

NRM Assets and Planning

State of the Region Study

Volume 2

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Prepared by



For

**Burnett Mary Regional Group for Natural Resource Management
Inc.**

Acknowledgements

This report draws heavily on the following documents:

- State of Region Report (Vol 1) the authors of which were Bill Thompson, Adrian Webb, Peter Shields and Dr Vince Montgomery.
- Technical Papers Commissioned by BMRG on Terrestrial and Aquatic Biodiversity, Water and Land Resources.

The key reports included:

Terrestrial Biodiversity

Terrestrial biodiversity in the Burnett Mary region (draft) Richard Knight Biodiversity Coordinator Burnett Mary Regional Group.

Additional Information provided by George Martin & Stephen Barry from the Queensland Environmental Protection Agency (EPA) is also relied on in the Terrestrial Biodiversity Section of this report.

Freshwater Aquatic Biodiversity

Freshwater aquatic biodiversity in the Burnett Mary region - condensed technical paper by Brian Stockwell (DPI&F), Michael Hutchison (DPI&F), Brad Wedlock (MRCCC), Eva Ford (MRCCC), Tom Anderson (NRM&E), Chris Thomson (NRM&E) and Kathy Stephens

Water Resources

Water Resources of the Burnett-Mary Region by Ross Ridge Consultancy

Land Resources

Sustainable primary production in the Burnett Mary region by Department of Primary Industries and Fisheries (edited by Brian Stockwell).

All of these papers include extensive bibliographies. Readers are referred to these technical papers if they require these reference materials

Whilst Section 3 of this volume is heavily based on the above technical papers, the conclusions drawn in this volume remain those of the LRAM and do not necessarily reflect the views or position of either the technical paper authors, the agencies they are retained by or indeed BMRG itself.

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1 Introduction

This report is Volume II of the Burnett Mary State of the Region (SoR) study. Volume I¹ reviewed readily available information on the biophysical assets of the region.

Volume 2 (this report) has been prepared against the background of the development of the NRM Plan. The original Terms of Reference for the SoR included a Phase II component which addressed similar issues to that required under an NRM Plan. In preparing this volume the authors have adopted the NRM Plan format (as opposed to the Phase II SoR format) as it is believed that this will increase the usefulness of the SoR study.

This report draws heavily on the following documents:

- State of Region Report (Vol 1)
- Technical Papers Commissioned by BMRG on Terrestrial and Aquatic Biodiversity, Water and Land Resources

2 Planning Frameworks

2.1 Non NHT/NAP Frameworks

With the exception of the Reef Water Quality Protection Plan and the Environmental Values and Water Quality Objectives (EV WQO) process, there are few other NRM multi asset planning frameworks available that set targets for NRM outcomes at either the region or basin level. The reef plan clearly identifies diffuse sources of nutrient and sediment as the primary issues of concern. The regional NRM plan will therefore have to have due regard to the reef plan and the role and function of diffuse sources when formulating a planning framework and associated targets for the region².

Those biophysical assets which fall directly under state government custodial responsibility (such as National Parks and Fish Habitat protection areas) all have their own asset/land management planning and implementation processes in place. The various planning documents for many of these assets refer to asset values and threats which are common to the private land assets of the region (for example weeds, water quality and fire management). For most of these asset values there is considerable monitoring undertaken by state agencies. Where commonality of issues and threats between public and private lands exist, there will no doubt be scope for the regional NRM Plan to indirectly contribute to NRM outcomes within the public estate. However, because of the different tenure, land management and “right of use” arrangements, the asset management and planning framework used for the core business of government controlled assets is unlikely to be of substantive relevance to the regional NRM plan.

For the majority of the region that falls within the private land ownership estate, remnant vegetation, protected species and habitats values as well as specific land and water resource issues such as Good Quality Agricultural Land, Acid Sulphate Soils, water allocations etc all have legislative and existing planning processes in place which also form part of the core business of government. To varying degrees, these planning initiatives deal primarily with the process of land use change – a process which is managed at the local government level under

¹ Version 3 of the SoR report was widely distributed and comments on that report have been included in Volume 1 of the final report.

² The environmental values and water quality objectives initiative of the state government currently under trial within the Mary Basin is another framework for setting relatively hard targets for NRM outcomes.

definitions of material changes of land use and resultant assessment codes. Few if any of these initiatives deal substantively with land management impacts on resource values – essentially because a change in land management is not considered a material change of land use under most planning schema. As a result regulatory mechanisms aimed at controlling land development tend to be the preferred means of obtaining improved resource outcomes. Some but not all of these initiatives involve ongoing monitoring and evaluation of resource conditions (eg mapping of changes in remnant vegetation cover and water quality and biological values monitoring under the Resource Operations Plans for water allocations).

Outside of these initiatives, it is the programs of individual industries (who operate mostly voluntary whole of farm enterprise and planning schema and/or various property QA processes), community group initiatives, individual enterprise based EMP and EMS systems and the extension activities within government and industry bodies that attempt to fill the void between the regulatory single sector higher level initiatives and on ground land management.

The regional NRM plan will ultimately have to interface with each of the existing frameworks. The extent of this interface will depend on a number of factors:

- Where there is commonality of issues and impacts on asset values, partnership arrangements between the NRM Plan and line agencies may be appropriate where the core business of government has common objectives with the NRM Plan. This is particularly the case with some issues such as weeds and fire management programs within the public and private land estate as well as where the core business of government interacts directly with resource outcomes of interest to the regional NRM Plan.
- Where there is a lack of capacity or information support within a framework that limits desirable resource outcomes from the management of the freehold estate, direct support within a partnership arrangement may be justified. Examples of this would be:

Partnering with local authorities for NRM planning and activities which directly enhance resource condition outcomes from improved approaches to managing land use change for local outcomes

Partnering industry based property management planning tools which support local or regional NRM outcomes

Direct support and Partnering to community groups involved in improving, managing or monitoring resource condition at local or regional levels

Partnering with GBRMPA and government in areas where external resource condition outcomes reflect the core business of these agencies.

