

# Chapter 1

## ICM in the Herbert River Valley

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## INTRODUCTION

Until recently, local government had a limited role in land use planning in rural areas and in the management of natural resources generally. Local government planning schemes applied mostly to urban areas and to the expansion of urban related uses into rural areas. Local government has always been a significant provider of rural roads and a key player in localised resource management matters such as drainage and water resources. But the development and management of rural natural resources for agriculture, forestry and other uses and the protection of environmental quality and nature conservation has been historically a state agency matter in Australia.

Local government in recent years is playing a much more significant role in this due to:

- the Integrated Planning Act and IDAS which increasingly give local governments the role of development manager
- delegation under state legislation such as the Environmental Protection Act and the Nature Conservation Act
- emergence of local community based programs such as Integrated Catchment (ICM) and Local Agenda 21 programs
- increased commitment to integrated resources management

The scope of local planning schemes in relation to rural areas is changing in quite fundamental ways - giving local government the opportunity and responsibility for resource management to an unprecedented level. The prospect is that local government could become the dominant force in managing local resources for example vegetation management on private lands, water use and waste water emissions, wetlands and coastal management within parameters set at other levels of government. Local government plans will thus be dealing with a wider range of activities than ever before including a direct relationship with agriculture.

Recent progress in the Herbert River basin, administered by two local governments, Hinchinbrook and Herberton Shires provides a good case study of the evolution of the role of local government in natural resources management. This paper is particularly concerned with the lower Herbert and the role of the Hinchinbrook planning scheme in relation to natural resources management. This area, largely the alluvial floodplain of the Herbert River, is one of the most intensively cultivated districts in the state, being a highly significant sugar producing region which produces approximately 20% of Australia's sugar. It has a set of chronic but not acute resource management issues, most important being those associated with water management, flooding, drainage, river system quality as well as nature conservation for remnant terrestrial habitat and wetlands.

Land use and resource management in the area is influenced, managed and controlled by a complex web of natural resource management programs most important of which are the caneland development and assignments process, Crown land administration and development (including subdivision and sale, forest and other reserve management), nature conservation including World Heritage National Parks, habitat conservation), Drainage Board, Hinchinbrook Shire infrastructure and town planning among others.

A Catchment Coordinating Committee was established in 1994 under the Queensland ICM program. Its activities and development are the prime focus of the project.

The research presented here is part of a five-year project in the CSIRO Division of Tropical Agriculture with cooperation from the Department of Natural Resources, Hinchinbrook Shire Council, the CSR and others. Funded by the (Commonwealth) Land and Water Resources

R&D Corporation. Recently this project has worked in cooperation with an NLP project in the Department of Local Government and Planning which is investigating the use of town planning in natural resource management in a number of rural local governments in Queensland.

## **The Natural Resources of the Herbert River Catchment**

The Herbert River catchment drains an area of approximately 10,000 sq km of the wet tropical coast of far north Queensland with its major river outlet flowing into the extensive mangrove areas of the Hinchinbrook channel (Figure 1). The catchment has a dominantly summer rainfall with approximately 75% on average falling between December and March. The lower catchment encompasses the shire of Hinchinbrook and the upper catchment area the shire of Herberton. The population in 1993 was estimated at approximately 18,000 people with 75% living in the lower catchment. The catchment has a rural economy based dominantly on primary production (ie. sugar, beef cattle, forestry), but given its proximity to the wet tropical coast including the Great Barrier Reef Marine Park fishing and recreational activities are also important contributors to the local economy.

The catchment comprises three separate environments: the tablelands, the central ranges, and the coastal lowlands, which are each described briefly below.

*The Tablelands:* encompass the upper catchment of approximately 6000 sq km. It includes the driest parts of the catchment with annual rainfalls ranging from 750 mm per annum in the west to 3,000 mm towards the coastal ranges in the east. Land use is dominated by extensive grazing on native pastures, with some fodder cropping, small pockets of dairying and horticulture in the north, and a number of operational and abandoned tin mines. Land tenure is mostly leasehold or Crown land and some areas of freehold.

*Central Ranges:* encompass the rugged high rainfall areas with 1500 to 3000 mm of rainfall per annum that separate the upper and lower catchment, and surround the tablelands areas in the north and east and the coastal lowlands in the north and south. They are mostly protected areas such as the World Heritage Area, National Parks and State Forest Reserves.

