REPORT

NORTH QUEENSLAND
REGIONAL WASTE MANAGEMENT STRATEGY

Prepared for
HEALTH & ENVIRONMENTAL SERVICES REGIONAL ORGANISATION OF COUNCILS – NORTH QUEENSLAND

Prepared by
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FOREWORD

This Regional Waste Management Strategy was prepared on behalf of the Health & Environmental Services Regional Organisation of Councils – North Queensland (HESROC-NQ) by Meinhardt (NSW) Pty Ltd. It has been prepared with funding assistance from the Environmental Protection Agency.

This report is based on information gathered from stakeholder consultation and research undertaken over the period of March 2000 to July 2000. Information contained within the report is current as at September 2000.

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EXECUTIVE SUMMARY

The Health and Environmental Services Regional Organisation of Councils – North Queensland (HESROC-NQ) is comprised of the Local Government Areas of Burdekin, Charters Towers, Dalrymple, Hinchinbrook, Thuringowa and Townsville. The HESROC-NQ region covers an estimated area of 83,609 square kilometres and has a total resident population of approximately 182,000.

HESROC-NQ has initiated this Regional Waste Management Strategy to provide a framework for an integrated approach to solid waste management across the North Queensland region in accordance with the principles of Ecologically Sustainable Development (ESD). While the Strategy focuses on Local Government involvement in solid waste management, there will be an ongoing involvement in developing strategies for other waste issues in the region, including commercial and industrial waste and privately operated disposal facilities.

The Regional Waste Management Strategy examines the existing waste management system with a view towards improving and streamlining regional operations. The Strategy provides a decision model for waste management planning for the next 20 years, however the Strategy will be reviewed on an ongoing basis to incorporate future developments in waste management practices in the region.

Recommendations for the preferred waste management options for the region have been developed through consideration of future population growth, economic evaluations, environmental and legal requirements, community consultation and compliance with best practice to ensure that the Strategy is sustainable and practical.

Current Situation

Domestic waste collection services are provided for approximately 93% of the population via a combination of Council labour and private contractors. The region is serviced by a network of nineteen landfills, seven transfer stations and sixty-two bulk bins for waste disposal. There are two material recovery facilities or recycling centres and a composting facility also located in the region.

Data on the amount of waste generated in the region is incomplete. However it has been estimated that approximately 213,000 tonnes of waste is disposed of to landfills in the region each year. This represents an estimated 1.14 tonnes of waste generated each year by every person in the region (excluding garden waste and recyclable material).

The regional population is expected to increase by close to 70,000 over the next 20 years, with a correlated increase in the amount of waste generated. Unless considerable progress is made in reducing waste generation and achieving more efficient waste management methods, the future environmental and financial burden of waste disposal in the region is expected to be significant.

Strategy Approach

The strategy provides a coordinated plan for the establishment and operation of waste management facilities and services to address the waste minimisation and disposal needs of the North Queensland region.

The overall strategy was developed after evaluation of various options for each component of the waste management structure. The objective was to provide residents across the region with an equitable level of service and at the same time be cost effective to implement.

It is expected that three regional landfills located in the northern, southern and western areas will service the region in the long term.

Strategy Actions

The proposed timeframe for implementation is divided into short term (5 years) and long term (20 years) planning horizons. Recommended actions are outlined in Table E1.

TABLE E1 REGIONAL STRATEGY

ACTION	SHORT TERM	LONG TERM
COLLECTION:		
Extend waste collection and recyclables contracts to align expiry dates, allowing opportunities for regional or sub-regional collection contracts to be entered into.	✓	
Investigate options for development of a pay-by-use collection service with waste minimisation incentives available to residents.	✓	
Encourage contractors and Councils to provide waste and recycling receptacles constructed of recycled material to support the recycling industry.	✓	
Contract specification should include awareness initiatives on recycling to encourage community participation in recycling.	✓	
Extend existing collection districts to include nominated areas not previously receiving a service and properties on route between towns.		✓
Investigate the feasibility of introducing a fortnightly garden waste collection service to residential areas.		✓
Putrescible domestic garbage collection systems employed throughout the region should be based on containers with a maximum weekly garbage capacity of 120L.		✓
Recyclables collection system employed throughout the region should be fortnightly service with 240L containers.		✓
Intra-regional collection system options should be market tested through the tender process.		✓
INFRASTRUCTURE:		
A pay-by-use system should be phased in at all facilities across the HESROC-NQ region to recover the costs associated with landfilling waste.	✓	
Upgrade existing landfills not expected to close in the short term to comply with best practice benchmarks. These landfills are: • Charters Towers: Stubley Street • Dalrymple: Greenvale • Hinchinbrook: Warrens Hill • Thuringowa: Ross • Townsville: Vantassel Street.	✓	
Close and remediate landfills at: • Burdekin: Kirknie Road, Ayr • Dalrymple: Balfes Creek, Homestead, Mingela, Pentland, Ravenswood and Sellheim • Hinchinbrook: Forrest Beach • Townsville: Cungulla, Majors Creek	✓	

ACTION	SHORT TERM	LONG TERM
Upgrade existing transfer stations to comply with best practice guidelines. These transfer stations are: • Burdekin: Ayr, Clare, Giru and Home Hill • Hinchinbrook: Halifax • Thuringowa: Bluewater, Toomulla.	✓	
Remove bulk bin facilities at the following locations: • Cordelia • Cooks Lane • Four Mile Road • Macknade.	✓	
Encourage waste segregation and resource recovery throughout the region through provision of appropriate infrastructure at all landfills.	✓	
Investigate the feasibility of establishing a southern regional waste-to-energy facility to incorporate treatment facilities for organic waste and Regulated Waste.	✓	
Establish transfer stations at the following locations: • Hinchinbrook: Forrest Beach, Ingham • Thuringowa: Jensen, Ross • Townsville: Majors Creek/Woodstock, Picnic Bay, Vantassel Street Transfer stations should be designed to meet best practice guidelines and consider the expected annual waste throughput over the next 20 years.	✓	
Make provision for separation and stockpiling of garden waste at all landfills and transfer stations throughout the region.	✓	
Close and remediate landfills at: • Hinchinbrook: Ingham • Thuringowa: Jensen • Townsville: Picnic Bay, Magnetic Island		✓
Further rationalise the number of landfills in all Council areas to result in 3 regional landfill sites to service the northern, southern and western areas.		✓
Install (or provide access to) weighbridges at regional landfills and equip with machinery capable of achieving a waste compaction of at least 800 kg/m^3.		✓
Review bulk bin provision with a view to removal of those close to transfer stations/landfills and where residents receive collection services. This includes: • Bemerside • Braemeadows • Christies Road • Gairloch • Gangemis Road • Mount Gardner Road		✓
Consider establishing a regional organic waste processing facility at the proposed southern regional facility. Consider incorporating industrial organic waste and biosolids into a regional processing facility.		✓

ACTION **OTHER**:	**SHORT TERM**	**LONG TERM**
Establish a Regional Waste Management Body to implement and review the Strategy.	✓	
Appoint a Regional Waste Officer to devise and implement waste minimisation and litter education programs through the region.	✓	
Encourage the development of specialist recycling facilities within the North Queensland region in conjunction with local industry.	✓	
Participate in an agricultural chemical container collection service in conjunction with drumMuster. Encourage the use of agricultural chemicals packaged in refillable containers.	✓	
Establish recycling bins adjacent to litter bins in public places, and encourage the use of recycling bins at public events.	✓	
Establish a regional waste exchange and encourage use of the Queensland and national waste exchange networks by industry.	✓	
Implement a 'smarter shopping' campaign to encourage the use of appropriate packaging, reusable and refillable products and products made of recyclable materials and packaging.	✓	
Promote litter control across the community through education and enforcement.	✓	
Promote and enforce the requirement that loads arriving at landfills and transfer stations are properly secured and covered.	✓	
Coordinate a series of regional mobile campaigns at schools, shopping centres and public events.	✓	
Utilise Council newsletters, direct mail, local papers and/or other media to promote waste minimisation and changes to existing services.	✓	
Review on an annual basis the progress made by member Councils towards achieving regional goals. Review Regional Waste Management Strategy on five year cycle.	✓	
Develop a central database to record the amount and types of waste and recyclables collected at kerbside and received at waste management facilities to determine effectiveness of recycling programs. The system should include trackable Regulated Wastes.	✓	
Establish a purchasing policy to encourage the use of products with recycled content and that are recyclable. Encourage adoption by member Councils.	✓	
Investigate future opportunities for waste minimisation throughout the region and encourage local industry to take an active role in avoiding waste and reusing and recycling recyclable material.		✓
Develop public awareness of the total cost of waste management.		✓
Formalise sharing of regional facilities between member Councils by establishing a Deed of Agreement.		✓

1. INTRODUCTION

The Health and Environmental Services Regional Organisation of Councils – North Queensland (HESROC-NQ) is comprised of the Local Government Areas of Burdekin, Charters Towers, Dalrymple, Hinchinbrook, Thuringowa and Townsville. The HESROC-NQ group has initiated this Regional Waste Management Strategy to provide a framework for an integrated approach to solid waste management across the North Queensland region in accordance with the principles of Ecologically Sustainable Development (ESD).

The HESROC-NQ region covers an area estimated to be 83,600 km^2 and has a total resident population of approximately 183,000. The municipalities of HESROC-NQ are shown in Figure 1.1. The area covers a strip parallel to the Queensland coast from Lucinda to Cape Upstart and as far west as White Mountains National Park. The main population centres are Townsville, Thuringowa, Charters Towers, Ayr and Ingham.

The region supports an extensive agricultural and mining industry. Major industries in the region include aquaculture, defence (Army and Air Force), metal fabrication and refining (copper, zinc, nickel, cobalt, gold), mining, port, rail, quarrying, recreational and commercial fishing, sugar milling and cane farming.

Current waste management services in the region consist of kerbside domestic waste collection in urban areas, bulk bins and a number of landfills, transfer stations and material recovery facilities (some of which are privately owned).

The Regional Waste Management Strategy provides an assessment of the existing waste management facilities and addresses garbage collection, resource recovery, waste minimisation and disposal throughout the North Queensland region. The Strategy has provided a decision model for an integrated regional waste management strategy for the next 20 years.

The North Queensland Regional Waste Management Strategy (RWMS) provides a strong emphasis on waste minimisation and resource recovery based on the waste management hierarchy. In order of preference, this hierarchy calls for waste avoidance, waste reuse, waste recycling and energy recovery from waste ahead of waste disposal. The objectives of the RWMS are detailed in Appendix A and include a focus on:

- reducing waste disposal;
- increasing opportunities for resource recovery and re-use;
- providing for more efficient management of wastes, waste collection services and waste management facilities;
- addressing the management and disposal of Regulated and special wastes; and
- reducing the potential for harm to the environment and public health.

Recommendations for the preferred waste management strategy for the region have been developed through consideration of future population growth, economic evaluations, environmental and legal requirements, community consultation and compliance with best practice to ensure that the strategy is sustainable and practical.

2. REGULATORY FRAMEWORK

2.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) is a major legislative tool used in Queensland to protect the environment. The EP Act was created to protect Queensland's environment maintaining ecological processes on which life depends, while allowing for development that improves total quality of life.

The EP Act establishes and defines a statutory framework through which the protection of environment is to be achieved. This framework includes a four-phase cyclic integrated management program and involves the following:

- **Phase 1** – involves establishing the state of the environment and defining environmental objectives in regard to those environmental values which are to be protected;
- **Phase 2** – encompasses the development of effective environmental strategies and policies which include waste minimisation and management advice;
- **Phase 3** – involves implementing environmental strategies and integrating them into efficient resource management and land use planning;
- **Phase 4** – looks to ensure accountability of environmental strategies. This includes evaluating the efficiency and effectiveness of environmental strategies and review impacts to the environment as well as the state of the environment.

The EP Act also details the drafting, implementation and review of Environmental Protection Policies. These subordinate pieces of legislation play a key role in the protection of the environment and the management of waste.

2.2 Environmental Protection Regulation 1998

The *Environmental Protection Regulation 1998* (EP Regulation) replaced the *Environmental Protection (Interim) Regulation 1995*. One of its main functions is to define all "environmentally relevant activities", set fees and whether a licence or approval is required. Under the EP Act two levels of environmentally relevant activities are defined. These are based on the risk of environmental harm from released contaminants:

- Level 1 – activities must be licensed or receive an approval;
- Level 2 – activities require an approval.

The EP Regulation also details the responsibilities and procedures to be observed in handling ozone-depleting substances. This includes lists of ozone-depleting substances and industry codes of practices for ozone-depleting substances.

The EP Regulation lists the general fees relevant to Environmentally Relevant Activities and also provides a definition for Regulated Waste as well as a list of declared Regulated Wastes.

The EP Regulation also details administrative arrangements including the devolution of powers to Local Government.

2.3 Environmental Protection (Waste Management) Regulation 2000

The *Environmental Protection (Waste Management) Regulation 2000* (Waste Management Regulation) was enacted on 1st July, 2000 in conjunction with the *Environmental Protection (Waste Management) Policy 2000* (Waste Policy) to address waste issues which were not dealt with, or were not clearly defined under previous legislation. The Waste Management Regulation provides clarification to waste producers as well as current and future State and Local Governments.

The objective of the Waste Management Regulation is to protect the Queensland environment by:

- minimising the impact of waste on the environment, in particular, the impact of waste so far as it directly affects human health; and
- establishing an integrated framework for minimising and managing waste under the principles of ecologically sustainable development.

The Waste Management Regulation addresses the following waste management issues:

- unlawful disposal of litter, unlawful waste dumping and subsequent penalties;
- waste facilities, unlawful disposal at waste facilities and the restrictions in place at waste facilities;
- a waste tracking system that tracks specified wastes and obtains data on the generation, transportation and treatment/disposal of these wastes within Queensland and interstate;
- clinical and related waste management planning, the management of clinical and related waste including the segregation of waste, storage and treatment of clinical waste; and
- management of polychlorinated biphenyls (PCBs) including the treatment, disposal and ultimate phasing out of specific PCB types.

The Waste Management Regulation also provides a list of all trackable wastes as well as the prescribed information required of waste generators, transporters and receivers for the waste tracking system. Disposal and treatment codes for waste tracking, waste origin codes for waste tracking and the National Environment Protection (Movement of Controlled Waste Between States and Territories) Measure are also provided.

The Waste Management Regulation also addresses the design requirements for waste containers and waste transport vehicles, and chemical, composting and incinerating toilets.

2.4 Environmental Protection (Interim Waste) Regulation 1996

The creation of the *Environmental Protection (Interim Waste) Regulation 1996* (Interim Waste Regulation) allowed for the transfer of responsibility for managing waste from Queensland Health to the Environmental Protection Agency (EPA). The regulation deals with the storage, removal and collection of domestic and commercial waste and requires Local Government to superintend waste disposal.

The Interim Waste Regulation covers aspects of waste management including the obligations for waste generators, waste transporters and waste receivers. The Interim Waste Regulation also stipulates that industrial waste generators

and/or transporters, as required, must provide Local Government with details on the nature and type of waste generated and the methods and location of disposal.

Since 1st July, 2000 amendments have been enacted to defer specific waste management responsibilities from the Interim Waste Regulation to the Waste Management Regulation and to ensure that the provisions of the Interim Waste Regulation are in accordance with the principles of the Waste Policy.

Additionally, waste management issues that were not covered by the Interim Waste Regulation were subsequently enacted through the *Environmental Protection (Waste Management) Regulation 2000*. These issues include:

- the handling and transportation of waste including the waste tracking system;
- clinical waste and related waste management issues; and
- the management of polychlorinated biphenyls (PCBs).

2.5 Environmental Protection Policies

2.5.1 General

In order to meet the object of the EP Act, Environmental Protection Policies (EPPs) are developed as part of an integrated management plan. EPPs can apply to the general environment or to an aspect or part of the environment specified in the policy. This must be stated in the policy, along with the environmental values that are to be enhanced or protected.

Under an EPP the following may be stated or established:

- objectives to be achieved and maintained;
- indicators, parameters, factors or criteria to be used in measuring or deciding any quality or condition of the environment;
- programs by which the stated objectives are to be achieved and maintained; and
- a program performance assessment procedure.

Under conditions specified by the EP Act, the Minister for Environment and Heritage must review an EPP every seven years. This procedure is to be aided by a report prepared by the chief executive on the policy's environmental effectiveness and economic efficiency.

As part of policy development a National Environmental Protection Measure (NEPM) is also to be taken as an environmental protection policy subject to approval by regulation.

2.5.2 Environmental Protection (Waste Management) Policy 2000

The *Environmental Protection (Waste Management) Policy 2000* (Waste Policy) was enacted on 1st July, 2000 in conjunction with *Environmental Protection (Waste Management) Regulation 2000* (Waste Management Regulation) as a step towards consolidating all waste requirements and addressing waste streams previously not subject to legislation.

Prior to the enactment of these two pieces of legislation, waste in Queensland was managed under provisions in the *Litter Act 1971* (Litter Act) and the *Environmental Protection (Interim Waste) Regulation 1996* (Interim Waste Regulation). Since 1st July, 2000 the Litter Act has been repealed while amendments have been made to the Interim Waste Regulation.

The purpose of the Waste Policy is to protect the Queensland environment with regard to all waste management issues. To achieve its objective the Waste Policy has identified environmental values to be enhanced or protected and provides a framework for:

a) managing waste in accordance with the principles of ecologically sustainable development;
b) minimising the actual and potential impacts of waste on the environment and human health;
c) minimising the overall quantity of waste generated from all sources including domestic, commercial and industrial sources;
d) promoting efficiency in the use of resources;
e) maximising the use of wastes as a resource; and
f) achieving continuous improvement in the standard of waste management activities, both public and private.

The Waste Policy details the waste management hierarchy and principles to be adopted for waste management in Queensland. The waste management hierarchy sets out the preferred order of waste management as listed below:

a) waste avoidance;
b) waste reuse;
c) waste recycling;
d) energy recovery from waste; and
e) waste disposal.

Other principles in the Waste Policy include the:

- *"polluter pays" principle,* which requires that all costs associated with the management of wastes should be borne by those persons who generate the waste, where practical;
- *"user pays" principle,* which requires that all costs associated with the use of a resource should, where practicable, be reflected in the price of the goods and services that are produced as a result of that use; and
- *product stewardship principle* whereby the producer of a product should plan its design and production to minimise the environmental harm that may be caused by waste generated from the production, proper use or disposal of the product and the importer of a product should take all reasonable steps to minimise the environmental harm that may be caused by waste generated from the importation, proper use or disposal of the product.

The Waste Management Policy also details mechanisms for waste management planning, focussing on areas such as:

- Local Government waste management strategic plans;
- State agency waste management strategic plans; and
- industry waste reduction program.

2.5.3 Environmental Protection (Air) Policy

The *Environmental Protection (Air) Policy* (Air Policy) was created in 1997 in order to protect the quality of Queensland's air environment. To achieve this the policy has:

- identified environmental values to be enhanced or protected. These include the qualities of the air environment that are conducive to suitability of life,

health and wellbeing of humans as the environmental values to be enhanced or protected;
- specified air quality indicators and goals to protect the environmental values; and
- provided a framework for management of the air environment and for community involvement.

Other significant parts of the framework include measures and management guidelines for certain sources of contamination and their unreasonable release and programs designed for whole-of-government management of air quality.

2.5.4 Environmental Protection (Noise) Policy

The *Environmental Protection (Noise) Policy* (Noise Policy) was enacted in 1997 and is intended to manage the acoustic environment. To achieve this the policy aims to:

- recognise the environmental values to be enhanced or protected;
- list a long-term objective for noise reduction;
- develop a framework to involve a whole-of-government approach to noise management;
- make accurate and consistent noise assessments;
- involve the community in environmental noise management; and
- encourage dispute resolution as an alternative to litigation.

2.5.5 Environmental Protection (Water) Policy

The *Environmental Protection (Water) Policy* (Water Policy) was enacted in 1997 with the purpose of regulating the quality of Queensland waters.

Under the policy, *"waste water"* means a liquid waste, and includes contaminated stormwater. Waste water management is addressed in the policy and includes:

- a waste management evaluation procedure; and
- details for waste water monitoring.

The step-wise evaluation procedure for wastewater management is based on the waste management hierarchy, with the options listed in the preferred order of:

i) evaluation of prevention options;
ii) evaluation of treatment and recycling options;
iii) evaluation of options for treatment and disposal to land, sewer or surface water; and
iv) evaluation of options for treatment and disposal to groundwater.

The policy also provides offences for unauthorised:

- release of oil, noxious liquid substances or harmful substances from ships into non-coastal waters;
- release of sewage from ships into non-coastal waters;
- disposal of rubbish from ships into non-coastal waters;
- prohibition on deposit or release of certain listed items, including various types of solid waste;
- release of stormwater run off which results in a build-up of sediment; and
- on-site domestic waste water treatment systems.

2.6 Integrated Planning Act 1997

The *Integrated Planning Act 1997* (IP Act) was introduced in order to establish the framework to integrate planning and development assessment. The purpose of the act is to seek to achieve ecological sustainability. The IP Act looks to achieve this by effectively streamlining the development process in the following ways:

a) coordinating and planning at the local, regional and State levels;
b) managing the process by which development occurs; and
c) managing the effects of development on the environment (including managing the use of premises).

The Integrated Development Assessment System (IDAS) is the component of the Act that deals with the integration of the assessment and approval processes for development. There are four possible stages to IDAS:

- application stage;
- information and referral stage;
- notification stage; and
- decision stage.

Under this legislative arrangement, development applications are managed and usually decided by assessment managers. In most cases the local government is the assessment manager. In certain circumstances a State agency may be the assessment manager. The information and referral stage allows referral agencies either as a concurrence agency whereby advice must be included in the decision or as an advice agency whereby advice may be included in the decision to integrate all approvals into a single development approval.

2.7 Integrated Planning Regulation 1998

The *Integrated Planning Regulation 1998* aims to identify the basic fee structure, define the type of assessment for assessable development and select the assessment manager for the application.

It is important to note that the IP Act gives Local Government the power to define which development in the Local Government area is assessable including types of development that should be subject to impact assessment.

2.8 Other Related Legislation

2.8.1 Wet Tropics Management Plan 1997

The Wet Tropics Management Plan was implemented in 1997 in order for the Queensland Government to meet obligations specified under the *Wet Tropics World Heritage Protection and Management Act 1993* (Heritage Act). The Management Plan was developed by the Wet Tropics Management Authority, a body created under the Heritage Act to ensure that Australia's obligation under the World Heritage Convention was met.

As a result of the plan, the Wet Tropics Area has been divided into management zones that have been determined on how activities may have a detrimental impact on the area's natural heritage values. Zones include:

i) activities prohibited;
ii) activities allowed; and
iii) activities allowed under permit.

In the Wet Tropics Area, the disposal of waste other than in an appropriate receptacle is a prohibited activity. An exemption applies only if-

i) no regular waste removal service is available for the land; and
ii) the land is at least 20 km by road from the nearest general waste disposal facility; and
iii) the waste is disposed of in a way that causes the least adverse impact on the land's integrity.

These activities are permitted only for landholders or native title holders.

However, waste disposal and other forms of waste management may be classified as activities permitted in all zones under a permit. A permit may be issued to a person to carry out an activity the person was lawfully carrying out immediately before the commencement day.

2.8.2 Coastal Protection and Management Act 1995

The *Coastal Protection and Management Act 1995* (Coastal Act) was created in order to provide for the protection, conservation, rehabilitation and management of the coastal zone. This also includes its resources and biological diversity.

Its establishment provides, in conjunction with other legislation, a coordinated and integrated management and administrative framework for the ecologically sustainable development of the coastal zone.

The Coastal Act requires compliance with the goals, core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development in the use of the coastal zone.

2.8.3 Mineral Resources Act 1989

Environmental planning and regulation in the mining industry in Queensland is currently managed under the *Mineral Resources Act 1989* (Mineral Act). The *Act* requires that an applicant for a mining lease provide a statement specifying proposals for protecting the environment, including surface water and ground water and proposals for progressive and final rehabilitation of the land. The Minister for Mines and Energy must assess these proposals. The Mineral Act also requires that miners lodge a security, which covers the rectification of any damage caused by mining.

Under the Mineral Resources Act the Governor in Council may make regulations that involve the:

- prevention of pollution or wastage due to prospecting, exploring or mining of water which may be used for domestic purposes;
- reservation of any accumulation or potential accumulation of water or of any watercourse, which might otherwise be so polluted or wasted, as a supply for domestic purposes;
- prevention, mitigation and remedying of pollution or obstruction of, damage to, or interference with watercourses, lakes and reservoirs and land adjacent thereto caused by the discharge therein or thereon of mineralised or impure water, sludge, or debris; and the

- cleaning and keeping clean of land the subject of prospecting permits, mining claims, exploration permits, mineral development licences or mining leases and the prevention or mitigation of any nuisance thereon.

Under the Mineral Act a person on occupied land or who resides on or stays on land must dispose of refuse, rubbish and human waste in a safe and sanitary way.

A policy for Environmental Management of Mining in Queensland was developed in 1991. The policy was created with the assistance of the mining industry and other State Government departments and introduced the concept of an "Environmental Management Overview Strategy" (EMOS). The EMOS is the essential link between planning and assessment and the actual Plans of Operation and the rehabilitation program.

Legislation soon to be introduced will transfer the responsibility for administration of environmental management for the mining industry to the Environmental Protection Agency under the Environmental Protection Act.

2.8.4 Nature Conservation Act 1992

The object of the *Nature Conservation Act 1992* (Conservation Act) is the conservation of nature. The Conservation Act is to achieve this objective through an integrated and comprehensive conservation strategy for the whole of Queensland that involves the:

- gathering of information on nature;
- dedication and declaration of protected areas;
- management of protected areas;
- protection of native wildlife and its habitat;
- use of protected wildlife and areas to be ecologically sustainable;
- recognition of interest of Aborigines and Torres Strait Islanders in nature and their cooperative involvement in its conservation; and the
- cooperative involvement of landholders.

2.9 Environmental Protection Agency

The Environmental Protection Agency (EPA) was formed in 1998 after the renaming of the Department of Environment and Heritage. It is the Queensland Government's main environmental body and administers several vital pieces of State legislation including the EP Act, the Nature Conservation Act, the Marine Parks Act, the Coastal Protection and Management Act and the Queensland Heritage Act.

The EPA also has obligations and direct involvement and interest in other Commonwealth and Queensland legislation and local laws of Local Government. The Agency's responsibilities also include a number of conventions, agreements, protocols and memorandums of understanding regarding its activities.

The EPA's core functions include:

- environmental planning;
- environmental policy and economics;
- environmental operations with service delivery to Southern, Central and Northern Regions;

- sustainable industries; and
- environmental and technical assistance.

2.10 Health & Environmental Services Regional Organisation Of Councils – North Queensland

HESROC-NQ is not a formal Regional Organisation of Councils but it is formed by the direction of the North Queensland Local Government Association (NQLGA) and is bound by the constitution of that Association. The organisation's objectives are as below.

- to foster open discussion and promote active participation by member Local Governments in dealing with common environmental management and public health issues and constraints on a regional basis in the Local Government areas of Burdekin, Charters Towers, Dalrymple, Hinchinbrook, Thuringowa and Townsville;
- to encourage responsible public health and environmental management practices within its member Local Governments;
- to facilitate a coordinated approach to public health and environmental management throughout its defined region;
- to develop networks for the receipt and dissemination of information of public health and environmental management issues relevant to the region and prepare appropriate submissions and recommendations;
- to invite the participation of representatives of State agencies and the private sector in discussion on relevant issues;
- to seek funding from State and Federal governments for appropriate projects; and
- to commission external organisations or persons to conduct investigations and report on relevant issues.

2.11 Summary

The *Environmental Protection Act 1994* establishes and defines the statutory framework for the protection of the environment. To meet the objectives of the Act subsequent regulations have been introduced and Environmental Protection Policies (EPPs) developed.

Two regulations, *Environmental Protection Regulation 1998* and *Environmental Protection (Interim Waste) Regulation 1996*, define and detail the "environmentally relevant activities" and give itemised waste management authority to EPA, respectively.

The *Environmental Protection (Waste Management) Policy 2000* and the *Environmental Protection (Waste Management) Regulation 2000* provide further clarification of waste management practices and safeguards. The former details the hierarchy and principles to be adopted for waste management practices, while the latter provides clarification on issues that were not addressed by earlier legislation. It also gives legislative support to a number of national guidelines, plans and Australian Standards.

Apart from waste management, EPPs have also been developed for air, water and noise. NEPMs were considered in the development of these policies. Table 2.1 summarises the policies and their relations to the strategy development.

TABLE 2.1 SUMMARY OF RELEVANT EPPS

POLICY	RELATED CONCERN
Environmental Protection (Waste Management) Policy	The purpose of this Policy is to protect the environment with regards to all waste management issues. The following assist in achieving this goal: minimising and managing waste, reducing the impact of waste, promoting efficient use of resources, use of waste as a resource and improvement of waste management standards.
Environmental Protection (Air) Policy	Air quality surrounding any waste management facilities, particularly landfills. The main concern is the odour emitted from these facilities, which may disturb the standard of life in the area.
Environmental Protection (Noise) Policy	Disturbance in the acoustic environment during the operation of waste management in the area. Areas of concern are traffic noise from collection services and the transportation of waste between the facilities, and machinery noise from the waste management facilities.
Environmental Protection (Water) Policy	Primary concern is the containment leachate from landfill cells and protection of surface and ground waters.

The *Integrated Planning Act 1997* (IP Act) establishes a framework to integrate planning and development in order to achieve ecological sustainability.

Other related legislation for the strategy development are summarised below:

- *Wet Tropics Management Plan 1998*: Waste disposal and other forms of waste management in the Wet Tropics area to meet the obligation to the *Wet Tropics World Heritage Protection and management Act 1993*.
- *Coastal Protection and Management Act 1995*: It provides a coordinated and integrated management and administrative framework for the ecologically sustainable development of the coastal zone.
- *Mineral Resources Act 1989*: The region supports a large number of mining operations and refineries. These industries produce considerable amounts of industrial and hazardous waste which may also be Regulated Waste. These wastes need to be managed appropriately in accordance with the Act.
- *Nature Conservation Act 1992*: The impact of the location and operations of existing and future waste management facilities on the surrounding environment needs to be considered.

3. EXISTING COLLECTION SERVICES

The existing waste collection services provided by Councils across the North Queensland region vary with respect to materials collected, collection methods, operators and frequency of collection. Collection services are governed by an array of contracts in each Local Government Area.

Details of collection services provided in each Local Government Area are outlined below.

3.1 Burdekin

Approximately 7,579 tenements are provided with a weekly domestic garbage collection service within the Burdekin Shire. The townships serviced include Alva Beach, Ayr, Brandon, Clare, Dalbeg, Giru, Groper Creek, Home Hill and Inkerman, and account for approximately 95% of all dwellings in the Shire.

Burdekin Shire provides residents with 240L MGBs for garbage collection. It is estimated that approximately 14,050 m^3 of compacted domestic garbage is collected every year; this is deposited at the Kirknie Road Landfill.

Burdekin Shire also provides a fortnightly collection of recyclables to 5,467 tenements from the above townships. Residents are provided with a 240L MGB for collection of recyclable material. Approximately 780 tonnes of recyclables are collected each year and transported to a Material Recovery Facility (MRF) in Mackay. The recyclable materials collected are:

- aluminium;
- glass;
- high density polyethylene (HDPE);
- paper and cardboard;
- polyethylene terephthalate (PET);
- polypropylene; and
- steel.

The contractor for both collection services is Townsville Trade Waste (in partnership with JJ Richards and Sons). Their contract expires on 30th August, 2005.

Burdekin Shire does not collect garden waste or domestic clean-up waste. Residents can deposit garden waste at the Ayr, Home Hill and Giru Transfer Stations.

The Shire also provides 60 litter bins at various locations and undertakes street sweeping. The litter bins are emptied daily, with approximately 370 m^3 of waste deposited at Kirknie Road Landfill each year. Street sweeping operations are undertaken three times a week in Home Hill, daily in Ayr and every 3 months in both Giru and Clare. Waste from street sweeping is transported to the relevant transfer stations. Sand and gravel collected is transported to the garden waste drop-off centres.

3.2 Charters Towers

Approximately 3,600 tenements are serviced by weekly kerbside garbage collection in Charters Towers, with each tenement provided with a 240L MGB.

Domestic garbage collected is deposited at the Stubley Street, Charters Towers Landfill. It is estimated that the amount of waste collected is in the order of 10,300 m^3 per annum.

No kerbside recycling service is offered.

3.3 Dalrymple

Kerbside collection of domestic waste is shortly to commence in the townships of Dalrymple Shire. Approximately 750 households will be provided with 240L MGBs in the townships of Balfes Creek, Greenvale, Homestead, Mingela, Pentland, Ravenswood and Sellheim. Waste will be collected by Council staff and transported for disposal to landfills at Greenvale, Pentland, Ravenswood or Stubley Street, Charters Towers.

It is expected that collected waste volumes will be in the order of 780 tonnes per annum.

No kerbside recycling collection service is provided.

3.4 Hinchinbrook

Approximately 3,929 tenements in the Shire of Hinchinbrook are serviced by a weekly garbage and recyclables collection service. Approximately 24,450 m^3 of garbage is collected every year and deposited at the Ingham Landfill. Residents utilise 240L split MGBs for collection of garbage and recyclables.

A private contractor (Mams Plant Hire Pty Ltd) provides the kerbside collection service under a contract which expires on 30th June, 2005.

Recyclable materials are manually sorted at the contractor's MRF in Ingham. The materials collected for recycling are:

- aluminium;
- cardboard;
- glass;
- HDPE;
- PET;
- polypropylene; and
- steel.

The collection areas serviced are Allingham, Bemerside, Blackrock, Braemeadows, Cooks Lane, Halifax Road, Cordelia, Four Mile Road, Halifax, Hawkins Creek, Ingham, Lucinda, Sunnybank Road, Taylors Beach, Toobanna and Trebonne.

Litter bins in Council parks and foreshores (43 x 240L MGBs) are serviced weekly by the Council contractor. Street litter bins (approximately 40-50) are serviced daily or as required by Council day labour.

Other kerbside collection services include green waste and hard waste pre-cyclone clean-ups offered biannually to all residents (rural residents by appointment only).

3.5 Thuringowa

Approximately 16,000 tenements in the Shire of Thuringowa are serviced by a weekly garbage and recyclables collection service. Many rural properties are also serviced by kerbside collection, including Balgal, Mystic Sands, Paluma, Saunders Beach, Toolakea and Toomulla.

Garbage and recyclables are collected in 240L split MGBs. The amount of domestic garbage collected every year is approximately 130,000 m^3; this is deposited at Jensen and Ross Landfills.

Approximately 1,200 tonnes of recyclables are collected annually and transported to the Cleanaway MRF located at Bohle Industrial Estate. Recyclable materials collected include:

- aluminium;
- glass;
- HDPE;
- paper and cardboard;
- PET; and
- steel.

Waste is collected by a contractor (Cleanaway) in all areas except Paluma, which is serviced by Council day labour. In areas serviced by the contractor, MGBs are the property of the contractor until the end of the contract on 30th June, 2002; ownership is then transferred to the Council. In Paluma, MGBs are owned by the ratepayer.

Council waste services also include servicing of litter bins and periodical street sweeping.