2.2 NAP/NHT Frameworks

The NHT/NAP framework is built around a cascading structure of assets, which have matters for target and resource condition indicators for these targets. Ultimately, it is this framework which will shape the regional NRM plan rather than the myriad other frameworks which currently exist. The basic elements of a plan based on such a framework are summarised in subsequent sections.

2.2.1 Asset Themes

Asset themes within the region include, Terrestrial Biodiversity, Freshwater Biodiversity (also referred to as inland aquatic ecosystems), Land Resources, Water Resources, Marine Biodiversity, Coastal and Marine Development and Social Capital and Capacity. The State of the Region study has focussed on the first four of these asset themes.

2.2.2 Targets

Targets are outcome objectives for investment in NRM. In an ideal situation detailed and specific targets for Assets and Sectoral Issues could be identified. This would require knowledge of the resource values at a level of detail that matched the scale of the land uses impacting on those values, and also insight into future land use interactions with these values. The heavy reliance of existing catchment scale assessments on modelling and condition indices as a means of identifying core NRM issues and their distribution would indicate that the baseline level of understanding is simply not in place for other than generalist targets at the asset level. The NHT/NAP framework acknowledges this type of difficulty in that it permits aspirational targets.

Aspirational targets can at best only provide a guiding rationale for investment in an asset. Investment at the Asset Issues level needs to be more objectively defined by harder targets. Under the framework, resource condition indicators are advocated as the preferred option for hard targets. However, as discussed in subsequent sections, data on resource condition is lacking for many asset themes. Data which describes the size and distribution of particular elements within an asset (either directly or by surrogate data sets) is available for much of the region. Data which provides a baseline condition statement and an assessment of the current direction and rate of change in condition are often lacking.

In addition to the above concerns, hard targets need to be readily measurable and unambiguous if monitoring and evaluation is to be used to refine individual programs through adaptive management. The most obvious targets which would describe improved resource condition outcomes may in fact not be the most cost effectively monitored. This is particularly the case with the Reef Water Quality Protection Plan targets for nutrient and sediment export from river basins. These targets will largely be based on SedNet modelling as the baseline condition data on water quality simply was not good enough to accurately relate water quality values and processes to land use. Adopting a water quality objective of so many parts per million of a particular element may seem logical, however, such targets will require long term investment in establishing initial baselines and thence subsequent monitoring and analysis. They would also require a detailed understanding of process in order to adequately separate change in target indicators due to episodic events or natural processes, from a change due to interventions supported by the NRM Plan.

An alternative approach to this issue of hard targets and their cost effectiveness in a planning sense, in the absence of adequate baseline data, is to set targets based on adoption of strategies which address known baseline condition factors. For example, if sediment supply from grazing lands is a major source of sediment and a 50% reduction in such supply is the Reef Plan target, then a reasonable target for the NRM Plan would be that Best Management Practises are adopted over 50% of grazing land estate.

3 Assets, Issues and Targets

3.1 Terrestrial Biodiversity

3.1.1 Resource Value and Status

The Burnett Mary Region encompasses parts of two *bioregions* and numerous catchments. The coastal plain and ranges comprise the northern half of the South East Queensland (SEQ) bioregion. The drier western part of the Region lies within the easternmost portion of the Brigalow Belt (southern) bioregion. A complex mosaic of geology, soils and micro-climate has interacted to produce a biodiverse landscape, as evidenced by the large number of Regional Ecosystems (191), the high levels of species diversity, and the occurrence of numerous species at the geographic limit of their distribution.

Remnant vegetation, mapped by the Queensland Herbarium as *Regional Ecosystems* (RE), covers 45% of the Region. Almost half of the Region's remnant vegetation exists in *public estate* lands. These contribute to an extensive network of bioregional vegetation corridors which link coastal lowland habitats with hinterland ranges, and large vegetation tracts to the north and south of the Region.

Existing levels of clearing and fragmentation have resulted in substantial numbers of REs with an *Endangered* (26) or *Of Concern* (68) conservation status under the Vegetation Management Act (VMA). This equates to 14% of the total number of regional RE's classed as Endangered (occupying less than 5% of the existing remnant vegetation area), and a further 36% of RE's being classed as Of Concern (occupying 17% of the remnant vegetation area).

Whilst conservation status under the VMA is largely determined by the size of the remnant RE areas versus presumed original pre clearing extent, the biodiversity values of the estate are based on a synthesis of values as outlined in the Biodiversity Planning Assessments (BPAs) compiled by the EPA. Under this schema, 8% of the area has local biodiversity values, 17% has regional values and 75% has state level value.

The Region's diverse flora includes 244 species of terrestrial vascular plants scheduled as rare or threatened under Queensland regulations. These include 47 endangered species, 78 vulnerable species and 118 rare species, and one species *Persoonia prostrata*, being presumed extinct

Terrestrial and wetland habitats support a large number of resident and migratory fauna. The seasonal presence of visiting species highlights the region's interconnectivity with other parts of Australia and indeed the rest of the world. Although the status of most species is presently secure, there are 69 fauna taxa scheduled under Queensland regulations. These include 7 endangered species (1 insect, 3 frogs, 2 reptiles and 1 bird); 22 vulnerable species (2 butterflies, 2 frogs, 6 reptiles, 6 birds and 6 mammals) and 38 rare species (3 frogs, 12 reptiles, 19 birds and 4 mammals). Two species are listed as presumed regionally extinct (*viz.* paradise parrot and western quoll).

Currently neither the Regional Ecosystems mapping nor the Biodiversity Planning Assessments include a baseline assessment of condition – other than that which could be inferred from mapped extent, or drawn from expert knowledge for specific areas. Baseline condition and trend assessments will be required to support biodiversity outcomes under an NRM Plan through investment in areas such as improved grazing and forested land management and environmental weed control.