*Coastal Lowlands:* comprise an active river delta with relatively fertile alluvial soils which have been extensively cleared and developed for intensive crop production (dominantly sugarcane) and some more limited areas of improved pasture for cattle. Rainfall in the coastal lowlands varies widely ranging from an average of 1500 to 2200 mm per annum. This area is subject to regular inundation by flooding with major flooding occurring on average every 3.5 years and minor flooding almost every 2 years.

Sugarcane production which is confined to the lower Herbert coastal plain is expanding its area under production at about 7% per annum. Currently approximately 75,000 ha of land is cultivated to supply the two mills in the region (Victoria and Macknade). Only about 5,500 ha of this area is licensed to be irrigated from surface supplies. The rapid expansion of sugarcane in recent years has largely occurred on the more marginal lands for production, that is on poorly drained coastal wetlands, and previous grazing lands.

## **Natural Resources Management Issues in the Herbert River Valley**

At the commencement of European settlement in the late 1800s, the Herbert catchment was heavily timbered with extensive freshwater wetlands in the coastal lowlands. The catchment has since undergone significant modifications with nearly 40% of the coastal lowlands cleared for crop production or improved pastures, and clearing of rainforest and open woodlands for

extensive cattle grazing and some small areas of cropping in the tablelands (Johnson and Murray 1997).

Concern over flooding has been a community issue in the lower catchment since the 1880s. However flood mitigation works and the development of uncoordinated drainage systems have been the cause of considerable community conflict. Since the 1970s, there have been a number of major studies commissioned by the Herbert River Improvement Trust (HRIT) and the Hinchinbrook Shire Council in collaboration with state government agencies that have examined water management related issues with respect to flooding management, rural drainage planning, and stream management planning (eg. Gutteridge Haskins and Davey 1976a , 1976b; Cameron McNamara 1980, 1984; and Ian Drummond and Associates 1993).

Table 1 summarises the natural resource management issues identified in some of these reports and also by community members and other industry and government stakeholders at a workshop held in 1995 (Bellamy *et al.*, 1995). This shows that perspectives on catchment issues now encompass a broader range of issues including concerns for impacts on tourism and recreation, wildlife and habitat management, riparian zone management, and water quality, and calls for greater community involvement in decision-making. Most significantly at the 1995 workshop (Bellamy *et al.*, 1995), the lack of long term planning of water management and rural land development was identified across several participant groups as a major issue needing to be addressed.

Perceived impacts of these natural resource management issues have evolved from an initial focus on productivity and infrastructure impacts to encompass loss of alternative use opportunities and environmental and ecological factors. Perceptions of the key mechanisms for resolution have also evolved from an initial focus on "engineering based" approaches to include policy incentives and legislative controls or individual action. The key mechanisms for a more integrated planning approach to resource management and land development were seen as an effective ICM process with the support of state government to foster cooperation, the development of industry codes of practice, and the use local government planning and development controls.

### **Layers of Resource Management**

Table 2 details the current resource management legislative and administrative framework within which the sugar industry operates. It reflects the maze of state agencies and their often conflicting statutory responsibilities. This complex arrangement combined with high expectations from the "public" for effective involvement in decision making suggests that the sugar industry will have to respond to, and indeed lead, the implementation of ecological sustainable development in cane areas.

ESD principles, to some extent, have been recognised and incorporated into the areas of the industry's operations. The environmental audit of the sugar industry sponsored by Canegrowers demonstrates a general concern for the environment. At a local level, many cane assignment boards have established a number of conditions on new assignments. While this trend is encouraging, effective establishment and implementation of assignment conditions relies on adequate information about the natural environment (eg hydrology, land suitability, flora and fauna). Without adequate information, local boards are unable to systematically determine the desirability and feasibility of assigning land for cane growing. Similarly, current arrangements do not allow for the adequate monitoring of either adherence to assignment conditions or the impact of conditions on the natural environment.