3.6 Townsville

The City of Townsville provides weekly waste collection services through its waste division (Citiwaste Townsville) to approximately 29,204 residential premises (including approximately 1,300 in Magnetic Island). Each residence is provided with either a 120L or 240L MGB. Approximately 1,470 multi-unit dwellings (such as flats and units) are provided with bulk bins.

Approximately 92,000 m^3 of compacted waste is collected each year from the kerbside collection on the mainland and deposited at the Vantassel Street, Townsville landfill. Approximately 14,000 m^3 of garbage from the kerbside collection on Magnetic Island is deposited at the Picnic Bay landfill each year. Some remote areas of Townsville are not served by kerbside collection services. However, there are plans to include areas in the south-east of Townsville in the kerbside collection service in the near future.

A garden waste collection service is not provided. Areas are set aside for the drop-off of garden waste at Vantassel Street, Cungulla, and Majors Creek landfills. A garden waste drop-off area is also provided at the Picnic Bay landfill on Magnetic Island.

Collection on the mainland is conducted by Council labour (Citiwaste Townsville). Waste on Magnetic Island is collected by Magnetic Waste under contract (which expires 1st August, 2006).

Kerbside recycling services have operated since 1992 in Townsville and Cleanaway currently provide the service under contract to Council. On Magnetic Island, Magnetic Waste transports the collected recyclables to the mainland.

Cleanaway provides fortnightly kerbside collection of recyclables in a 240L MGB. The recyclables collection service covers the same areas as the domestic garbage collection. Recovered materials are sorted at the Cleanaway Material Recovery Facility (MRF) at Garbutt. Thuringowa and Townsville Councils have a joint contract with the operator Cleanaway. The types of recyclable materials collected include:

- aluminium;
- glass;
- HDPE;
- paper and cardboard;
- PET; and
- steel.

Litter bins are emptied by Council on a daily to weekly basis from both the mainland and Magnetic Island (depending on requirements). The mainland has approximately 440 bins and Magnetic Island has approximately 70 bins. Other services provided by Council are street sweeping (removing litter from streets and highways) and removing dead animals from roads.

3.7 Summary

The majority of urban areas and townships in the region are serviced by a kerbside waste collection provided by the Council or various contractors. However most of the rural areas are not serviced by kerbside waste collection service. In these areas, the residents transport their waste to the nearest waste management facility.

Figure 3.1 illustrates the existing kerbside collection areas in the North Queensland Region. Table 3.1 summarises the current domestic kerbside garbage collection systems provided in the region.

TABLE 3.1 DOMESTIC KERBSIDE GARBAGE COLLECTION

MUNICIPALITY	TENEMENTS	FREQUENCY	METHOD	RECEIVING LANDFILL	CONTRACTOR
Burdekin	7,579	Weekly	240L MGB	Kirknie Road Landfill	Townsville Trade Waste
Charters Towers	3,600	Weekly	240L MGB	Charters Towers Landfill	Council
Dalrymple	750	Weekly	240L MGB	Greenvale, Pentland, Ravenswood & Charters Towers Landfills	Council
Hinchinbrook	3,929	Weekly	240L split MGB	Ingham Landfill	Mams Plant Hire Pty Ltd
Thuringowa	16,000	Weekly	240L split MGB	Ross & Jensen Landfills	Cleanaway, Council (Paluma)
Townsville	29,204	Weekly	120L / 240L MGB	Vantassel Street, Townsville & Picnic Bay Landfills	Council, Magnetic Waste (Magnetic Island)
REGION	**61,602**				

From this table it can be seen that approximately 61,600 residences receive a domestic garbage collection service on a weekly basis throughout the region, representing over 90% of households in North Queensland. Additionally, multi-unit dwellings and commercial and industrial premises receive Council-provided services in some sections of the region (particularly Townsville).

The domestic kerbside collection services for recyclables are summarised in Table 3.2. Recycling services are provided for a lower percentage of North Queensland households than for domestic garbage, with approximately 54,600 tenements (over 80% of households) serviced.

TABLE 3.2 DOMESTIC KERBSIDE RECYCLABLES COLLECTION

MUNICIPALITY	TENEMENTS	FREQUENCY	METHOD	MATERIALS COLLECTED	CONTRACTOR
Burdekin	5,467	Fortnightly	240L MGB	Aluminium, glass, HDPE, paper & cardboard, PET, polypropylene, steel	Townsville Trade Waste
Charters Towers	-	-	-	-	-
Dalrymple	-	-	-	-	-
Hinchinbrook	3,929	Weekly	240L Split MGB	Aluminium, cardboard, glass, HDPE, PET, polypropylene, steel	Mams Plant Hire Pty Ltd
Thuringowa	16,000	Weekly	240L Split MGB	Aluminium, glass, HDPE, paper & cardboard, PET, steel	Cleanaway
Townsville	29,204	Fortnightly	240L MGB	Aluminium, glass, HDPE, paper & cardboard, PET, steel	Cleanaway, Magnetic Waste (Magnetic Island)
REGION	54,600				

3.8 Commercial Waste Collections

Throughout the North Queensland region there are a number of private contractors who collect waste on a commercial basis from rural, residential and commercial sources. However details of the quantities collected are not available due to reasons of commercial confidentiality.

There are some commercial and industrial premises whose waste is collected by Council-provided services, including in Hinchinbrook and Townsville.

Some commercial operations in Townsville also have their own separate contract with Cleanaway to collect recyclable materials. Recyclables collected by Cleanaway from commercial premises include:

- aluminium;
- glass;
- HDPE;
- liquid paperboard (LPB);
- paper and cardboard;
- PET; and
- steel.

4. EXISTING WASTE MANAGEMENT FACILITIES

4.1 Overview

The North Queensland region is serviced by a number of landfills, transfer stations, bulk bins and Material Recovery Facilities (MRFs). The number of waste management facilities currently servicing the region is summarised in Table 4.1.

TABLE 4.1 EXISTING WASTE MANAGEMENT FACILITIES

MUNICIPALITY	LANDFILLS	TRANSFER STATIONS	MRFS / RECYCLING CENTRES	BULK BINS
Burdekin	1	4	-	-
Charters Towers	1	-	-	-
Dalrymple	8	-	-	-
Hinchinbrook	3	1	1	62 at 28 locations
Thuringowa	2	2	1 (shared with Townsville)	-
Townsville	4	-	1 (shared with Thuringowa)	-
REGION	**19**	**7**	**2**	**62**

An assessment of the operations of waste disposal facilities under the control of member Councils in HESROC-NQ was undertaken. Each landfill and transfer station was inspected and assessed according to a set of criteria based on best practice. Where landfill Site Based Management Plans (SBMPs) were available, assessments also took into consideration the site's compliance with environmental management measures outlined in the SBMP.

Detailed site descriptions of landfills and transfer stations are contained in Appendix B. These assessments and the site summaries included in the following sections reflect the operating conditions at each site at the time of inspection as detailed in Appendix B.

Annual waste throughput at each facility has been estimated based on available data from Council records; in many cases, only minimal data was available. In some cases no data is currently recorded and figures have been estimated based on average waste generation for the population serviced by the facility. Volume to weight conversion has been estimated based on a number of factors including the composition of the waste stream, type of collection vehicle and likely compaction rates achieved at specific landfills given the type of compaction equipment used.

The locations of waste management facilities are depicted in Figure 4.1, with a radius of 20km reflecting the waste catchment area for each facility. Previous surveys of Australian communities have shown that a distance of 20km is considered to be the maximum distance residents in regional areas wish to travel to dispose of waste.

4.2 Assessment Of Existing Landfills

4.2.1 Burdekin

Kirknie Road Landfill

The Burdekin Shire Council currently operates one landfill for the entire municipality. The Kirknie Road Landfill site is approximately 16km from Home Hill. The site has a buffer zone of approximately 20 metres, with the Burdekin River approximately 1-2 km west of the site. Hours of site operation are 8.00 a.m. to 4.30 p.m. on Monday to Friday and 1.00 p.m. to 5.00 p.m. on Saturday.

The method of landfill operation is cell excavation. The majority of waste received at the site is sourced from kerbside collection services and the Shire's four transfer stations (refer Section 4.3.1). The landfill accepts all types of waste except hazardous waste. The annual waste throughput is approximately 55,000 m^3 (or 16,500 tonnes). Based on *the Draft Burdekin Shire Waste Management Report*, it is estimated that the Kirknie Road Landfill has a remaining lifespan of 23 years.

There is a leachate monitoring program at the landfill and four groundwater monitoring bores are located on site. Access roads are unpaved and site signage requires upgrading. Litter management systems to address windblown litter also need to be addressed.

4.2.2 Charters Towers

Stubley Street, Charters Towers Landfill

The Stubley Street facility is the only landfill in Charters Towers. The site is located approximately 500 metres from the nearest residence. Surrounding land uses include a rifle range, golf course and a cemetery. The landfill is situated in a natural depression and the method of operation is above ground. The site is accessible seven days a week from 6.00 a.m. to 6.00 p.m., however the site is not supervised during operating hours. The landfill site receives approximately 20,500 m^3 (or 6,150 tonnes) of waste per annum. The remaining lifespan of the facility is unknown. Hazardous waste is not accepted. The site has one Council plant operator.

A Site Based Management Plan has been developed for the Stubley Street Landfill. It appears that site operations are generally compliant with the Plan with the exception of litter control. Litter control measures were not evident on inspection of the site. Groundwater monitoring wells have been installed. Water and leachate control measures were not apparent. It appeared that leachate drained from the landfill into low-lying land.

4.2.3 Dalrymple

Dalrymple Shire Council currently operate seven landfills; an additional private landfill is located at Belyando. These landfills service very small populations, ranging from 20 to 140 households. The lifespan of the landfills currently servicing the region is unknown. Council has developed a Landfill Environmental Program for all landfills under their control, however, based on site observations it appears that requirements of the program are not enforced. In particular, water and leachate management measures appear to be inadequate at all sites.

Balfes Creek Landfill

Balfes Creek Landfill is located approximately 25 km west from Charters Towers. The landfill receives approximately 4,500 m^3 (or 450 tonnes) of waste per annum. The method of operation is above ground.

The site is surrounded by agricultural and bush land. The site entrance was waterlogged at the time of inspection. The site is generally not maintained in a neat and tidy condition. The waste disposal area is not contained and it appears that the waste deposited has been exposed for some time. There appear to be no environmental controls at this site. There also appears to be no provision for fire control at the disposal sites.

Greenvale Landfill

The landfill is located approximately 2 km from the township of Greenvale in the northern region of Dalrymple Shire. The landfill receives approximately 10,000 m^3 (or 1,000 tonnes) of waste per annum. The operation is cell excavation. Litter control measures appear to be effective. However, there is no evidence of a stock-proof perimeter fence. An area is allocated for green waste disposal.

Homestead Landfill

Homestead Landfill is less than 1km away from the township. The landfill is surrounded by bushland. The method of operation is above ground and approximately 3,700 m^3 (or 370 tonnes) of waste is received each year. At the time of site inspection, it appeared that the waste had been exposed for some time.

Mingela Landfill

The landfill is located in the township of Mingela. The method of operation is above ground and approximately 3,200 m^3 (or 320 tonnes) of waste is received per annum. There are no groundwater, leachate or water control measures at the site. At the time of the site inspection, leachate pondage was evident in the disposal area. Based on site observations, the frequency of waste covering is not adequate and the site is not maintained. Site fencing is inadequate.

Pentland Landfill

Pentland Landfill is located near the township of Pentland. The method of operation is above ground. Approximately 4,200 m^3 (or 420 tonnes) of waste is received per annum. Garden waste is segregated and stockpiled for recovery. Burning of the waste disposal area was apparent during the site inspection. The site was generally untidy.

The site access road crosses over a small causeway that is potentially susceptible to flooding. It appears that surface run-off from the tipping area enters the adjacent creek. There are no leachate or groundwater control measures.

Ravenswood Landfill

Ravenswood Landfill services the township of Ravenswood and receives approximately 6,200 m^3 (or 620 tonnes) of general waste per annum. The

operation is a combination of an above ground and cell excavation. A mine operates in the vicinity of the landfill.

The excavated cover material acts as a temporary bund for stormwater diversion. However, it is evident that stormwater drains towards the adjoining creek. At the time of the inspection, deposited waste was sited in the adjacent creek gully.

Sellheim Landfill

Sellheim Landfill is located in the township of Sellheim approximately 15km east of Charters Towers. The annual waste throughput is approximately 2,100 m^3 (or 210 tonnes). The method of landfill operation is cell excavation. A litter fence has been placed round the newly constructed cell and appears to be effective in containing litter. The site area is relatively flat and is possibly subject to flooding. Stormwater run-off from the tipping face drains into the local creek.

4.2.4 Hinchinbrook

The Shire of Hinchinbrook is currently serviced by three landfills, owned and operated by Council.

Forrest Beach Landfill

The Forrest Beach Landfill is located on Wattle St, Allingham on tidal wetland with a sandy soil profile. Groundwater monitoring wells (2 bores) have been installed. It is anticipated that site operations will cease in June 2001.

This unsupervised landfill is accessible 24 hours per day. The method of operation is above ground. Cover material is imported from Warrens Hill Landfill. Green waste is also received at the site and burnt under permit. The annual waste throughput has been estimated at approximately 1,350 m^3 (or 610 tonnes). Scavenging is not permitted, however is generally unpoliced.

Ingham Landfill

Ingham Landfill is located on Fairford Road and has a buffer distance of approximately 50 metres separating the landfill from wetlands and recreational areas. The nearest residence is located approximately 500 metres from the site. The landfill is open from 6.00 a.m. to 6.00 p.m. seven days a week; operators work until 4.30 p.m. however the landfill is not supervised on a full-time basis. Designated areas are allocated for recycling including tyres, chemical containers, car bodies, oil, steel, glass and garden waste.

The landfill receives approximately 7,600 m^3 (or 6,080 tonnes) of waste per annum from domestic and commercial waste sources, including waste from bulk bin facilities and the Halifax transfer station. It is anticipated that this volume will increase as new waste disposal arrangements are put in place at Palm Island. Due to the lack of waste infrastructure on the Island, it is planned to transport putrescible waste from the Island for disposal. It is estimated that an additional 1,040 m^3 (or 210 tonnes) per annum will be deposited at the Ingham Landfill, commencing in the second half of 2000.

It is anticipated that the landfill would have a lifespan in excess of 20 years. Council has prepared a Site Based Management Plan for Ingham Landfill. Operating procedures and waste minimisation objectives outlined in the plan are being implemented. However, surface water management is a concern given the location of the facility. The site is situated within a water catchment area of the

Herbert River and is prone to flooding. Diversion drains surrounding the site divert stormwater into Log Creek. Groundwater protection measures include six on-site groundwater monitoring wells. Council is in the process of retro-fitting a leachate drainage system to collect and divert leachate to the municipal sewage system.

Warrens Hill Landfill

Warrens Hill Landfill is situated on Bosworths Road at the base of Mount Mercer in an old quarry reserve. The site is located approximately 6.5km from the township of Ingham. There are five residential properties located approximately 100 metres from the site. The surrounding land is predominantly used for open grazing and sugar cane farming, with a buffer distance of approximately 20 metres. The remaining air capacity is unknown, however it is anticipated that the lifespan would be in excess of 50 years.

The method of landfill operation is above ground. The annual waste throughput is approximately 4,560 m^3 (or 3,650 tonnes). Putrescible and non-putrescible waste is received from domestic and commercial sources. Garden waste is burnt on-site under permit. The site is not supervised and is accessible 24 hours per day.

Council has produced a Site Based Management Plan for the facility. Based on the site inspection, groundwater and surface water protection measures appeared to be inadequate. Current practices in waste covering also appear to be inadequate. At the time of the assessment large volumes of waste were exposed. Litter control measures were not evident.

4.2.5 Thuringowa

The City of Thuringowa is serviced by two landfills. The Jensen and Ross Landfills are open seven days per week from 6.00 a.m. to 6.00 p.m. with supervision maintained for ten hours per day. Council has prepared a Site Based Management Plan for each landfill.

Jensen Landfill

The Jensen Landfill is located on Geaneys Lane, Jensen in a rural-residential zoned area and has an estimated lifespan of 15 to 20 years. A contracted salvager undertakes some supervision. The annual waste throughput has been estimated at approximately 49,170 m^3 (or 29,500 tonnes). Sources of waste include the domestic collection system, transfer stations, the commercial and industrial sector and the construction and demolition sector. The facility is an aboveground operation with waste covered daily. Garden waste is stockpiled and mulched by Blinks Chop and Chip Tree Recyclers. Northern Tyre Salvage, Markwell and NQ Resource Recovery recover the separated streams of tyres, concrete and waste oil respectively.

Groundwater protection works include three groundwater monitoring bores. Leachate is collected into an evaporation pond. At the time of assessment the site was heavily water logged, and surface water management controls appeared to be inadequate. During rainfall periods, surface water from the tipping area flows into the Stoney Creek system approximately 100 metres from the site.

Ross Landfill

The Ross Landfill is located on Hervey Range Road, Alice River. The surrounding area is zoned as rural and is a camping reserve. The site abuts Hervey Range Rd and the Little Bohle Creek. The method of operation is above ground. The annual waste throughput is approximately 40,000 m^3 (or 24,000 tonnes) and it is estimated that the landfill has a lifespan of 30 to 50 years. Waste is received from commercial, industrial and domestic sources. Areas are allocated for the collection of recyclable material including garden waste, car bodies, steel scrap, tyres, white goods, waste oil and aluminium cans.

Groundwater protection works include three groundwater monitoring bores. Leachate is diverted into a leachate evaporation pond. Surface water management controls appear to be inadequate. Wind blown litter is a problem.

4.2.6 Townsville

The City of Townsville has three landfills on the mainland and one landfill on Magnetic Island. Council has developed Site Based Management Plans for all landfill sites.

Cungulla Landfill

The Cungulla Landfill is located in the township of Cungulla. The site is located on a sand dune surrounded by a low lying wetland region. This location is not favourable due to a high water table and flooding. Disposal operations are aboveground with cover material sourced on-site. Capping material for landfill closure works will have to be sourced off-site. The annual waste throughput is approximately 650 m^3 (or 200 tonnes). Windblown litter appears to be a problem. The site is not supervised and has unlimited access. Sampling and testing of the underground aquifer is undertaken from two bores. It is expected that landfill operations will cease in 2001; the EPA concurs with anticipated closure of this landfill.

Majors Creek Landfill

Majors Creek Landfill is located in a flood plain area, adoining a creek approximately 500 metres away. Local residents have disposed of their waste at the site for approximately 20 years. It is estimated that the existing landfill cell has a lifespan of 1 to 2 years, with a total landfill lifespan of 5 years with establishment of an additional cell. The annual waste throughput is approximately 40 m^3 (or 10 tonnes). The method of operation is above ground. Cover material is sourced from on-site excavations. The site is not supervised and access is unlimited. Groundwater monitoring from two bores is undertaken on a periodic basis. The EPA has also noted the anticipated closure of this landfill in the short term.

Picnic Bay Landfill

The Picnic Bay Landfill is located at the foot of a mountain near Picnic Bay on Magnetic Island. The site is supervised 9 days a fortnight but it is open 24 hours, 7 days a week. The landfill services approximately 3,000 Magnetic Island residents and receives approximately 14,000 m^3 (or 8,400 tonnes) of waste per annum from domestic, commercial and industrial sources. Wastes prohibited at the landfill (i.e. Regulated Wastes) are transported on a ferry to Vantassel Street Landfill. According to the *Townsville City Council Waste Management Strategy*

(March 1999), the anticipated lifespan of the Picnic Bay Landfill would be in excess of ten years.

The method of operation is a combination of cell excavation and above ground. Adjacent land uses are residential and bush and the facility has a sealed access road. Adequate fencing exists around part of the site perimeter. Groundwater monitoring from four bores is undertaken on a periodic basis.

Vantassel Street, Townsville Landfill

Vantassel Street, Townsville Landfill is in the suburb of Stuart. The surrounding land uses include a cattle trucking station, power station, zinc refinery, meatworks, garden waste recycling depot and rail junction. The supervised site is accessible seven days a week from 6.00 a.m. to 6.00 p.m. The method of operation is cell excavation (cell construction and fill by layer). The base of the landfill is clay lined; the finished cover is capped with clay, loam topsoil and composted dewatered biosolids from the sewage treatment plant.

It is anticipated that the lifespan of the Vantassel Street landfill would be in excess of 70 years. The waste throughput is approximately 143,330 m^3 (or 114,670 tonnes) each year. Wastes accepted at the site include Regulated Wastes, domestic, transfer station, commercial and industrial, and construction and demolition waste. Areas are designated for the collection of recyclables including garden waste, tyres, waste oils, batteries, steel, aluminium, glass and white goods. Tyres are not accepted for landfill. A salvager operates at the site.

Groundwater protection measures include the installation of seven groundwater monitoring bores around the perimeter of the site. Drainage channels divert run-off away from landfill cells and collected leachate is diverted to evaporation ponds.

Planned site improvement works include a fencing and landscaping program, installation of a weighbridge, construction of a transfer station, and provision of recycling facilities. This is expected to be completed during 2001.

4.2.7 Summary

The operational details of the landfills in the North Queensland region are summarised in Table 4.2.

TABLE 4.2 EXISTING LANDFILLS

MUNICIPALITY	FACILITY	LIFESPAN (years)	OPERATOR	ANNUAL THROUGHPUT	
				(m^3)	(tonnes)
Burdekin	Kirknie Road	23	Council	55,000	16,500
Charters Towers	Stubley Street, Charters Towers	Unknown	Council	20,500	6,150
Dalrymple	Balfes Creek	Unknown	Council	4,500	450
	Greenvale	Unknown	Council	10,000	1,000
	Homestead	Unknown	Council	3,700	370
	Mingela	Unknown	Council	3,200	320
	Pentland	Unknown	Council	4,200	420
	Ravenswood	Unknown	Council	6,200	620
	Sellheim	Unknown	Council	2,100	210
Hinchinbrook	Forrest Beach	1	Council	1,240	370
	Ingham [1]	>20	Council	7,600	6,080
	Warrens Hill	>50	Council	4,560	3,650
Thuringowa	Jensen	15-20	Council (gate master, machine operators) Private scavenger (Meloury)	49,170	29,500
	Ross	30-50	Council (gate master, machine operators) Private scavenger (Bell)	40,000	24,000
Townsville	Cungulla	1	Council (Citiwaste)	650	200
	Majors Creek	5	Council (Citiwaste)	40	10
	Picnic Bay	>10	Council (Citiwaste)	14,000	8,400
	Vantassel Street, Townsville [2]	>70	Council (Citiwaste) Private scavenger (Bertrand)	143,330	114,670
REGION				369,990	212,920

Notes: 1. Additional 1,040 m^3 (or 210 tonnes) of waste from Palm Island expected to be deposited at Ingham Landfill every year (commencing late 2000).
2. Includes 6,800 tonnes per annum transported from Johnstone Shire for deposition at Vantassel Street, Townsville Landfill.

4.3 Assessment Of Existing Transfer Stations

4.3.1 Burdekin

There are four transfer stations in Burdekin Shire.

Ayr Transfer Station

Ayr Transfer Station is located at Railway Street, Ayr. The facility consists of three bays each containing a 34 m^3 skip with a litter screen. The unloading area is not roofed. The annual waste throughput is approximately 24,400 m^3 (or 4,880 tonnes). Waste from domestic, commercial and industrial, construction and demolition waste streams are received at the transfer station. Waste collected is transported to Kirknie Road Landfill. Areas are designated for the receival of waste oils, batteries, chemical drums, tyres, white goods and other recyclables including garden waste, glass, paper and cardboard, aluminium and steel.

The site is surrounded by an industrial area and has a buffer zone of 50m from the nearest property. Site amenities include a site office and toilet. The transfer station is well maintained, has adequate fire control systems and first aid training. Operating hours are 8.00 a.m. to 6.00 p.m. every day.

Clare Transfer Station

The Clare transfer station is located on the Ayr/Dalbeg Road and is sited on a Local Government Reserve on the bank of the Burdekin River. The facility receives approximately 2,200 m^3 (or 440 tonnes) of waste per annum from agricultural and domestic sources. Waste is deposited in a 34 m^3 skip (fitted with a litter screen) and is transported to Kirknie Road Landfill. The unloading area is not roofed. Designated areas are allocated for recyclable materials including garden waste, aluminium, steel and triple-rinsed chemical containers.

The site is surrounded by cane fields and bush and has a buffer zone of 10m from the road. Cyclone fencing is erected only on the site perimeter adjacent to the road. Signs are erected at the facility and indicate hours of operation, charges and methods of payment, and waste types accepted. Fire control measures include a fire extinguisher. The site appears to be well maintained. Site amenities include a portable office. Operating hours are 7.00 a.m. to 10.00 a.m. on Sunday, Monday and Friday and 3.00 p.m. to 6.00 p.m. on Wednesday and Saturday.

Giru Transfer Station

Giru Transfer Station is located at Cromarty Creek Landing Rd, Giru on a former landfill site on tidal lands. Sugar cane fields surround the site. The facility consists of two 34 m^3 skips, with one skip reserved for waste from the Invicta Sugar Mill. Litter screens are attached to the skips however the disposal area is not roofed. Approximately 4,400 m^3 (or 880 tonnes) of waste is received from domestic and agricultural sources every year. There are no provisions for the separation of recyclables, however an area is designated for the collection of garden waste.

A portable site office is available to staff. A 1.2m fence is erected on the roadside perimeter. The site is well maintained and signage indicates the hours of operation, disposal charges and wastes accepted. Provisions for fire control include a fire extinguisher. Site operating hours are 3.00 p.m. to 6.00 p.m. on Wednesday, Friday and Saturday, and 7.00 a.m. to 10.00 a.m. on Sunday.

Home Hill Transfer Station

The Home Hill transfer station is located on Bojack Rd, Home Hill (on a former landfill site) and is surrounded by agricultural land. The waste throughput is estimated at 9,000 m^3 (or 1,800 tonnes) per annum. Waste accepted includes putrescible waste, unsorted general waste, tyres and car bodies. Waste is transported to the Kirknie Road Landfill. Recyclable materials accepted include garden waste, glass, paper and cardboard, aluminium, steel, oil filters and cooking and motor oil, batteries, triple-rinsed chemical containers, clothing/textiles and white goods.

The facility consists of a 34 m^3 skip fitted with a litter screen; the waste disposal area is not roofed. Site amenities include a portable site office and toilet facility. A cyclone fence is erected around the site perimeter. Site operating hours are 10.00 a.m. to 6.00 p.m. on weekdays and 8.00 a.m. to 6.00 p.m. on weekends.

4.3.2 Hinchinbrook

Halifax Transfer Station

The Halifax transfer station is located at Rifle Range Rd, Halifax. The site is surrounded by sugar cane fields and has a buffer zone of approximately 10m from the road. The facility consists of three bays, however only two 26 m^3 skips (fitted with litter screens) are used. The disposal areas are roofed. The facility appears to be well maintained and is open from 6.30 a.m. to 6.00 p.m. each day. Site amenities include a site office and toilet facility. Cyclone fencing is erected around the perimeter of the site. Signage is adequate.

Domestic waste is accepted and transported to Ingham Landfill for disposal. The annual waste throughput is approximately 3,100 m^3 (or 620 tonnes). Areas are allocated for the receival of recyclables including garden waste, aluminium, plastic, glass, steel, oil filters and motor oil, batteries, triple-rinsed chemical containers, and clothing and textiles.

4.3.3 Thuringowa

Bluewater Transfer Station

Bluewater transfer station is located on the closed Bluewater landfill site and is approximately 200 metres from Bluewater Creek and 800 metres from the nearest residence. The facility is open from 6.00 a.m. to 6.00 p.m. daily, however the site is not supervised. Waste received at the facility includes domestic waste, garden waste and solid inert waste. The facility contains two 30 m^3 skips (fitted with litter screens) for waste disposal. The annual waste throughput is estimated at 6,240 m^3 (or 1,250 tonnes); this is transported to Jensen Landfill for disposal. There is no provision for recycling. Leachate management works include a leachate sump and grated pit.

Toomulla Transfer Station

The Toomulla transfer station is situated adjacent to the closed Toomulla Landfill. Facility operating hours are from 6.00 a.m. to 6.00 p.m. daily, however the site is not supervised during these hours. Wastes permitted at the site include domestic waste, garden waste and solid inert waste; this is transported to Jensen Landfill for disposal twice a week. The waste throughput is approximately 3,120 m^3 (or 620 tonnes) per annum. The facility contains one 30 m^3 skip (fitted with a litter screen) for the receival of waste. Signage and access roads are adequate. Leachate management works include a leachate sump and grated pit.

4.3.4 Summary

Table 4.3 provides a summary of transfer stations within the North Queensland region.

TABLE 4.3 TRANSFER STATION DETAILS

MUNICIPALITY	FACILITY	RECEIVING LANDFILL	OPERATOR	ANNUAL THROUGHPUT	
				(m^3)	(tonnes)
Burdekin	Ayr	Kirknie Road	Council	24,400	4,880
	Clare	Kirknie Road	Council	2,200	440
	Giru	Kirknie Road	Council	4,400	880
	Home Hill	Kirknie Road	Council	9,000	1,800
Hinchinbrook	Halifax	Ingham	Council	3,100	620
Thuringowa	Bluewater	Jensen	Council (unsupervised)	6,240	1,250
	Toomulla	Jensen	Council (unsupervised)	3,120	620
REGION				52,460	10,490

4.4 Bulk Bins

Hinchinbrook Shire Council provides 62 bulk bins at 28 locations throughout the municipality. Waste collected at these facilities is transported to Ingham landfill for disposal. There is no provision for the segregation of recyclables at these facilities. These facilities are generally unsecured sites, with no litter management or environmental protection measures in place.

The following list shows the locations where the bulk bins are placed and the number of bulk bins at each location.

- Abergowrie Road (3)
- Bambaroo (4)
- Bemerside (1)
- Braemeadows (1)
- Broadwater Road (1)
- Capras Road (1)
- Christies Road (1)
- Cooks Lane (2)
- Cordelia (3)
- Crystal Creek (5)
- Dungeness Carpark (1)
- Dungeness Wharf (1)
- Four Mile Road (2)
- Gaias Road (1)
- Gairloch (3)
- Gangemis Road (1)
- Hawkins Creek (4)
- Lannercost Extension (2)
- Macknade (3)
- Mount Gardner Road (3)
- Peacock Siding (3)
- Pennas Road (3)
- Pinnacle Hill (2)
- Sheahans Road (3)
- Stone River Road (3)
- Toobanna (2)
- Upper Stone (2)
- Yuruga Road (1)

Figure 4.2 shows the locations of bulk bins in Hinchinbrook Shire.

4.5 Other Facilities

There are also several privately owned waste management facilities in the region. These are summarised in Table 4.4.

TABLE 4.4 OTHER FACILITIES

MUNICIPALITY	FACILITY	OPERATOR	THROUGHPUT (tonnes/year)
Dalrymple	Belyando Landfill	Private	Unknown
	Mine Landfills	Private mining companies	Unknown
Hinchinbrook	Mams Material Recovery Facility	Mams Plant Hire Pty Ltd	70
Townsville	Cleanaway MRF	Cleanaway	6,240
	McCahill Composting	McCahill Earthmoving Pty Ltd	Unknown

Belyando Landfill

This small landfill is located near the township of Bundubaroo at the southern end of Dalrymple Shire. The landfill services a caravan park and is essentially a tipping ground with no environmental controls.

Mine Landfills

A number of mining companies operating in the Shire of Dalrymple have their own private landfills for deposition of waste generated from on-site operations. These facilities do not accept any off-site waste.

Mams Material Recovery Facility

Mams MRF is located on Challand Street, Ingham. Recyclables received are sourced from the recycling collection service provided by the Hinchinbrook Shire.

It is estimated that the following recyclable materials and quantities are recovered each year:

- aluminium (2.8 tonnes);
- cardboard (2 tonnes);
- coloured plastics (0.3 tonnes);
- glass (45.7 tonnes);
- HDPE (11.7 tonnes);
- PET (3.4 tonnes); and
- steel cans (5 tonnes).

In total, approximately 70 tonnes of recyclable material is recovered each year.

Cleanaway Material Recovery Facility

The MRF is situated on Blakey Street, Garbutt and has been operating since 1997. The facility is owned by Cleanaway and receives approximately 6,240 tonnes of recyclables each year, including recyclable material from the Thuringowa and Townsville Councils' kerbside collection service. Materials received for recovery include aluminium, glass, HDPE, paper and cardboard, PET and steel.

Approximately 65% of received material is recovered, with the contaminated proportion disposed of at the Jensen Landfill. Contamination levels of recyclables

from Thuringowa and Townsville have been estimated by Cleanaway at 85% and 45% respectively; this differs markedly from contamination levels determined by Council.

In December 1999, Townsville City Council conducted an audit of contamination levels in recyclable material collected from the domestic kerbside service. According to the audit, contamination ranged from 17% to 23.3%. The disparity between contamination levels may be considered a function of operations at the MRF (i.e. not materials presented by residents for collection at kerbside).

McCahill Composting

The McCahill composting facility is operated by McCahill Earthmovers Pty Ltd and is located at the Vantassel Street, Townsville Landfill. Garden waste deposited at the landfill is processed (with other organic material) into compost products and sold to the landscaping industry.

5. WASTE STREAM PROJECTIONS

The development of the waste management strategy requires an estimation of future waste generation rates. Population growth and waste generation rates are projected over the next 20 years. This information is used to predict the lifespan of existing waste management facilities and thus enable scheduling of new facilities.

5.1 Population

5.1.1 Resident Population

The resident population for each Local Government Area in the North Queensland Region is summarised in Table 5.1. This data is derived from 1996 census figures provided by the Australian Bureau of Statistics (ABS). The complete set of ABS data is contained in Appendix C.

TABLE 5.1 RESIDENT POPULATION STATISTICS

MUNICIPALITY	POPULATION (1996)	DWELLINGS	AVERAGE PERSONS PER DWELLING
Burdekin	18,426	6,831	2.7
Charters Towers	7,579	2,845	2.7
Dalrymple	3,496	1,276	2.7
Hinchinbrook	14,938	5,227	2.9
Thuringowa	43,835	14,201	3.1
Townsville	80,704	31,367	2.6
REGION	**168,978**	**61,747**	**2.7**

Source: ABS

It is anticipated that different population changes will occur across the region in the future. Population rates of change have been provided by Townsville Enterprise Limited, and are summarised in Table 5.2 below. This table shows that there is expected to be a considerable increase in the Thuringowa and Townsville areas (mainly due to increased economic activities), a slight increase in the Dalrymple and Hinchinbrook areas, and a slight decrease in Burdekin and Charters Towers.

TABLE 5.2 POPULATION CHANGE RATES (1998-1999)

MUNICIPALITY	POPULATION GROWTH RATE (%)
Burdekin	-0.4
Charters Towers	-0.4
Dalrymple	0.3
Hinchinbrook	0.2
Thuringowa	3.3
Townsville	1.2
REGION	**1.3**

Source: Townsville Enterprise Limited

5.1.2 Tourist Population

In determining the waste generated in the region the tourist population should also be considered. The tourist numbers and distribution within the region may impact on the volume of waste disposed to landfill.

Data on the annual number of tourists for each municipality is limited and therefore estimations were made according to several different data sources. Overnight tourist numbers were derived from ABS accommodation data on the number of guest nights for the Northern Queensland region. Annual tourist numbers were calculated on the basis that the data for the 1999 June quarter (the most recent data available) was typical of any three month period of the year.