3.1.2 Pressures and issues

The major historic pressure on terrestrial biodiversity values has been land clearing – primarily for agricultural development but also for forestry plantation developments.

This form of threat is now controlled under the VMA in Queensland; however the controls apply predominately in rural sectors. Within the non rural section (urban and industrial development) exemptions on land clearing do exist and the local authorities which regulate land development will require extensive support to ensure that biodiversity values are protected.

Outside of the urban land development area, threats are primarily associated with land management – particularly weed, fire and regrowth management within the grazing and forested land use sectors. The potential significance of these issues is indicated by the fact that whilst less than 5% of the remnant vegetated area is classed as endangered because of limited extent and past clearing impacts, some 75% of the remnant vegetation area has a state or higher (ie external) level of biodiversity significance.

3.1.3 Past and present action in the region

Wildlife conservation (both species and their habitat) has been facilitated through the establishment of a number of terrestrial and marine national parks, and by the scheduling under international agreements of landscapes of particular high value (e.g. Fraser Island World Heritage Area and Great Sandy Straits *Ramsar listed* wetland). Under the Southeast Queensland Forest Agreement significant areas of Crown timber reserves will transition to tenures managed primarily for conservation outcomes by 2025 –

3.1.4 Targets and Actions

Protection of Terrestrial Biodiversity will require investment to focus on a number of broad aims:

- Ensuring that the current baseline of regional extent and composition of remnant vegetation is maintained as a minimum, and preferably increased/improved.
- Within the regional extent, to ensure that condition and ecosystem function is maintained as a minimum, and preferably increased/improved.
- Ensuring that the high value components (including sites of known EVR taxa) of the estate are protected from both land development and land management impacts.

3.1.5 Investment Priorities, Partnership and Linkages

Preserving regional ecosystem extent, condition and function are all largely core business for the EPA and DNR&M in Queensland under the VMA.

The difficulty faced for the regional organisation is simply one of scale. With 45% of the region having remnant vegetation and 75% of that area having a state level of biodiversity significance, there is some 1.2 million ha or 35% of the region which would have a high priority for investment if the current regional ecosystem and BPA assessments were the sole criteria used to define the scale of investment.

Current Priority Action initiatives of the region aim at prioritising investment within the freehold component of the above area as well as supplying information on condition and trend of the priority asset areas. This information should be available in 2005.

Once these priority investment areas are established, appropriate linkages and partnership arrangements could be formalised. These could include:

- Relationships based on the line agencies implementing their core business activities across the region where BMRG initiatives value add to the core business

- Partnering arrangements with local authorities in implementing enhanced local government planning to minimise land development impacts on biodiversity values
- Partnering arrangement with community and industry groups (possibly via devolved grants processes) to directly address weed fire and grazing/forested land management impacts on biodiversity.

3.1.6 Monitoring and Evaluation

Monitoring and Evaluation of Terrestrial Biodiversity investment outcomes will depend on types of targets selected for investment. The types of indicators which could be used are listed below.

M&E	Indicator	Comment
Extent of Regional Ecosystems	Extent of Clearing	Core Business DNRM under existing programs
Biodiversity Condition and Function	Clearing as a surrogate, however detailed data on species composition, structure and weed infestation etc is preferable	To be collected under current Priority Actions for some High Value areas (emphasis on areas with development pressure). Will require updating over investment period by region
Protection of Value Components	Extent of high value areas covered and protected by local authority plans	Will require M&E system to be developed at regional level
	Extent of high value areas with a management plan at property/landscape scale.	
	EVR locations covered by management plans at property/landscape scale.	

3.2 Freshwater Aquatic Biodiversity

3.2.1 Resource Value and Status

The Burnett Mary Region is at an interzone between southern temperate coastal freshwater fish species (eg Australian bass, Australian smelt, short-finned eel, and purple striped gudgeon) and northern tropical freshwater species (eg barramundi, mangrove jack, Rendahl's catfish, jungle perch, barred grunter). It also contains some endemic groups either restricted to the Burnett Mary region or restricted to sub-tropical Queensland and northern New South Wales (eg. Mary River cod, Australian Lungfish, Honey blue-eye, Oxleyan pygmy perch, freshwater mullet, Duboulay's rainbowfish and Marjorie's hardyhead) as well as species with a wide distribution in eastern Australia (eg purple spotted gudgeon, Tandanus catfish, bully mullet, long-finned eel).

A number of fish species are classified under the Environment Protection and Biodiversity Conservation Act (EPBC) as threatened (The endangered Mary River cod and vulnerable Australian lungfish, honey blue eye, and Oxleyan pygmy perch).

Eight frog species in the Burnett Mary region have been listed as endangered, vulnerable or rare under the Nature Conservation Act (Wildlife) Regulations 1994 and two of the six species of turtles in the Mary System (*Elseya* sp. affinities to *dentata*, *Elusor macrurus* –

Mary River Turtle) appear to have a declining population and a restricted distribution. Two crayfish with distributions restricted to the rainforest streams in the Conondale Ranges, are entered on the IUCN's red list of endangered fauna (*Euastacus hystricosus* – vulnerable and *Euastacus urospinosus* - endangered). The Giant spiny crayfish (*Euastacus hystricosus*) is restricted to upland streams located in wet sclerophyll forests and rainforests throughout the Conondale and Blackall Ranges of southeast Queensland.