At the farm level, ESD principles have been recognised with the use of Property Management Plans (PMPs). The development and implementation of PMPs is one voluntary method that can play key role in minimising environmental degradation (Queensland Landcare Council, 1991). Supported by Landcare and ICM groups, PMPs can be developed with a high level of owner involvement. Hence, PMPs provide another facility by which cane growers can more actively participate in farm management planning with the assistance of government officials. While PMP is receiving widespread acceptance on new cane lands, the industry must foster a similar approach on existing cane lands. Its future is dependent not only on an increased acceptance by existing growers but also improvements in the quantity and quality of natural resource and other information to guide effective decision making.

### **River Management to Catchment Management**

As previously noted (see Table 1), the major focus in the past in the Herbert catchment has been on river management issues, especially issues relating to flooding and drainage associated with the major river systems. Solutions have generally been seen to be engineering works.

*Flooding:* The Herbert Catchment experiences regular major floods. Flooding is recognised as causing major damage to crops and property, considerable inconvenience to the community, and river bank erosion. Local governments have been responsible for providing protection for urban communities and the HRIT addresses the needs of the broader region. However the approach to flood protection has often been piecemeal and reactive to some catastrophe.

*Drainage:* Expansion of caneland in the lower catchment since the early 1900s has extended progressively into soils of poorer drainage. The drainage system for these lands was developed in an ad hoc way with a series of 25 separate voluntary schemes and gazetted drainage boards evolving over time. Efforts to improve farm drainage were uncoordinated and often with little regard to adequacy or the downstream impact of farm outfalls. This has caused significant environmental impacts with social conflicts resulting. Substantial conflicts have also emerged between upslope and downslope farmers regarding cost-sharing arrangements for maintenance of drains and levees, and property damage.

*Integrated Catchment Management:* More recently increasing community calls have been made for greater community involvement, better coordination of decision-making, and a broader more strategic perspective that takes a long term view and encompasses both water management and land development planning on a whole catchment basis.

ICM commenced in the Herbert Catchment in March 1993 with the establishment of the Herbert River Catchment Coordinating Committee (HRCCC) on a voluntary basis by local community interests. The impetus for its formation was the recognised need for better community participation in decision-making relating to river management issues. Current representation on the HRCCC includes Canegrowers, Cattleman's Union, Rare Fruit Council of Australia, Queensland Commercial Fisherman's Organisation, CSR Herbert River Mills, HRIT, Combined Drainage Boards, Hinchinbrook Shire Council, Herberton Shire Council, Landcare, conservation, Hinchinbrook Citizens Association. Currently of the 15 members there is no State or Commonwealth Agency representation, and only one representative from the upper catchment.

The HRCCC's stated objectives are to:

- coordinate government agencies and the community to pursue common goals
- seek community involvement in catchment management
- identify and rectify natural resource degradation

- promote ways to prevent and reduce natural resource degradation
- promote the wise use of all natural resources within the Catchment
- identify key indicators of biodiversity and monitor as a measure of catchment health
- encourage the retention of significant natural habitats within the Catchment. (HRCC 1996).

The HRCCC activities since formation have primarily focussed around:

- (i) single-issue activities to get 'runs on the board' rather than issues of strategic importance (eg., promotion of owl boxes for pest control);
- (ii) being a referral agency for proposed projects and other catchment activities by state and local government (eg., SIIP proposal, Hinchinbrook Shire Planning Scheme)
- (iii) the formulation of a draft Herbert River Catchment Management Plan for public review and comment.
- (iv) brokering funding for others to undertake natural resource management activities in the catchment (eg., for recent round of NHT funding).

The draft Catchment Strategy is seen to provide a framework for future management of the Herbert River Catchment. It was prepared by HCCC members through a series of working groups and internal workshopping. The key management and planning issues identified relate to land management, water management, stream management, and habitat management. The key issues relating to each of these are identified in Table 3. For each of these issues the strategy identifies a range of actions, and suggest which landholders, Government agencies and resource users are responsible for doing it.

At this stage in the development of ICM in the Herbert, key HCCC members perceive the strategic plan development more as a means of getting funding rather than a framework for ICM implementation in the Herbert. Their perception of their role also is evolving from one of delivering outcomes or solving natural resource problems on the ground, to one more of facilitating ICM principles as a way of doing business, or facilitating a strategic direction for the catchment.

