Orchid	K							K	K		K

K = species is known to occur in water source

E = species is expected to occur in water source

It should also be noted that some threatened species, such as the Eastern Freshwater Cod, are highly sensitive to low flow extraction, whilst other threatened species, such as plants that occur in the riparian zone, are less sensitive. Accordingly, threatened species considered to be highly sensitive to low flows are given a highly priority for protection.