The proportion of tourists in each municipality of North Queensland was based on the 1996 census visitors' data and on the spread of tourist attractions in the area. It is also assumed that the Shire of Bowen, which is also included in the Northern Queensland regional data, has an insignificant number of tourists compared to large tourist areas such as Townsville. It has been assumed that city areas have a higher proportion of the region's tourists due to high business activities, coastal attractions and major sporting events such as rugby league (North Queensland Cowboys) and basketball (Townsville Crocodiles).

Table 5.3 shows the estimated number of overnight tourists and the yearly equivalent population. Details of calculations are included in Appendix D.

TABLE 5.3 ESTIMATED TOURIST POPULATION

MUNICIPALITY	TOURIST NIGHTS	YEARLY EQUIVALENT POPULATION
Burdekin	37,008	101
Charters Towers	37,008	101
Hinchinbrook	37,008	101
Thuringowa	286,812	786
Townsville	462,600	1,267
REGION	925,200	2,535

It is emphasised that the tourist figures are estimates only, as details of visitor numbers provided by the ABS represent only a portion of the tourist influx to the region.

The calculated equivalent tourist population has been added to the resident population figures to determine the total population for the North Queensland region. Comparison with the total population shows that the tourist population equates to a small increase in the overall population. It has been assumed that the growth in tourist population is likely to be at the same rate as the resident population.

The tourist population is less likely to generate garden waste but may also be less likely to recycle during their stay. Therefore it is assumed that the waste generated by the tourist population is similar to the residential population on a per capita basis.

5.1.3 Total Population Projections

Population projections, incorporating both resident and tourist populations, have been undertaken based on the information outlined above. Projections for the next 20 years are detailed in Table 5.4.

TABLE 5.4 TOTAL POPULATION PROJECTIONS

WASTE FACILITY	2000	2005	2010	2015	2020
Burdekin	18,234	17,872	17,517	17,170	16,829
Charters Towers	7,559	7,409	7,262	7,118	6,977
Dalrymple	3,538	3,592	3,646	3,701	3,757
Hinchinbrook	15,159	15,311	15,465	15,620	15,777
Thuringowa	50,726	59,667	70,183	82,553	97,104
Townsville	85,930	91,211	96,817	102,767	109,083
REGION	**181,146**	**195,062**	**210,890**	**228,929**	**249,526**

Each municipality has been further divided into waste management facility catchment areas to give an indication of the population utilising each waste management facility. This information is presented in Table 5.6. Details of the calculations are presented in Appendix D.

Information has been provided by some Councils on the destination of waste collected from their kerbside collections. For other areas, it is assumed that residents within each census collection district area utilise the nearest waste management facility, whether it be a landfill, transfer station or bulk bin.

The population serviced by the larger landfills in the region is difficult to quantify since there are many instances of cross-sharing of facilities, as evidenced by current practices at Jensen and Ross landfills in Thuringowa and Vantassel Street landfill in Townsville. Commercial and industrial waste and construction and demolition waste generated in Townsville is often transported to Thuringowa for disposal. Contaminated recyclable material from both Thuringowa and Townsville is disposed of at the Jensen landfill.

The Vantassel Street landfill also receives kerbside collected waste from the Shire of Johnstone. The additional population from Johnstone Shire serviced by Vantassel Street landfill in Townsville has been accounted for as shown in Table 5.5. The amount of waste that is transported is estimated to be 6,800 tonnes per annum (30% of total waste volume). The equivalent population (30% of the total population) is accounted for in the total population serviced by the Vantassel Street landfill. The current contract arrangements with Johnstone Shire expire in June 2004 but it is likely that these disposal arrangements will continue past this date.

TABLE 5.5 ADDITIONAL PROJECTED POPULATION TO VANTASSEL STREET LANDFILL

	2000	2005	2010	2015	2020
Johnstone	20,000	20,813	21,659	22,539	23,455
Equivalent Population	6,000	6,244	6,498	6,762	7,037

This equivalent population has been incorporated into figures included in Table 5.6.

TABLE 5.6 WASTE MANAGEMENT FACILITIES AND POPULATIONS SERVICED

WASTE FACILITY	2000	2005	2010	2015	2020
BURDEKIN					
Ayr TS	11,703	11,471	11,243	11,020	10,801
Clare TS	194	190	186	183	179
Giru TS	724	710	696	682	669
Home Hill TS	3,672	3,599	3,527	3,457	3,389
Kirknie Road LF[1]	18,234	17,873	17,518	17,170	16,830
CHARTERS TOWERS					
Stubley Street LF	7,560	7,410	7,263	7,119	6,978
DALRYMPLE					
Balfes Creek LF	438	445	452	458	465
Greenvale LF	978	992	1,007	1,023	1,038
Homestead LF	513	521	529	537	545
Mingela LF	318	323	327	332	337
Pentland LF	489	496	504	511	519
Ravenswood LF	591	600	609	618	628
Sellheim LF	212	215	218	221	225
HINCHINBROOK					
Forrest Beach LF	1,790	1,808	1,826	1,844	1,863
Halifax TS	2,760	2,788	2,816	2,844	2,873
Ingham LF[1, 2]	13,216	13,451	13,586	13,722	13,860
Warrens Hill LF[1]	1,943	1,936	1,982	2,002	2,022
THURINGOWA					
Bluewater TS	4,056	4,771	5,612	6,601	7,764
Jensen LF[1]	27,581	33,542	39,454	46,408	54,587
Ross LF[1]	23,119	27,194	31,987	37,625	44,257
Toomulla TS	1,977	2,326	2,736	3,218	3,785
TOWNSVILLE					
Cungulla LF	300	318	338	359	381
Majors Creek LF	100	106	113	120	127
Picnic Bay LF	3,100	3,291	3,493	3,707	3,935
Vantassel Street LF[3]	88,430	93,740	99,371	105,343	111,676

Notes:
1. Population estimates are based on the total population serviced by the landfill, including populations serviced by transfer stations and bulk bins for ultimate disposal at landfills.
2. Includes population of Palm Island
3. Includes equivalent population of Johnstone Shire
4. LF – Landfill
5. TS – Transfer Station

5.2 Waste Generation Rates

A waste generation rate per capita can be derived by comparing the quantity of waste disposed to landfill with the population. Based on the figures for landfilled waste and total population included in the previous sections, waste generation rates for the North Queensland region have been calculated. Waste quantities for some of the facilities in the region are unknown and estimates have been made to determine approximate regional waste generation rates. It should be noted that the waste quantities used relate only to waste deposited to landfill, and do not include recovered material such as recyclables or garden waste which is mulched.

Appendix E contains details of waste generation rate calculations. The waste generation rates for the region are summarised in Table 5.7.

TABLE 5.7 WASTE GENERATION RATES

MUNICIPALITY	WASTE GENERATION RATE (tonnes/person/year)
Burdekin	0.90
Charters Towers	0.81
Dalrymple	0.96
Hinchinbrook	0.70
Thuringowa	1.05
Townsville	1.36
REGION	**1.14**

Table 5.7 shows that waste generation rates in the North Queensland region vary between 0.70 tonnes/person/year in Hinchinbrook to 1.36 tonnes/person/year in Townsville.

Waste generation rates for other regions of rural Australia range from 0.43 to 1.22 tonnes/person/year. Past studies by the Victorian EPA have calculated average generation rates of 1.20 tonnes/person/year in non-metropolitan areas.

The North Queensland regional generation rate of 1.14 tonnes/person/year is consistent with the findings for regional areas. This does not take into account the much higher volumes of garden waste generated in North Queensland (a significant portion of which is still deposited in landfills). From Table 5.7 it is apparent that the waste generation rates for the North Queensland region generally fall within the range of 1.20 tonnes/person/year, with the exception of Townsville.

It should be noted that Townsville has a high percentage of regional industries, many of which are significant waste generators. Townsville waste management facilities (especially Vantassel Street Landfill) also receive large quantities of waste from outside the region (e.g. domestic garbage from Johnstone Shire). Private waste management contractors service businesses from as far away as Cairns, and transport material for deposition in the Vantassel Street Landfill. Quarantine waste generated from ships berthing at the Port of Townsville is also deposited at Vantassel Street Landfill. The records available do not allow the exact quantities of all of this waste to be calculated and estimates have been derived.

5.3 Waste Stream Projections

Utilising waste generation rates calculated in the previous section, waste generation projections were determined for the 20 year planning period. These projections are detailed in Table 5.8. Detailed calculations are included in Appendix E.

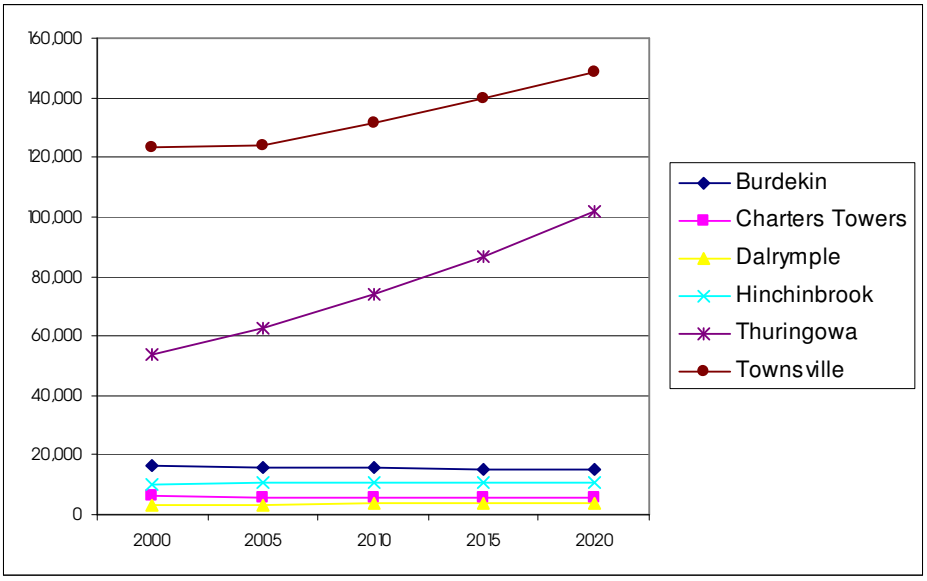
It should be noted that Table 5.8 reflects projections for waste generated within the boundaries of the HESROC region, i.e. waste generated by Palm Island (part of the Hinchinbrook Shire) is included, but waste generated in Johnstone Shire and transported for disposal to Vantassel Street Landfill is not. While it is known that some commercial and industrial waste generated from outside the region is deposited at Vantassel Street Landfill, there is no data currently recorded on the amount of this waste; accordingly it has not been excluded from projected figures.

TABLE 5.8 WASTE PROJECTION BASED ON CURRENT WASTE GENERATION RATES

MUNICIPALITY	WASTE GENERATION (tonnes/annum)			
	2005	2010	2015	2020
Burdekin	16,085	15,765	15,453	15,146
Charters Towers	6,001	5,882	5,766	5,651
Dalrymple	3,448	3,500	3,553	3,606
Hinchinbrook	10,718	10,825	10,934	11,044
Thuringowa	62,650	73,692	86,681	101,959
Townsville	124,047	131,671	139,763	148,353
REGION	**222,949**	**241,335**	**262,150**	**285,759**

Table 5.8 shows that on current waste generation rates it is anticipated that the region will generate in excess of 285,000 tonnes of waste per annum by 2020. This represents an increase of approximately 38% over current figures. This growth will differ for each municipality. Figure 5.1 shows the projected annual waste quantities for each Local Government Area.

FIGURE 5.1 WASTE PROJECTION BASED ON CURRENT RATES (tonnes/annum)



The implementation of waste minimisation strategies over the next 20 years is expected to impact on future waste generation rates. An additional waste stream projection has therefore been calculated based on a realistic reduction in the amount of waste generated. Appendix F details relevant calculations.

These reduction targets are based on the premise that an improved regional effort in diverting waste from landfill is possible. It is anticipated that waste reduction achievements may be in the order of:

- 15% reduction of 2000 waste generation rates by 2005;
- 20% reduction of 2000 waste generation rates by 2010; and
- 25% reduction of 2000 waste generation rates by 2015.

Appendix F shows detailed calculations of waste stream reduction targets which are summarised in Table 5.9. Current diversion was based on the amount of recyclables collected at kerbside and garden waste mulched at a small number of waste management facilities. Realistic targets were estimated by considering the state of recycling facilities and the markets for recyclables collected in the region.

TABLE 5.9 WASTE STREAM REDUCTION TARGETS

MATERIALS	CURRENT DIVERSION		RECOVERY TARGETS	
	Current Collection (tonnes/annum)	Current Diversion (% of total waste))	Realistic Target (% of total waste)	Additional Target (tonnes/annum)
Plastic	420	5.3	30	2,000
Paper	1,170	3.1	30	10,200
Steel	290	7.2	70	2,500
Aluminium	95	20.8	90	310
Glass	1,070	7.7	60	7,300
Organic	22,000	60	75	10,325

Waste diversion targets can be achieved by:

- more extensive kerbside collection of recyclables in the HESROC-NQ region;
- establishment of a regional composting facility to accept garden waste and paper;
- diversion of waste from landfill to a waste-to-energy recovery facility; and
- enhancing community education about the benefits of recycling to increase community recycling participation.

Waste generation for each municipality based on this reduction scenario is presented in Table 5.10.

TABLE 5.10 WASTE PROJECTION BASED ON REALISTIC REDUCTION

MUNICIPALITY	Tonnes/annum				
	2000	2005	2010	2015	2020
Burdekin	16,500	13,761	12,612	11,675	11,444
Charters Towers	6,150	5,112	4,720	4,342	4,256
Dalrymple	3,390	2,909	2,807	2,665	2,705
Hinchinbrook	10,310	8,727	8,196	7,810	7,889
Thuringowa	53,500	53,700	58,954	65,217	76,712
Townsville	116,480	111,278	111,339	110,988	117,809
REGION	**206,330**	**195,487**	**198,628**	**202,697**	**220,815**

Figure 5.2 illustrates the projected annual waste quantities using the anticipated reduction in waste generation rates in each municipality of the region.

FIGURE 5.2 WASTE PROJECTION BASED ON REDUCED GENERATION (tonnes/annum)

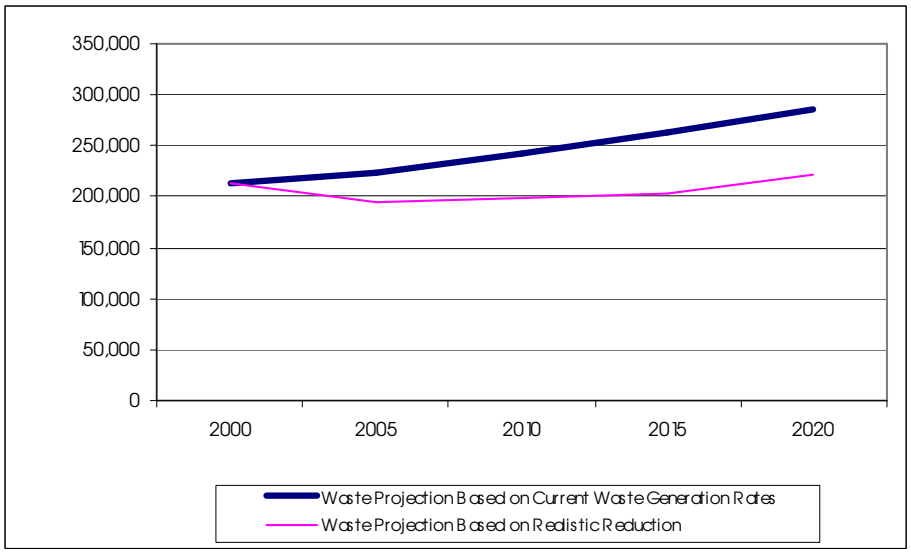
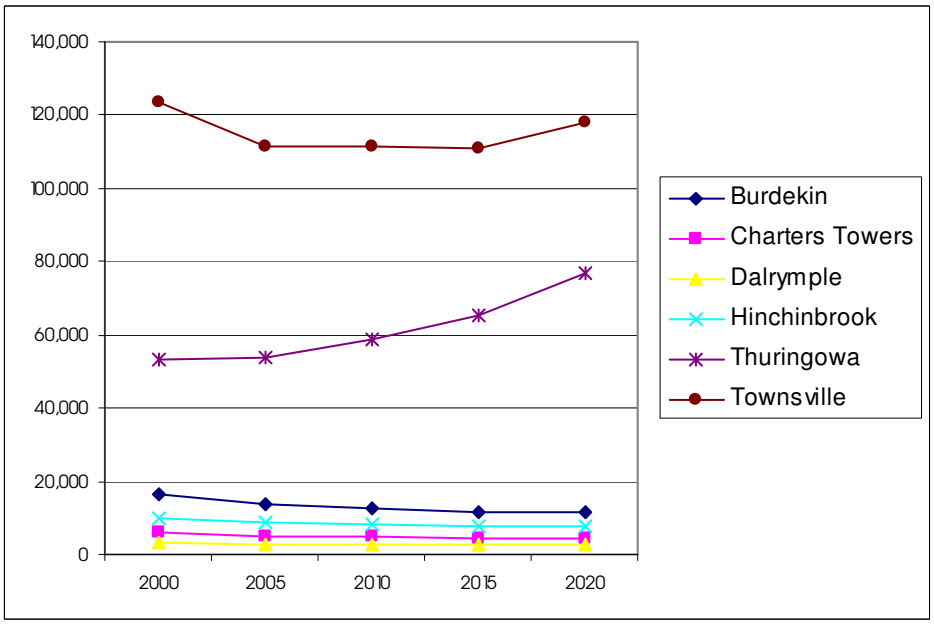


Figure 5.2 compares the current waste generation projection with a realistic achievable reduction. By comparison, these figures indicate that a substantial reduction in the amount of waste deposited to landfill can be achieved.

Figure 5.3 shows the composition per municipality of the anticipated waste projections.

FIGURE 5.3 WASTE GENERATION PROJECTION COMPOSITION (tonnes/annum)



It should be noted that waste reduction is also a function of population. In Burdekin and Charters Towers, anticipated reductions in the population are expected to contribute to decreased waste generation. However in Townsville and Thuringowa, anticipated reductions are likely to be off-set by population

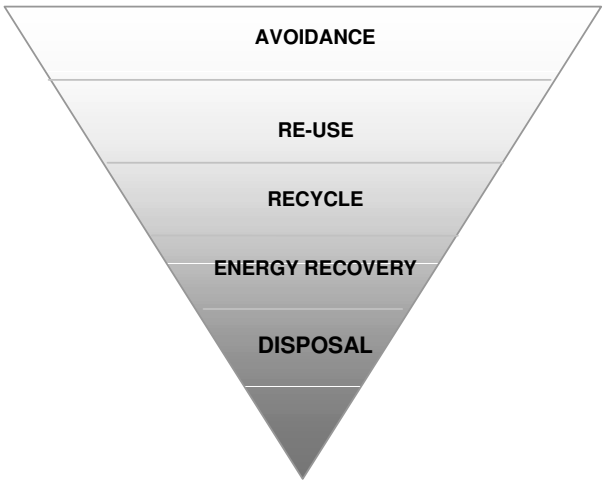
growth in the short to medium term. Substantial waste minimisation measures will need to be implemented in order just to maintain the volume of waste generated in these municipalities to current 2000 levels.

6. RESOURCE RECOVERY & WASTE MINIMISATION

6.1 Overview

Reducing the overall quantity of waste from the domestic, commercial and industrial sources is a key objective of the *Environmental Protection (Waste Management) Regulation 2000*. The waste management hierarchy adopted to achieve this goal is illustrated in Figure 6.1. The components of the waste management hierarchy are listed in order of preferred adoption, with emphasis on waste avoidance ahead of disposal.

FIGURE 6.1 WASTE MANAGEMENT HIERARCHY



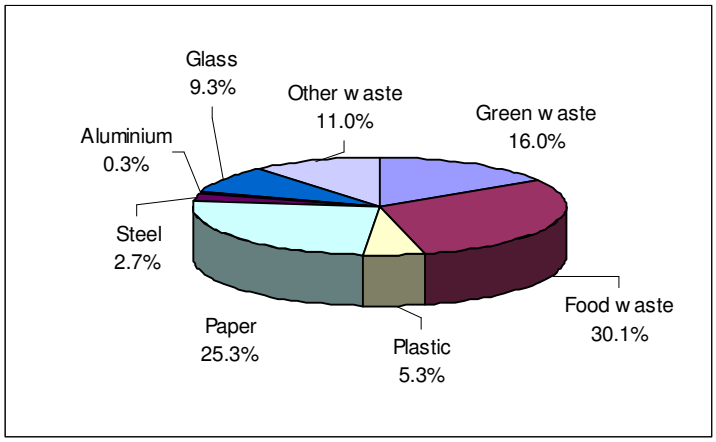
The following sections review current and future markets for recyclable materials, future trends in waste minimisation and examine waste minimisation opportunities for the HESROC-NQ region in terms of the waste management hierarchy.

6.2 Recycling

6.2.1 Domestic Waste Stream

The domestic waste stream is a major source of recyclable material. Figure 6.2 shows the typical composition of the domestic waste stream as determined by audits undertaken in Melbourne and Sydney.

FIGURE 6.2 DOMESTIC WASTE STREAM COMPOSITION BY WEIGHT



Source: Beverage Industry Environment Council (1998) *Garbage Bin Analysis and Recycling Container Audit.*

From this data it can be seen that the main component of the domestic waste stream (approximately 70%) is organic waste (including paper), food waste and garden waste. Up to 40% of the domestic waste stream is recyclable, including paper, glass, plastic, aluminium and steel.

The results of an audit on Townsville domestic waste conducted in July 1998 shows strong correlation with Figure 6.1, particularly with food waste, paper and glass. The 'other' waste category may account for the marginal difference in other categories, i.e. plastic.

The domestic waste stream for the North Queensland region is likely to be slightly different to that of Figure 6.1 in rural areas. Recyclable agricultural wastes (such as steel, other metals and plastic containers) are likely to increase the ratio of various waste components due to the number of farming communities in the region. However recyclables such as glass, aluminium, plastic and paper are a significant proportion of the waste stream in the North Queensland region.

6.2.2 Recyclable Materials

Paper and Cardboard

Total usage of waste paper by the Australian paper industry is approximately 600,000 tonnes annually and represents a recycling rate of 30% of total paper consumption.

Much of the cardboard collected is used in the packaging industry to provide the fibre strength for its recycled packaging. Approximately 40% of recycled paper is derived from collected newsprint.

An alternative market for paper reuse within the region may be to utilise paper and cardboard in compost and mulch products and animal bedding. The use of newsprint as a feed supplement for beef cattle being transported for export is currently under investigation by the Publishers National Environment Bureau Limited and Gatton University. If these trials are successful, an additional market opportunity for recovered newsprint may exist in the North Queensland region.

Other options include use of paper and cardboard as a fuel source, in insulation and building products and export for recycling overseas.

Plastic

Several types of plastics are currently collected for recycling and these typically include PET (Code 1) and HDPE (Code 2). Polypropylene (Code 5) is also collected in Burdekin. The price paid per tonne varies for each type of plastic. The markets are quite variable and tend to be dominated by a small number of companies.

A variety of companies are being established in Australia which use composites of plastics and rubber (from waste tyres) to manufacture railway sleepers, traffic bollards, fencing poles and many more products.

The value of recycling plastic decreases at or below the cost of collection and there are restrictions on its reformation in products. For example, the transport of collected PET requires compaction of the plastic into bales because of low weight to volume ratio.

Opportunities exist to minimise the use of plastic or reuse within the region. For example, encouraging staff at shopping centres to reduce the number of bags used at the counter. Retailers may also be encouraged to stock durable carry bags for purchase by customers. To support the recycling of plastic, where a new collection system is being introduced, HESROC-NQ may encourage member Councils to utilise MGBs that are manufactured from post-consumer plastic products.

In the long term, the impact of plastic in landfill can be minimised through the development of biodegradable plastic for single-use applications such as fast food containers and film bags.

Glass

A variety of applications are being explored which include the use of glass cullet as a sand blasting abrasive, flux agent in tile manufacture and as a composite in a range of concrete products. In addition to secondary markets having a vital role in landfill reduction, colour sorting equipment is expected to sort a small amount of mixed colour broken cullet into a condition ready for treatment in furnace.

Maturation of the glass market is expected in the next 20 years. As new buyers enter the market, prices received per tonne of glass will become more competitive.

Aluminium

Kerbside recycling presents the greatest opportunity for continual improvement of aluminium can recycling. Aluminium has a high residual value and industry is able to recycle all aluminium it receives. Reprocessing can be cost effective compared to manufacturing aluminium cans from raw material. Higher prices are paid for highly compacted aluminium hence there may be benefits in purchasing high density compaction equipment.

Opportunities for HESROC-NQ to expand the collection of aluminium are available and include the involvement of fundraising/charity groups and drop-off centres.

Non-Ferrous Metal

Non-ferrous metals include copper and brass, and generally originate from commercial and industrial sources. These sources include cookware, appliances, tools, pipes, copper wire, automobiles and furniture. High market returns exist for non-ferrous metals, however, separation of non-ferrous metals from the waste stream generally does not receive the same level of commitment as other recyclable metals despite the good prices received.

Steel

Steel in the form of car bodies and other scrap metal is a material of particular interest in the region. This is due to the bulky nature of these wastes and the large volume of airspace consumed if landfilled.

The Canmakers Institute of Australia, in conjunction with other industry groups, assists Councils to recycle steel cans by:

- providing a specific market for cans which are collected;
- instigating and supporting steel can recovery implementation and promotion programs;
- encouraging the formation of efficient regional collection and sorting programs; and
- assisting Councils by providing balers or magnets where appropriate.

Market prices for steel vary depending on whether the steel is heavy or light. All new steel products contain 20% recycled steel, hence there is a continual demand for this material.

Furniture and White Goods

Furniture and white goods are either landfilled (usually at unsupervised sites) or segregated for recycling of their metal components.

There is an option of re-using household items in whole or part through the establishment of a Repair and Reuse Centre. These centres provide the opportunity for re-commissioning and re-use of goods after repair. This offers a source of income to waste facility operators and may provide regional employment opportunities. These centres are discussed further in Section 6.6.

Tyres

Tyres are a large volume waste of particular concern in the North Queensland Region. In addition to tyres from domestic and commercial sources, significant waste volumes of large tyres used in the mining industry are produced in the region.

Tyres can be reused in a range of activities, including as retaining walls and bollards. Recycled tyres are largely used in applying retreads to tyres. Pulverised rubber can be utilised in tile manufacturing and asphalt production. However, the latter use does not meet Department of Main Roads specifications and markets may therefore be limited in Queensland. Other uses of recycled rubber include carpet manufacturing, matting, adhesives, fenders, belting and tennis court surfaces.

Use of recycled tyres as a fuel source is also an option in the North Queensland Region. Discussions have been initiated by LAWMAC with Queensland Cement Limited for the use of waste tyres as an energy source for their Gladstone factory.

Waste Oil and Batteries

Waste oil and car batteries are Regulated Wastes requiring specialised treatment and disposal methods. At many facilities in the region waste oil and car batteries are collected and stored in either bunded areas or large storage tanks; this is not the case in all facilities in the region.

6.3 Construction and Demolition Material

Future developments in Thuringowa and Townsville are inevitable given the anticipated population growth rates. Apart from housing developments, other future major developments in the region may include mining, tourism developments and transport infrastructure.

Construction and demolition waste is typically generated from the construction, demolition, repair and/or modification of buildings, infrastructure (including roads, bridges, railways) and excavated material resulting from construction activities.

Construction and demolition waste comprises a range of materials from these activities including concrete, asphalt, bricks, timber, soil, metal, glass and garden waste. Recycling of some of these materials is more problematic than others. The quantity and types of materials generated varies and is generally dependent on the level of activity in the construction industry.

HESROC-NQ may consider coordinating a survey that identifies major producers of construction and demolition waste throughout the region to quantify and categorise the types of waste generated. The implementation of systems and/or infrastructure to manage waste types (consistent in composition and quantity) could be investigated.

Member Councils could consider specifying the requirement for a waste management plan for construction and demolition proposals as part of the approval process. The plan should develop strategies addressing potential opportunities for waste minimisation, reuse and recycling for all facets of the development project including design, construction, demolition and excavation. During the design phase the use of recycled products should be specified where possible. Packaging waste can be reduced by returning packaging material to suppliers, purchasing in bulk and using returnable packaging, i.e. storage pallets and reels. Materials resulting from the demolition process should be separated and opportunities for reuse identified. During construction, material resulting from excavations should be used as clean fill in rehabilitation works or in landscaping works (provided that the material is not contaminated).

The largest future market of asphalt and concrete is likely to be in road construction as a base or sub-base material. The major limitation on the potential the use of demolition wastes in road construction is the low level of acceptance of the material and standard specifications for construction. However, consideration should be given to using concrete and bricks for the preparation of internal roads and hard-stand areas at waste management facilities.

Wood waste resulting from construction and demolition activities can be chipped and composted or used for landscaping purposes. However reuse of wood is likely to be restricted in the case where the material has been chemically treated.

Other uses for construction and demolition wastes include:

- bricks in construction, landscaping, driveways and drains;
- timber in formwork, flooring, furniture, fencing, craft and landscaping;
- glass as an aggregate for concrete products; and
- garden waste as compost or mulch.

6.4 Agricultural Waste

6.4.1 Agricultural Chemicals

The use of chemicals in the agricultural industry is significant, particularly in crop and animal protection. It has been estimated that 270 tonnes of unwanted and potentially hazardous pesticides (such as Dieldrin and DDT) are stored on agricultural properties throughout the State. Much of this material may end up in landfills, contributing to groundwater contamination and environmental health risks.

The EPA has initiated a one-off collection service to target organochlorine pesticides (Dieldrin and DDT). Temporary collection facilities will be established throughout Queensland regional areas over the next two years. The program provides temporary collection facilities where licensed contractors collect, store, transport, treat and dispose of the chemicals. The EPA and Local Government are selecting appropriate collection points. The program is currently under trial in the Darling Downs region.

Following the outcomes of the ChemCollect trial program, ChemClear (an industry driven program) will be instigated throughout the North Queensland Region.

6.4.2 Agricultural Chemical Containers

The disposal of agricultural chemical containers is a concern in the HESROC-NQ region given the considerable volumes generated and the hazardous nature of their contents. Historically, containers have been deposited in landfills. Uncontrolled disposal of containers can lead to environmental degradation through leaking chemical waste and represent an inefficient use of landfill airspace.

Over 70% of the containers used by the crop protection and animal health industry are plastic. There is a range in capacity, with the majority sized between 1L to 200L. Approximately 72% of liquid chemicals are sold in 20L drums and 18% in 200L drums. However, 200L drums are generally made from metal.

The drumMUSTER program has been developed to allow farmers to deliver empty, triple-rinsed containers to designated collection points run by participating Local Councils. DrumMUSTER is funded by a levy on crop protection and animal health products sold in non-returnable chemical containers. The levy encourages farmers, as end users, to purchase chemicals packaged in refillable, cardboard or paper containers. Thus it will encourage manufacturers to develop better means of packaging. The levy funds are distributed to collection centres to cover the costs of inspection, collection, processing and transporting of containers.

Some landfills and transfer stations in the North Queensland region have collection areas for triple-rinsed chemical containers. However, the collection is

mostly unsupervised and anecdotal evidence suggests that the percentage that is triple-rinsed is low.

6.5 Household Chemicals

Household chemicals should be disposed of correctly as they pose a threat to human health and the environment. Typical household chemicals include insect sprays, furniture polish, paint and chemical paint stripper, pharmaceuticals, cleaning products, batteries and battery acid, and swimming pool chemicals.

There are currently no programs for collection of household hazardous waste in North Queensland; much of this waste is deposited directly in landfills posing a potential risk to the environment where landfills are not adequately constructed and/or managed to protect groundwater and surface water.

6.6 Repair & Re-Use Centres

Repair and Re-Use Centres often operate in conjunction with a transfer station, landfill or Material Recovery Facility. They can provide a reduction in waste going to landfill as well as other services to the community. Articles received at the waste management facilities are inspected and those deemed to be potentially useful are separated. These items are repaired and resold to the members of the general community. Articles typically repaired and resold include furniture, whitegoods, bicycles and other household items.

These centres are labour intensive and as a result often utilise local groups as part of an employment scheme. These community groups may include local disabled associations, service groups or unemployment networks. Depending on the cost of labour, Repair and Reuse Centres can provide a source of revenue to the operators from sale of repaired items.

At present, there are a small number of scavenging operations at selected waste management facilities in the North Queensland Region. Articles are collected from the landfill face by contracted scavengers and offered for sale. However articles are not under cover, and damage by the weather affects their re-sale value. None of this material is repaired and very little waste material is re-used.

6.7 Drive-Through Recycling Centres

These facilities provide residents with disposal points for various waste types. The Centres are intended to provide householders, small businesses and local Councils with a facility to deposit a range of materials including garden waste, white goods, dry recyclables, clothing, batteries and unused paints. Centres may have second-hand or recycled shops.

Establishment of this type of facility (to accept over 60 different material types) at a location in metropolitan Sydney is currently being investigated, however there are no drive-through recycling centres operating as yet in Australia.

6.8 Public Recycling

Public recycling is a small component of the overall waste management strategy but provides significant recognition by ratepayers. Currently there is limited public recycling in the North Queensland region, however there are more opportunities in participating both at public events (such as the Burdekin Water Festival, Charters Towers Country Music Festival and Ingham Italian Festival)

and in public places which attract significant numbers of people (such as Townsville's Flinders Mall).

At sanctioned events, Councils may encourage the exclusive use of recyclable food and drink containers and require provision of recycling bins. Public recycling bins should be positioned adjacent to litter bins, be colour coded and sign-posted (including the use of graphics) in order to promote use. Lids should be provided to discourage litter problems. The bins should also be located at public places such as pedestrian malls, shopping centres and recreational areas, and be emptied on a regular basis.

6.9 Future Trends

6.9.1 Overview

It is acknowledged that the transport distances involved in delivering recyclables from regional centres to end markets have environmental and economic consequences. Transport potentially impacts on greenhouse gas emissions and results in considerable costs. Cost reductions and environmental impacts can be achieved through more efficient procedures for bulk handling. Other opportunities include identifying and/or creating local markets for recyclables. The development of a regional processing centre would also minimise these impacts.

Composting and mulching garden waste components of the waste stream and separation of recyclables are well established waste minimisation practices. However, other practices and technologies are emerging which may extensively alter waste management in the longer term.

Many of the emerging technologies require large inputs in terms of capital and ongoing operational costs. Some cost recovery is possible, with many of the options being based on energy recovery. Currently energy generation in the region is limited to firing of bagasse in sugar mill furnaces and two gas turbines located at Yabulu and Stuart. The nearest coal fired power station is located at Collinsville, 82km south west of Bowen. All of these facilities are private ventures.

Viability of energy recovery schemes from landfill gas and waste-to-energy plants may increase with growing pressure to reduce our reliance on fossil fuels. The Queensland Government has indicated that the State's power generation needs should move towards use of renewable energy and gas to help meet Australia's commitment to 2% of energy production from renewable sources and reduce greenhouse gas emissions.

The following technology options can be considered as individual systems but often a combination of options can be found.

6.9.2 Thermal Treatment

Incineration is the most common method of reducing waste deposited to landfill by thermal treatment. Thermal treatment generally involves the combustion of the waste stream to significantly reduce the volume, resulting in a residual ash. Previously, incineration has not been favoured in Australia due to cost and air pollution issues. Improvements in available technology have been aimed to address air quality concerns. Energy generated from these processes can be recovered to assist in offsetting capital and operating costs. There are a number

of incineration technologies available. Fluidised bed and rotating drum incinerators are used extensively overseas.