### **Local Government Planning and ICM in the Herbert**

The Hinchinbrook Shire Council (HSC) has been involved in resource development of their Shire since its foundation in 1933 in many and various ways. HSC is a partner in the Drainage Board gazetted in 1977, in a number of voluntary boards for sub-catchments and of the recently established the Herbert River Information Centre. HSC councillors have been on the HRCC since its inception a role which expanded considerably in 1996 with the appointment of the Shire Chair as Deputy Chair of the HRCC along with another councilor. There are many and various informal means by which the HSC as the elected local government have had on resource management in the Shire - lobbying, negotiation, advice etc.

In 1995, the Shire determined to revise its town planning scheme and in doing so to prepare its first Strategic Plan. Until this time the HSC relied on a traditional zoning scheme and by-laws which were totally focussed on the regulation of urban development in the Shire, admittedly a modest challenge in an area with relatively little population growth. The new town plan preparation began in mid-1995 and a draft went on public display in October 1996. It was prepared by Sinclair Knight Merz since, in common with many rural local governments, the HSC does not have a professional planner on staff. Planning issues are managed by the CEO in conjunction with the engineer and the Deputy Shire Clerk. Following public display and objections, the revised plan was dispatched to the DLGP for review and approval in March 1997. That is where the plan rests at the time of writing.

It is also relevant to note that there is an NLP funded project "Integrated Catchment and Local Government Planning Schemes" (See QLGA, 1997) involving the Queensland Local Government Association and the Department of Local Government and Planning selected HSC as one of the four case study shires. This arose directly out of the review document and communication plan prepared in the same project. (QDNR, 1996) The Hinchinbrook Shire identified four priority issues in relation to ICM for this project. They were:

- wetlands and mangroves
- riparian vegetation
- drainage
- local roads and railways (including light rail)

#### *Overview of the New Plan including the Strategic Plan, Zoning Scheme and Performance Standards*

The new planning scheme consists of the normal battery of planning instruments:

- a strategic plan as an overall framework for guiding land use change (preferred future land uses) through a set of objectives,
- a zoning scheme which defines a (conventional) table of zones (without consent, subject to conditions, consent and prohibited),
- a subdivision by-law,
- general and use specific development standards and
- a range of administrative provisions.

Each of these elements has relevance to natural resources management and ICM but only the highlights will be reviewed here.

#### The Strategic Plan and its Objectives

In the Strategic Plan HSC makes a specific and substantial commitment to rural resource management and to ICM. It signals the approach to implementation largely through its stated likely response to development applications as illustrated in the following edited extracts from the plan.

##### *Rural Objective 2(iii)*

"Where future expansion of agriculture is proposed through a development application, the Council will require the submission of a property management plan where it has determined first that adverse environmental impacts may result from such development. Of particular interest to Council will be applications for new cane assignments in the areas of drainage paths, ground water resources, wetlands, riparian vegetation and associated stream bank stability, remnant areas of native forests, rural views and quiet rural amenity. The Council will not support any development application for agricultural expansion where it has determined that unacceptable environmental impacts will be caused by the development" (p6)

##### *Rural Objective 5*

"To protect existing rural values such as surface water (drainage paths) and ground water resources (recharge areas), soil and other land resources, riparian vegetation and stream bank stability, remnant areas of native forests, rural views, and quiet rural amenity."

The Council will only support those development applications which will contain potential adverse impacts within the site so that the costs of any rural activity are not widely spread and are not unfairly borne by others."

#### ICM Objectives

1. To identify and designate the catchments and the sub-catchments of the Herbert River which lie wholly or partly within the Shire. The Council will "take into account" the catchment strategies and assess proposals on that basis.

2. To ensure that, as a result of the development and use of land no environmental impacts affect any lands elsewhere within a catchment designated in this Strategic Plan.  
Implemented by a commitment to having "regard for" and "shall implement the principles of ICM" and the "may refuse to support any proposal which will generate unacceptable effects upon any land ...", and " may require the preparation of an EIA" where detrimental downstream effects or impacts are possible.
3. To promote sensitive and sustainable land use practices through the development process.  
Discussion of implementation includes "all development and land uses will be required to adopt sound management practices so as to minimise, ....."; "The Council may refuse to support any proposal ..."; and "logging of privately owned timber shall not entail the removal of any vegetation within 50 metres of a known creek or watercourse."