3.2.2 Pressures and issues

A wide range of land use and land and water development impacts on freshwater aquatic systems are evident in the region. The more significant include:

- **Barriers to migration.** These include barrages, weirs, high dams, road crossings, culverts and bunds. Some major barriers have been mitigated via fish ladders etc in the Kolan, Burnett, and Tinana systems but many key barriers remain in these systems. In comparison to other major rivers of the region and south-east Queensland generally, the Mary River contains no major barriers to fish movement throughout most of the main river channel.
- **Loss of estuarine habitat and linkages to the estuary.** Changes to the estuary and adjacent habitats are particularly severe in the Burnett River while less severe changes have occurred around the Kolan estuary and parts of the Mary system.
- **Inundation of pool-riffle habitat and flow regulation.** Apart from barrier effects, weirs and dams can impact biodiversity and abundance of species by inundating pool and riffle habitats whilst the impoundment created by dams favours some species over others.
- **Loss of habitat complexity.** In the past it has been common practice to remove logs and branches from rivers to improve flow and provide boat access. The Burnett Mary region was no exception. There is historical evidence of substantial log removal between Gympie and Tiaro and also around the Gympie area, which has diminished aquatic habitat availability & variability.
- **Degraded Riparian Zones and Habitats.** Over 80% of the Burnett and 45% of the Mary is rated as poor or very poor under the State of the Rivers project for aquatic habitat condition. However only 20% of the streams bank lengths are rated as unstable. The major impact on aquatic habitat condition is the loss of riparian vegetation habitat structure and function.
- **Pest Species.** Translocated and alien fish species pose a potential threat to native fish species through predation, competition for food and habitat, disruption of breeding and introduction of disease and parasites and sometimes through habitat alteration. Species of concern include *Oreochromis mossambicus* (Tilapia) and *Gambusia holbrooki* and translocated Australian species such as the sleepy cod in the Burnett River and the Isis, balancing storage.

3.2.3 Past and present action in the region

The current level of understanding of freshwater aquatic biodiversity values is relatively restricted at a regional level. Whilst the region contains a number of endangered and vulnerable species and a much larger number of species of lesser conservation status, the understanding of the ecosystem and habitat requirements and the effects of in stream infrastructure and stream flow manipulation regimes remains limited for many of these species. The knowledge gaps that do exist are in the process of being substantively addressed in parts of the Burnett catchment as a result of the research and monitoring studies initiated following the decisions to construct Paradise Dam and Walla Weir in the Burnett. These studies are likely to continue well into the initial years of any NRM Plan implementation.

Planning frameworks exist in both the Mary and Burnett Catchments, with the Mary River & Tributaries Rehabilitation Plan, the Burnett Geomorphic Assessment of Reaches (GAR) and a previous draft classification of the Conservation values of the Burnett Catchment waterways by the EPA. The Mary River & Tributaries Rehabilitation Plan, prepared by the MRCCA in conjunction with DNR&M, strategically prioritises the responses the community and government can take to rehabilitate the Mary River Catchment. Current Priority Action being undertaken by BMRG will refine this prioritisation for future and ongoing investment in the Mary and extend the approach to the Burnett/Kolan/Baffle system.

There are only a limited number of recovery plans in place for EVR taxa. The most notable are plans for the Oxleyan perch and the Mary River Cod.

3.2.4 Targets and Actions

Investment in Freshwater Aquatic Biodiversity will need to focus on a two broad aims:

- Protection of High Value Biodiversity sites and sites associated with EVR taxa and mitigation of barrier effects within stream reaches.
- Mitigation of threats through protection of stream reaches in good and better condition and containment or eradication of key pest/weed threats

3.2.5 Investment Priorities, Partnership and Linkages

There are number of ongoing initiatives with direct linkages to investment in these areas. The various research and development and monitoring projects in the Burnett initiated as a result of the investment in new infrastructure and the current priority actions of the region dealing with Rivercare initiatives should assist in targeting investment. Key factors in targeting will include a focus on:

- Those stream reaches currently in good or better condition - the Baffle and Burrum catchments and proportionally less of the other Basins will be considered under this criterion
- EVR recovery based program locations within most basins
- Improvement of linkages within systems and removal of barriers to migration particularly in the lower reaches of streams.

There are a wide range of potential partnerships for investment under this asset. Both the EPA and QDPIF as well as some of the community groups (such as MRCCA and a number of Landcare groups) are currently involved in activities similar to those recommended above.

3.2.6 Monitoring and Evaluation

Monitoring and Evaluation of Freshwater Aquatic Biodiversity investment outcomes will depend on types of targets selected for investment. The types of indicators which could be used are listed below.

M&E	Indicator	Comment
Protection of Priority Condition Stream Reaches and Wetlands	Maintenance or improvement of Riparian Condition Indices	Core Business DNR&M/DPI&F etc for Condition and Trend (C&T)Assessment
	Wetlands Protected	Will require M&E system to be developed at regional level
	Mitigation of Weed/Pest	Should be covered in C&T

M&E	Indicator	Comment
	Threats	monitoring
Recovery and Protection of EVR	EVR locations with management plans	Will require M&E system to be developed at regional level
Linkages Improvement and Barrier mitigation	Number of barriers with functional migration facilities	

3.3 Land Resources

3.3.1 Resource Value and Status

The current level of understanding of land resources across the whole of the region is variable. Apart from broadscale regional level coverage of land resources, the coverage at a more detailed level is patchy. What is known about the land resources of the region suggest that apart from narrow strips of alluvium and associated flood plains, small coastal deltas, and coastal sand mass deposits, the majority of the remaining landscapes are largely based on comparatively old geologies – often in a highly complex distribution patterns.

Apart from the better quality alluvial landscapes (largely developed for irrigated cropping) and areas of deeply weathered basaltic uplands (Blackall Range, parts of the Isis and Maryborough Irrigation areas, and the Kingaroy Bell Wondai complex of residual arable red soils), much of the region is at best suited mainly for grazing with large parts of the grazing lands suited only to native pastures. This paucity of land quality combined with a relatively high frequency of state forests both in the inland and coastal areas has resulted in the region being one of most significant hardwood forestry resource areas in the state. In addition substantial parts of the higher rainfall forestry tenure lands are used for pine plantations.