Gasification and pyrolysis are more recently developed thermal treatment technologies. These technologies are yet to be proven in Australia however, extensive investigation of gasification is under way with the establishment of a pilot gasification plant in Wollongong which is expected to commence operations in the near future.

Gasification technology being trialled at the Wollongong facility involves three steps. Firstly the waste is processed using heat and steam, then it is separated into organic pulp, recyclable materials and inorganic residue. The gasification process is applied to the organic component by subjecting it to high temperatures in a low oxygen environment which results in production of syngas and an inert residue (char). The final stage involves the use of the gas in gas engines or gas turbines to generate power. Gasifying systems are also being developed to improve the efficiency of the energy recovery from brown coal and biomass.

Thermal treatment technologies can be designed for either mixed solid waste, processed waste (refuse-derived fuel) or certain components of the waste stream such as the organic fraction and hazardous wastes. By-products of thermal treatment include nitrogen oxide, sulfur oxide, carbon dioxide, fly and bottom ash, wastewater discharges and sludges. Some of these products can be landfilled but the gaseous emissions will require further treatment to remove the contaminants before being emitted to the atmosphere.

Thermal treatment of specific types of waste with high calorific value is a possibility for the region, i.e. the use of tyres as an energy source at the Gladstone cement kiln. Currently, recovered tyres are being used as fuel for cement kilns at a number of locations in Australia. There are also options for co-burning of wastes such as separated garden wastes in existing energy recovery operations (such as in sugar mills where bagasse is long established as a fuel).

In Western Finland, fuels are being produced from waste. Biogas production from organic waste and fuel pellet production from plastic and paper waste are two of the main methods. The biogas can be used for electricity generation, heat production and fuel for vehicles.

Combustion of the entire waste stream will require significant infrastructure investment. Further investigation of thermal processing and pollution control technology is required to determine whether it may be a viable option for specific elements of the waste stream.

6.9.3 Mechanical and Biological Treatment

Among the available technologies, composting is the most common method for mechanical and biological treatment of waste, primarily used for the organic fraction. Composting of the source-separated organic fraction is further discussed in Section 11.0 Organic Waste Management.

Composting of the entire waste stream has been used as a volume reduction technique overseas and a facility has been established in Port Stephens, NSW. In Queensland, Cairns City Council, Douglas Shire Council and Mareeba Shire Council are proposing to establish a facility with a capacity to process 300 tonnes/day of solid waste (significantly larger than the Port Stephens facility).

Composting of mixed waste requires an enclosed composting system and use of emission scrubbing processes. The technology currently used in Australia utilises a digester, a large enclosed rotating drum in which the material is biomechanically processed under aerobic conditions. Biosolids are also co-composted with the mixed waste. After three days, the material is screened and transferred to aerated static piles for further volume reduction and curing. A compost product can then be fine-screened out and a residual of 20-25% of the original volume can then be disposed of.

6.9.4 Landfill Gas Recovery

Landfills are a significant source of methane which adds to greenhouse gas emission in Australia. To help reduce these emissions and make use of landfill gas as a fuel source, collection systems are being established. In smaller landfills, gas capture and flaring are common methods to reduce the impact of the methane but as the size of the landfill increases there are more opportunities for power generation. The electricity is sold back to the electricity generating authority, providing a source of revenue.

A critical volume of waste of over 1 million tonnes of waste needs to be deposited in the landfill before it becomes a viable option for a landfill gas extraction scheme. A private venture may be attracted to setting up a scheme in the region if a landfill has or will have the necessary volume of waste and if electricity can be sold for at least $50 to $60 per MW. The viability of this may increase with the renewable energy target of 2% for energy production across Australia.

A landfill can be managed to optimise methane gas production which allows levels of biogas required for recovery to be achieved earlier and speeds up stabilisation of the waste. Landfills managed in this way are known as bioreactors. The system involves reticulation of leachate through the waste to maximise microbial activity hence methane production. This process can be adapted for new landfill cells as well as for the whole landfill.

6.9.5 Summary

A range of alternative waste management technologies is available, some at varying stages of proven success in Australian conditions. The trend in all of these technologies is towards development of large infrastructure capable of maximising resource recovery and minimising environmental impact. Future waste management practices are moving away from individual municipal disposal points and recognise the financial imperative of waste management on a regional basis.

It should be noted that the feasibility of some of these future treatment technologies is subject to a number of factors, including:

- availability of technology and expertise;
- applicability to local conditions;
- competition of low cost disposal methods;
- viability of long term markets for end use products;
- capital availability; and
- environmental impacts.

Additional technologies may also be developed over the 20 year planning period. The appropriateness of any of these treatment technologies for waste management in the North Queensland region over the next 20 years needs to be further assessed in the light of technologies proven to be successful in the future.

7. COLLECTION SYSTEMS

7.1 Overview

The garbage and recyclables collection system is a highly visible aspect of a local Council's waste management activities and therefore of primary importance to ratepayers.

The collection systems employed throughput the region vary considerably due to geography, population density and collection costs. Any collection system implemented should take into consideration the size and physical characteristics of the collection district and subsequent costs of waste and recyclables collection. It will also need to reflect the level of service expected by the community and encourage waste minimisation. Thus the provision for collection receptacles and frequency will vary between townships and rural areas due to economic viability.

7.2 Pay-By-Use Collection Systems

The aim of user pays collection systems is to make residents aware and directly accountable for the amount of waste they dispose. A number of incentives exist for residents to reduce the amount of waste they generate. Options include frequency-based incentives and volume-based incentives. These options are intended to minimise the amount of waste generated. Councils are required under legislation to provide a weekly garbage collection service irrespective of whether all tenements use the service each week.

A frequency-based system encourages residents to reduce the number of times bins are put out for collection. Rebates are given to the residents who put their bins out less than a set number of times per year. There are different components to the rebate systems, including a base charge, weekly fee for the time that the bin is put out for collection and thresholds for one or two payment rates. Under the rebate system, the residents pay the standard service level and either obtain a rebate for utilising the service less often or pay an excess for overuse. This system requires MGBs to be fitted with microchips where the bins can be identified and the following information can be recorded:

- frequency of bin collection;
- tracking of individual bins to residential property; and
- time and date of collection.

A pay-by-volume system charges by the volume of waste presented for collection and is measured by the size of the MGBs. Different sized MGBs are charged at different rates, with smaller bins cheaper. Implementation of the system is quite inexpensive and residents are encouraged to reduce the amount of their waste.

A program of public education is required to accompany the implementation of the pay-by-use domestic garbage collection service. The public needs to be aware of how the system works and benefits they would receive by reducing the amount of waste generated and put out for collection.

7.3 Diversion And Recovery Rates

Research conducted by the Beverage Industry Environment Council (BIEC) between 1993-1997 indicates that variations in recycling diversion rates are affected by the size and type of the receptacles used.

BIEC found that the average household using a 240L MGB generates significantly more garbage than a household using an 80L or 120L MGB. The trends also show that the diversion rate amongst 240L MGB households is less than half that achieved by smaller bin households. Another negative impact on recycling, composting and waste minimisation by the larger MGBs is that the proportion of organic waste is much greater in the 240L MGBs than the smaller MGBs. Table 7.1 summarises the findings in the 1997 research.

TABLE 7.1 DIVERSION AND RECOVERY RATES BY BIN SIZE

BIN SIZE	DIVERSION RATE %	RECOVERY RATE %
80L MGB	42.6	77.7
120L MGB	29.9	68.2
240L split MGB (garbage/recyclables)	37.9	75.5
240L MGB	18.0	50.7

Source: BIEC Recycling Audit and Garbage Bin Analysis June-Sept 1997

Diversion and recovery rates are also affected by the type of recycling containers used. From the BIEC research, the optimum waste management system to achieve maximum diversion and recovery rates, with low levels of contamination in the recycling stream, is an 80-120L MGB for garbage and a rigid container for the collection of recyclables. Table 7.2 summarises the performance of recyclable containers.

TABLE 7.2 DIVERSION AND RECOVERY RATES BY RECYCLING CONTAINER

RECEPTACLE	DIVERSION RATE %	RECOVERY RATE %
Bag	17.9	48.6
Crate	19.2	52.9
240L split MGB (garbage/recyclables)	37.9	75.5
240L MGB	38.9	78.0

Source: BIEC Recycling Audit and Garbage Bin Analysis June-Sept 1997

Actual diversion rates for the North Queensland region could be determined by conducting audits of the various systems implemented throughout the region.

7.4 Garbage System Options

Traditional Bins

The traditional bins used for garbage collection are 55L or 75L bins. These are made from either plastic or steel and are generally purchased by the household owners.

Advantages of the traditional system include:

- relatively inexpensive to implement (capital costs only excluding labour costs); and

- trucks used to collect waste are adaptable to different terrains.

Disadvantages of the traditional system include:

- expensive to operate;
- higher occupational health and safety risks as the user must lift and carry the bin;
- higher litter generation potential due to spillage caused by animals; and
- involves more labour intensive collection than the MGBs.

MGB Systems

Mobile Garbage Bins (MGBs) are universally accepted as the leading receptacle for collection of domestic and recyclables. A variety of MGBs are currently in use throughout the region, ranging in size from 120L to 240L.

Advantages associated with the MGB system include:

- can be collected by a solo-operated 'one-armed' collection vehicle which reduces the labour requirements when street conditions are favourable;
- containers are durable with a longer life expectancy;
- reduced potential of animals accessing waste and causing litter spillage; and
- user need not lift the bin.

Disadvantages associated with the MGB system include:

- in comparison to the traditional bin system, costs associated with the establishment of the MGB system infrastructure is higher;
- in densely populated areas or on unmade roads, manoeuvring of the 'one-armed' operated collection vehicles may experience difficulties (some trees may need to be lopped for the vehicle access);
- large capacity MGBs such as the 240L do not encourage users to develop on-site waste minimisation habits such as home composting and recycling; and
- empty 120L or 140L MGBs may be subject to instability in high winds.

MGBs are generally manufactured from post consumer products such as HDPE milk bottles and retired bins. The proportion of raw and recycled material in the plastic mixture depends on the material available, however, a typical content of the recyclable material ranges from 30%-50%. A minimum recycled content is often specified in Council contracts. The use of MGBs manufactured from recycled post consumer product indicates to residents that recycling efforts are beneficial, as the large amount of diverted HDPE from waste stream has a credible end market.

Split MGB Systems

Various collection arrangements can be made with a split bin system. It allows two different materials to be collected in the same bin. In the North Queensland Region, Hinchinbrook and Thuringowa have the split MGB system, with garbage and recyclables collected together.

In comparison to the stand alone MGBs, split bins have the following advantages and disadvantages.

Advantages include:

- collection transport cost savings may be achieved from only one collection required for both waste and recyclables;
- householders are only required to use one MGB to fully utilise the service; and
- there can be reduced collection labour requirements.

Disadvantages include:

- specialised trucks are required to collect the bins to keep materials separated;
- there is a greater potential for cross contamination between compartments;
- liners cannot be used;
- where the ratio between recyclables and waste is high, transport costs may increase due to requirement to empty partial loads; and
- implementation of the pay by use collection system is difficult as garbage and recyclables are presented in the same collection receptacle.

Currently there are two types of split bin systems available for domestic waste and recyclables collection – East-West and North-South split. The major difference between the two systems is that the North-South bin can be fitted with two individual lids, one for each compartment. It has been shown that the dual lid system leads to an increased potential for residents to more effectively sort their waste.

7.5 Recycling System Options

Bag System

The main advantages of the bag system are the lower capital costs incurred in establishing and servicing the contract. Disadvantages of the system include increased street litter problems, relatively low recovery rates, poor storage capacity, occupational health and safety and shorter container life.

Crate System

Crate sizes currently available for use are 50L, 55L and 60L capacity. Lids can be provided to minimise any litter problems experienced.

Advantages of the crate system include:

- relatively low container costs;
- higher storage capacity and more convenient than bags;
- reduced litter potential compared to bags;
- well suited to high residential areas;
- higher resident participation rates and yield of recyclables are observed;
- longer container life compared to bags; and
- open crates reduce the incidence of contamination by unacceptable materials.

Disadvantages associated with the crate collection system include:

- manual lifting of crates creates an increased risk of injury compared to MGBs;
- lower recovery rates are observed and the storage capacity is less than that of MGBs;
- greater litter potential compared to MGBs particularly for wind blown litter;
- where a lid is not provided, privacy issues may be a concern;

- the need to make residents aware of requirements to crush containers given lower capacity; and
- the user must lift and carry crate.

Bundled Paper System

The bundled paper collection system is cost effective to implement initially and reduces the cost of separating paper from other recyclables. However, implementation of this system in the North Queensland region is not practical given the climatic conditions (ie extended periods of rainfall).

MGB System

The MGB recyclable collection unit has the highest diversion and recovery rate of all collection units currently in use. Street littering potential is lowered with this system. The main disadvantages associated with the system are that costs involved in establishing and servicing the system are higher than the bag or crate. Fortnightly recyclable collection is possible due to larger volume availability.

7.6 Summary

The existing waste and recycling collection systems vary throughout the North Queensland Region (as detailed in Section 3). In selecting collection systems, there are benefits of having a regional approach for both waste and recyclables. These include potential economies of scale and greater opportunities to take advantage of new techniques in waste minimisation.

Studies by BIEC show that more waste is generated per household when larger bins are used for waste collection and that more recyclables are placed in the waste stream. Therefore to minimise waste produced, containers used for collection of garbage should provide a weekly capacity of not more than 120L. However, a larger bin would be required for systems that involve collection of both domestic and garden waste.

8. LANDFILL MANAGEMENT

8.1 Overview

The effective management of landfills minimises environmental degradation and extends the operational life of a landfill. It also encourages resource recovery and waste minimisation. Poor landfill operation can lead to contamination of groundwater, surface water and surrounding flora and fauna, and can become a source of public complaint if offensive odours or litter are generated or if the operations are aesthetically displeasing.

There are no standards or guidelines for the development, operation and rehabilitation of landfills in Queensland. Guidelines have been establish in other States, *viz.* NSW EPA *Environmental Guidelines: Solid Waste Landfills* and Victorian *State Environment Protection Policy (Siting and Management of Landfills Receiving Municipal Wastes)*. Best practice for operations at North Queensland landfills has been developed from these documents, together with experience in establishment of major landfills in the Brisbane region. A comparison of NSW and Victorian guidelines is included in Appendix G.

8.2 Landfill Operations

This section outlines best practice requirements for a number of factors pertinent to landfill operations.

Signage: Prominent signage is a feature of best practice and can encourage resource recovery. Signage is required at the main point of entry and should specify (as a minimum):

- types of waste accepted;
- types of waste prohibited;
- prohibition of flammable liquids or any burning requirements applicable to the site;
- location of where waste can be deposited;
- types of materials recycled;
- hours of operation; and
- fees.

Signage should also be used to direct traffic movements at the facility.

Fencing/Security: Effective secure fencing is required. The security requirements of a landfill will vary with respect to rural or urban locations. Site fencing can consist of a wire mesh fence around the site perimeter, stock-proof fence, lockable gates and relocatable litter screens near the tipping area.

Aesthetic Screening: Aesthetic screening forms part of best practice. However the degree of site screening implemented will vary according to the landform, location and the visual impact of the landfill operations. Site screening may include planting of trees, shrubs and other vegetation or the use of fences and/or earthen embankments.

Access Roads: All weather internal roads should be constructed from the site entrance of the landfill to the initial tipping area. Wheel washing equipment should be installed so that mud from vehicles is not taken off-site.

Fire Control: Landfills should provide adequate fire control mechanisms. These may include fire breaks, access from all areas to reticulated or non-reticulated water supplies, fire contingency plans and provision of fire fighting equipment. On-site burning of materials should be restricted.

Cover Material: Sufficient stockpiles of cover material for a given period should be provided and readily available on site. Typically waste should be covered within 24 hours of the day of delivery to minimise the exposure of waste and hence minimise vermin, litter and odour issues.

Airspace: Landfill capacity can be optimised with heavy compaction and diversion of low density material. Machinery capable of achieving high waste compaction should be used at landfills where feasible.

Surface Water / Stormwater Management: The use of cut-off drains and/or diversion banks to control surface water and management of stormwater is recognised as best practice. To minimise the potential impact on waterways, landfills should be sited away from any water bodies and floodplain areas.

Leachate Management: A leachate collection and management system should be implemented to minimise potential impacts on groundwater and surface water quality.

Groundwater Management: According to best practice, landfill cells should be lined to minimise the infiltration of leachate into the groundwater system. Groundwater monitoring and sampling programs should be implemented to ascertain whether measures undertaken to prevent groundwater pollution are adequate.

Landfill Gas: Where landfill gas is generated in excess of permissible levels or presents an odour problem or a hazard, best practice requires collection and combustion or recovery and use. Monitoring is also required.

Supervision and Waste Inspection: Waste management facilities should be supervised to allow monitoring of incoming waste and to ensure that waste is being handled appropriately. The degree of supervision may depend on the size of the landfill and/or population served.

Waste Recording: Waste recording systems should be implemented at waste disposal facilities. The amount, type and source of incoming waste should be reported on a monthly basis. Waste should be classified according to the system utilised by the Australian Waste Database.

Recycling: Site Environmental Management Plans should provide a strategy for the recovery of material. This may include the recovery of recyclable materials such as glass, plastic, aluminium, paper/cardboard and steel, reprocessing of garden waste into mulch, and provision of a Reuse and Repair Centre at the facility.

Vermin Control: A program should be developed to control vermin. Measures include minimising the exposure of waste at the tipping face.

Litter Control: To minimise the generation of litter the exposure of waste should be minimised. Litter containment measures such as relocatable litter screens should be implemented. Site fencing, gates and litter screens should be frequently cleared of litter.

Staff Training: Staff training that enables environmentally responsible and safe management of waste and ensures compliance with Site Based Management Plans should be undertaken.

Complaints: Landfill operators should maintain a record of all complaints and have a response procedure in place.

8.3 Site Evaluation

All landfills in the region have been rated on their level of compliance with best practice guidelines outlined above. The assessment summarised in Table 8.1 is based on site observations. It is acknowledged that Site Based Management Plans have been developed for several facilities operating throughout North Queensland. Operations at landfill sites generally comply with specifications in the plans. However, it should be noted that the assessment summarised in Table 8.1 is based on site observations and does not necessarily reflect the content of the Site Based Management Plans.

Each category has been rated as follows:

A	The measures provided are adequate
B	Most measures provided – minimal upgrade required
C	Minimal measures provided – extensive upgrade required
D	Measures not provided
FIR	Further investigation required

TABLE 8.1 OPERATION COMPLIANCE WITH BEST PRACTICE GUIDELINES

Municipality	Signs	Fencing	Site Screening Works	Access Roads	Fire Control	Cover Material	Water Management Works	Groundwater Quality	Landfill Gas	Recycling	Vermin Control
BURDEKIN											
Kirknie Road	C	C	C	B	B	B	C	FIR	D	D	C
CHARTERS TOWERS											
Stubley Street	C	C	C	A	C	B	C	FIR	D	C	C
DALRYMPLE											
Balfes Creek	D	C	C	C	D	C	D	FIR	D	D	D
Greenvale	D	D	C	C	D	C	D	FIR	D	D	D
Homestead	D	C	C	C	D	C	D	FIR	D	D	D
Mingela	D	C	C	C	D	C	D	FIR	D	D	D
Pentland	D	C	C	C	D	C	D	FIR	D	D	D
Ravenswood	D	C	C	C	D	C	D	FIR	D	D	D
Sellheim	D	D	C	C	D	C	D	FIR	D	D	D
HINCHINBROOK											
Forrest Beach	D	D	D	C	D	C	D	FIR	D	D	D
Ingham	C	C	C	B	C	A	C	FIR	D	C	C
Warrens Hill	C	C	C	B	C	A	C	FIR	D	D	C
THURINGOWA											
Jensen	B	C	B	C	C	A	C	B	D	B	C
Ross	B	C	C	B	B	A	C	B	D	B	C
TOWNSVILLE											
Cungulla	B	D	D	C	D	C	D	B	D	D	D
Majors Creek	B	C	C	C	D	C	D	B	D	D	C
Picnic Bay	B	B	B	B	B	C	C	B	D	D	C
Vantassel Street	B	C	C	B	B	A	C	B	C	B	C

8.4 Mechanical Equipment Required

The density of waste achieved in landfill operations will bear a significant influence on the lifespan of the facility. In turn the density of waste in landfills will vary depending on the type of compaction equipment used and the composition of the waste.

Compaction attained by the tracks of a bulldozer of D4/D6 size or equivalent will achieve a density in the order of 300 kg/m^3. In comparison, the density of domestic garbage in a compactor collection vehicle is approximately 360 kg/m^3. Specialised compaction plant can achieve a density of between 700 kg and 800 kg/m^3. Heavy compaction, shredding, baling equipment and reducing the volume of low density materials disposed to landfill can achieve landfill densities of over 1 tonne per m^3.

The majority of landfills in the region achieve only minimal compaction. Compaction is usually by bulldozer or similar plant, with densities in the order of 300 kg/m^3 for the smaller rural landfills.

In the larger landfills the density of compaction ranges between 450 and 800 kg/m^3. This is due largely to compaction during collection, the use of heavier plant at the landfills and also some natural settlement. Estimated compaction rates achieved at landfills in the North Queensland region are outlined in Table 8.2.

TABLE 8.2 ESTIMATED LANDFILL COMPACTION RATES

MUNICIPALITY	LOCATION	COMPACTION RATE kg/m^3
Burdekin	Kirknie Road	300
Charters Towers	Stubley Street, Charters Towers	300
Dalrymple	Balfes Creek	100
	Greenvale	100
	Homestead	100
	Mingela	100
	Pentland	100
	Ravenswood	100
	Sellheim	100
Hinchinbrook	Forrest Beach	450
	Ingham	800
	Warrens Hill	800
Thuringowa	Jensen	600
	Ross	600
Townsville	Cungulla	300
	Majors Creek	300
	Picnic Bay	600
	Vantassel Street, Townsville	800

8.5 Landfill Rehabilitation vs Landfill Upgrade

Environmental protection measures required at landfill sites to protect groundwater and surface water, reduce greenhouse gas emissions and minimise future environmental liabilities are likely to be prohibitive at many smaller landfill sites. Accurate costings will depend on more detailed assessments of the environmental protection measures required at each site.

The main advantage of retaining smaller landfills is that rehabilitation costs are incurred later rather than sooner, therefore not adding to budget pressures for

capital funds. The cost of providing kerbside collection services may be increased if waste has to be transported greater distances to a regional landfill site.

The advantages of closing and rehabilitating landfills and replacing them with transfer stations are many:

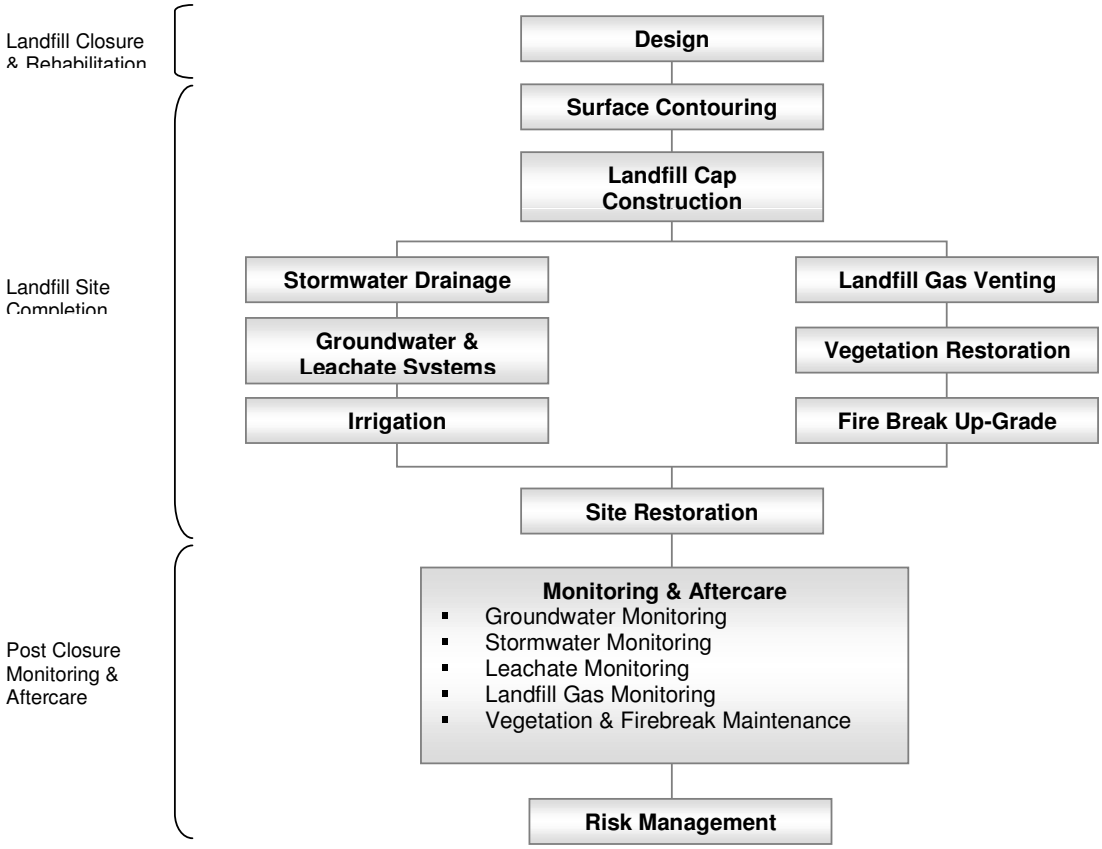
- the cost of upgrading landfills to minimise potential environmental impacts is avoided;
- better environmental standards and reduced environmental effects;
- improved separation of materials and recovery of resources can be achieved;
- greenhouse gas emissions can be reduced through better management procedures;
- rehabilitated land is available for uses other than waste disposal;
- transfer stations can be operated so that off-site impacts are less than that for a landfill (i.e. the waste is not actually disposed on site);
- less community opposition to the operation of a transfer station rather than landfill;
- lesser buffer distances required;
- cost savings through the purchase of landfill machinery for one site rather than many sites; and
- reduced operating costs through economies of scale.

8.6 Landfill Site Completion & Rehabilitation

Best practice requires that a detailed rehabilitation or closure plan be prepared and submitted to the EPA prior to closure. The requirements for site completion for those sites expected to close in the short term (5 years) will vary depending upon the size of the site, the method of landfilling and environmental conditions.

The closure and rehabilitation plan approach is outlined in Figure 8.1.

FIGURE 8.1 CLOSURE & REHABILITATION PLAN APPROACH



Upon completion a site-sealing or final layer of low permeability compacted earth, not less than 0.5 metres in depth should be installed. The final surface of the tipping area or part thereof should be covered with topsoil, sloped, drained and vegetated to minimise erosion and infiltration and to prevent the ponding of stormwater.

Best practice works for landfill rehabilitation are summarised as follows:

- **Seal-bearing layer:** properly designed and engineered layer of material.
- **Gas drainage layer:** minimum thickness of 0.3 metres. Calcium carbonate content of layer must not exceed 10% by weight in order to prevent encrustation
- **Sealing layer:** consist of a clay layer at least 0.5 metres thick with a permeability of less than $K = 10^{-8}$ ms^{-1}. If the sealing layer is to be left for a period greater than seven days before the following layer is placed, a flexible membrane liner protection layer should be temporarily put into place.
- **Infiltration drainage layer:** drainage layer to be placed over sealing layer. This layer should not be less than 0.3 metres in thickness with a permeability of at least $K = 10^{-5}$ ms^{-1}.

- **Revegetation layer:** this final layer should not be less than 0.1 metres in thickness. It should be noted that vegetation selected should not have root systems that will penetrate beyond the revegetation layer or the drainage layer.

Final settlement of the seal-bearing surface should leave a gradient of greater than 5% to defined drainage points.

In accordance with best practice a closure plan should be submitted to the EPA. Specifically the plan should include:

- the proposed steps taken in closing and stabilising the premises concerned and the time frame required;
- outline of leachate collection, gas collection, stormwater sediment controls, monitoring and reporting practices to ensure ongoing standard equivalent to that during operation of the site;
- proper recording of complaints from local residents and relevant contacts for the discussion of any community problems; and
- documentation of the intention to use waste materials in the remediation of the site.

8.7 Greenhouse Gas Emissions from Landfill

Landfills are the main source of greenhouse gas (GHG) emissions from solid waste. The impact from landfills can be minimised through the diversion of organic material from landfills. Options for the management of landfill gas are listed below in order of preference:

- waste reduction;
- reuse, recycling or energy recovery;
- landfill gas energy recovery;
- landfill gas flaring; and
- landfill gas monitoring.

As discussed in Section 6.10.4, a critical volume of over 1 million tonnes of waste needs to be deposited in landfill before it becomes a viable option for a landfill gas extraction system. Based on all total waste generated in the North Queensland region, this quantity is achieved in less than 5 years.

It is estimated that the greenhouse gas emissions from a regional landfill (i.e. all waste to one facility) is in the order of 250,000 tonnes CO_2e/annum). Should an energy recovery system be implemented to convert methane to electricity, it is estimated that the amount of electricity generated would be in the order of 20,000,000 kWh/year.

8.8 Summary

It follows that the number of landfills in the region should be rationalised in terms of:

- minimising future environmental liabilities;
- cost of compliance with best practice works;
- continued costs of landfill operation and maintenance;
- size of population served;
- proximity of landfill to other waste disposal facilities;
- improved economics through use of transfer stations; and
- remaining lifespan of landfill.

The North Queensland region should investigate a program of landfill closure and rehabilitation across the region as detailed in Table 14.1. The majority of landfills that are not recommended for closure could serve as sub-regional landfills. Proposed future landfills should be operated as sub-regional or regional landfill sites and developed such that the requirements listed by the EP Act, the EPP (Waste Management) and other best practice guidelines are met.

Regional landfills provide a higher level of service option in terms of landfill management. The development of a number of regional landfills has implications for waste minimisation by HESROC-NQ through better compaction of landfilled waste. Specialised waste compaction machinery will achieve a compaction rate of at least 800 kg/m^3 and should be used at regional landfill facilities.

9. TRANSFER STATION MANAGEMENT

There is a trend towards replacing landfills with transfer stations as this is seen to be a more environmentally and economically sound option than replacing landfills with new landfills. Siting requirements for new landfills are becoming more demanding according to the policies following best practice. Maintaining appropriate buffer distances and not impacting on any beneficial use of groundwater is costly. Establishing transfer stations is an alternative to landfills.

9.1 Best Practice

The *Guide to Best Practice at Transfer Stations* (EcoRecycle Victoria 1998) provides a framework for best practice environmental management. Issues to be addressed when constructing a new transfer station or operating an existing facility include:

- resource recovery and recycling;
- environmental impacts;
- occupational health and safety;
- traffic management;
- site infrastructure and equipment; and
- management systems.

9.1.1 Resource Recovery and Recycling

Removing recyclable material from the waste stream provides income from the sale of recyclables, reduces landfill disposal costs, extends the life of landfills and meets community expectations for recycling. Transfer stations will encourage resource recovery and recycling through provision of infrastructure and education strategies to maximise the amount of material recovered. The following strategies will maximise the amount of material recovered:

- provision of easy access to the recycling section through appropriate entry arrangements, traffic circulation, signage, unloading areas and hours of operation;
- minimise contamination of the recycling stream through supervision, signage, usage of appropriate containers for recyclables collection and regular cleaning of the site; and
- community education, signage and differential pricing for disposal of waste and recyclables at transfer stations.

9.1.2 Environmental Management

Environmental management plans must be in place to overcome potential environmental risks. The most significant factors influencing the environmental impact of a transfer station are the type of wastes accepted and the duration that the waste resides in the transfer station before transfer to landfill.

Impacts addressed should include waste receival, litter control, odour management, stormwater management, vermin control, noise attenuation, dust control, aesthetic appearance and risk management.

9.1.3 Occupational Health and Safety

Work practices at transfer stations should comply with the relevant legislation. A code of practice for the waste management and recycling industry entitled *Health and Safety at Work: Waste Management & Recycling Industry* has been developed for use in NSW and Victoria, and may be used as a guide.

An occupational health and safety plan should identify risks and emergency responses. Dangerous materials including batteries, oils and asbestos require special storage, handling and transport in order to minimise adverse impacts on operators, the public and the environment. Physical conditions on site, emergency planning, safety equipment, barriers, signs and site supervision is important for public safety.

9.1.4 Traffic Management

All weather access should be provided at transfer stations. Access roads should have adequate queuing space and easy entry and exit arrangements. Internal roads should be wide enough to accommodate trucks and signs should direct the public towards recyclables and waste unloading areas.

9.1.5 Site Infrastructure and Equipment

Basic infrastructure including fencing, signage and fire fighting facilities is required at all transfer stations. Different equipment is required for different size, type and waste volumes of materials handled in a transfer station.

The operational efficiency of a transfer station depends largely on the design, layout and provision of site structures. Site structures include buildings, paving and roofing, staff and/or public amenities and landscaping. Design of the site structures should be similar to the level of service expected by the community served by the facility.

9.1.6 Management Systems

Effective management systems for productive and efficient operations of transfer stations should be in place. Key elements include organisational management, environmental management plan, financial reporting and control, and quality control. The correct management system implemented for a transfer station should be flexible enough to allow for changing demands of the community, local Councils, EPA and any other relevant bodies.

9.2 Transfer Station Design

The type of transfer station chosen for a particular site depends on:

- site requirements and restrictions;
- transport logistics and economics;
- waste type and throughput; and
- population serviced and distribution.

A number of types of transfer stations exist and include skips, transfer trailers, push pits and mechanical rams. The commonly used transfer stations types are categorised in Table 9.1.

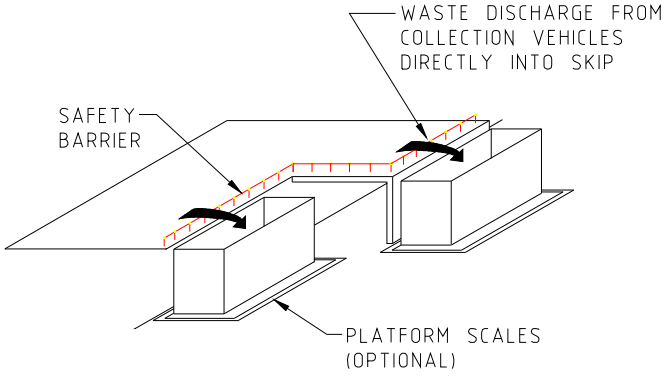
TABLE 9.1 TRANSFER STATION CLASSIFICATION

CLASSIFICATION	THROUGHPUT (tonnes/annum)	FACILITY
Category 1	500 – 10,000	Skips, Transfer Trailers
Category 2	10,000 – 30,000	Push Pits, Skips
Category 3	30,000 – 50,000	Mechanical Ram, Push Pits
Category 4	>50,000	Mechanical Ram, Push Pits

Skips

Waste from collection trucks and/or the general public is directly emptied into skips. The size and number of skips utilised at the transfer station is dependent on the waste throughput and range in size from 3m^3 to 40m^3. Waste from the skip is either transferred to a transporter truck or deposited into a compactor truck and sent to landfill. Alternatively, the skip may be transported to landfill for disposal of waste and then returned to the site. Figure 9.1 illustrates the skip arrangement.