#### The Zoning Scheme

The conventional zoning scheme has only five zones, namely, Rural, Town, Village, Public Purposes, Special Activities. The Rural Zone covers most of the Shire. The most significant innovation in this zone is that intensive agriculture is listed as a use which may be carried out in this zone subject to the notification of conditions. Intensive agriculture which includes most farming activities, is a prohibited use in all other zones:

*Intensive Agriculture:* "means the use of land for the intensive production of crops, such as but not limited to sugar cane, at rates or production beyond the natural carrying capability of the land whether or not the land is irrigated for such purposes. The term includes the establishment of any infrastructure necessary for the conduct of the use. The term does not include small-scale agriculture conducted on premises or a site less than 5 hectares in area."

#### The Performance Standards for Intensive Agriculture (7.7.2)

- I. In considering an application for intensive agriculture the Council shall have regard to the following matters:
  - A. the extent of vegetation loss and earthworks proposed
  - B. the likely changes to hydrological regimes for both surface and groundwater reserves within the catchment of a site
  - C. the proposed manner of environmental management including the containment of downstream effects such as excessive water demand, the quality of run-off water; the maintenance of environmental flows in streams; the management of water tables to prevent salinisation; and the alteration of ecological processes
  - D. [sic] the likely access requirements to the land having regard to projected production rates and operational schedules, and the capacity of the existing road and tram network to respond to increases in traffic flows;
  - E. any other matter of relevance to the application
- II. The Council may require a development application for "intensive agriculture" to be supported by an assessment of any of the matters raised in considering the application pursuant to provision 7.7.1 above

This plan clearly reflects a strong commitment by HSC to natural resources management and given that this is HSC's first plan, is to be commended. What now needs to be done is to create the details that will make such a plan implementable. In the elements extracted above there are ample powers to intervene in a significant number of rural development decisions. The Plan raises many questions as to what is the "small print" in relation to the various steps involved in regulating rural uses in this way, some of which are:

- What are the designated uses requiring approval ? - the intensive agriculture definition which is critical, could create confusion unless unambiguously defined. The Pest and Productivity Board in a submission to the Plan proposed that sugar not be regarded as an intensive use !
- What is the minimum area threshold ? - clearly very small areas should not require regulation but setting the minimum threshold too high could allow many significant developments to go unregulated. For example a minimum of 5 hectares as proposed in the draft HSC plan which is equivalent to a square area with sides greater than 220metres, seems too large.
- What are the criteria for approval of regulated uses, for example the relevant environmental issues, natural resource protection, off-site effects water quality and quantity issues, habitat and nature conservation issues etc. What are allowable changes to water courses and riparian zones, impacts on drainage and flood regimes. This requires the introduction of guidelines and specific performance standards and hopefully examples of good practice. These conditions need to be specified in planning documents in such a way to give clear prior guidance as to desired developments.
- How will development applications be assessed against those criteria - for example what are significant habitat areas and where they are specified ? (on what maps), Will applicants need Property Management Plans ? Who will appraise the plans/proposals against the criteria (which agency by what process)? Will the applicants require impact assessments ?
- Will there be any monitoring provisions? What will be monitored and who will do it ?
- What sanctions are proposed ?
- Are there to be any concomitant effects on other land use planning activities for example cane land assignment, land valuations and rates?

These questions pose some new challenges for local governments and their rural planners. There has been some progress in addressing these questions in the Herbert.

#### *Riparian Vegetation*

Protecting riparian zone has been one of the most contentious issues in the Herbert indeed in most rural areas. The main planning issues are: Should there be a buffer along watercourses, what is a water course, how wide should the buffer be and what management requirements apply to the buffer zone ? Each issue is contentious and has implications for the environment and property rights (and politics).

The protection of streambank vegetation in the Herbert is believed to contribute to bank stability through the physical binding provided by the tree roots, reduction in bank water content as well as to provide habitat corridors. The technical questions arising from the planning issues are to define water courses, determining the width of the riparian buffer be and examining the impacts of various activities in the buffer (for example should any clearing or logging be permitted). As an HRCC initiative, streambanks were evaluated in a detailed study of the lower Herbert River by Andrew Petrokowski. The provisions of the *Water Act* requires conservation of the riparian zone of major watercourses within a 40 metre buffer. This controversial requirement is criticised on the grounds that it is insensitive to local circumstance and needs. The Petrokowski study recommended a more sensitive approach that defines the width of the buffer zone in terms of two factors: flood risk and bank erosion risk. Only in areas of high risk would the full 40 metres be required whereas in other areas lesser distances would be calculated on the basis of an index of these two factors.