Land use for the study area is summarized below.

	Conservation ha	Forestry ha	Grazing ha	Intensive and Dairy ha	Dry Crop ha	Horticulture ha	Other Irrigation ha	Industrial and Mining ha	Urban and Rural Residential ha
Baffle	76218	8023	280805	700	1430	1200	1540	260	23040
Burnett	186567	410448	2873134	29760	82590	8800	64260	6200	49330
Burrum	46647	66638	166595	370	949	2273	33775	2202	7818
Kolan	17415	19591	156732	341	353	888	17874	222	10828
Mary	242526	210892	453418	29967	1204	8523	25265	7480	55410
Sandy Strait	70	26	3	6		9	122	431	873
Total excl. Sandy Strait	569373	715592	3930684	61138	86526	21684	142714	16364	146426
%	10	12	69%	1	1.5	<1	2.5	<1	2.6

Grazing is the dominant land use in area terms followed by conservation and forestry. These uses also contain the greater part of the remnant vegetation of the region and their land management is therefore important to the protection of the terrestrial ecosystem values.

Dryland cropping is largely restricted to the Barambah, Stuart and Boyne subcatchments within the Burnett Basin – principally in the Proston/Durong area (where some of the Central Queensland/Dawson Callide dryland farming systems are extensive) and in the peanut, corn and pulse crop farming systems of the Kingaroy, Kumbia and Wondai areas. Whilst dryland cropping is a small land use in overall region terms, its concentration in particular areas makes it locally significant.

Intensive livestock and dairying occupies a similar proportion of the study area to dryland cropping. In the main these uses are highly dependent on access to irrigation water. In the Mary Basin these uses are as extensive as all other forms of irrigation (largely cane farming systems) and are commonly contiguous to the riparian zone. In the Burnett these uses are proportionally less important, however, they are possibly of significance in the middle and upper reaches of the system (particularly the Barker/Barambah area) where they tend to dominate land use in the riparian zone as in the Mary, but have less reliable stream flows than in the Mary.

Horticulture (predominately irrigated) takes a number of forms. It is common in the Burnett Basin but is restricted largely to the riparian irrigated orchards in the Gayndah/Mundubbera area and to annual based crops within the Bundaberg irrigation areas where it extends over into the Burrum basin. Horticulture within the Mary basin is dominated by perennial tree crops and is less reliant on irrigation supplies.

Irrigated cropping (largely cane) is concentrated in the main irrigation areas of the Burnett and Mary. Cropping extends along the key riparian reaches of streams such as the Barker Barambah and Three Moon Creeks where farming systems including cotton, grain and legumes dominate.

The total area allocated to the major non rural forms of land use (industrial and mining) and urban/rural residential currently exceed that of irrigated cropping. These uses occur throughout the catchment but are disproportionately represented in the Baffle and Kolan Basins where there has been extensive subdivision of rural lands as well as in the Mary and in the upper Barambah/Barker Creek areas. In the Baffle basin, these subdivisions are also coincident with extensive areas of remnant vegetation within the coastal plains. Whilst residential and industrial uses have yet to develop totally over this area, current land tenure and planning arrangements indicate that up to 3.5% of the study area is allocated to these uses.

Within the coastal areas of all Basins but principally the Baffle, Burrum and Mary Basins, tourism (both active and eco-tourism based sectors) has grown substantially in the last four decades from a base that primarily serviced regional needs to a level which services and actively markets to regional, Australian domestic and International sectors. Tourist visitation levels continue to rise in most areas and this has necessitated both strategic and management planning for sectors and areas such as Fraser Island and the whale watching industry. The challenge facing these sectors lies in land development and land management strategies which will sustain the environmental values on which these types of industries are based.

3.3.2 Pressures and issues

Historic land development scenarios when combined with land quality, availability of water and demands from other sectors for lands has resulted in two distinct forms of land use and development pressures:

- Within the inland areas, where there is limited demand from other land use sectors, substitution of rural land uses has been the major 'development' scenario. Improved pasture uses based on cleared and timber treated native forests have replaced native forested pastures across the region. Despite this substitution over the last 30 years, almost half of the grazing land estate has either remnant vegetation or regrowth. Cotton based farming systems and the wine grape industry have also substituted for both dairying and row crop irrigation in the Barker Barambah system. These types of changes are essentially land management changes with significant economic implications for the communities in these areas.

- Within the coastal areas and the higher rainfall catchments such as the Mary system, similar substitution of one use for another has occurred. However, the dominant form of land use change has been associated with alienation of commercial rural land uses by non rural or part time rural uses in order to meet demands associated with population growth. The Blackall Range is now largely non commercial rural in character and large parts of the near coastal areas have undergone urbanisation impacts. These types of land use changes are irrevocable, however because they involve land development, these changes can be readily managed under current planning schema such as shire strategic plans.

The land resource condition impacts of these pressures have included:

- Secondary salinisation with some over 1500 known outbreaks of salinisation throughout the region. These outbreaks are associated with both the inland areas (where land development pressure has eased) and the coastal areas where land development pressure of landscapes known to contain high levels of salinity continues.
- Erosion and declines in structural integrity of soils which initially was of major concern within the dryland crop lands (where improved farming practises have mitigated the incidence of severe erosion) and is now of concern as a source of sediment export as a result of erosion from grazing lands as well as stream banks
- Effects of land clearing and land management on the biodiversity values through habitat removal or modification (simplification, introduced species etc).
- As harvest levels from state owned land has reduced over the last decade (in response to the SEQ Forest Agreement), this lost production has largely been absorbed by increased harvesting on private land. In many cases uncertainty over the Vegetation Management legislation has also contributed to increased harvesting rates. In addition drought places pressure on the resource through harvesting timber to supplement cash flows of many landowners reliant on farm incomes.