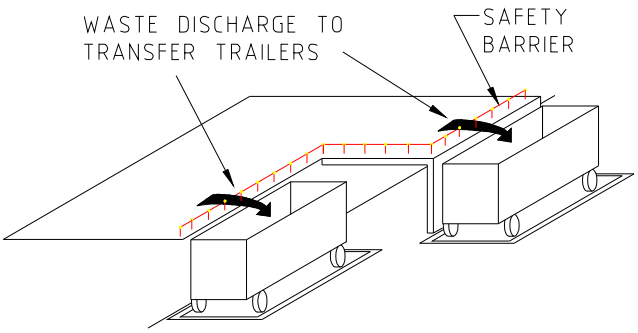
FIGURE 9.1 SKIP TYPE TRANSFER STATION



Transfer Trailers

This arrangement is similar to the skip operation, however, transfer trailers can be connected to prime movers for haulage to landfill. Unlike skips, transfer trailers have a greater capacity ranging up to 70m^3. Thus, transfer trailers will be used in preference to skips when the expected throughput is larger and the facility is within close proximity to the landfill. Figure 9.2 illustrates the transfer trailer arrangement.

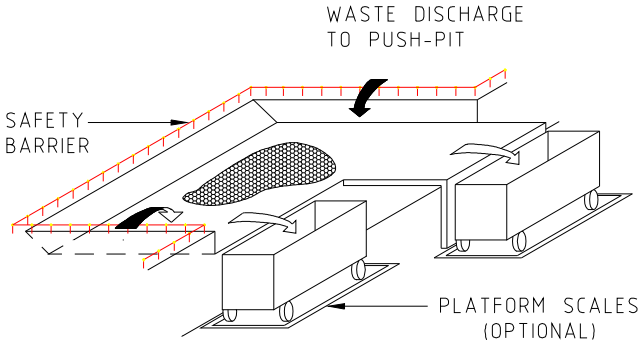
FIGURE 9.2 TRANSFER TRAILER TYPE OPERATION



Push Pits

Waste is emptied into a push pit prior to being discharged into transfer trailers. This arrangement allows for storage and further recovery of recyclable material. A schematic of this type of operation is shown in Figure 9.3.

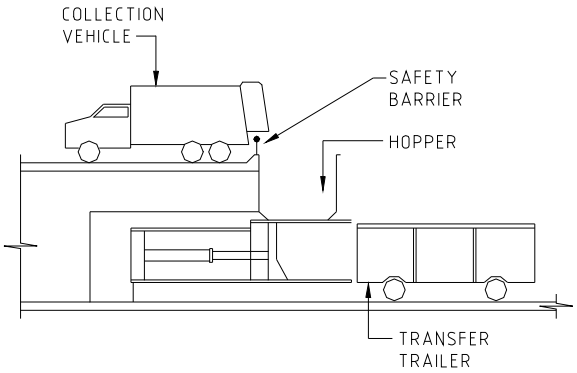
FIGURE 9.3 PUSH PIT TYPE OPERATION



Mechanical Rams

The mechanical ram arrangement utilises a hopper, compactor and transport vehicle. Waste is deposited into the hopper which in turn empties the waste into the transport vehicle. The waste is then compacted mechanically by a stationary compactor. Mechanical rams are usually only installed when a transfer station is expected to receive over 30,000 tonnes/annum of waste. A schematic of this type of arrangement is shown in Figure 9.4.

FIGURE 9.4 MECHANICAL RAM TYPE TRANSFER STATION



9.3 Summary

Transfer stations should be established in terms of best practice and designed such that infrastructure is appropriate for the expected annual waste throughput. Consideration should be given to the expected waste throughput in 20 years time.

Transfer stations are a better alternative to landfill given the cost of complying with landfill best practice and difficulties in siting new landfills. Transfer stations are able to maintain, or increase, the level of service provided to residents in terms of disposal of domestic waste and collection of recyclables and garden waste.

It is important in operation of transfer stations that a high level of amenity is maintained. This will encourage the users to use the facility in an appropriate manner.

10. COMMERCIAL & INDUSTRIAL WASTE MANAGEMENT

10.1 Overview

The North Queensland region supports a variety of industries including agricultural, mining and refining, and manufacturing industries. The types of solid wastes produced by these industries include chemical containers, packaging waste, general office waste, putrescible waste from food manufacturing and processing, bagasse, mill mud, slag and tailings.

Commercial and industrial waste management is not typically the responsibility of Local Government. However, if a policy response or strategic approach is taken by HESROC-NQ it may lead to number of advantages:

- maximise recycling from commercial and industrial waste management;
- contribute to the viability of an organic processing facility; and
- improved industry economics.

The commercial and industrial sector produces a number of wastes that can be problematic due to their hazardous nature or the sheer volumes of waste produced. Whilst many of the wastes produced are industry specific, common problems with wastes (such as tyres, particularly for the mining industry) are shared across the region.

Industry generally employs private waste management contractors to collect wastes and transport them to landfill. Segregating paper, cardboard and metals is a well established practice in some businesses but for others it has not been considered.

10.2 Commercial & Industrial Sector Profile

The number of businesses in the North Queensland region commercial and industrial sectors are listed in Table 10.1. Whilst the majority of businesses are small operations with less than 10 employees, a significant number are operations with large numbers of employees. Both small and large operations can be targeted for waste minimisation programs. For smaller businesses, education can be focussed at the industry sector e.g. food retail outlets. In larger companies (for example employing over 50 people), individual enterprises may be approached.

TABLE 10.1 NUMBER OF BUSINESSES IN NORTH QUEENSLAND (1998)

INDUSTRY CLASSIFICATION	NO. OF EMPLOYEES						
	N/A	<5	5 - 9	10 - 19	20 - 49	50 - 99	> 100
Agriculture, Forestry, Fishing	1,137	884	35	9	5	0	0
Mining	0	52	11	6	16	4	2
Manufacturing	0	236	105	65	38	7	13
Electricity, Gas, Water	0	21	8	3	2	4	3
Construction	0	872	121	41	16	6	1
Wholesale, Retail	0	1,448	562	210	55	22	16
Transport & Storage	0	452	61	35	22	3	2
Communication	0	36	7	5	5	0	3
Finance & Insurance, Property & Business	0	990	229	99	56	14	5
Government Administration & Defence	0	37	16	20	18	6	8
Health & Community Services, Education, Recreation & Cultural Services	0	671	206	123	79	32	21
Accommodation, Cafes, Restaurants	0	214	117	66	27	9	1
Personal & Other Services	0	370	84	16	9	3	2
TOTAL	1,137	6,283	1,562	698	348	110	77

Source: ABS Business Data – North Queensland (1998)
Note: N/A - Not available

10.3 Regulated Wastes and Special Wastes

The EPA has recently released the outcomes of a Regulated/Hazardous Waste survey for Queensland. The volumes give an indication of the main types of Regulated Wastes being produced by different industries and what types of wastes are generated. The predicted volumes of wastes (both industry specific and for generic wastes) in the North Queensland region are given in Tables 10.1 and 10.2.

TABLE 10.2 NORTH QUEENSLAND INDUSTRY SPECIFIC WASTES

WASTE TYPE	UNITS	VALUE	WASTE TYPE	UNITS	VALUE
Abattoir effluent	ML	1,000	Infectious wastes	kL	1.3
Abattoir sludge	kt	43	Metal finishing effluent	kL	27
Alum sludge	kt	2.6	Metal finishing residue	T	130
Biosolids	kt	22	Pharmaceutical wastes	T	25
Cytotoxic wastes	t	13	Photo-processing effluent	kL	2,900
Dairy processing effluent	ML	0.18	Pickling liquors	kL	16
Dairy processing sludges	kt	0.01	Printing effluent	GL	7.6
Electroplating effluent	ML	14	Seafood processing effluent	kL	0.38
Electroplating residues	t	53	Seafood processing sludge	T	120
Food processing effluent	GL	0.51	Slag and dross	kt	5.3
Food processing solids	kt	5.7	Sugar processing effluent	ML	2,100
Foundry sand	kt	3.7	Sugar processing solids	kt	4,900
Heat treatment salts	kg	320	Timber treatment wastes	T	1.5
Industrial effluent n.e.c.	GL	270	Vegetable oils	kL	280
Industrial sludges n.e.c.	t	290			

Source: Summary of the Regulated/Hazardous Waste Survey for Queensland 1997 (EPA 2000)
Note: n.e.c. – not elsewhere classified

TABLE 10.3 NORTH QUEENSLAND GENERIC WASTES

WASTE TYPE	UNITS	VALUE	WASTE TYPE	UNITS	VALUE
Abrasive sand/grit/residues	t	75	Oils	kL	900
Acids and acid solutions	ML	90	Oily wastewaters	ML	7
Adhesives	L	2,100	Paint wastes – solv. based	T	13
Alkalis/alkaline solutions	ML	190	Paint wastes – water based	T	40
Alkalis and lime residues	t	4	Pesticide wastes	kL	27
Asbestos	t	1,100	Resins	kL	9.2
Batteries (car)	No.	22,000	Saline effluent	ML	12
Biocides	L	1,100	Saline residue	T	280
Catalysts	kL	40	Solvent recovery residues	T	2,500
Detergents	kL	250	Solvents—aqueous	kL	24
Dyes	L	1,200	Solvents – chlorinated	kL	8
Fly ash	kt	520	Solvents – general	kL	39
Herbicide wastes	kL	7	Surfactants	kL	16
Inks	kL	120	Tars and tarry residues	T	14
Laboratory effluents	kL	620	Tyres	No.	110,000
Lubricant grease wastes	t	22	Vehicle wash down waters	ML	12
Oil interceptor sludges	kL	460			

Source: Summary of the Regulated/Hazardous Waste Survey for Queensland 1997 (EPA, 2000)

These figures are estimated volumes of wastes produced solely in the HESROC-NQ region. It should be noted that Regulated Waste from outside the region (e.g. Cairns) is also brought into the North Queensland region for treatment and disposal (refer Section 10.4.1). The volume of this imported waste is not known.

As can be seen from these tables, a variety of waste types are produced by a number of industries in the region. The cost of handling, transport and disposal of these wastes impacts on the viability of regional industries, as well as contributing to additional waste infrastructure requirements that need to be provided by local Councils. Improving the management of commercial and industrial waste is necessary to achieve significant reduction in the waste deposited to landfill. Waste minimisation and reuse will also improve the efficiencies of businesses in the region.

A number of the wastes produced in the region have been identified as possible resources for other industries. These wastes/resources are discussed further in the following sections.

10.3.1 Biosolids

Biosolids from local sewage treatment plants can provide a useful nitrogen rich feedstock for composting or can be used in other organic waste processing options such as energy recovery. Land application of biosolids can also be considered. It has been predicated that 22,000 tonnes of biosolids were produced in the North Queensland region for the 1996-97 period (EPA 2000).

The use of biosolids in organic waste processing is discussed further in Section 11.

10.3.2 Agricultural Wastes

Agriculture in the North Queensland region is a significant industry, with beef cattle farming the most prominent agricultural enterprise in most Council areas,

with the exception of Burdekin and Hinchinbrook. Sugar cane growing is the largest agricultural industry in these two municipalities; it is also significant in Thuringowa. Prawn and marine fishing is another important industry in the region.

Beef cattle grazing and sugar cane farming itself do not produce large amounts of waste; most waste is produced at the processing stage (i.e. abattoirs, sugar refineries). However, plastic and metal containers from chemicals such as fertilisers and pesticides are a problem, together with wire, corrugated iron, pipes, and old farm equipment which is typically disposed to landfill. Black plastic used in horticulture is often burnt. Alternatives for the management of these wastes are discussed in Section 6.

10.3.3 Sugar Cane Milling and Refining

In production of raw sugar, mills produce wastes such as molasses, bagasse and mill mud. Molasses has a dark syrupy texture and can be used in distillation of industrial alcohols (such as ethanol), rum and carbon dioxide. Molasses also has a significant market as stock feed for animals such as cattle, both domestically and overseas.

Bagasse is the fibrous material left after the sugar juice has been extracted and is used successfully as a fuel for steam and electricity generation at the mills. Excess electricity can be exported to the State electricity grid. Bagasse is also used as mulch and in paper production.

Filter mud (mill mud) which is produced in extremely large volumes is often returned to the cane farms to replenish soil organic matter. Boiler ash is also produced from the mill stacks.

10.3.4 Mineral Ore Mining and Refining

Mining companies and metal refineries (copper, nickel and zinc) in the region have their own waste management strategies that cover collection and disposal. Some wastes are disposed to the municipal waste management facility, however, wastes such as mine tailings and liquid wastes are treated/disposed on the property of the mining company.

The wastes from the refineries vary in composition depending on processing and extraction methods used. They often contain heavy metals which may impact adversely on some production processes. The potential to use or recover these materials is subject to the requirements of specific processes and must be assessed individually following chemical analysis of waste constituents.

10.3.5 Waste Oils & Grease Trap Sludges

Waste oil and grease trap sludge from the North Queensland region is collected by a private company (NQ Resource Recovery) licensed to do so by the EPA. The oil and sludges are transported from the bulk storage area to a hydrocarbon recycling plant, where it is reprocessed as a fuel oil capable of meeting the emission limits required by the EPA.

Waste sludges and cooking oils may be incorporated into a regional composting or similar organics processing facility depending on quality.

10.3.6 Service Industry Waste

The service industry is a major source of recyclable material such as paper, cardboard, glass, aluminium and food waste. Some of these industries currently receive a waste and recyclables collection service from local Councils throughout the HESROC-NQ area. Institutions and offices should be encouraged to encompass the 'paperless' office mentality. Reusable containers can be utilised for the transport of products to retail stores. These may be made from recycled plastic.

10.4 Regulated Waste Management

10.4.1 Current Regulated Waste Treatment/Disposal

Currently two private contractors in North Queensland accept a variety of Regulated Wastes from both within and outside the HESROC-NQ region. NQ Resource Recovery carry out hydrocarbon recycling where waste oil and oily water is processed into fuel oil at their Bohle plant. Clinical wastes from hospitals in the region are treated by Regwaste Australia using an autoclave in Townsville, with residual waste being deposited at the Vantassel Street, Townsville landfill. The business also collects lead batteries, solvents, detergents, acids and alkaline solutions.

NQ Resource Recovery also has a chemical fixation, stabilisation and solidification plant. This allows for chemical conversion of products to reduce solubility and immobilise the harmful components. The resulting encapsulated solids are then subjected to leaching tests to determine whether the material can be disposed of safely. Hazardous materials that cannot be immobilised by chemical fixation are sent to an incinerator in Melbourne for safe disposal.

Tyres are another Regulated Waste which is generated in large volumes in the North Queensland region; currently these are shredded and landfilled, although it is proposed that they be used for fuel in a cement kiln in Gladstone.

10.4.2 Future Treatment Options

Regional contracts may be established to service all the potential sources of hazardous and Regulated Waste. Options could be investigated for a regional Regulated Waste facility should further treatment be required in the North Queensland region. While such a facility would require significant capital costs to establish, it would reduce the high on-going transport costs involved in transport of Regulated Waste to facilities in southern Australia (viz. Melbourne). This facility could form part of a Southern Regional Waste Management Facility as discussed in Section 14.7. Approval would be required from the EPA to establish such a facility.

Options for treatment of hazardous wastes commonly involve high temperature technology which allows the adaptation of a waste-to-energy plant to also cater for these wastes. High temperature technologies include gasification, plasma arc combustion, hydrogenation, molten media and vitrification. Some technologies are better suited for specific types of hazardous waste such as soils contaminated with pesticides or liquid wastes. Non-combustion technologies include solvent extraction and ionic replacement.

A detailed investigation of the Regulated Waste produced in the region is required to determine the viability of establishing a new facility or whether existing facilities have adequate capacity or the potential to be expanded for this purpose.

10.4.3 Waste Tracking System

Tracking systems using waste transport certificates have been established for some time in a number of Australian States (including NSW, Victoria and South Australia), and a National Environment Protection Measure has been implemented to monitor the movement of hazardous waste between the States and Territories. The *Environmental Protection (Waste Management) Regulation 2000* enacted on 1st July, 2000 recently established new requirements on tracking of Regulated Waste in Queensland. The Waste Management Regulation outlined a wide range of trackable wastes for which records must be maintained to monitor the movement of these waste types from generator to transporter through to receiver (or disposal point). This requirement does not apply to the non-commercial transportation of less than 250 kg of trackable waste.

The waste tracking system requires the receiver of trackable waste to record information regarding the waste source, transportation and acceptance of waste, and provide this data to the EPA. Information required includes:

- generation details, including the name and address of the generator, the type, amount and physical nature of the waste;
- transportation details, including the transporter's name and address, environmental authority number and vehicle registration;
- amount and type of waste accepted; and
- whether the waste is received for recycling, conversion to energy, another type of treatment, storage or disposal.

A number of these trackable wastes are deposited at landfills under the management of HESROC-NQ member municipalities. Trackable wastes which account for significant volumes deposited at landfills in the region include tyres, residues of clinical wastes and animal effluent and residues. As a receiver of trackable waste, member Councils may therefore have obligations to record and provide information on this waste to the EPA.

Current systems to record data on waste received at North Queensland landfills are unsophisticated, and information on the source, types and amounts of Regulated Waste deposited at each landfill in the region is incomplete. It is known that trackable wastes are deposited at the Vantassel Street Landfill in Townsville. It is also possible that trackable wastes are deposited at unsupervised facilities in the region; establishment of supervision at appropriate landfills should therefore be a priority of HESROC-NQ.

A data recording system should be established to enable HESROC-NQ member Councils to provide the required information on trackable wastes to the EPA. The system may incorporate manual recording or (with the approval of the EPA) be established in electronic format.

10.5 Regional Industry Collaboration

Interest has been expressed by a number of regional industries in collaborating on waste minimisation issues. In order to initiate this process, industry representatives should be encouraged to participate in a regional round table discussion to identify common industry waste management needs.

An outcome of this process may be the formation of an Industry Task Force to provide an opportunity for ongoing collaboration and exchange of ideas regarding

waste minimisation. It may also provide opportunities for the establishment of regional contract arrangements for the collection of recyclables and supply of materials in bulk. For example, a regional contractor can collect organic sludges and materials from industries and transport the waste to a regional composting facility.

The Industry Task Force could also identify opportunities for and investigate techniques in cleaner production practices to eliminate or reduce the production of wastes. Avoiding or minimising the packaging of raw material from suppliers and products is also an area to be considered. One industry in the region has already made gains in this area with bulk supply of chemicals as part of their contracts. This experience could be shared with other industries and further investigation of methods for optimising the use of raw materials and recycling of waste products can be made.

Support by industry was also flagged for a Regional Waste Officer. This role could help the Task Force and individual industries implement identified waste minimisation practices and education. The Regional Waste Officer could also keep industry informed of changes in legislation and new programs initiated that impact on industry in the area.

Other established organisations in the region such as Townsville Enterprise Limited may also be able to help coordinate this collaboration as they already have experience in education and training with many industries in the area.

A regional program can also focus on small to medium sized businesses, not only the large industries present in the region.

10.6 Waste Exchange

The Local Government Association of Queensland (LGAQ) is establishing an electronic Resource Exchange Register to help facilitate transfer of industry by-products to other industries as potential resources. This Resource Exchange will be closely linked to the Australian Reusable Resource Network (ARRnetwork) with information from Queensland being fed into the national site.

During the stakeholder consultation, it was highlighted that whilst a State- and nation-wide exchange program had its merits, a more regionally focussed network would be more beneficial, particularly in terms of transport issues. To develop and maintain this, the Regional Waste Officer and/or organisation could provide this service in addition to industry training and assistance.

11. ORGANIC WASTE MANAGEMENT

Over 50% of the total waste stream in the North Queensland region is organic waste. Significant savings can thus be made in landfill capacity if easily separated organics are diverted. Diversion of organic waste from landfill also provides added benefits of reduction in methane and leachate generation which helps lessen the environmental impact of the landfill.

11.1 Current Organic Waste Management

Separation of garden waste is encouraged at the majority of landfills and transfer stations in the region with the provision of a designated area for stockpiling. Management of separated garden waste varies for each site with periodic mulching (such as at transfer stations in Burdekin and Hinchinbrook), and to a lesser extent burning, occurring when stockpiles reach sufficient volumes. Private contractors also provide services to chip garden waste at kerbside and from parks in the region.

Mulching and composting operations are taking place at Vantassel Street Landfill in Townsville. Mulching is also being carried out under contract at the Ross and Jensen Landfills in Thuringowa. The composting operation in Vantassel Street Landfill is an open windrow method with turning of compost piles using backhoe equipment. The compost produced does not undergo any Australian Standards compliance testing.

At landfills in Thuringowa separated garden waste is mulched and used as cover material. This practice has been very successful to date and also saves costs for soil excavation for cover material.

Vermiculture trials have also been established in the region. One such trial is at Ingham Landfill (Hinchinbrook) where fruit and vegetables collected from a supermarket are mixed with shredded newspaper and some garden waste then processed by worms. A small vermiculture trial was also carried out at Giru; this operation did not produce large quantities of vermicast. Other trials are being undertaken outside the HESROC-NQ region (e.g. Johnstone Shire) with support from LAWMAC.

11.2 Sources of Organic Waste

There a number of sources of organic waste within the region that have the potential to be recycled as part of an organic waste management strategy. A significant proportion of organic waste originates from the domestic sector but industries in the North Queensland region that also generate considerable quantities of organic wastes include sewage treatment plants, abattoirs, food manufacturers and processors and the sugar industry. Many commercial and industrial organic wastes, particularly from the sugar industry, do not currently enter the waste stream managed by HESROC-NQ Councils. However, consideration of these wastes is important in a regional approach as they may prove to be valuable feedstock sources for processing systems that require specific composition of wastes or large volumes for viability.

Organic wastes produced in the North Queensland region include:

- **Garden Waste** – Sources of these materials include prunings, leaves, grass, large branches and trees. Grass clippings can be highly putrescible whilst

the remainder is relatively stable. Due to the nature of the region, a high proportion of fibrous material from palms is produced. This material can be troublesome for certain shredding/mulching machinery so the volume of this material will need to be considered in selecting processing equipment.

- **Food Waste** – Food scraps from domestic waste and from commercial operations such as restaurants, bakeries and other food processing plants. Food waste is comprised of non-fatty materials such as vegetables and fruits and fats such as dairy and meat products.

- **Untreated Timber** – Timber off-cuts, crates, pallets and wood packaging from commercial sources. Care needs to be taken to ensure that treated timbers are not included in this stream. Identification of treated timbers can be difficult.

- **Natural Fibrous Material** – Seed husks and straw produced from agricultural industries and can also be used for stock food supply.

- **Processed Fibrous Material** – Paper, cardboard, paper processing sludges and wastes from local packaging industry, brewery sludges and wastes and non-fatty food wastes.

- **Biosolids and Manures** – Sewage biosolids, animal manure, mixtures of manure and biodegradable bedding materials. These wastes are generated from sewage treatment plants, intensive cattle farms such as dairies and feedlots, piggeries and saleyards.

11.3 Processing Methods

A number of processing options are available to recycle organic materials. Methods vary in capital and operational inputs therefore can range significantly in cost per tonne of organic waste processed. Products from these can also have different characteristics hence end uses and value. Processing options are detailed in the following sections.

11.3.1 Size Reduction

Grinding, chipping or mulching is commonly used to process garden waste and wood materials into mulch or for feedstock prior to composting, anaerobic digestion and vermiculture processes. Mulched garden waste may require further pasteurisation (e.g. by heating) to kill weed seeds and other pathogens.

Currently private contractors (both local and Brisbane-based) provide this service in the region on an “as required” basis.

11.3.2 Composting

Complex organisms, naturally presented in the organic waste, carry out biological conversions to form stabilised humus. The organisms are bacteria, fungi, protozoa and nematodes. Heat is generated in the conversion and hence weed seeds, insect eggs and most importantly, pathogens are broken down. The composted material can then be used for a range of products including soil conditioners and potting mix.

There are a number of composting methods including aerated static piles, windrows and in-vessel composting. In Australia, open windrow composting is

the most common type of operation due to the availability of land and the lower capital cost of processing.

In windrow composting, mixed organic waste is placed in rows typically three metres wide, 1.5 to 5 metres high and of variable length. Diffusion and frequent mechanical turning of the pile facilitates aeration. This operation can produce the best balance between operating cost and product value for garden waste.

Independent research by Meinhardt shows that population centres of over 10,000 people can sustain a viable composting facility when significant nitrogen waste sources are available, eg. grease trap sludges and biosolids.

The main parameters to facilitate composting processes are:

- nutrient balance;
- particle size and structural support of compost pile;
- moisture control;
- aeration requirements; and
- temperature and pH.

One of the most critical factors in composting is the suitable carbon to nitrogen ratio and selection of raw materials to achieve this ratio. Addition of biosolids can assist in maintaining this ratio.

For consistent quality of the finished product, it is important to maintain the composting system. This requires monitoring and frequent turning of the piles to ensure that the entire pile is subject to thermophilic conditions for a sufficient period of time. Source separation of organic wastes from the general waste stream helps reduce incidence of contamination (e.g. heavy metals in batteries) in the finished product. Ensuring good source separation is achieved at the beginning of the process will save costs incurred at the end to remove contamination or as loss of product value.

Where composting feedstock is highly odorous, in-vessel composting is the preferred option. A number of technologies are commercially available ranging from composting pile covers through to in-shed composting and totally encapsulated tunnel composting. In Australia, tunnel composting has been adapted to save on space requirements by using a vertical column. Enclosed or in-vessel options can require high costs for establishment and operation. More sophisticated systems provide filters to remove odours from the process air. These filters also often utilise mature compost to form a biofilter to assist in removing volatile substances.

Methods to compost the entire waste stream are available (as discussed in Section 6.8).

11.3.3 Vermiculture

Earthworms are used to convert organics into a soil-like product. Work is under way to quantify whether pathogens are still present after processing or whether microbial action within the worm is sufficient to break them down.

There is concern that the vermiculture process does not adequately treat weed seeds since the relatively high temperatures required to destroy seeds are not achieved. Some vermiculture operations include an initial composting stage to help overcome these issues. This is known as vermicomposting. A number of

high value products can result from vermiculture operations such as vermicast, vermicompost and liquid fertiliser.

Vermiculture operations have a long history in small on-site processing of food and other organic wastes. On a commercial level, success has been seen for a vermiculture processing plant in Queensland and other large commercial projects are currently being contracted in parts of Australia. These operations have been focussed on processing large volumes of biosolids. Additions of other feedstock such as newsprint and other paper, animal manures, food industry sludges are being made.

A vermiculture operation in North Queensland would require higher process control due to climatic conditions. It is expected that operations would need to be conducted in a covered facility (to reduce water infiltration into the beds) with raised beds (to discourage migration of worms).

11.3.4 Anaerobic Digestion (Biogasification)

A fuel source, methane, is formed when the organic materials are transformed biologically in the absence of oxygen. Soil-like product is also formed at the end of the process or adaptation for pellet production can be made. Energy can be recovered successfully from these systems.

This technology has been readily proven in the sewage treatment industry and has been adapted for organic wastes. The process is more suited to the high moisture components of the organic waste stream such as food and manures rather than garden and wood wastes.

11.3.5 Energy Recovery

Other methods of utilising the fuel value of organic wastes (such as gasification, co-burning, charcoal and ethanol production) generally have high capital requirements and operational costs. Co-burning is the simplest of these options where organic waste, primarily wood and garden waste, is used to supplement existing fuel sources such as coal or bagasse.

The closest coal fired power generation plant is at Collinsville nearly 300 km away from Townsville. This option would have a significant transport cost and the lower efficiency of garden waste as a fuel also reduces the viability of this option. Use of garden waste in bagasse fired furnaces in closer proximity to the HESROC-NQ region would be a better alternative to be further investigated.

More capital intensive options include the establishment of gasification, charcoal or ethanol production. Many of these technologies have yet to be proven for Australian conditions but trials are being progressed. Combination of a drying stage in gasification or charcoal production is being done to help improve the efficiency of these processes for high moisture feedstock, such as garden waste and other biomass, or low rank coal.

11.4 Home Composting

An essential part of achieving greater diversion of organic waste from landfill is to encourage home composting (or other on-site measures such as worm farming) and waste minimisation.

Due to the climate in the North Queensland region, home composting may require a higher level of input by the householder to prevent compost piles

becoming problematic. To increase the success of such a strategy, it is important to provide some assistance to householders on how to best manage their compost bin or worm farm to reduce drop out rates of use.

HESROC-NQ may look at developing an information brochure as part of the education strategy to encourage home composting and worm farming. This brochure could include information on the environmental impact of home composting, health precautions, and methods of composting or worm farming that best suit the North Queensland region.

Subsidised composting bins have previously been offered by Councils in the region.

11.5 Collection of Organic Wastes

Garden and food waste unable to be managed on-site by residents should be source separated for (free) garden waste drop-off services at a waste management facility or for Council collection.

A number of collection options existing from bundled or containerised collection and frequency of collection can vary from fortnightly to every 6 months. Containerised systems tend to achieve the highest recovery rates. Many of the Councils already provide pre-cyclone collection services.

Investigation of collection of food wastes from domestic sources is being undertaken by some Councils across Australia. The trials undertaken to date have shown encouraging results. Trials have tended to focus on collecting only the non-fatty food components (e.g. vegetable and fruit scraps) in conjunction with containerised garden waste collection.

A higher frequency of collection is required if the more odorous components are sourced or in the summer months. It is also important to ensure that the facility accepting the high nitrogen material can deal with the associated odours. If outdoor windrow composting was utilised, a high level of process control would be required.

11.6 Markets For Finished Product

Products derived from organic materials are as below:

- compost;
- mulch;
- soil conditioner;
- growing media/potting mixes; and
- energy recovery.

In regard to compost production, a number of studies have determined the size of the compost market to be dependent on the population base of an area. Estimates indicate an average of 0.08 m^3 of compost per capita per annum is sold (Meinhardt 1997). Using this figure, North Queensland region has a market of approximately 11,000 m^3/year. However, this does not take into account commercial applications such as mine rehabilitation and golf courses.

Energy recovery may also be a potentially large market if the material can meet requirements necessary for use in furnaces, gasifiers or anaerobic digesters. The material may compete against other fuel sources on moisture content,

calorific value, level of processing required (i.e. shredding), level of contamination, availability, cost and transport. Substantial upgrades may also be required for existing furnaces or establishment of new technology necessary.

The following market criteria need to be considered:

- size of existing markets;
- projected future of markets;
- present size of market share;
- difficulty of accessing markets;
- implications of product contamination; and
- market location.

Potential local markets for recycled organic products include landscaping, public parks and gardens, agriculture, horticulture, revegetation, land rehabilitation works, compost retailers and as a fuel. Potential also exists for international markets.

In determining the future market viability consideration should be given to the periodic flooding of the market due to Council activities, future developments, and seasonal occurrences (i.e. cyclones).

11.7 Summary

There are a number of options HESROC-NQ may wish to pursue for organic waste management. These include:

- mulching of garden waste at landfills and transfer stations;
- establishing an organic composting facility to compost garden waste, domestic food waste, paper and/or industrial organic wastes; and
- developing energy recovery options.

A range of options are available to collect and transport organic waste to a central or number of processing facilities. These options are outlined as follows:

- provide residents with garden waste kerbside collection (bundled or containerised);
- compost all kerbside collected waste, including garden waste;
- provide bulk bins or transfer trailers at waste management facilities for collection of garden waste, with regular transport to a composting facility;
- rely on resident self-haul of garden waste; and
- agreements with local industry for transport of industrial organic wastes.

Whilst markets exist for compost and soil conditioners in the area, there needs to be greater development of these, with consideration given to competing products such as mill mud.

12. LITTER MANAGEMENT

12.1 Overview

Litter is a very prominent waste issue in the public domain due to the impact on public amenity but there are other serious threats from litter on wildlife and the State's natural resources.

Litter management is carried out in most of the municipalities in the North Queensland region. Burdekin Shire has 60 litter bins which are emptied daily and waste is transported to one of the transfer stations. Regular street sweeping is also undertaken in a few of the townships. Hinchinbrook, Thuringowa and Townsville have weekly litter bin collections and street sweeping as part of their Council services.

A large amount of street litter may be generated during the tropical cyclones which are a common event in the region. Other annual events and festivals such as the Greek Festival and Palmer Street Festival will also generate large amounts of waste on the street.

The collection, management and reduction of litter causes many problems for individual communities. The most significant problem in controlling litter stems from its random and diverse sources. Litter can be sourced from a number of categories:

- by individuals on a random basis;
- from major events;
- from garbage and recycling collections;
- by windblown litter at landfill sites;
- by windblown litter from transfer stations and material recovery facilities; and
- from construction sites.

As mentioned previously, provision of public place litter bins and street sweeping operations are established as litter prevention and control activities in the region. Numerous waste management facilities in the region have also been fenced in an effort to reduce off-site litter.

Illegal dumping was highlighted in the stakeholder consultation process as a significant problem for some areas within the region. As a part of the Waste Management Regulation, persons who unlawfully dispose of litter will be penalised.

12.2 Domestic Collection

Litter generated from kerbside collection depends on the following factors:

- handling of garbage by collection operators;
- efforts of householders in securing garbage;
- adequacy of receptacles provided to residents; and
- weather conditions.

Garbage Collection: Councils are encouraged to use MGBs to reduce litter generation from garbage spillage. MGBs have fixed lids that minimise windblown litter from the bins; they are also less likely to be tipped over by animals.

Recyclables Collection: In windy conditions, overfilled bags and uncovered containers may cause litter problems. Clear instructions should be given to residents on the preparation of recyclables for collection.

Resident Education: Programs to promote litter reduction should be undertaken by Councils. Education programs should encourage residents to:

- avoid overfilling bins and recycling containers;
- use containers rather than plastic bags for waste collection; and
- crush items such as aluminium cans and plastic containers.

12.3 Landfill Operations

Uncovered Loads: After a community awareness campaign, Councils should adopt a stronger enforcement approach to ensure loads are properly secured. If uncovered or unsecured loads give rise to litter, penalties may be applied under the Waste Management Regulation enacted on 1st July, 2000.

Landfill Operations: Litter problems at landfills can be managed by implementing litter collection activities using mobile maintenance crews. Another option is to include litter management in addition to the cell excavations/covering operations in the earthmoving contracts. Litter screens and perimeter fencing will reduce in and off-site litter problems.

12.4 Other Local Government Activities

"Carry In, Carry Out" Policy

"Carry In, Carry Out" policies in suitable parks and gardens may be trialed to help avoid the problems of overfilled bins and windblown litter.

Public Place Litter Bins

Strategically placed public place litter bins will reduce litter problems in the streets. The bins should be placed near a waste generation source such as outside take-away and fast food shops, seating and table areas. At special events, frequency of collection and number of receptacles should be increased.

Other methods of litter management include increasing the area currently covered by street sweeping services and introducing new street sweeping areas. Promoting litter control through a community education and awareness campaign can also help improve litter management.

The provision of public place recycling which reflects the recycling system provided to local residents can also be useful in reinforcing the education message and reduce confusion.

Special Events

Additional public place litter and recycling bins may be required at special events in order to ensure that the number of receptacles is proportional to the estimated population expected. Receptacles should be strategically positioned and emptied regularly to prevent overfill. The sizes of the receptacles should reflect the expected volume of waste generated and fitted with a lid to prevent windblown litter.

Special events also provide an opportunity to promote waste minimisation and recycling. This should build upon education on recycling directed at residents.