### *Drainage*

As previously discussed uncoordinated drainage systems on canelands has been a long term issue creating significant social conflict in the Herbert. The HSC in conjunction with the HRIT has undertake a number of major studies in the lower in the lower Herbert. A significant outcome has been the move to amalgamate all existing gazetted and voluntary drainage boards into a combined body in support of a more coordinated and consistent approach to the drainage. This has been a fundamental element of the Herbert submission for funding under the Sugar Industry Infrastructure Package for support to major infrastructure works currently under consideration by the Commonwealth Government. The HSC successfully lobbied DNR to appoint a technical drainage expert to provide interpretation and advice on drainage issues. This officer should be able to resolve technical issues associated with development approvals required by the town planning scheme

### *Wetlands and mangroves*

The expansion of intensive agriculture has already made significant changes to the area's wetlands environments. The HSC in collaboration with the HRCCC and industry has supported initiatives with industry and private landholders to foster the development of artificial wetlands which have dual purposes of nature conservation and the redirection of water emissions from the CSR mill to create artificial wetlands rather than direct disposal into local drainage lines. On individual farms the HSC is encouraging the construction of artificial wetlands for nature conservation with benefits to production on adjacent lands arising from water management.

Current mapping and assessment programs will provide a firmer foundation for defining what ecologically significant wetlands and mangrove areas are to be included with the regulated area. Included here is concern about acid sulphate soils which can create substantial ecological and productivity effects off-site if they are excessively drained. A problem here is the erratic distribution of risk areas

### *Local roads and railways (including light rail)*

The HSC has been involved in negotiations with QR and DOT on the design of road and rail bridges and embankments on local drainage networks on the floodplain. There is now an agreed referral process amongst these authorities to coordinate drainage and to minimise the flooding effects of such works.

## **CONCLUSIONS**

The expanded role of local governments into rural environmental planning has many challenges for planners. It introduces a whole new set of technical and political dimensions to their work for which they may have little training, no experience and can not call on well-developed precedents to guide the way. It will therefore be a significant learning period for councils, their staff and advisors.

The underlining planning process will have some similarities with conventional urban based planning in terms of land use control and setting of performance standards and managing the development approval process. The differences will be partly technical in dealing more with ecological and land resources issues but also more complex in that the planning and management will need to be more site and local landscape specific than normally applies to urban planning matters.

There are serious obstacles too, not the least of which is the potential for councils to be in conflict with land owners over loss of use rights, injurious affectation and potentially the need for compensation. Some of the suggested processes lead councils into unexplored territory, for

example the reliance on Property Management Plans, the application of EIA to small land development proposals

Unfortunately regulating new developments only through the planning process will not be effective in dealing with existing resources management problems. To the extent that existing uses are unsustainable or that minor variations in those uses will not be affected by any planning provisions, this approach will not contribute to ESD.

Substantial progress has been made in a relatively short time - better coordination between authorities and in extending the reach of town planning. HRCC through the ICM philosophy has had a significant facilitating role and forum for the diversity of interests involved on a day-to-day basis. It has opened lines of communication between previously unconnected groups and to get a wider range of perspectives on resource management issues

The challenge is to develop effective contributions of local planning schemes in natural resources management in a situation of little previous experience here in Queensland. What can be achieved? What is best practice? What are the obstacles in terms of the capabilities of local government organisations and their staff and what training and development programs will be required to overcome these obstacles?

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**Table 1. Natural resource management issues identified in selected studies in the Herbert Catchment.**