3.3.3 Past and present action in the region

Responses to above issues have ranged widely within the region. At an industry level, a number of industries have developed codes of practise or quality assurance systems largely aimed at sustainable production outcomes. Examples include; Code of Practice for Native Forest Timber production (State Lands) (EPA, 2002), a similar code under development for private lands, Farmcare – Code of Practice for Sustainable Fruit and Vegetable Production, Code of Practice and COMPASS – Sustainable Cane Growing In Queensland, Queensland Dairy Farming Environmental Code of Practice, National Beef Cattle Feedlot Environmental Code of Practice and an Environmental Code of Practice for Queensland Piggeries.

In addition to the above industry level schema, the Vegetation Management Act and Water Act have created an overarching framework for land and water management planning at the property level. Under these acts there is likely to be an increase in property level management plans and Environment Management Systems which previously have been largely voluntary processes.

The challenges facing industry lie in inculcating resource condition type objectives into what are largely sustainable production based schema.

3.3.4 Targets and Actions

A range of investment targets have been identified within this asset.

- Within the freehold forestry sector, the increased uptake of forest management codes of practise for sustainable use as well as biodiversity outcomes is seen as a priority. Despite the extensive areas of forested lands in private ownership, the condition status of this resource remains unclear.
- Soil salinity is a significant issue throughout the region. Targets based on ensuring that current outbreaks do not significantly impact off site values and where appropriate remediation of current outbreaks are worthwhile – particularly given the quite large potential for salinity hazards within the region. Current Priority Action initiatives will be focussing on this issue.
- Sustainable grazing and arable land management issues are seen as being of critical importance within the region. Both land use sectors have a range of whole of farm/property planning initiatives in place. Investment to achieve sustainable utilisation of land resources by these sectors should be delivered through these industry based initiatives so that resource condition targets can also be realised.

3.3.5 Investment Priorities, Partnership and Linkages

Under the broad targets identified above, investment for outcomes in this asset will be widely distributed. Achieving reduced export rates to the Reef Lagoon as well as the Great Sandy Straits will require a major increase in the adoption of whole of property management practices across both forestry and grazing land use as well as the arable land use sectors. Close working relationships, linkages and in some cases partnerships with various industry bodies will be required to achieve optimal outcomes.

Conversely, departments such as DNR&M and EPA as well as GBRMPA who have an interest in sustainable land management and in improving resource conditions will be important partnering organisations.

3.3.6 Monitoring and Evaluation

Monitoring and Evaluation of Land Resources investment outcomes will depend on types of targets selected for investment. The types of indicators which could be used are listed below.

M&E	Indicator	Comment
Improved Grazing and Forested Land Management Outcomes	Biodiversity condition of native pasture and forestry lands	Core Business EPA, DNR&M/DPI&F etc for Condition and Trend (C&T)Assessment
	Long term decline in export of sediments and nutrients	Will require M&E system to be developed at regional level
	Number of holding operated under property plans or BMP	
	Mitigation of Weed/Pest Threats	Should be covered in C&T monitoring
Improved Arable Land Management	Number of properties operating within approved plans or codes of practice	Will require M&E system to be developed at regional level
	End of catchment water quality values within environmental values	

M&E	Indicator	Comment
	guidelines (EVWQO)	
Mitigation Of Salinisation Effects	End of Catchment Impacts as flow weighted salinity levels in streams relative to Environmental Values	
	Return of currently unproductive areas to productive use as a result of lowered soil salinity levels	
Linkages Improvement and Barrier mitigation	Number of barriers with functional migration facilities	

3.4 Water Resources

3.4.1 Resource Value and Status

The current level of understanding of water resources within the region is variable. Under the *Queensland Water Act 2000*, operational strategies for stream flow and diversions have been developed for the main Mary and Burnett/Kolan Basins. The scope for NRM investment under the regional plan on flow regulation is therefore limited. There is however greater scope for investment in water quality objectives.

Water Infrastructure, Demand and Supply

There are 47 major dams and weirs in the Burnett Mary region, with a combined capacity of 1.45 million ML. The majority of these storages are in the Burnett Basin. Currently there are approximately 465000 ML/annum of surface water nominally available for urban and rural water use, and groundwater supplies of approximately 94000 ML/annum. The current urban and industrial water demand is approximately 71000 ML/annum, with irrigation and other rural water use taking up the remainder of the available water.

Proposed new Burnett Basin Water Storage Infrastructure will provide an additional 200000 ML/annum of water with 20200 ML/annum of this being reserved for urban use. Additional structures planned for the Mary and Burrum River catchments would provide 101600 ML/annum, for urban and agricultural use. With the completion of new water storages it is believed that water supplies will meet future water demand in the Burnett region in the medium to long term, and that reliability of water supply will be more assured. Major expansion in any demand sector will however be difficult to accommodate. Parts of the region which are likely to have medium to long term supply difficulties include coastal growth areas such as Hervey Bay and Cooloola and the inland energy sector around Tarong/Kingaroy.

The release and use of regulated water is strictly controlled as a separate entity within each section of the Burnett Catchment under the Burnett Basin Resource Operation Plan (ROP), completed by the Department of Natural Resources and Mining (NRM) in 2003. NRM&E are currently preparing for the ROP for the Mary River catchment, and will upgrade the Burnett ROP as new water storages are completed. The ROP also allows for specified environmental flows to be maintained in the Burnett Catchment, and where possible these are incorporated by SunWater in the day to day management of water releases (eg. fish ladder operation), by set releases of water at nominated times of year for different storage structures, and during periods of high stream flow.

In the Lower Burnett groundwater reserves within the Bundaberg Irrigation Area are currently over committed, and this has led to saltwater intrusion into the aquifers close to the coast adjacent to the Elliott River and the Burnett River Delta. There is an urgent need for a rescue package to supply surface water to these high risk areas to substitute for groundwater. This water could be made available from the additional water provided by approved and proposed structures on the Burnett River. Within the Three Moon Creek areas in the Upper Burnett, salt water intrusion into commercial aquifers is also an issue.