Other Litter Management Techniques

Local community groups or committees may have organised clean up days involving picking up litter from public places. Further development of this through existing organisations can be very successful, for example with the establishment of a special annual clean up day for the North Queensland region. This may be conducted in line with the national Clean Up Australia Day program which has significant publicity and awareness reach. Alternatively, an additional local clean up day could be organised during August in accordance with local climatic conditions.

The Tidy Towns and Adopt-a-Highway campaigns can also help reduce litter and target areas of particular concern for littering such as roadsides and along riverways.

Education

Waste and litter education can be effectively addressed as part of the regional strategy. A resource kit for each Council to use can be developed for use in education. A Regional Waste Officer (discussed in Section 13.3) can play a pivotal role in ensure that litter prevention education is effectively and consistently implemented across all Councils.

Litter Traps

Litter traps play an important role in preventing litter from entering waterways.

12.5 Illegal Waste Dumping

Illegal waste dumping is a significant problem in some parts of the region. Illegal dumping can include the following:

- illegal disposal of waste to land (including littering);
- disposal of prohibited substances at landfills not licensed to accept those types of wastes; and
- illegal waste landfilling on land not licensed as a landfill.

Overcoming illegal dumping in the North Queensland region is particularly problematic due to the size and the remoteness of some parts of the Council areas. As a result, education is a vital tool to acknowledge the impacts on the environment and costs to the community that occur from illegal dumping.

Reduction of operating hours at landfills and transfer stations and closure of landfills across the region may contribute to the dumping of waste, although experience in other regions has found that this is not a long-term cause of illegal dumping. Member Councils should investigate “hot spots”, areas where dumping frequently occurs. The “hot spots” will need to be restored, litter removed and signs erected to prevent further dumping. The Regional Waste Officer (refer Section 13.3) has an important role to play in developing programs to prevent illegal dumping with each Council.

Another form of illegal dumping involves prohibited waste being disposed at existing facilities not suitable to accept that waste type. This is exacerbated by

landfill and transfer station sites being unsupervised. Supervision at facilities is recommended to prevent this.

Use of land illegally as waste disposal sites can be a serious problem. Education of the community and industry of the need to dispose of waste to licensed managed facilities should be considered.

12.6 Regional Litter Management Approach

HESROC-NQ may wish to develop a regional litter strategy to address litter minimisation issues. This would allow the organisation to obtain a better understanding of litter generation in the region. Such a strategy could address the types of litter currently collected in public place litter bins, positioning of the bins, the frequency of collection and how existing services may be improved. It could also help quantify the cost of littering to the community in terms of clean up and loss of amenity particularly for the tourism industry.

A Regional Waste Officer (refer Section 13.3) would play a pivotal role in litter minimisation education which is an important aspect of the overall strategy. The Regional Waste Officer could help identify “hotspots”, quantify the amount of litter produced and assist in developing programs to address management of hotspots.

13. EDUCATION

13.1 Introduction

Waste minimisation and recycling are becoming increasingly important issues in everyday living requirements for the community and Councils who are responsible for waste management.

The Queensland Government is advocating waste minimisation as a key consideration in waste management planning undertaken by councils. To achieve this it is important that the entire community receives waste minimisation messages so that Council programs on waste minimisation are effective.

Councils provide waste collection and recycling services that vary throughout the region. An effective community education campaign should cater for both regional and individual municipalities' needs to maximise the impact that changes in waste collection services, resource recovery and recycling make throughout the region. This will progressively encourage waste minimisation participation by households in order to utilise the Council resources effectively.

The following recommendations will provide Councils with a cost-effective platform to launch an educational campaign to provide both short and long term educational benefits for the entire North Queensland region.

The following analysis and recommendations address the issues of:

- Regional Focus:
  - increasing community awareness
  - providing a cost effective regional program.

- Municipal Focus:
  - responding to individual municipality needs
  - educating municipality ratepayers
  - providing a cost-effective municipal program.

13.2 Educational Analysis

To ensure the education campaign's achievement of full potential, an analysis of certain marketing aspects must be undertaken. The following components must be investigated in order to carry out the campaign successfully to the specific target market, in this case the residents and companies in the North Queensland region:

- penetration of the market;
- analysis of delivery sources;
- the delivery process;
- monitoring process; and
- follow up.

All the preceding elements must form part of the strategic marketing approach.

Delivery sources need to be analysed carefully. If the media does not deliver the message effectively, the educational campaign will be unsatisfactory and costly. Coordination of message delivery is needed to ensure that the campaign provides a responsible message across the entire region whilst being cost

effective. A level of expertise and understanding of the reach factors is required to facilitate this. The North Queensland Region is covered by:

- five television networks (dependant on the reception);
- sixteen local newspapers/magazines; and
- eight community and commercial radio stations.

The objective of any campaign is the need to reach as many of an identified target audience with the message as possible. Generally the delivery mode selection will ultimately determine the level of success that is achieved. There must be an understanding of the strengths and weaknesses of the individual sources identified above, as some will deliver a regional message more effectively and others a municipal one. The following five areas are considered in the delivery of the education message for the North Queensland Region:

- television;
- press;
- radio;
- direct mail; and
- education/promotional.

Television

Television is the single strongest advertising medium available today to provide reach, create impact and develop an image. However it has disadvantages in that it:

- requires experienced schedule placement to provide reach and frequency to desired target viewers; and
- has five networks to select from, each providing strengths and weaknesses in different demographics.

Of the five stations available, three have a regional broadcast service. Based on this, a campaign can be effectively targeted for regional issues without being diffused by different regions' messages. Therefore television will provide a strong cost effective medium for a regional approach for education.

Press

Editorials or advertisements in the press provide local Councils with an effective medium to provide residents with detailed information on local waste management initiatives and strategies. This allows tailoring of messages to address local issues and builds upon messages provided on a regional basis.

Radio

Radio is an excellent support medium for mixed media promotions. As with television, frequency is essential for total efficiency of radio promotion. Radio programming differs greatly, with some stations opting to appeal to the young and others targeting the older audience. An understanding of a station's programming is essential when target marketing is required. Radio will also provide support to press and stand-alone campaigns, particularly for individual municipalities (depending on the coverage available). A number of radio stations broadcast from Townsville and would be more suited for regional messages and targeted Townsville and Thuringowa messages. Both Charters Towers and Ingham have radio stations which can be utilised for Charters Towers, Dalrymple and Hinchinbrook campaigns.

Direct Mail

Direct mail can provide outstanding results when it is used effectively and has the advantage of the most targeted approach for delivering detailed information on waste management. The use of mail provides the opportunity to deliver educational messages to a large number of people at the one time. However, reliable and controlled distribution is needed for efficient delivery to the residents.

The most effective form of distribution is through Australia Post or newspaper inserts. Walker delivery in residential areas is a cheaper alternative but users must be prepared to allow for at least a 25% drop-out rate compared to Australia Post and newspaper delivery services.

13.3 Regional Education Strategy

13.3.1 Overview

The purpose of a regional campaign is to educate people on the benefits of responsible waste management and highlight the impact of excessive waste production on the community and environment. A regional campaign can also help reinforce any waste education undertaken by the Queensland Government on a State-wide basis in the future.

The implementation of an educational campaign on a regional basis and at municipal level requires a coordinated approach, otherwise the cost to carry out an adequate educational campaign will be sizeable. It is also essential that regional and municipal messages are complementary and do not send any contradictory information.

The EPA should be approached for funding assistance to support the implementation of the regional campaign. The EPA is committed to supporting a proposed *Community Education Program to Address the Issue of Contamination of Kerbside Recyclables*. This program has the support of several Councils in the region. Features of the campaign include:

- television advertising campaigns;
- print media campaign;
- school groundsperson program;
- primary school education program;
- provision of recycling receptacles to schools;
- recycling displays at major shopping centres;
- high-profile launch;
- Resource and Recovery Education Program (RARE); and
- links with School Communities Recycling All Paper (SCRAP) Program.

13.3.2 Regional Waste Officer

For uniform approach and a continual focus on the educational needs of the region and individual Council, a Regional Waste Officer is required. The officer should have:

- local knowledge of the region;
- an understanding of the media;
- marketing experience; and
- be able to source sponsorship to minimise cost.

Support for a Regional Waste Officer has been indicated during stakeholder consultation from industry, and a role for the Regional Waste Officer to provide industry education was evident. Services which could be provided to industry include education on waste minimisation and cleaner production techniques and assistance in training of staff on waste management.

An additional function of the Regional Waste Officer could be to facilitate a waste exchange between different industries and help form purchasing partnerships to enable bulk purchase of products such as chemicals. By using the Regional Waste Officer, this allows for a distancing of parties which may have a regulatory role to play and hence may be a disincentive for industry to participate.

The Regional Waste Officer may also be associated with existing organisations (such as Townsville Enterprise Limited) which already has training and education roles in the area. For example, the organisation has the role of secretariat for an education cluster which includes James Cook University, local TAFE, schools and private training organisations. This interaction may provide a useful collaboration of technical and educational expertise.

13.3.3 Regional Education Strategy

The Regional Education Strategy should include the following.

- Create a regional theme to act as the major focus in all initial educational promotions. The theme can build upon elements that are unique to North Queensland or be more generic to be complementary to initiatives by the State Government. A campaign will provide the region with a direction in which to base a planned regional launch platform from, and gain additional free media exposure by providing a meaningful 'news' item. A regional register could be set up to identify appropriate educational material for Councils to provide a coordinated library of information for the region.

- A series of television commercials be produced to create the selected waste theme and message or to focus on a common problem that the region recognises. For example:
  - reduction of waste disposed to landfill;
  - saving to the environment in the North Queensland region;
  - waste avoidance and responsible recycling; and
  - awareness of the impacts of roadside and other illegal dumping.

  Promotion of State Government initiatives or information lines is useful in this.

- Produce a 'waste minimisation' education kit for distribution to households in the region. Each information kit should focus on the region as a whole. It should consist of a corporate document and include any relevant information pertaining to specific issues or individual municipal information.

- Produce a 'waste minimisation' education kit for use in schools in the region. Each information kit could provide teaching aids and student activities. There are similar programs developed and to some extent implemented (such as SCRAP or WasteWise) which can be used or schools can be encouraged to participate in.

- Organise a community education action group within each municipality to identify specific educational requirements in their municipality and on a regional basis. A waste action group may be formed to facilitate this.

- A series of 'travelling' educational street display promotions to create awareness in the community can be organised for Council offices, at strategically targeted shopping centres or retail outlets. The display could commend the efforts of individuals or groups in waste minimisation and provide updates of innovative waste minimisation projects. A specially prepared media kit to assist in promotion of the display in the community through local newspaper and radio could also be included. Special events should also be targeted to provide good exposure to large number of people. Special events are discussed further in Section 13.4.

- Organise a week focusing on regional waste issues to involve community members in areas where Councils need assistance. For example this may involve clean up of particular dumping sites or along rivers. This would provide opportunities for media participation providing good publicity for the campaign.

- Develop a campaign that promotes 'smarter shopping'. The campaign would promote the purchase of products that use appropriate packaging, reusable and refillable products, products with recyclable packaging and products made of recyclable materials.

- Industry could be targeted with respect to their waste generation practices and purchasing patterns. This would involve encouraging the individual industries to examine their waste disposal requirements with a view to minimising their current generation rates and investigate opportunities for waste exchanges.

- Small to medium businesses could also be targeted with respect to their waste generation practices and purchasing patterns. This would involve encouraging the businesses to assess their waste disposal requirements and highlight options for minimising waste and promote overall cleaner production practices.

13.4 Municipal Education Strategy

While the regional education campaign will create an awareness factor there is still a need for each municipality to deliver their total waste management message to ratepayers. Thus it is important for carefully planned education strategies to be developed for individual Councils. This would address the specific needs of each municipality, particularly where significant differences and unique issues arise between the more densely populated Councils and ones with large tracts of rural land.

The following components of the education campaign should be considered for a successful education strategy for each municipality:

Review of Educational Material

Existing educational material needs to be reviewed by all Councils. Steps are then required to ensure all waste management components are covered prior to the commencement of any regional or local campaigns.

For example:

- the production of a "Waste Minimisation" information brochure highlighting any changes to waste collection/recycling/disposal practices that may need to be undertaken;
- the production of educational material addressing issues that have been identified as particular problems; and
- preparation of a booklet for local businesses to assist in implementing waste minimisation practices.

Local Media Involvement

Involve local media by inviting them to contribute to the education process through joint sponsorship of:

- media campaigns eg. Waste Wise Week;
- press and radio advertisements and advertorials about recycling 'tips/hints';
- newspaper testimonials of local people/identities ("waste champions") supporting waste management and emphasising the benefits for the community and the environment;
- a 'talk back' promotion on a local radio station to answer questions and clear up issues on recycling;
- a 'Recycling Hint' segment where handy hints on recycling are promoted; and
- reporting of success stories in the local media.

Involving the Community

Involvement of the community in waste awareness raising is essential, as well as a cost effective way in which to convey a message. This is where the Regional Waste Officer has a particular role to facilitate the following:

- establishing a 'Waste Watch' community group to identify problem areas within the community and to act on those problems;
- arranging a business forum to assist local businesses in identifying waste, reducing waste and providing specific workplace waste minimisation training required for employees;
- developing educational information and activities that local schools can participate in (for example, school children are invited to collect milk cartons and grow seedlings in it to sell to the community); and
- setting up a community recycling 'Hot Line' to handle inquiries.

Event Education

Exposure of waste education to a large number of people in the community is possible through major or weekly events organised by community associations. Areas other than home are highlighted in these events, such as the following:

- football grounds;
- netball/basketball stadiums;
- music festivals; and
- agricultural shows.

Councils can lead by example through the provision of waste/litter and recycling bins. It is important that recycling services provided at special events reflects those available at home. This helps build upon messages that householders are familiar with and reduces confusion.

Garden Waste

A significant portion of household waste is food and garden waste. Targeting education for the community to promote composting and mulching will assist in reducing the amount of waste landfilled. The strategy should include such activities as the following.

- media campaign on the benefits of composting and mulching;
- assisting and encouraging worm farming or composting participation at schools (Councils can offer schools a free worm farm or composting kit; this is more likely to be successful if some training and follow up is offered to schools);
- production and delivery to households of a 'Compost Guide' in the form of a fridge magnet that highlights what is suitable for composting from the kitchen and around the home; and
- provision of at-cost worm farms and composting bins by Council for ratepayers.

Success of these schemes will be increased if follow up is provided to help troubleshoot problems that householders experience, particularly in regard to composting in the North Queensland climate.

13.5 Community Education Process

To ensure that the level of awareness on waste management issues is increased, community consultation forms a significant part of developing this Regional Waste Management Strategy. This will help develop a level of ownership of the strategy that will contribute to its success.

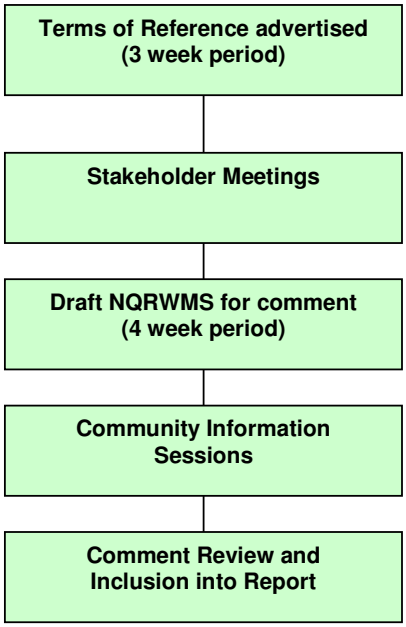
Consultation commenced when the Terms of Reference outlining the issues to be addressed in the Regional Waste Management Strategy were made available for public comment (refer Appendix A). In March 2000 the Terms of Reference were published in the *Townsville Bulletin* with an invitation to submit comments and register to attend stakeholder meetings.

The next stage of consultation involved a series of stakeholder meetings held in Townsville, Thuringowa, Ingham (Hinchinbrook), Ayr (Burdekin) and Charters Towers (Charters Towers and Dalrymple). Waste contractors and industry representatives were specifically targeted to attend these meetings. This approach was taken to optimise opportunities for key stakeholders to raise individual issues to waste management practices throughout the region. A list of stakeholders invited is provided in Appendix H.

The Draft Regional Waste Management Strategy will be made available for public review for a period of 4 weeks. During this time, a series of community information sessions will be held to allow opportunities to discuss the strategy. Comments received during this public review process will be reviewed and where appropriate included in the final report.

The consultation process is outlined in Figure 13.1.

FIGURE 13.1 COMMUNITY CONSULTATION PROCESS



14. STRATEGY OPTIONS

14.1 Methodology

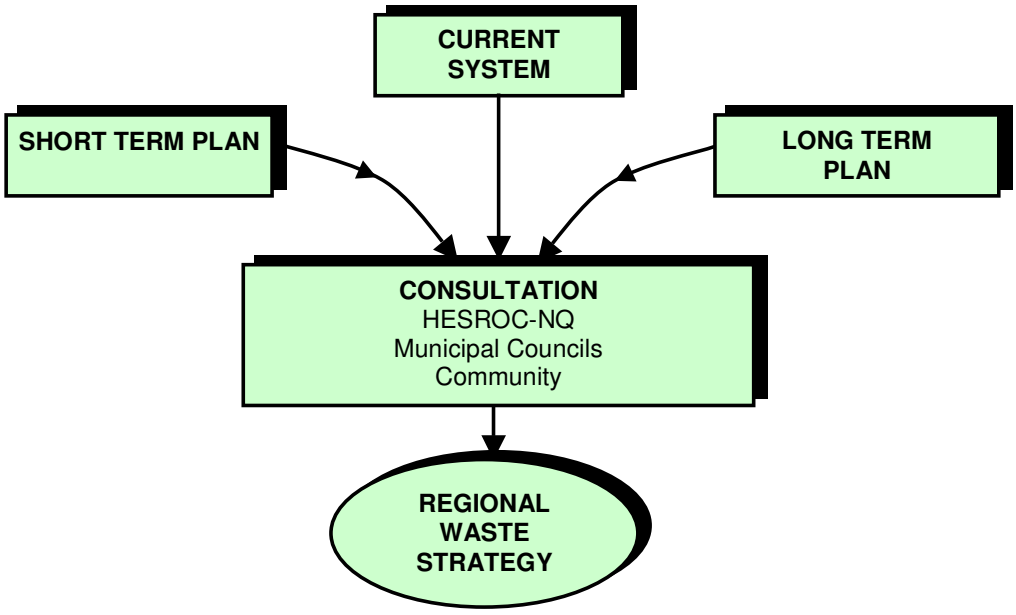
The proposed strategies presented in this chapter have been developed for a long term focus. The short term (5 year) strategy has been developed to consider both the current systems implemented in the region and the objectives of the proposed 20 year plan. This method has been adopted to provide the HESROC-NQ region with a well-structured waste management strategy and allow new services to be smoothly incorporated within the existing waste management system as the North Queensland region moves towards its 20 year plan.

The method outlined below was used to develop strategy options for the management of waste in the HESROC-NQ region.

- Evaluate current system and project the impact of a 'do nothing' approach to develop a base line case.
- Develop long term (20 year) service strategy options.
- Develop short term (5 year) service strategy options through interpolation between the current system and 20 year plan.
- Present the proposed plan to HESROC-NQ, municipal Councils and the community for discussions and comments.
- Develop the preferred 20 year plan.
- Develop the preferred 5 year plan through interpolation between the current system and the preferred 20 year plan.
- Adopt and implement the proposed waste management strategy for the HESROC-NQ.
- Compare expected results against baseline case.

The following strategy options presented have been developed by the method presented in Figure 14.1.

FIGURE 14.1 STRATEGY OPTION DEVELOPMENT



For each component of the overall waste management strategy, long and short term goals have been developed. The long term scenario incorporates a more extensive service to be provided to residents in the future. The minimisation of waste should occur in both the short and long term strategies.

A commitment to the level of collection service adopted is subject to the expiry of existing contracts and tendering of new contracts. The preferred option will also depend largely on the community's willingness to pay the cost involved. However, member Councils should be committed to implementing MGB garbage collection systems with a maximum weekly capacity of 120L and recyclables collection systems based on MGB containers in the long term.

A financial evaluation of the infrastructure program is detailed in Section 15. The level of service provided to residents should be as equitable as possible across the region. However, community expectations of the service provided will differ. For example, residents in large population centres would expect a different service to residents living in small remote townships.

14.2 Collection System Strategy

14.2.1 Overview

The collection system strategy has been developed to most effectively meet the needs of the region, member municipalities and satisfy community expectations. Current collection services vary considerably throughout the region. Existing systems need to be standardised such that sub-regional contracts can come into effect.

The introduction of a regional approach to the collection system across the North Queensland region is encouraged. The advantages of the regional approach include:

- opportunities for economies of scale across the region through fewer contracts;
- competitive contract bidding will be encouraged;
- reduced administrative costs through more efficient communication between the contractor and the waste management authority;
- effective waste auditing due to controlled and measurable collection system;
- changes in the system can be more effectively communicated to the public through media channels, e.g. television advertisements; and
- uniformity in waste minimisation targets.

Under the regional approach, collection areas are governed by utilising the capacity of collection vehicles rather than municipal boundaries, hence achieving transport economics.

However, applying such a collection system strategy may not be viable in all areas due to geographic and population density changes. The objective is to provide residents with an equivalent level of service.

Several kerbside collection services are available for possible application. These are:

- garbage collection;
- recyclables collection;
- garden waste collection;

- domestic clean-up waste collection; and
- inert waste collection.

However, providing all services across the region will not be viable. When determining a collection system strategy best suited to an area, the following parameters should be considered:

- most appropriate collection receptacles and frequency of collection;
- cost and viability of collection services in different townships;
- economies of scale achievable through different collection areas/districts;
- community expectations, demands and willingness to pay for collection services; and
- other waste management services available.

14.2.2 Receptacle Size

Receptacle sizes currently used vary considerably throughout the region. Whilst it is necessary to standardise the receptacle type across the region to enable sub-regional contracts to work, it is not essential to standardise receptacle sizes as collection vehicles can be fitted to allow collection of a range of bin sizes. However, reducing the size of receptacles will assist in achieving waste minimisation objectives, which correlates to HESROC-NQ's aim to reduce the amount of waste disposed to landfill.

Advantages of smaller MGBs include:

- lower capital costs;
- increased incentive to households to reduce waste; and
- better mobility.

Disadvantages of smaller MGBs include:

- large households may find the volume of the bins inadequate;
- weekly rather than less frequent collections are required (however, weekly collections for garbage are likely to be needed due to odour and health concerns); and
- set-out rates of bins are likely to be consistently higher, meaning that collection vehicles have to stop more often, reducing collection efficiencies.

It could be expected that the larger volume receptacles would have higher quantities of waste, increasing waste transport and disposal costs per household. For this reason a 240L MGB is not recommended.

A 120L MGB is recommended in the long term as it will provide more than adequate volume for most households if kerbside recycling services are also provided. It has similar per weekly costs to an 80L MGB and provides greater mobility and cost advantages over a 240L MGB. Provision may be made for households requiring additional disposal volume to pay a fee to receive an additional 120L MGB.

An issue for HESROC-NQ is the range of MGBs already in use within the region. Member Councils that provide kerbside collection systems currently utilise 240L or split 240L MGBs. Capital costs will be incurred if existing MGBs are replaced with 120L MGBs. However, the existing 240L MGBs can be re-used as a receptacle for recyclables and the split 240L MGBs can be easily modified and re-used as a receptacle for recyclables.

14.2.3 Collection Frequency

The frequency of domestic garbage collection services currently provided in the North Queensland region is weekly; this is a legislated requirement for Councils in Queensland.

The cost of providing a collection service is heavily dependent on the frequency of collection. According to EcoRecycle Victoria (the Victorian Government body responsible for waste minimisation in Victoria), a higher frequency of collection is generally regarded as raising costs more than it raises yield. Hence it is recommended that Councils provide a fortnightly collection of recyclables.

14.2.4 Extending Existing Collection Areas

Existing collection areas may be expanded to provide a kerbside collection service to a greater number of residents throughout the region. The areas to receive a service would be determined through the process of competitive tendering. However, a survey of residents would need to be conducted to determine whether or not a kerbside collection service is demanded in a particular area not currently receiving a service.

Options in extending existing collection areas include:

- extending the collection area to include rural residential areas;
- providing a service to tenements residing on town fringes;
- providing a collection service to other townships; and
- providing a collection service to residential properties along the collection route between major townships.

Extension of existing collection areas is considered in cases where the collection vehicle is required to pass through the township. Extensions should result in full use of the vehicle's capacity.

In the North Queensland region, only limited areas will be added in the proposed collection districts as larger extensions are not viable due to lack of access or low population density.

In areas where kerbside collection of recyclables is not considered economically viable at current waste and recycling costs, recycling commodity prices and community willingness to pay, recyclable drop-off facilities at landfills, transfer stations and bulk bin facilities should be established and/or maintained.

14.2.5 Collection Services

The following figures provide possible arrangements available to each municipality in the North Queensland region for the collection of domestic waste, recyclables, garden waste and domestic clean-up waste.

The collection service strategies outlined in the figures show the current systems and the proposed long term collection service level.