	<b>Herbert Technical Studies 1976, 1980, 1984</b>	<b>Community Workshop August 1992</b>	<b>ICM Evaluation Project Stakeholder Workshop June 1995</b>
<b>Key Issues Identified</b>	<p>Lower Herbert Catchment focus:</p> <ul style="list-style-type: none"> <li>• flood mitigation</li> <li>• stream and river bank erosion</li> <li>• uncoordinated drainage on river floodplain</li> </ul>	<ul style="list-style-type: none"> <li>• flooding</li> <li>• sedimentation</li> <li>• bank erosion</li> <li>• major river course changes</li> <li>• rural drainage</li> <li>• tourism and recreation</li> <li>• biological issues (including wildlife habitats)</li> <li>• water quality and quantity</li> </ul>	<ul style="list-style-type: none"> <li>• lack of long term planning of water management and land development</li> <li>• lack of coordinated drainage strategies</li> <li>• conflict over flood protection works</li> <li>• riparian zone management</li> <li>• habitat management and protection</li> <li>• increased erosion and sedimentation in river</li> <li>• pest management planning</li> <li>• long term sustainability of agriculture</li> <li>• land development/conservation conflicts</li> </ul>
<b>Perceived Key Impacts</b>	<ul style="list-style-type: none"> <li>• economic consequences (e.g. major crop losses)</li> <li>• infrastructure and property damage</li> </ul>	<ul style="list-style-type: none"> <li>• loss of valued land</li> <li>• loss of production</li> <li>• infrastructure/asset damage</li> <li>• access difficulties</li> <li>• loss of recreational and tourism opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• loss of crop production and profitability</li> <li>• land degradation</li> <li>• river aggradation</li> <li>• reduced stream capacity</li> <li>• stream bank destabilisation</li> <li>• habitat destruction/modification</li> <li>• water quality and quantity problems</li> <li>• localised flooding</li> <li>• conservation impacts</li> <li>• social conflicts</li> <li>• alienation of land for other uses</li> </ul>
<b>Key Mechanisms Identified for Addressing Issues</b>	<ul style="list-style-type: none"> <li>• a range of largely engineering-based studies to investigate stream processes/river morphology for flood management and rural drainage coordination</li> <li>• flood mitigation works (e.g. levees, floodgates, overflow channels, rock works)</li> <li>• removal of river vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• a range of infrastructure and related works programs (eg. removal of river sediment, bank stabilisation; rationalisation of levee system; increased capacity of flood gates; stream bank revegetation)</li> <li>• review/reform of institutional structures and arrangements for river management</li> </ul> <p>ICM implementation to support a coordinated approach to decision-making and to facilitate community participation, community education and PR plan</p>	<ul style="list-style-type: none"> <li>• create a common understanding of ICM</li> <li>• foster and maintain a long term commitment to an ICM process which is seen as a "way of doing business" for government and the community</li> <li>• local government as action agency - use planning and development controls</li> <li>• state government to foster cooperation</li> <li>• use controls on leasehold land</li> <li>• industry codes of practice</li> </ul>

**Table 2. Some important legislative and administrative initiatives affecting natural resources management in Queensland**

Initiative	Lead Agency	Resources Effected	Objectives	Processes	Outputs
<b>Local</b>					
Planning Environment and Development Assessment (Bill)	Dept. of Housing Local Government and Planning	All private sector development applications	Integrated planning, development assessment and approval including economic, social and environmental aspects	Local Development Management, community involvement, regional forums, state concurrence and referral	Statutory plans, Regional plans. State planning policies, integrated development assessment, approval and appeals
<b>State</b>					
Nature Conservation Act	Dept. of Environment and Heritage	State conservation reserves Habitat conservation	Flora and fauna conservation Endangered species, biodiversity conservation	Land acquisition Cooperative agreements	Regulations, management plans Voluntary agreements Guidelines
Environmental Protection Act	Dept. of Environment and Heritage	All air, land and water	Air, noise & water quality protection and waste management	Standards Guidelines	Environmental Protection Policies and Plans
Lands Act	Dept. of Lands	Crown Lands	Use and development of land	Leasehold conditions	
State Public Works and Development Organisation	Premiers Department	Prescribed (large) projects	Integrated development	Coordination	Infrastructure coordination and impact assessment
Natural Resources Management (Discussion paper)	Dept. of Primary Industries	State owned or controlled water and forests, privately controlled natural resources			NRM plans for water, forests, fisheries, private lands (critical areas), licences, codes of practice
Integrated Catchment Management	Dept. of Primary Industries	Defined river basins	Integrated natural resources management	CCCs, community involvement	Catchment management strategies
Coastal Management (proposed)	Dept. of Environment and Heritage	State controlled tidal and coastal lands	Coastal protection, habitat management		Coastal Plans
<b>National</b>					
National Landcare Program	Dept. of Primary Industries and Energy	All land and water in Australia	Community based land conservation	Facilitation community groups	Property management plans; Integrated resources management
Australian Heritage Commission	Dept. of Environment, Sports and Tourism	All significant natural, historical and cultural heritage	Identification and protection of heritage	Inventory which must be taken into account	Australian Heritage Register; Heritage Guidelines
World Heritage Properties Conservation Act	Dept. of Environment, Sports and Tourism	Australia's eleven World Heritage Areas	Conservation, rehabilitation and presentation of WHAs	Management Authorities, including joint management	Strategic Plans, licenses and infrastructure
Commonwealth Environmental Protection Authority	Dept. of Environment, Sports and Tourism	All of Australia (potentially)	Environmental quality protection	Environmental standards setting Assessment	Environmental standards; Impact Assessment
Rural Adjustment Scheme	Dept. of Primary Industries and Energy	All of Australia's agricultural and grazing areas	Integrated economic, social & environmental restructuring	Regional programs	Structural adjustment funds