Potential problem areas identified are largely commercial in nature. Nevertheless, these are important for water resource planning and are outlined below:

- In both the Lower Burnett and Lower Mary the major user of supplemented water supplies is the sugar industry. The viability of this industry is threatened by current and projected sugar prices, and it will have limited capacity to meet increased water charges (for existing and projected water supplies);
- There is an urgent need for viable alternative irrigated crops to sugarcane in the short to medium term, other than current tree and small crops, which have a limited, but developing market capacity. In the longer term the sugarcane industry is predicted to adapt to market conditions, and the market for existing alternative crops to continue to expand;
- While current groundwater management strategies have arrested the expansion of saltwater intrusion in the Lower Burnett there is a need for evaluation of a groundwater replacement scheme in affected areas and neighbouring areas. Currently water restrictions are affecting the economic viability of farms in the region, and there is the risk of further deterioration of soils in the region with continued groundwater use;
- Water use efficiency is primarily an issue within irrigation areas (both on and off farm) within the Burnett/Kolan Basins.

Water Quality

Marginal water quality hotspots within the Burnett Mary Region have been identified in a number of studies. Sources of contaminants have been found to be a combination of both diffuse and point sources. These include sediment and nutrient loss from agricultural land and outfalls from intense forms of land use.

Current approaches to addressing these issues include adoption of *Codes of Practice* for environmental sustainability by various rural industries; and research and community discussion to establish target Environmental Values (EVs) and Water Quality Objectives (WQOs), initially for the Mary and Burrum Catchments and the adjacent coastal marine environment. Tentative EVs and WQOs have been proposed for the Burnett Catchment, but these have not yet been exposed to community evaluation and approval.

Modelling studies have been used to assess the magnitude of diffuse inputs from different components in the catchment, particularly in relation to assessment of the export of nutrients and sediment to the Great Barrier Reef Marine Park. There is a need for these models to be backed up with improved water quality data collection in high risk areas, and evaluation of the impact of changed management on sediment and nutrient loadings.

- Across the region as a whole, condition and trend assessments are needed to at least identify areas of greatest concern as well as support any future Environmental Values and Water Quality Objective initiatives. Past assessments have highlighted the poor data coverage at a regional level.

- Current gaps in water quality monitoring are more serious in the inland areas, in rivers systems other than the main Mary and Burnett and in the marine areas down stream of the estuaries. These gaps assume some level of significance given the emphasis in the Reef Water Quality Protection Plan on the impact of broad hectare land use management within the catchments on reef water quality.
- Water Quality concerns identified from the monitoring data base within the region also appear to be primarily related to the intensity of adjoining land use and point sources (within the Mary and Burnett Basins) as well as management of low flow regimes and impoundments within the Burnett.

3.4.2 Pressures and issues

Factors implicated in water quality concerns include:

- Reduction in stream bank stability;
- Reduced vegetation cover on developed land increasing susceptibility to soil erosion;
- Use of agrochemical and fertilisers by intensive arable industries;
- Use of herbicides and pesticides in the agricultural sector and their downstream impacts on coastal/marine organisms;
- Acid Sulphate impacts within coastal areas;
- Stormwater and point source outfalls from industry and urban areas;
- Degradation of riparian zone vegetation and wetlands that act as natural filters for sediment and nutrients;
- Effects of impoundments on water quality.

Whilst evidence from the incomplete monitoring network indicates that each of these factors are of concern in various parts of the region, the monitoring network does not adequately cover either the whole region or all types of flow events associated with these.

3.4.3 Past and present action in the region

A number of initiatives are currently underway within the region which will ultimately impact on water quality resource conditions. The Reef Water Quality Protection Plan sets end of catchment export targets of a reduction of between 50 and 66% in exports of sediment and nutrient from the Reef Catchments which includes the Burnett, Kolan and Baffle catchments. Environmental Values and Water Quality Objectives planning to set both regulatory and advisory frameworks for particular sections within the catchments have commenced in the Mary catchment, however the same process has yet to be extended to other parts of the region.

The current monitoring network is not sufficient to adequately underpin either of these planning processes. Data is currently collected by three government departments, some local authorities and community groups. Under the current Priority Action and WQ SIP programs, the adequacy of these data sets is currently being assessed.

3.4.4 Targets and Actions

A number of broad targets are possible within the water resources asset. These include:

- Across the region as a whole, condition and trend assessments are needed to at least identify areas of greatest concern as well as support Environmental Values and Water Quality Objective initiatives which will underpin targets for other assets (eg Land Resources). Past assessments have highlighted the poor data coverage at a regional level;
- Water Quality concerns identified from the monitoring data base within the region also appear to be primarily related to the intensity of adjoining land use and point

sources (within the Mary and Burnett Basins) as well as management of low flow regimes and impoundments within the Burnett. Maintaining adequate environmental flows, management of acid sulphate areas and addressing inputs from point and concentrated diffuse sources close to streams will also be important targets;

- Water use efficiency is primarily an issue within irrigation areas within the Burnett/Kolan Basins. Both on farm irrigation and off farm water distribution efficiency are areas of concern. On farm Water Use Efficiency Initiatives have been a particular focus of past industry based activity;
- Within the groundwater areas, concerns have been raised in the Bundaberg, Isis and Three Moon Creek irrigation areas with the management of salt water intrusion and drainage waters. Within the coastal sand mass aquifers, EV and WQO for their sustainable use to serve as guidelines for future management of the resources are also of concern. In the case of all of these areas, there has been considerable monitoring undertaken which should allow intervention strategies and EV and WQO to be set.

3.4.5 Investment Priorities, Partnership and Linkages

Achieving Water Resources targets will require coordinated actions from all levels of community and government. The GBRMPA with its reef water quality end of catchment targets is a key partnering organisation as are DNR&M and EPA with their regulatory and monitoring networks.