Figure 14.2 Burdekin: Collection Service Strategy

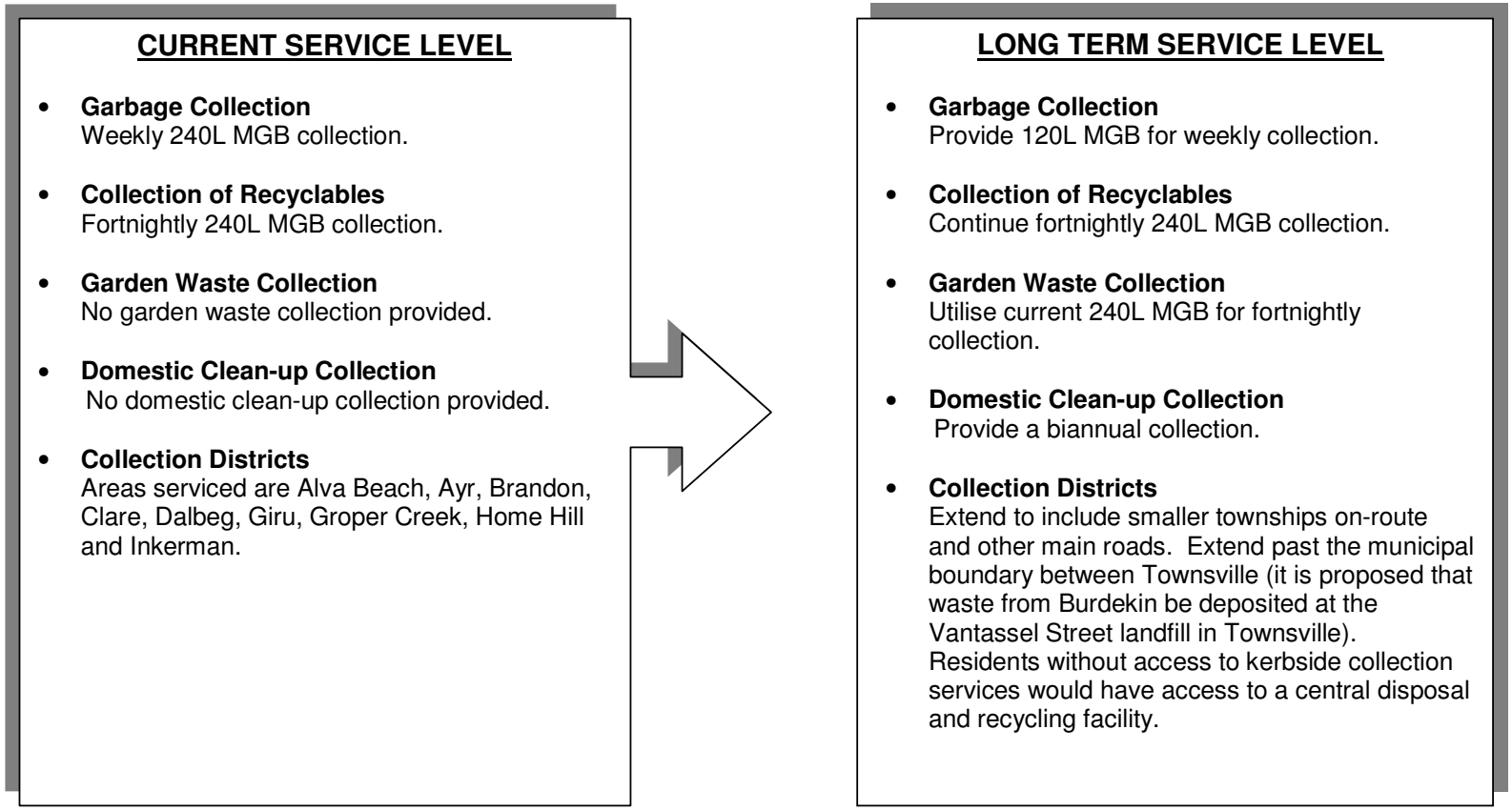


Figure 14.3 Charters Towers: Collection Service Strategy

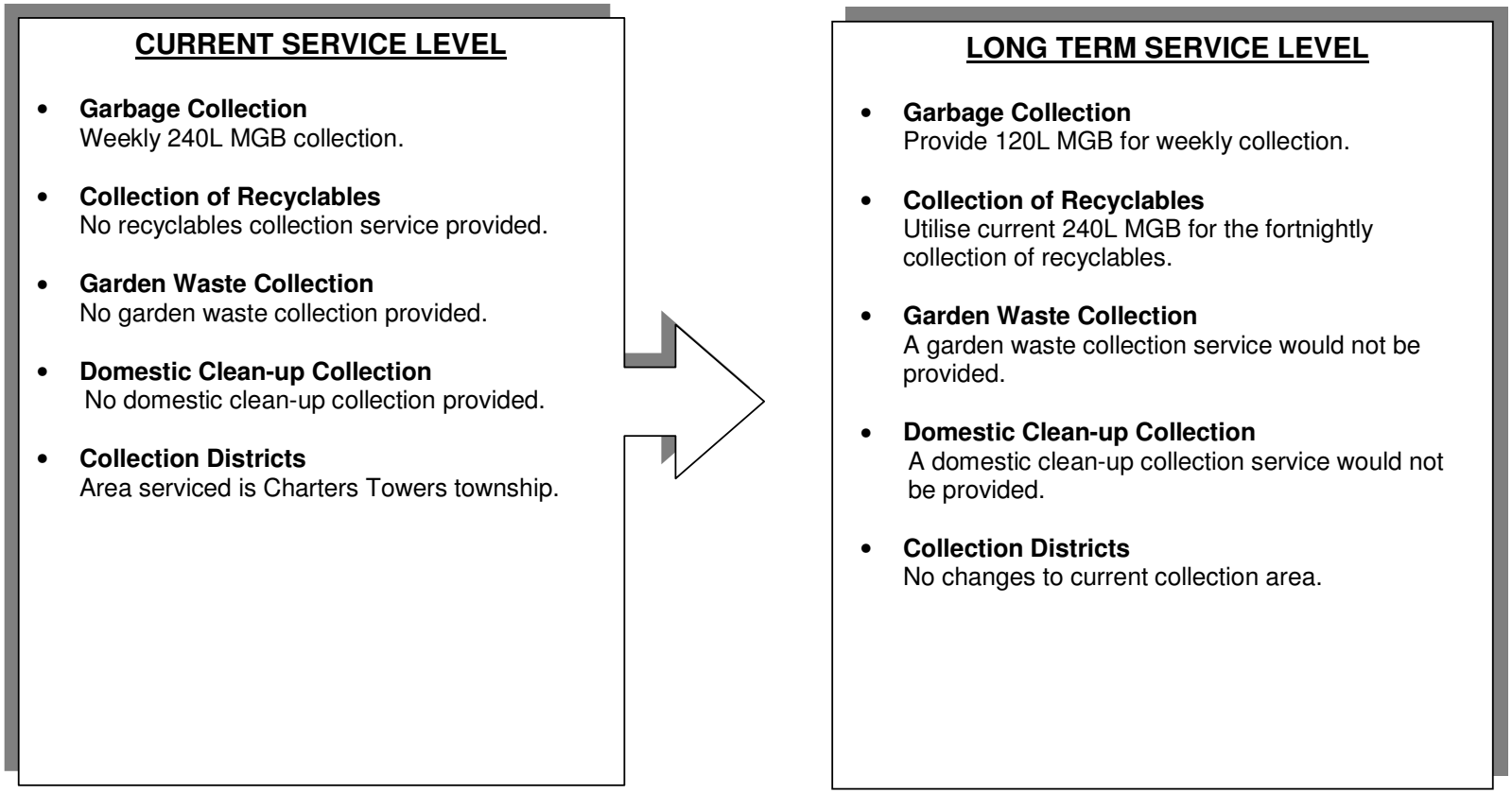


Figure 14.4 Dalrymple: Collection Service Strategy

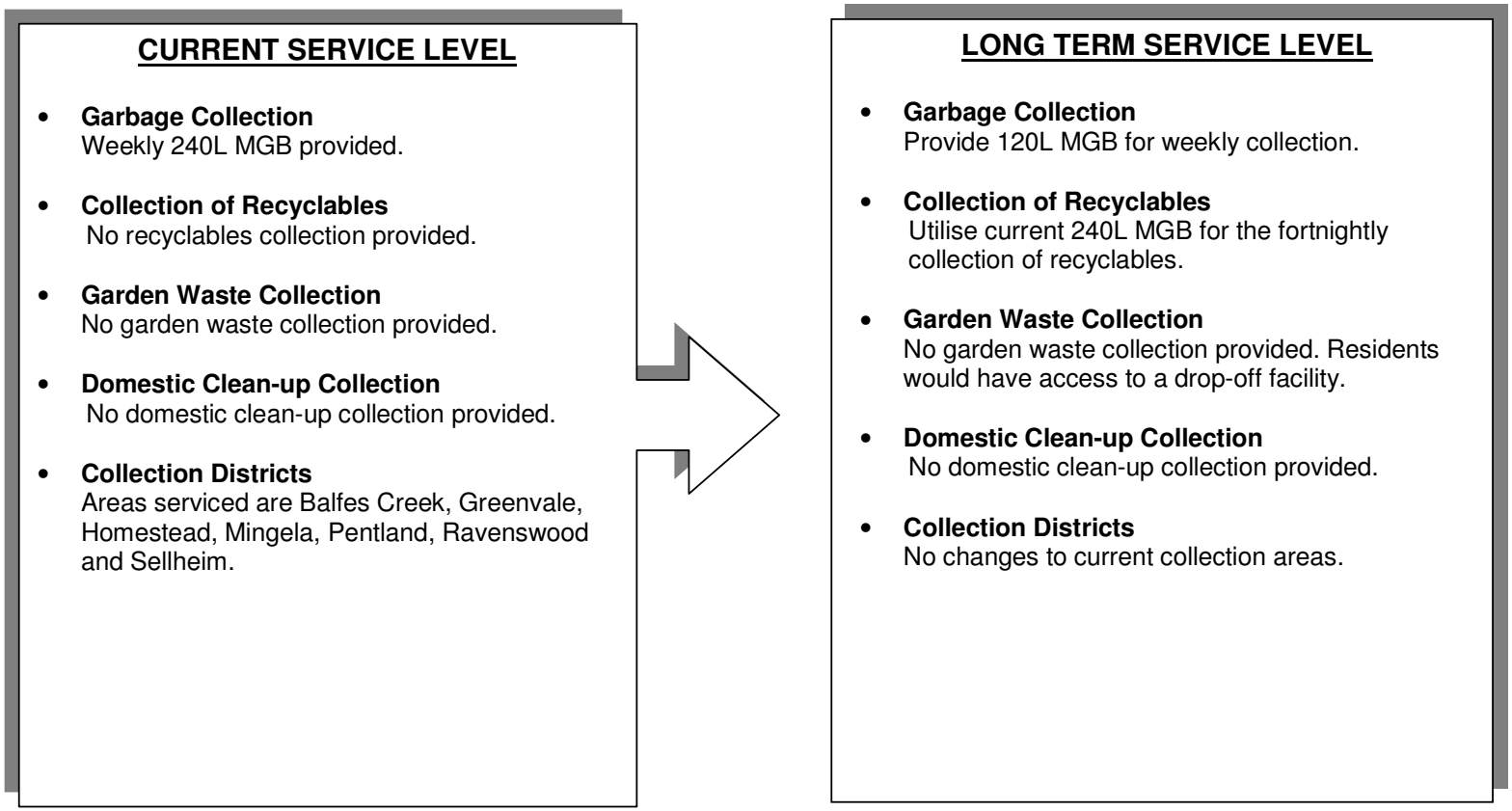


Figure 14.5 Hinchinbrook: Collection Service Strategy

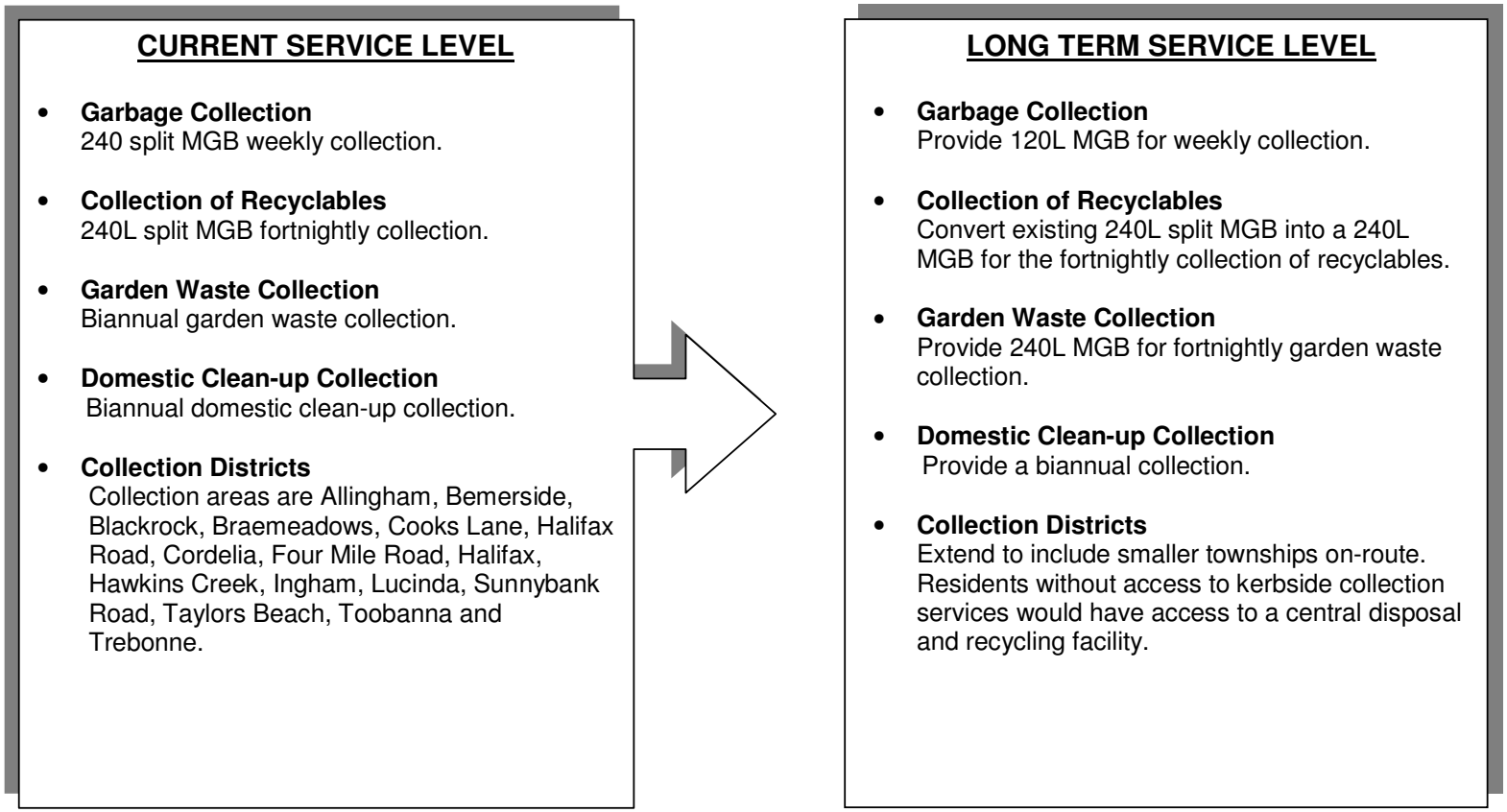


Figure 14.6 Thuringowa: Collection Service Strategy

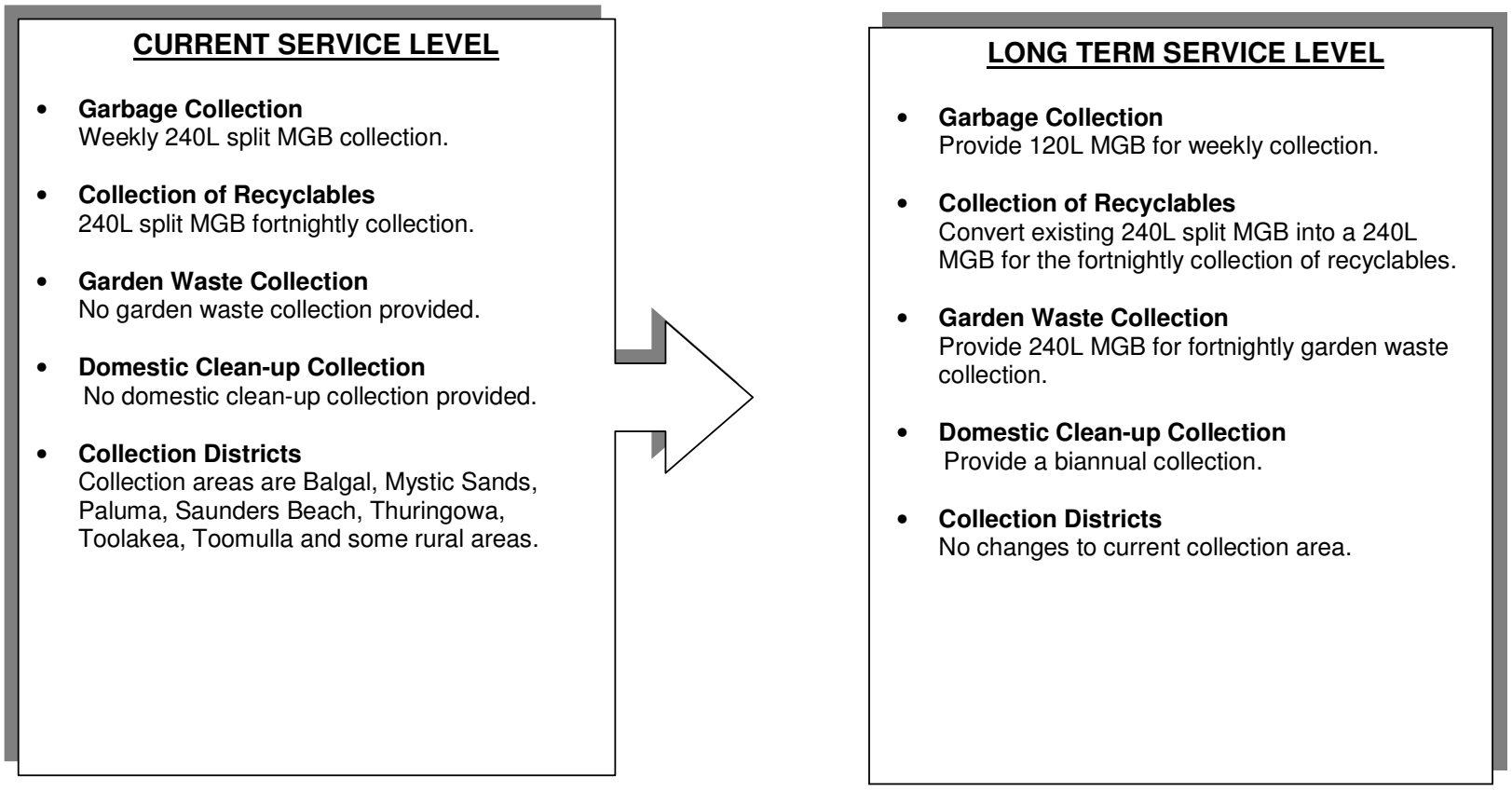
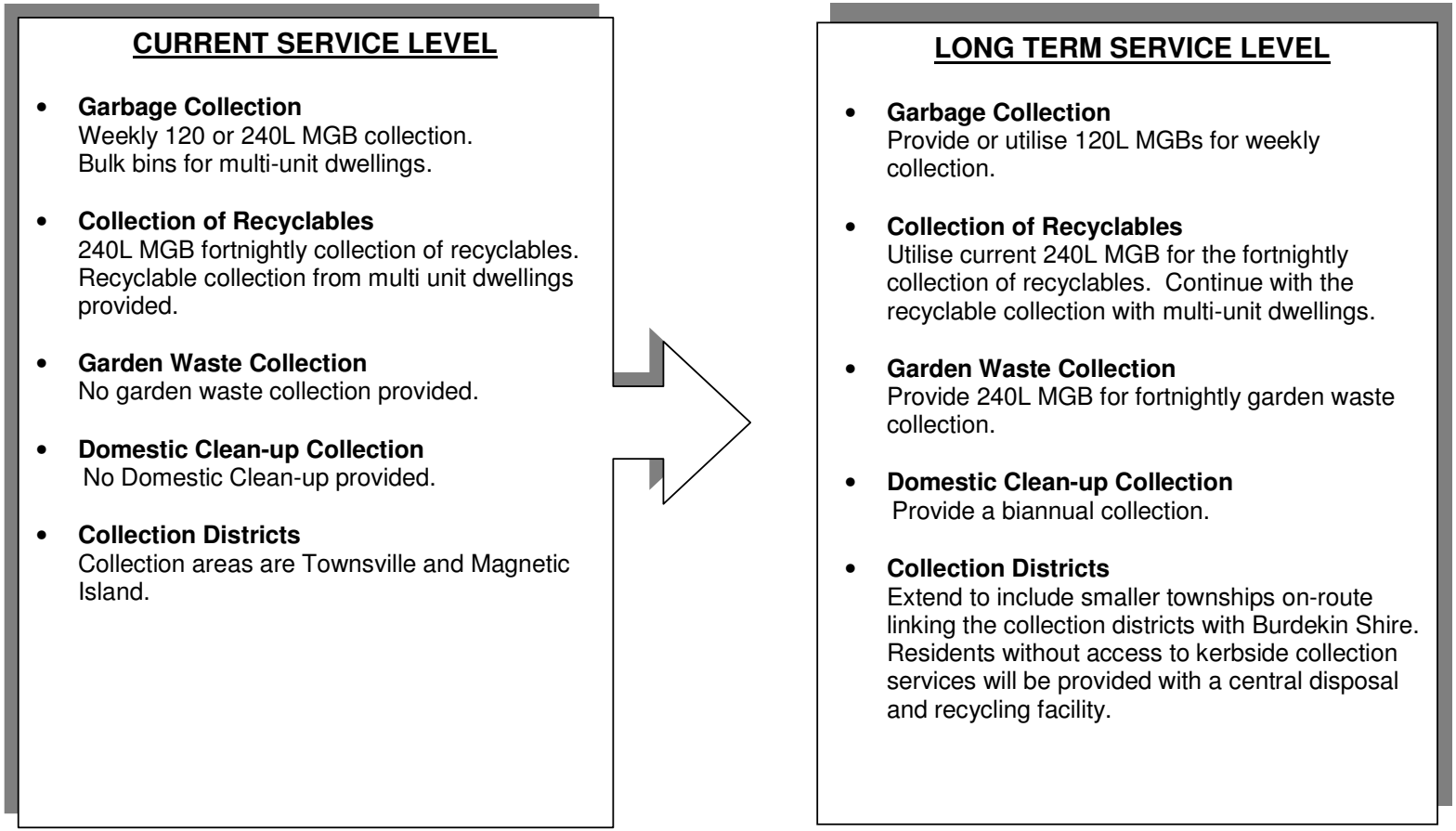


Figure 14.7 Townsville: Collection Service Strategy



Current (short term) and long term service level collection districts are depicted in Figure 14.8. The long term service level provides a more extended service compared to current service levels.

The viability of providing a fortnightly garden waste collection under the long term service level is dependent on the support of a processing facility which is capable of receiving and processing collected volumes.

The proposed long term collection strategy generally does not impact on the total receptacle volume currently available to ratepayers. The proposed system intends to proportion the volume available in accordance with the waste minimisation objectives of the region (i.e. encourage the diversion of recyclables from the waste stream). Table 14.1 provides a comparison of the total volume provided by the existing system and the long-term collection strategy.

TABLE 14.1 COLLECTION SYSTEMS - VOLUME COMPARISON

MUNICIPALITY	EXISTING COLLECTION SYSTEM			LONG-TERM COLLECTION STRATEGY		
	Garbage	Recyclables	Total Weekly Volume	Garbage	Recyclables	Total Weekly Volume
Burdekin	240L weekly	240L fortnightly	360L	120L weekly	240L fortnightly	240L
Dalrymple	240L weekly	-	240L	120L weekly	240L fortnightly	240L
Charters Towers	240L weekly	-	240L	120L weekly	240L fortnightly	240L
Hinchinbrook	120L weekly	120L weekly	240L	120L weekly	240L fortnightly	240L
Thuringowa	120L weekly	120L weekly	240L	120L weekly	240L fortnightly	240L
Townsville	120L weekly	240L fortnightly	240L	120L weekly	240L fortnightly	240L
	240L weekly	240L fortnightly	360L	120L weekly	240L fortnightly	240L

The total volume available to residents under the proposed short-term collection strategy remains unchanged in Charters Towers, Hinchinbrook and Thuringowa. Residents in Burdekin and some residents in Townsville are oversupplied with bin capacity (i.e. 360L per week). This is not compatible with the regional objectives to minimise waste. The large volume available for garbage collection is a disincentive to recycle. It is emphasised that larger volume receptacles would have higher quantities of waste, hence increasing waste transport and disposal costs per household.

In the longer term, it is expected that considerable reductions in waste generation would be achieved through changes in consumer behaviour. The region should strive to achieve a further reduction in receptacle size. It is recommended that the region review its collection strategy in the next 10 years when contract expiry dates are aligned. This review may find that 120L MGBs can be further reduced to collection services based on 80L MGBs for the weekly collection of garbage and 120L MGBs for the fortnightly collection of recyclables.

14.3 Landfill Management Strategy

An analysis of each landfill site in the North Queensland region for compliance with best practice and environmental controls is provided in Section 8.0. In many cases it is deemed economically unviable to upgrade the facility to meet environmental compliance and for these sites the environmental risk is considered significant.

The number of landfills in the North Queensland region should therefore be rationalised based on:

- cost of compliance with best practice, i.e. cost of works required for each site, including fencing, water and groundwater management and site screening;
- suitability of landfill location (i.e. buffer distances);
- limited airspace capacity;
- environmental safeguards and considerations (i.e. flora and fauna, groundwater quality);
- continued costs of landfill operation and maintenance;
- size of population serviced;
- proximity of landfill to other waste disposal facilities; and
- improved economics through use of transfer stations.

The regional strategy outlined calls for 3 landfills to service the northern, southern and western areas of the North Queensland region. This includes the nomination of Stubley Street, Charters Towers (western) and Warrens Hill (northern) landfills as regional landfills. The southern area of the region may be serviced by Vantassel Street, Townsville or Ross Landfill, or an alternative facility established in the area. This is discussed further in Section 14.7. All regional landfills should have weighbridges (or access to weighbridges) to allow accurate recording of waste types and volumes. Councils will need to report on waste types and volumes; reporting of trackable wastes to the EPA is a legislated requirement under the Waste Management Regulation enacted on 1st July, 2000.

It is proposed that further investigation be undertaken to determine the feasibility of a southern facility which may incorporate a waste-to-energy system to handle all wastes (including Regulated Waste). The facility may play a role in organic processing, energy recovery of recyclable materials, and final landfill disposal of char residue from the waste-to-energy conversion. It should be within economic transport distance from Townsville industries (either by road or rail) and be able to provide electricity to the local power system. The Vantassel Street, Townsville landfill fills a number of these criteria, however it may not necessarily be the optimum site in the longer term. Establishment of the southern facility could replace all landfills if it was deemed viable to transport the waste from regional areas to the central facility (refer Section 14.7).

The proposed arrangement is illustrated in Figure 14.9. Table 14.2 outlines the schedule for landfill operation and subsequent closure and rehabilitation.

14.3.1 Burdekin

The Burdekin Shire Waste Management Plan supports the establishment of transfer stations to service the waste management needs of the Shire in place of rural landfills. All remote disposal facilities have been closed in recent years. The Kirknie Road landfill is the only remaining landfill servicing the Shire. Although the landfill has a remaining lifespan of 23 years it is proposed that operations at the facility cease in 2003/04. It is considered that extensive

upgrades are necessary for environmental compliance. This will be required particularly in the protection and monitoring of groundwater and management of leachate at the site.

Kerbside collections and transfer stations at Ayr, Clare, Giru and Home Hill adequately service the waste management needs of the Shire. The diversion of waste from the Shire's transfer stations and kerbside collections to the Vantassel Street landfill in the City of Townsville is proposed.

14.3.2 Charters Towers

It is recommended that the Stubley Street landfill continue to serve the City and Dalrymple Shire Council. Areas requiring attention include litter control, groundwater monitoring and surface water management.

Opening hours to the public should be restricted to minimise safety risks. The airspace capacity of the landfill should be investigated to determine the remaining lifespan.

14.3.3 Dalrymple

The majority of landfills currently operating within the Shire are inappropriately managed, lack environmental controls and impose an environmental risk. The cost of maintaining the landfills to best practice and environmental standards would be prohibitive. Hence, all landfills except Greenvale landfill are proposed for closure. The landfills deemed for closure within the next four years are:

- Balfes Creek;
- Homestead;
- Mingela;
- Pentland;
- Ravenswood; and
- Sellheim.

Although upgrades are required at the Greenvale landfill, due to the remoteness of the township, it is proposed that operations continue provided that measures are undertaken to minimise the impact of site operations on the environment.

14.3.4 Hinchinbrook

Forrest Beach Landfill

The Shire of Hinchinbrook anticipates the closure of Forrest Beach landfill by 1st June, 2001. A transfer station would be established at the site to replace operations at the landfill. Waste deposited at the transfer station would be transferred to Warrens Hill landfill.

Ingham Landfill

The lifespan of the Ingham landfill is estimated to be in excess of 20 years. The location of the landfill within the water catchment area of the Herbert River is a concern. The landfill site is also prone to flooding. Based on site observations, extensive upgrades will be required to minimise environmental risks. Hence, it is recommended that facility operations cease. Council intends to continue operations at the landfill until the proposed landfill closure profile (i.e. final contour) is achieved. It is expected that this would be achieved in approximately eight years. A transfer station should be established at the site to replace

operations at the landfill. Waste deposited at the transfer station would be transferred to Warrens Hill landfill for disposal.

Warrens Hill Landfill

It is expected that the Warrens Hill landfill will service the Shire for at least 50 years. The Warrens Hill landfill would fill the role of a regional landfill for the northern part of the North Queensland region. An investigation into the site's airspace should be undertaken to determine the airspace capacity, accounting for the additional waste throughput.

Public access to the tipping face should be restricted so that safety risks are minimised. Based on site observations, it is expected that extensive upgrades will be required in the areas of groundwater protection, surface water management, leachate collection and litter control.

14.3.5 Thuringowa

Jensen Landfill

The future management of Jensen landfill is discussed in the *City of Thuringowa Solid Waste Management Strategy 1999-2004*. Two options were reviewed:

- Option 1 – continue use for landfill disposal and allocate sufficient revenue to cater for site preparation, access, remediation and plan renewal; and
- Option 2 – cease to use the Jensen landfill, provide a major transfer station at this site and remove all but dry inert waste to the Ross landfill.

Based on site observations, the location of the landfill is unsuitable due to ground conditions and potential environmental risks. Council's preferred option is to cease landfilling operations at the Jensen landfill. According to *the Thuringowa Solid Waste Management Strategy*, Council is committed to the provision of a waste transfer facility at the present Jensen Landfill before 2004.

The closure of the landfill and establishment of a transfer station are considered the most viable option in terms of economics, environmental protection and improving the level of service to residents. Operation of the transfer station is anticipated for 2001/02. Proposed roadworks are expected to reduce the travel distance (including return trip) between the Jensen transfer station and Ross landfill to approximately 15km by 2005.

It is expected that the Jensen landfill will be open on appointment basis only for the receival of construction and demolition waste.

Ross Landfill

The Ross Landfill may continue to service the region, accepting waste from waste collection districts and former landfill areas. It is estimated that the Ross landfill has a lifespan of 30 to 50 years. It is recommended an investigation into the site's airspace capacity be undertaken.

The site's future should be further analysed when assessing the feasibility of a southern regional waste-to-energy facility. Ross Landfill is one option identified as a possible southern facility; alternatively, if the facility is deemed feasible and established, it may be located elsewhere, requiring closure of the Ross Landfill.

According to the *Thuringowa Solid Waste Management Strategy*, Council is committed to the provision of a waste transfer facility at the Ross Landfill before 2004, provided costs are within budgetary constraints. It is expected that improvements will be required in the management of surface water and litter control.

14.3.6 Townsville

Cungulla Landfill

Closure of the Cungulla landfill is anticipated for 2001. It is expected that extensive rehabilitation works would be required in the areas of surface water management and groundwater protection given the close location of the site to mangrove estuaries and tidal salt marshes in an environmentally sensitive area.

Picnic Bay Landfill

The lifespan of the Picnic Bay landfill is estimated to be in excess of 10 years. However, the landfill is located close to the Magnetic Island National Park in an environmentally sensitive area. Council should implement measures to minimise environmental impacts from this operation. Given the potential environmental risk and inadequate operations in the areas of groundwater and surface water protection, it is recommended that landfill operations cease prior to reaching its capacity. Council should aim to cease operations by 2005/06. It is recommended that a transfer station be developed at the facility to improve operations at the landfill, restrict access to the tipping face and encourage resource recovery. In the longer term (post-landfill closure), consideration should be given to employing a compactor at the transfer station to reduce the number of trips required to the mainland. Waste from the island would be transported by barge to the mainland for disposal at Vantassel Street landfill.

It is anticipated that the landfill will be open on appointment basis only for the receival of construction and demolition waste and garden waste.

Majors Creek Landfill

Closure of the landfill is anticipated for 2002. The site is located close to a creek in an agricultural/pastoral area which relies on its groundwater reserves for livestock/crop watering and hence it is expected that extensive rehabilitation works would be required in the areas of groundwater and surface water protection.

It is proposed that a transfer station be established at either Majors Creek or Woodstock to replace operations at the landfill. Waste deposited at the transfer station would be transferred to Vantassel Street landfill.

Vantassel Street Landfill

Considerable site improvement works have been undertaken and are continuing at the Vantassel Street landfill. The lifespan at Vantassel St landfill is in excess of 70 years. The landfill may continue to service the region, or an alternative facility established.

Vantassel Street landfill has the greatest potential to continue as the possible southern regional waste-to-energy / landfill site. This is due to the close proximity to existing infrastructure (e.g. highway and railway) and large industrial waste generators in Townsville. The feasibility of Vantassel Street landfill taking on this role should be further investigated.

14.3.7 Summary

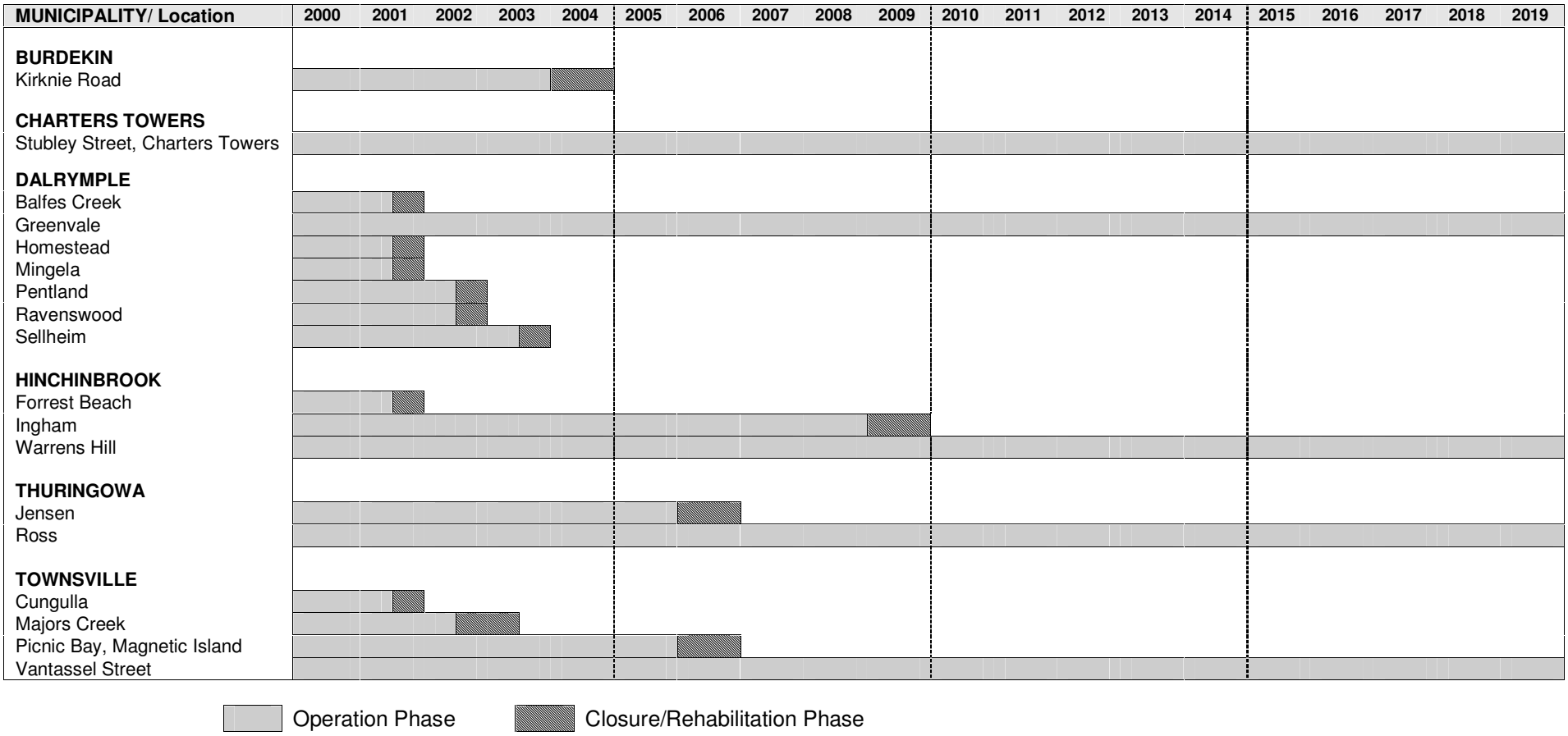
The proposed arrangement for landfill management throughout the region is summarised in Table 14.2.

TABLE 14.2 LANDFILL CLOSURE STRATEGY

MUNICIPALITY	FACILITY	SHORT-TERM (2000-2005)	LONG-TERM (>2005)
Burdekin	Kirknie Road	✓	-
Charters Towers	Stubley Street	-	-
Dalrymple	Balfes Creek	✓	-
	Greenvale	-	-
	Homestead	✓	-
	Mingela	✓	-
	Pentland	✓	-
	Ravenswood	✓	-
	Sellheim	✓	-
Hinchinbrook	Forrest Beach	✓	-
	Ingham		✓
	Warrens Hill	-	-
Thuringowa	Jensen	-	✓
	Ross	-	-
Townsville	Cungulla	✓	-
	Majors Creek	✓	-
	Picnic Bay	-	✓
	Vantassel Street	-	-

The schedule is provided in more detail overleaf in Table 14.3.

TABLE 14.3 LANDFILL MANAGEMENT SCHEDULE



NB: The life of Ross and Vantassel Street Landfills may be affected by the establishment of a southern regional facility. Should it be deemed feasible to establish a southern regional waste-to-energy facility, the proposed facility would be established in lieu of the Ross and Vantassel Street Landfills (although it may be located at one of the sites).

14.4 Transfer Station Strategy

Transfer station facilities or drop-off facilities to service self-haul waste are required at several locations for the following reasons:

- to maintain a level of service upon the closure of local landfills;
- to enhance waste segregation and resource recovery;
- to restrict public access to the tipping face at large landfills in accordance with best practice; and
- to provide a basic level of service in the event that kerbside collection of garbage is not provided.

14.4.1 Transfer Station Location and Point of Disposal

Transfer stations need to be located such that maximum coverage is provided to each municipality. Equitable travel distances to a transfer station, or landfill, should be provided as much as possible for each resident.

In the case where it is proposed that existing landfill operations be replaced with a transfer station, the former landfill site will not necessarily be the optimum location in regards to equitable travel distances.

However, establishing transfer stations at former landfill sites has a number of advantages. These include:

- waste disposal practices are established, i.e. residents already deposit waste at that location eliminating necessity for change by the community; and
- planning approval for waste disposal exists, and may not necessarily require amendment.

The level of service is largely determined by the travel distance to a waste management facility, opening hours, whether or not site supervision is provided and provision for on-site recycling facilities. The proposed transfer station arrangement is illustrated in Figure 14.9. The proposed disposal routes are illustrated in Figure 14.10.

14.4.2 Design Criteria

A transfer station type has been selected for each proposed transfer station. The transfer station type selected is based on the following factors:

- amount of waste going to existing landfill if the transfer station is to be located at a former landfill;
- population serviced;
- site and access road parameters and distance to receiving landfill; and
- transfer station classifications

The proposed transfer station types and ultimate disposal sites are summarised in Table 14.4. Disposal routes are illustrated in Figure 14.10. A schedule of transfer station establishment is provided in Table 14.5.

TABLE 14.4 PROPOSED TRANSFER STATION ARRANGEMENT

MUNICIPALITY	PROPOSED TRANSFER STATION	CLASSIFICATION	DESIGN OPTION	RECEIVING LANDFILL
Burdekin	-	-	-	-
Charters Towers	-	-	-	-
Dalrymple	-	-	-	-
Hinchinbrook	Forrest Beach	Category 1	Skip	Warrens Hill
	Ingham	Category 1	Skip	Warrens Hill
Thuringowa	Jensen	Category 2	Skip	Ross
	Ross	Category 2	Skip	Ross
Townsville	Majors Creek/Woodstock	Category 1	Skip	Vantassel Street
	Picnic Bay	Category 2	Skip	Vantassel Street
	Vantassel Street	Category 2	Skip	Vantassel Street

14.5 Bulk Bin Strategy

14.5.1 Hinchinbrook

Hinchinbrook Shire Council provides 62 bulk bins at 28 locations throughout the Shire. The Shire is over-serviced with these facilities with significant cost implications to Council and ratepayers. Considerable upgrades are required at these bulk bin disposal facilities including security fencing, signage and provision of recyclables drop-off facilities. The cost of providing and maintaining these facilities will increase.

It is therefore recommended that these facilities be rationalised in areas located near (less than 20km) waste management facilities being Warrens Hill Landfill, proposed Forrest Beach Transfer Station and proposed Ingham Transfer Station, and where residents in these areas receive kerbside collection services.

In the short-term, bulk bin facilities should be removed at the following locations:

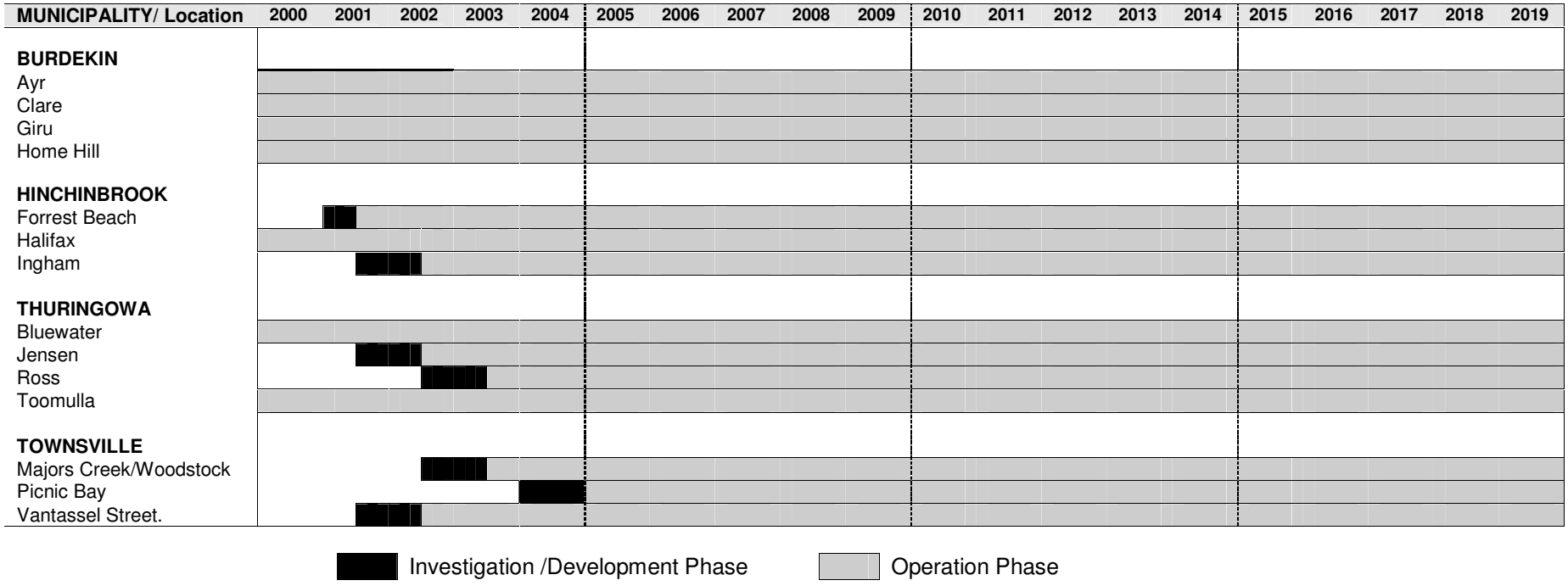
- Four Mile Road;
- Macknade;
- Cordelia; and
- Cooks Lane.

Council should review the provision of bulk bin facilities at the following locations in five years time (2005), with a view towards closure:

- Bemerside;
- Braemeadows;
- Christies Road;
- Gairloch;
- Gangemis Road; and
- Mount Gardner Road.

The long term rationalisation of bulk bin facilities is illustrated in Figure 14.11.