Source: Adapted from McDonald (1995)

Table 3. Key management and planning issues

Key Issues	Recommended Strategies
<p>Land Management</p> <ul style="list-style-type: none"> <li>• inappropriate land use allocation and its impact on resources and natural systems</li> <li>• impacts of land management on productivity</li> <li>• impacts on other values of land and adjacent land and water resources</li> </ul>	<ul style="list-style-type: none"> <li>(i) Coordinate land use planning to achieve balanced use of land, water and related natural resources</li> <li>(ii) Encourage best management practices in all rural industries</li> <li>(iii) Implement arrangements to reduce adverse impacts of agricultural drainage on natural systems and existing developments</li> <li>(iv) Reduce adverse impacts of non-agricultural land uses.</li> </ul>
<p>Water Management</p> <ul style="list-style-type: none"> <li>• Full and over-allocation of existing resources</li> <li>• increasing demands on finite surface and groundwater supplies</li> <li>• limited monitoring of water quantity and quality</li> <li>• threats to quality of surface and groundwater supplies</li> </ul>	<ul style="list-style-type: none"> <li>(i) Assess available resources and develop appropriate allocation policies in consultation with stakeholders</li> <li>(ii) Promote efficient use of water resources in the Catchment</li> <li>(iii) Promote the coordinated planning and implementation of water management schemes in the catchment</li> <li>(iv) Reduce contaminant inputs to surface and groundwater systems from point and diffuse sources</li> <li>(v) Establish and promote water monitoring priorities and standards for the catchment.</li> </ul>
<p>Stream Management</p> <ul style="list-style-type: none"> <li>• lack of awareness of stream values shown in development actions</li> <li>• stream bank erosion and stream migration</li> <li>• sedimentation</li> <li>• impact of uncoordinated levee banks and flood mitigation schemes</li> <li>• impacts of degradation of riparian zones</li> <li>• instream habitat degradation such as weed invasion and loss of water holes</li> </ul>	<ul style="list-style-type: none"> <li>(i) Continue implementation of a strategic approach to stream management</li> <li>(ii) Facilitate appropriate management of riparian zones throughout the catchment</li> <li>(iii) Ensure development and engineering works associated with streams take account of all stream functions and issues</li> <li>(iv) Identify and protect sensitive areas, to retain the function and health of our stream systems</li> <li>(v) Develop fisheries and habitat management plan for the stream systems of the catchment, involving stakeholder groups and the broad community</li> </ul>
<p>Habitat Management</p> <ul style="list-style-type: none"> <li>• threats to significant terrestrial and aquatic habitats and species</li> <li>• loss of instream habitat quality and subsequent impacts on fish stocks</li> <li>• fragmentation of remaining habitats through loss of connectivity (ie. corridors)</li> </ul>	<ul style="list-style-type: none"> <li>(i) Promote the values of habitat retention and restoration to the broader community through awareness, technical support and incentives</li> <li>(ii) Maximise the habitat values of existing protected areas</li> <li>(iii) Ensure the retention of significant habitat values outside protected area reserves</li> <li>(iv) Protect and rehabilitate wetland habitats on the Floodplain</li> <li>(v) Re-establish and manage riparian vegetation on watercourses throughout the catchment and ensure retention of existing riparian vegetation.</li> </ul>