Ultimately however, industry and local community groups will be the key agents for change in terms of water quality outcomes – particularly those related to diffuse sources. Industry, land holders and community groups will need to develop the capacity to implement changes to land use and land management as well as monitor and evaluate the impacts of these changes.

3.4.6 Monitoring and Evaluation

Monitoring and Evaluation of Water Resources investment outcomes will depend on types of targets selected for investment. The types of indicators which could be used are listed below.

M&E	Indicator	Comment
Improved water quality outcomes based on EV/WQO process and/or RWQPP	Once targets are set, these would be a mixture of in stream monitoring indicators for sediment and nutrients at various flow conditions and adoption of improved point and diffuse source management plans.	
Base Environmental Flows and Water Use Efficiency	Numbers of properties operating within approved plans or codes of practice and frequency with which flow objectives are met.	Will require M&E system to be developed at regional level
Sustainable Management of Groundwater Resources	Remediation and Management Plans in place for over exploited/degraded systems EV/WQO process and resultant management plans in place for coastal sand mass systems	

4 Capacity Building under the NRM Plan

Achieving the asset themes outcomes and the M&E requirements will require significant investment in capacity. Whilst it is true that past NRM investment programs such as NHT1, NLP etc have significantly contributed to heightened capacity and awareness at various levels, the outcomes targeted approach under NHT2/NAP aim principally at what has to be achieved to obtain desired NRM outcomes. The actions within the asset themes all involve prioritising investment at locations for those NRM issues which will have the greatest impact. This does result in investment being directed to locations and issues where the capacity building benefits from earlier programs may have had limited impact.

At this stage of the NRM Plan development, the capacity building requirements can be divided into a number of broad investment thrusts:

- Investing in local community groups (i.e. Voluntary Sector) to establish capacity in areas and locations currently not covered and to improve capacity to operate effectively within a target setting approach to NRM outcomes;
- Investment in medium level NRM expertise and capacity located within partnering organisations such as industry and local authorities. Such investment aims at building on existing investment in support of regional NRM Targets within these organisations as opposed to duplicating existing capacity;
- Investing in extension and training programs delivered by the above groups & organisations that are regionally or sub-regionally specific and which provide the NRM information needs of land managers;
- Investment in higher level expertise and capacity to manage and direct the above investment theme. This same capacity should also be able to direct M&E activities. This expertise is likely to be located and resourced within the regional organisation.

Capacity Building under the Plan

Sector	Current Capacity/Issue	Broad Approach	Comment
Local Government Planning	Only the larger rate based shires have in house capacity and the smaller shires tend to use the same outside consultants	PAPs and MAs will provide the baseline data to better incorporate NRM outcomes in shire plans. Strategic Planning Assistance will be required once this data is available to continually refine IPAs	Moderate Priority and could be achieved by partnership arrangements with shires
Local Government NRM	Only some of the larger rate based shires have in house capacity. NRM/Land Care officers are located in a small number of shires and shared across sub regional areas – part funded by shires.	Capacity under shared or in house arrangements may not be well aligned with asset themes and locations. Gap filling of capacity will be required.	High priority to provided greater coverage by partnering with shires in other areas to increase numbers of NRM officers and targeting training to NRM officers. Regional NRM

Sector	Current Capacity/Issue	Broad Approach	Comment
			planner/coordinator will be required
Industry	Industry based Property and Environment Management Planning as a major avenue for delivering investment to bring about land management changes at the property level.	The coverage and penetration of these programs across all industries to be increased by building capacity – including capacity to operate within a devolved grants framework for on ground implementation.	High priority to build existing knowledge capacity early in investment period. Partnering to extend coverage once industry programs are in place and partnered to NRM Plan.
Community Groups – direct program management monitoring and implementation capacity	Highly variable levels of capacity in restricted geographical areas (for example limited capacity to directly influence land management but higher capacity to monitor impacts of land management).	Capacity of local groups in areas of high priority for investment to be upgraded. Probably at the Landcare or Waterwatch district level	Differentiation between Industry based and community based models requires attention under partnership arrangement to maximise efficiency of delivery and use of limited regional capacity. Fostering of closer working relations between LGA, industry and community groups should be a priority
Local Community Groups – on ground implementation (is this project implementation)	Small number of groups have extensive capacity to undertake on ground works via devolved grants program – other groups have limited capacity and coverage	Understanding of the target driven approach will have to be improved in existing as well as any new groups. Some groups will need facilitated access to skills, knowledge and training.	Partnerships with Local Groups under NRM plan required and will need to be supported by extensive training at the leadership level.
Training and Extension Programs	NRM extension and training programs current do not relate well to NRM targets – particularly with respect to land management. NRM Plan/success requires higher rates of adoption of better practises than has been achieved	Realistic, regionally and sub regionally targeted extension program capable of providing information required by land managers and supporting all other sectors is to be developed.	Partnerships with Industry and State agencies will be required. Delivery through members – community groups & education institutions

Sector	Current Capacity/Issue	Broad Approach	Comment
	under past approaches.		
Monitoring and Evaluation – Baseline Monitoring	Expertise Capacity exists within state departments – but not necessarily at the regional level. Also there may be limited state priority in assembling baseline data beyond the level required to fulfil state interests	Partnering to state, CRC, Tertiary Institutions initiatives and independently commissioned baseline studies will be required.	Because of the multidisciplinary nature of the baseline, necessary levels of expertise could not be held in house.
Monitoring and Evaluation - Targets	With exception of some water quality data and extent of land clearing, few if any of the targets (adoption rates of BMP, condition of asset, changes in distribution of asset etc) are routinely monitored	Specific Capacity will have to be built to implement M&E tasks	Capacity to manage these tasks at a regional level will have to be built to allow for adaptive management of individual programs.