TABLE 14.5 TRANSFER STATION MANAGEMENT SCHEDULE



14.6 Recycling Drop-off Facilities

14.6.1 Garden Waste

Separation of garden waste at landfills and transfer stations is standard practice at waste management facilities. Contamination of garden waste stockpiles, by paper and plastic wastes in particular, can be a problem. This may be overcome by provision of adequate signage and supervision at the facility.

Collection of garden waste at waste management facilities has a number of advantages over other collection systems. The cost of providing this service is minimal compared to other systems as it relies on residents to self-haul the waste to the facility.

Issues associated with drop-off facilities include:

- accessibility;
- management of stockpiles;
- fire control;
- screening to minimise contamination;
- odour control;
- the need for periodic mulching or grinding; and
- sale of mulch product.

It is recommended that municipalities in HESROC-NQ make provision for the segregation of garden waste at all waste management facilities. Garden waste dropped-off at waste management facilities may be mulched, stockpiled, composted to form a soil-like product and used as landfill cover when sites are closed and require rehabilitation, or sold as compost products. This provides a 'market outlet' for garden waste and may result in cost savings by avoiding the need to purchase large quantities of topsoil. Municipalities can help develop this market through favourable purchasing policies.

However there are concerns with Council liability issues with respect to selling mulch that may not comply with Australian Standards. Hence liability needs to be considered in provision of this service.

14.6.2 Recyclables Drop-off Facilities

Councils need to ensure that recyclables drop-off facilities are provided at all transfer stations, landfills and other waste management facilities in the region. In areas where it is not viable to provide a kerbside collection service residents must be provided with an alternative; hence the need for drop-off facilities.

Recyclables drop-off facilities typically provide the infrastructure able to collect all or some of the following materials:

- paper and cardboard;
- glass (separated into colours);
- aluminium;
- plastics;
- steel (including car bodies and white goods);
- garden waste and timber;
- tyres;
- car batteries (from domestic sources only);
- oil (from domestic sources only); and

- concrete.

Facilities accepting car batteries and oil from domestic sources would require bunded and roofed areas for the receival of these materials. Additional consideration would be required for the transport of this material.

Repair and Reuse Centres can provide a facility for waste minimisation. Such centres recycle materials such as furniture, clothing, white goods, toys, bric-a-brac and other household goods. The cost of operating Repair and Reuse Centres is high due to high labour requirements. Hence labour is often sourced from local community organisations, unemployment training networks or local disabled associations. While not always economically viable, Repair and Reuse Centres are often seen to be a social good from an environmental and employment perspective. Local Councils may facilitate the development of Repair and Reuse Centres though the provision of an appropriate building at minimal rent to groups interested in establishing a centre.

14.7 Southern Regional Facility

The regional infrastructure strategy proposes a southern facility in the Townsville/Thuringowa area to accept deposition of Regulated Waste, other commercial and industrial waste and local domestic waste. Given the volumes of waste in this region, it may be viable to establish a facility encompassing energy recovery, organic processing, sorting of recyclable material and deposition of residual waste.

Volumes to be disposed from this area may attract interest from private contractors wishing to establish a facility similar to those established interstate (e.g. Wollongong and Port Stephens in NSW). Such a facility would contribute to regional economic development, as well as providing a more environmentally acceptable method of waste disposal than landfilling, with the added benefit of reducing greenhouse gas emissions. This may also provide a market for recyclable material collected in the region and preclude the transport of materials to Brisbane and other southern markets. This may contribute to the economic viability of kerbside collection services in the North Queensland region.

The two technologies used at Wollongong and Port Stephens (and soon for Cairns) also have the greatest potential for the Southern Facility. The co-composting system (Port Stephens and Cairns) involves plant that features a waste receival area, digestors and compost curing/maturation area. These areas are located in an enclosed building allowing greater process control and measures to reduce odour and dust emissions. General waste and biosolids are composted together after sorting of bulky materials. The Eweson Digester undertakes the biomechanical pre-processing to reduce the volume, enhance the microbiological activity for decomposition and bio-mechanical separation. Temperatures in the digesters reach 68^{o}C with decomposed material produced after three days. The non-decomposable material is screened off at this stage. The compost is then windrowed for curing purposes. The remaining waste to be disposed of is 20% of the input waste.

The gasification system being piloted in Wollongong involves the conversion of waste into heat and steam, then it is separated into organic pulp, recyclable materials and inorganic residue. The Wollongong plant, when operational, expects to be able to process up to 150,000 tonnes of general waste and 20,000 tonnes of garden waste. It is estimated that a facility of this size would cost $35-45 million to establish and have a waste processing cost of $50-60 per tonne. The electricity generation capacity is approximately 10-12 MW (EDL 1999).

Potential to recover capital and operational costs may be achieved with the sale of generated electricity to the local authority (Ergon) and contribute to meeting the 2% renewable energy target set by the Commonwealth Government. The State Government has reinforced this commitment by releasing an energy strategy which calls for electricity retailers to source 15% of their power derived from fuels other than coal. Of this target, at least 2% must be generated from renewable sources.

A gasification plant can potentially recover 0.9 MWhr per tonnes of waste. Therefore a 150,000 tonne plant could produce enough electricity for around 15,000 households (based on a household using 9 MWhr/year).

It is recommended that HESROC-NQ consider this option further through undertaking an assessment of the feasibility of establishing such a facility in the southern HESROC-NQ region. Issues which should be considered include:

- proximity to transport and electricity infrastructure;
- distance from large volume industrial waste generators in Townsville/Thuringowa region;
- competing technologies;
- optimum site location;
- commodity price of electricity; and
- infrastructure capital and operating costs.

14.8 Commercial & Industrial Waste Strategy

There is commitment in the North Queensland region from both the private and public sectors to address commercial and industrial waste management, especially with respect to Regulated Waste. An effective commercial and industrial waste management strategy should build on this commitment through the establishment of an Industry Task Force to provide for collaboration in addressing waste minimisation issues.

The Industry Task Force may facilitate the establishment of a Regional Waste Officer to address waste issues such as:

- the promotion of cleaner production technologies for avoidance of waste generated; and
- the establishment of a Waste Exchange mechanism to allow reuse of waste resources by other industries.

The Task Force should encourage industry-specific waste minimisation actions to be undertaken by major industries in the North Queensland region. This may include:

- research and development of recovery options for biosolids from local sewage treatment plants as a potential feedstock, an energy source and/or as a fertiliser in land applications;
- continue and expand the drumMUSTER program to encourage farmers to purchase chemicals packaged in refillable cardboard or paper containers;
- enforce triple-rinsing in landfills by increasing the level of supervision and imposing fines for repeat offenders;
- research and develop recovery options for molasses, bagasse and mill mud;
- investigate the potential for wastes to be used as feedstock, fuel for steam and electricity generation, and as a soil conditioner;
- research and develop recovery options for mine tailings, liquid wastes and tyres; and

- investigate recovery options of waste tyres and the potential for use in carpet manufacturing, matting, as a road base, retreads, adhesives, fenders, belting, as a fuel source and in tennis court surfaces.

14.9 Organic Waste Strategy

Collection of organic wastes has been discussed as part of the Collection Strategy (Section 14.2). At waste management facilities, adequate signage and room for stockpiling of garden waste needs to be provided.

Detailed analysis should be undertaken of the viability of establishing organic waste processing facilities at each of the three proposed regional waste management centres (Northern, Southern and Western) or whether a single organic processing site is required. The viability of a central organic processing site will depend on receiving a high value for the processed product to compensate for high costs of transport. If a regional energy recovery facility is established, it may result in a high enough demand to justify this.

It is recommended that:

- mulching operations continue at landfills to provide cover material;
- organic waste be processed to meet appropriate Australian Standards;
- further investigation into use of organic waste in sugar mill furnaces is undertaken for garden wastes sourced from the northern and southern parts of the region; and
- further investigation of a regional energy recovery facility is undertaken to determine its viability and minimum organic waste volumes required.

14.10 Litter Strategy

A regional litter strategy should be established for the North Queensland region. This strategy should include the following key actions:

- establishing a Litter Prevention Task Force;
- incorporating provisions for spill clean-ups in waste and recyclables collection contracts;
- promoting and enforcing the requirement that loads arriving at waste management facilities are properly secured and covered;
- increasing frequency of collection of public place litter bins (particularly in tourist areas);
- providing waste collection bins at special events;
- adopting a “carry in, carry out” policy in the remote areas of the region;
- raising awareness and enforcing penalties on illegal dumping at “hotspots”; and
- investigating the potential for entering into partnerships with community groups such as Landcare.

Litter management forms an integral part of the North Queensland education strategy, with the Regional Waste Officer playing a pivotal role in educating the community on the impacts that litter has on the environment and its cost to the community.

14.11 Education Strategy

Incorporation of the existing education programs and building upon these for a regional strategy should be undertaken. To help facilitate this on a regional level,

a Regional Waste Officer should be considered. Such an Officer would have responsibilities including:

- informing residents of changes to the existing services;
- informing residents of the true cost of waste management;
- promoting waste minimisation practices to residents, small businesses and industry;
- promoting litter management; and
- assist in facilitating a Waste Exchange for industry.

The education program may be undertaken through media advertising, brochures and municipal newsletters and notices. In addition to advertising, community education boards may be established at waste management centres. These boards would promote waste minimisation messages for residents.

Environmental and waste minimisation education should be promoted in local schools, shopping centres and other public places.

15. FINANCIAL EVALUATION

15.1 Revenue

15.1.1 Cost Recovery at Waste Management Facilities

There are number of options for cost recovery at waste management facilities. These options may be summarised as follows:

- establishing a user pays system and rationalising operating hours; and
- sale of recyclables.

The present market for recyclables is variable, and offers no quantifiable level of income for cost recovery. A user-pays system remains the only viable option for cost recovery.

User-pays Systems

The introduction of user pays principles at waste management facilities represents a more equitable system for passing costs on to the community. Disposal charges also create a direct financial incentive to reduce, re-use and recycle waste.

Councils may adopt a waste management levy, whereby residents who pay the annual levy are exempt from waste disposal fees at waste management facilities. Fee-paying residents should be issued with an identification card or voucher to distinguish themselves from non-fee paying residents.

The existing waste disposal charges tend not to reflect the true cost of the provision of waste management services. Disposal charges should be consistent and reflect the true cost of landfilling waste. When determining waste disposal charges the following factors should be accounted for:

- establishment costs;
- operating costs;
- administrative costs;
- land opportunity costs;
- replacement costs; and
- rehabilitation and after care costs.

A user-pays system requires that all waste management facilities be supervised. It will be necessary to limit the operating hours of a number of facilities so that the increased cost of site supervision does not outweigh any increases in revenue.

Site supervision has a number of other advantages in addition to collection of fees including:

- increased segregation of waste;
- less contamination of recyclables;
- illegal dumping of hazardous wastes is prevented; and
- waste can be covered more frequently, reducing litter problems.

However, it is not practical or cost effective to supervise all sites, especially those that service small populations.

15.1.2 Existing Charges at Waste Management Facilities

Each municipality has a range of specified items and fees for the disposal of wastes into landfills and/or transfer stations. There are a number of differences for each Council, such as no fee or limit on accepted items to variations in charges. Thuringowa and Townsville have the most specific list of items while Dalrymple and Hinchinbrook accept all items with no fee.

Charges on items, wherever enforced, range from:

- $8 to $12 for commercial waste;
- $30 (plus $6/m^3) to $50 (plus $25/m^3) for special disposal items (pathological waste);
- $20 to $25 for car bodies;
- $2.40 to $4.00 for car tyres;
- no charge to $4/m^3 for garden wastes; and
- $3.50 to $13.00 for truck tyres.

It should be noted that as from 1st July, 2000, the Goods and Services Tax (GST) applies to waste disposal charges. Figures included in fees outlined for each Council in the following sections do not include the 10% GST now applicable.

Burdekin

Fees are required for the disposal of selected items to four facilities in Burdekin Shire. These four facilities include Ayr, Clare, Giru and Home Hill Transfer Stations. The only items not listed include commercial waste, special disposal items (pathological waste) and asbestos. The following table summarises types of wastes and their associated fees for disposal for each of the four transfer stations in Burdekin Shire.

TABLE 15.1 WASTE DISPOSAL FEES FOR BURDEKIN

ITEM	FEE
Wet scraps in bag	No Charge
Cars (sedans, station wagons, vans)	$2.00
240L MGB- unsorted general waste	$2.00
Cars with trailers- unsorted general waste	$10.00
Utilities and trucks -unsorted general waste	$10.00
Trucks with a registered GVM of 3 tonnes or less	$10.00
Utilities and trucks with trailers	$20.00
Tyres- all types	P.O.A
Vehicle bodies	$20.00 each
Large tree waste in truck	$8.00/m^3
Garden Waste, Recyclables	No Charge

Charters Towers

Stubley Street Landfill is the only landfill in the City of Charters Towers and charges fees for a number of specified items. However, there are a few items that are not included such as commercial waste, special disposal items (pathological waste), car bodies, and garden wastes. The following table summarises the items accepted and the associated fee for each.

It should be noted, however, that these fees are not currently collected as there is no site supervision at the Stubley Street Landfill.

TABLE 15.2 WASTE DISPOSAL FEES FOR CHARTERS TOWERS

ITEM	FEE
Domestic Waste- unsorted general waste	No Charge
Car tyres	$2.40/tyre
Light truck tyres	$3.50/tyre
Truck tyres	$13.00/tyre
Asbestos	$30.00/m³
Recyclables (glass and cardboard)	No Charge

Dalrymple

There are eight landfill facilities in Dalrymple Shire and all of them accept any waste at no charge.

Hinchinbrook

The Shire of Hinchinbrook only specifies 'domestic wastes' in the items being disposed of and also accepts them at no charge. There are three landfills as well as the Halifax Transfer Station which receive domestic waste at no charge. These landfills include Ingham, Warren Hill and Forrest Beach Landfills. The Halifax Transfer Station specifically states 'domestic waste only' which is similar to most transfer stations with the exception of Burdekin Shire.

Thuringowa

There are two landfills in the City of Thuringowa as well as two transfer stations that accept certain wastes for a specified fee. Bluewater and Toomulla Transfer Stations both accept 'domestic waste only' at no charge. Only a few items are not specified, which include asbestos and recyclables. The following table summarises the items and fees for Ross and Jensen landfills.

TABLE 15.3 WASTE DISPOSAL FEES FOR THURINGOWA

ITEM	FEES
Domestic Waste- unsorted general waste	No Charge
Commercial Refuse- loose	$8.00/m³
Commercial Refuse- compacted	$10.00/m³
Garden Waste	$4.00/m³
Special Disposal (confidential papers, pathological waste)	$30.00 plus $6.00/m³
Car bodies	$25.00 each
Car tyres	$4.00/tyre
Truck tyres	$10.00/tyre

Townsville

The City of Townsville has four landfills which have a specified group of wastes accepted for disposal including an associated fee for each. This system is comparable to the disposal fee systems implemented by Burdekin, Charters Towers and Thuringowa. Only a few items are not specified, such as asbestos and recyclables. The following table summarises the items accepted for disposal and their associated fee.

TABLE 15.4 WASTE DISPOSAL FEES FOR TOWNSVILLE

ITEM	FEES
Domestic Waste- unsorted general waste	No Charge
Commercial Refuse- loose	$9.00/m³
Commercial Refuse- compacted	$12.00/m³
Garden Waste	$4.00/m³
Special Disposal and pathology waste	$50.00 plus $25.00/m³
Car bodies	$25.00 each
Car tyres	$4.00/tyre
Truck tyres	$10.00/tyre

15.2 Expenditure

Financial models have been developed in order to determine the cost of implementing strategy options, and these are contained in detail in Appendix I. In summary, this analysis of the proposed strategies shows financial implications as outlined in the following sections.

It should be noted that due to the difficulty of separating out GST and non-GST applicable items, GST has not been applied to any of these figures.

15.2.1 Collection Costs

Collection Pick-Up Costs

Garbage and recyclables are collected using a range of systems within the North Queensland region. Relative costs of different collection systems are shown in Appendix I - Tables I (a) to I (c). These figures do not include transport and landfill disposal costs. It should be noted that these calculated costs are not intended to provide Councils with actual costs, rather the intention is to provide a basis for comparison of relative costs only.

The calculated pick-up costs have been determined based on a range of information provided by waste management contractors and are as follows:

- 120L MGB weekly collection = $0.39
- 240L MGB weekly collection = $0.42
- 240L MGB fortnightly collection = $0.25

The following table (Table 15.5) summarises the collection pick-up costs for the various collection systems.

TABLE 15.5 RELATIVE COSTS OF COLLECTION SYSTEMS (Receptacle & Pick-Up Excluding Transport & Disposal/Treatment)

SERVICE TYPE		INDICATIVE COLLECTION PICK-UP COST ($/household/week)
1	Garbage 120L MGB for weekly collection Recyclables 240L MGB for fortnightly collection Garden Waste 240L MGB for fortnightly collection	$0.89
2	Garbage 120L MGB for weekly collection Recyclables 240L MGB for fortnightly collection	$0.64
3	Garbage 240L MGB for weekly collection	$0.42
4	Garbage 120L MGB for weekly collection Recyclables 120L MGB for weekly collection	$0.78
5	Garbage 240L MGB for weekly collection Recyclables 240L MGB for fortnightly collection	$0.67

In terms of providing an adequate level of service (one that complements the waste minimisation objectives of the region), service types 1 and 2 are preferable. However, service type 2 is the most economically viable of the two.

Garbage Collection Cost Comparison – 120L MGB Vs 240L MGB

There is a marginal difference in the pick-up cost for the weekly collection of garbage in a 120LMGB and 240L MGB. This is essentially due to the difference in the purchase cost of the receptacles. However it is emphasised that these pick-up costs do not reflect the cost of transporting and disposing of the waste collected.

According to recycling and garbage bin audits undertaken by the Beverage Industry Environment Council (BIEC), there is a strong link between garbage bin size and garbage levels. For households using a 120L MGB, the average garbage amount is 12.33 kg. For households using a 240L MGB, the average garbage amount is 18.76kg. This considerable difference in amounts impacts on transport and disposal costs. For larger volumes it is expected that more vehicle trips to the disposal facility would be required. In Appendix I, Tables I (d) and I (e) provide a cost comparison for the collection of garbage in 120L MGBs and 240L MGBs. The following table provides a summary of the analysis.

TABLE 15.6 COMPARISON OF RECEPTACLE SIZE FOR WEEKLY GARBAGE COLLECTION

Collection	120L MGB	240L MGB
Pick-up Cost ($/household/week)	$0.39	$0.42
Transport Cost ($/household/week)	$0.98	$2.27
Disposal Cost ($/household/week)	$0.49	$0.75
Total Cost ($/household/week)	$1.86	$3.44
Total Cost ($/household/annum)	$96.94	$178.83

According to this analysis, collection of garbage in a 120L MGB is more economically viable. It is emphasised that costs are indicative and are for comparison purposes only.

15.2.2 Infrastructure Financial Analysis

Due to the linkage between upgrade, development or closure of landfills and the development of transfer stations, the financial analysis of both the landfill and transfer station strategy is inextricably linked. Where closure of a landfill is proposed, development of a transfer station would be required in order to maintain the same level of service to the community. These facilities are both very capital intensive, and costs tend to vary considerably with size. A further issue to be considered with the establishment of a transfer station is the travel distance to the receiving landfill.

Indicative costs of capital works are contained in Table 15.7.

TABLE 15.7 INDICATIVE INFRASTRUCTURE COSTS

COMPONENT	THROUGHPUT SIZE (tonnes/annum)	COST $
Landfill Closure / Rehabilitation	<1,000	37,000
	1,000-5,000	57,000
	5,000-10,000	94,000
	>20,000	112,000
Landfill Upgrade	10,000	346,000
	20,000	380,000
	50,000	431,000
	150,000	577,000
Landfill Cell Development	10,000	128,000
	20,000	221,000
	50,000	500,000
	150,000	1,310,000
Transfer Station Development	300-10,000	100,000
	10,000-25,000	245,000
	> 25,000	824,000
Transfer Station Upgrade	300-10,000	13,000
	10,000-25,000	41,000
Bulk Bin Development	<300	8,000
Bulk Bin Upgrade	<300	5,000

Notes: 1. Figures are rounded to the nearest '000
2. Where appropriate, figures provided by Council have been used.

Landfill Rehabilitation

Rehabilitation costs have been estimated for landfills throughout the North Queensland region. These figures are indicative only and are to be confirmed during the planning phase for rehabilitation in which site surveying and analysis of soil conditions will clarify the extent of earth moving works, drainage and water/groundwater protection requirements.

Some landfills in the North Queensland region suffer from a lack of locally available capping material. Rehabilitation would therefore require transportation of material to the site in some locations. However the source of material and the distance from each landfill proposed for closure will vary considerably for each site. Consequently transport costs will also vary considerably, and will need to be quantified during the landfill finalisation process. Transport costs for capping material have therefore not been included; an exception to this is Picnic Bay landfill, where an indicative cost of barging in material from the mainland has been included.

Operational costs for landfill post-closure and aftercare (i.e. monitoring and disposal of collected leachate) have not been included. It should be noted that all costs exclude detailed design.

Landfill Development/Upgrade

Landfill upgrade costs refer to the lining of landfill cells and are exclusive of leachate and groundwater management infrastructure.

A considerable capital outlay is required to establish a landfill that meets best practice requirements. Costs that need to be considered include:

- design costs;
- implementation costs;
- site establishment costs;
- closure costs;
- post-closure and maintenance costs; and
- financial assurance.

Transfer Station Development/Upgrade

Costs estimated for transfer station development are indicative only and depend on site conditions. Infrastructure requirements have been based on best practice. It should be noted that costings exclude detailed design.

Establishment of transfer stations at Jensen and Vantassel Street Landfills has incorporated push-pit type infrastructure; all other transfer stations are based on provision of skips.

Upgrades to transfer stations are typically in the areas of roofing of the disposal area, upgrade of recycling area and provision of safety barriers.

Bulk Bin Facility Upgrade

Upgrades typically comprise of fencing, signage and provision for recycling.

These indicative costs have been further refined for individual waste disposal facilities in the North Queensland region. These costs are provided in full in Appendix I. A Net Present Value (NPV) analysis has also been undertaken for capital costs using discount rates of 5%, 8% and 10%. The NPV is calculated to determine the current value of future payments.

The cost of implementing the infrastructure strategy is summarised in Table 15.8. These capital costs include landfill upgrade, cell development, landfill closure, rehabilitation, transfer station/bulk bin development and upgrade. A 40% plant renewal cost after 10 years has been applied to all transfer stations; this cost is apportioned annually.

TABLE 15.8 INFRASTRUCTURE CAPITAL COSTS

MUNICIPALITY	2000/01-2004/05	2005/06-2009/10	2010/11-2014/15	2015/16-2019/20
Burdekin	$754,000	$80,000	$80,000	$80,000
Charters Towers	$942,000	$640,000	$640,000	$640,000
Dalrymple	$1,191,000	$325,000	$325,000	$325,000
Hinchinbrook	$2,557,000	$1,558,000	$940,000	$940,000
Thuringowa	$6,547,000	$2,862,000	$2,750,000	$2,750,000
Townsville	$9,356,000	$6,883,000	$6,755,000	$6,755,000
REGION	**$21,347,000**	**$12,348,000**	**$11,490,000**	**$11,490,000**

On the basis of establishment of the infrastructure outlined above, the capital cost per household has been calculated as follows in Table 15.9.

TABLE 15.9 INFRASTRUCTURE CAPITAL COST PER HOUSEHOLD

	SHORT TERM		LONG TERM	
	Households	Cost/Hhold/yr	Households	Cost/Hhold/yr
Burdekin	6,722	$23	6,330	$3
Charters Towers	2,800	$68	2,636	$49
Dalrymple	1,291	$183	1,351	$48
Hinchinbrook	5,269	$97	5,429	$42
Thuringowa	16,170	$74	26,316	$21
Townsville	32,900	$55	39,346	$35
REGION	65,152	$63	81,408	$29

Notes: 1. Number of households based on ABS data.
2. Long term projected households include population growth rates supplied by Townsville Enterprise Ltd.

It should be noted that long term infrastructure needs may change considerably if the proposed southern regional waste to energy facility should prove feasible. Similar facilities in other regions have been undertaken by the private sector under a 'BOOT' (Build, Own, Operate, Transfer) scheme, whereby capital costs are incurred by external contractors. Should a southern regional facility be established in North Queensland under a BOOT scheme, the capital funding needs of member Councils for waste management infrastructure is expected to reduce over the long term.

These facilities would require on-going operating costs as detailed in Appendix I. Infrastructure operating costs are summarised in Table 15.10. Transport costs associated with transfer stations are included. All operating costs include CPI at 3%.

TABLE 15.10 INFRASTRUCTURE OPERATING COSTS

MUNICIPALITY	2000/01-2004/05	2005/06-2009/10	2010/11-2014/15	2015/16-2019/20
Burdekin	$3,332,000	$3,119,000	$3,617,000	$4,193,000
Charters Towers	$835,000	$967,000	$1,122,000	$1,301,000
Dalrymple	$552,000	$220,000	$254,000	$296,000
Hinchinbrook	$5,521,000	$5,859,000	$5,780,000	$6,700,000
Thuringowa	$5,366,000	$7,216,000	$8,357,000	$9,679,000
Townsville	$6,867,000	$9,033,000	$10,429,000	$12,090,000
REGION	**$22,473,000**	**$26,414,000**	**$29,559,000**	**$34,259,000**

The total capital and operating costs for infrastructure per household have been outlined in Table 15.11 below.

TABLE 15.11 TOTAL INFRASTRUCTURE COSTS PER HOUSEHOLD

MUNICIPALITY	COST/HOUSEHOLD/YEAR	
	SHORT TERM	LONG TERM
Burdekin	$ 123	$ 118
Charters Towers	$ 128	$ 134
Dalrymple	$ 268	$ 86
Hinchinbrook	$ 305	$ 267
Thuringowa	$ 135	$ 85
Townsville	$ 96	$ 88
REGION	**$ 130**	**$ 103**

15.2.3 Additional Expenditure

A number of other actions have been recommended in the Regional Waste Strategy to ensure successful implementation, which have a cost implication for

HESROC-NQ member Councils. Table 15.12 summarises expenditure required in addition to infrastructure and operational costs.

The Education Strategy will include advertising costs for television, radio and print and costs for promotional materials such as community displays for shopping centres and other public places. The cost of the education strategy during the 20 year is difficult to quantify but will need to include the cost of employing a Regional Waste Officer.

Feasibility of establishing the Southern Regional Facility including options for energy recovery should be further investigated. Opportunities for processing of organic waste regionally including use in sugar mill furnaces should also be evaluated.

Support for the commercial and industrial sectors for education and development of a network maybe necessary early on. The ongoing support for programs can then be maintained by industry. This is applicable to the construction and demolition sector as well.

TABLE 15.12 OTHER STRATEGY IMPLEMENTATION EXPENDITURE

STRATEGY COMPONENT	INDICATIVE COST ($)
Establishment of a Regional Waste Management Body	5,000
Establishment of a regional waste data survey/collection system	80,000
Development of Deed of Agreement for sharing of regional facilities across member Councils	5,000
Education Strategy including print media, television and radio advertising and promotional displays and programs (e.g. SCRAP) (2 campaigns during initial 5 year period)	150,000⊗
Regional Waste Officer (cost per annum)	60,000
Litter prevention and management program	∇
Development of purchasing and pricing policies	NIL#
Feasibility study for establishing alternative technology (e.g. gasification and composting) for Southern Regional Facility	80,000
Establishment of Industry Task Force	NIL#
Investigation of waste types, amounts and disposal pathways of commercial and industrial waste. Initiation of an Industrial Waste Exchange.	50,000
Development of business waste management network including regional waste exchange and training	20,000
Investigate opportunities for local businesses to use recycled materials	10,000
Review of Regional Waste Management Strategy (5 years)	40,000
TOTAL	420,000

Cost associated may be borne across Member Councils
⊗ Based on Proposed Community Education Program (EPA Sustainable Industries Division)
∇Depends on scope of activity, including frequency of action.

16. MANAGEMENT OPTIONS

There are a number of regional organisational management issues that should be considered by HESROC-NQ in conjunction with waste management planning. These management issues will impact upon future strategic directions.

16.1 Regional Waste Management Body

To ensure that the Regional Waste Management Strategy becomes a live document it is imperative that an organisational structure is developed to take on the responsibility for implementing and reviewing the strategy.

This waste management body should have well defined responsibilities for implementation of regional programs in coordination with member Councils' objectives. This should include facilitation of waste minimisation strategies (such as awareness and education programs, cleaner production techniques, etc), as well as infrastructure planning and establishment. The body would also be responsible for ongoing review of the Regional Waste Management Strategy.

The review of the Regional Waste Management Strategy must become an on-going process to ensure that the document remains relevant and up to date. It will become necessary to amend the strategy in line with environmental legislation and policy decisions. The Waste Management Regulation requires review of the Regional Waste Management Strategy on at least a five year basis.

The Regional Waste Management Body should also have an active role in planning to ensure that adequate buffer zones are planned around existing and future disposal facilities to prevent inappropriate development and any future conflict of interest.

16.2 Data Collection

At present information on the source, amount and types of waste in the North Queensland region is incomplete. The collation of waste management data is not consistent across the member Councils and does not facilitate a regional planning approach for all waste types.

There are some landfills in the region for which no data is held at all; for others only estimates are available. This does not provide data of sufficient detail to allow targeting of waste minimisation programs to waste types or sources. Should the feasibility of a southern regional waste to energy facility be investigated, much more detailed information would be required to determine the estimated throughput and energy recovery expected from such a facility. Member Councils whose landfills receive trackable Regulated Waste also have a regulatory requirement to provide detailed information on this waste to the EPA.

Consideration should therefore be given to establishing a coordinated waste database maintained by each municipality, however enabling the amalgamation of data for a regional perspective. This would provide a means of measuring achievements against planned targets and determine the success of minimisation and education strategies.

16.3 Risk Management

The body responsible for the ownership and management of landfills must have in place an appropriate risk management strategy. This strategy should provide the management framework for any future environmental problems caused by a landfill.

16.4 Purchasing Policies

HESROC-NQ should support the recycling industry through establishment of a purchasing policy focused on the use of recycled products; member Councils should be encouraged to incorporate the policy throughout their activities. Consideration should also be given to incorporating conditions into planning permit approvals with respect to the management and minimisation of construction and demolition waste.

16.5 Pricing Policy

The cost of disposal of waste is recovered from two main sources. These are domestic charges levied on properties which receive a collection service (collection fees) or waste disposal charges levied when accessing the tip (gate fees). The strategy calls for the introduction of price parity across all waste management services. The fee structure adopted should not provide financial disincentives to use one facility over another. The fee structure should aim to:

- recover the costs of operations and facility upgrades, including replacement costs of landfill airspace and depreciation of infrastructure;
- provide funding for expanded services that better meet community expectations (e.g. kerbside recycling services);
- communicate the costs of waste management to waste generators;
- provide incentive for waste minimisation and increase recycling participation rates; and
- reward behaviour that favours management objectives.

16.5.1 Facility Gate Fees

Gate fees for the deposition of waste destined for landfill should be introduced at all facilities. These fees should reflect the costs of managing the waste and ensuring that waste management assets and facilities can be maintained.

At facilities that service areas that do not receive kerbside collection service, disposal costs might be paid through rates, with residents being issued with passes allowing them to dispose of a certain number of loads of materials for free throughout the year. Non-residents would have to pay a gate fee at these facilities.

Incentives for source separation of recyclables and reusable materials should be offered in the form of free or reduced fees from receiving such materials. It is recommended that some fees to support recycling or composting be charged for materials that will have a net cost to recycle/reuse. Determination of the net cost of management of different materials should consider avoided disposal costs and any revenues received from sale of products.

Further incentives for source separation can be provided by applying penalty rates to vehicles that have large volumes of unsorted recyclables in loads. Such an option may be considered if waste haulers do not take advantage of drop-off facilities and financial incentives. This option may be considered where

investment in drop-off and recycling operations is based on high levels of material throughput.

16.5.2 Host-Guest Sharing

Cross-sharing of waste management facilities occurs between Townsville and Thuringowa. Financial arrangements are negotiated to cross-subsidise the waste collection and landfill disposal fees. The proposed landfill management strategy requires the sharing of landfills across municipal borders. In summary the landfill strategy is as follows:

- Northern Region – Warrens Hill landfill is intended to service Hinchinbrook.
- Southern Region – Ross/ Vantassel Street landfills.
- Western Region – Charters Towers (Stubley Street) landfill.

Under the proposed landfill strategy, Burdekin Shire would enter into financial agreements with the City of Townsville for the disposal of waste at the Vantassel Street landfill. The Shire of Dalrymple would also be required to enter into agreements with the City of Charters Towers.

Host-guest arrangements should be formalised through a Deed of Agreement. This would detail disposal arrangements and the basis for financial compensation agreed to between both parties.

16.5.3 Infrastructure Costs

Over the following five years, the region will experience significant capital costs associated with the up-grade of infrastructure and rehabilitation of landfill sites. There are also on-going infrastructure operating and depreciation costs that cannot always be met by gate fees without setting gate fees too high and promoting inappropriate waste disposal.

The development or extension of a landfill could be supported through a waste management special charge whereby a charge is imposed on properties for a fixed period.

Where infrastructure costs are for measures such as establishing or up-grading transfer stations, establishing new landfills and purchasing MGBs, consideration should be given to securing and servicing loans through rates revenue.

Alternatively, member Councils could enter into “Build Own Operate Transfer” (BOOT) schemes whereby a contract is let to the private sector to build, own and operate a facility and at the end of the contract period the private sector relinquishes ownership of the facility to Council.

16.6 Contracts

The fewer contracts entered into will reduce administration and contract management costs, and will attract contractors with resources, incentive and ability to reduce per unit waste management costs through optimal economies of scale. Hence it is recommended that member Councils bring the expiry dates of existing collection contracts into line. This may make management of contracts simpler and could result in more economical solutions through regional or sub-regional letting of contracts.

Sub-regional contracts could either be "total" waste management contracts for that area, or the operations could be split into smaller contracts. Possible combinations or division of contracts include:

- combined collection of garbage and recyclables, and operation of all waste management facilities (a "total" sub-regional contract);
- combined collection of garbage and recyclables, with separate contracts for management and receival of waste at landfills, transfer stations or MRFs; and
- separate contracts for garbage collection, recycling collection, operation of landfills, operation of transfer stations, and receival of materials at MRFs.

Table 16.1 summarises the majority of services provided by each municipality. These services are either under contract or provided by Council.

TABLE 16.1 SERVICE AND CONTRACTOR SUMMARY

MUNICIPALITY	SERVICE	CONTRACTOR/OPERATOR	CONTRACT EXPIRY DATE
Burdekin	-Collection/Recycling	• Townsville Trade Waste	August 2005
	-Supervision at Transfer Stations	• Burdekin Night Alert	-
	-Landfill Operators	• Council	-
Charters Towers	-Kerbside Collection	• Council	-
	-Landfill Operators	• Council	-
Dalrymple	-Landfill Operators	• Council	-
Hinchinbrook	-Collection/Recycling	• Mams Plant Hire Pty Ltd	June 2005
	-Supervision at Transfer Station	• Council	-
	-Landfill Operators	• Council	-
Thuringowa	-Kerbside Collection	• Cleanaway • Council (Paluma)	June 2002
	-Kerbside Recyclables	• Cleanaway	June 2002
	-MRF	• Cleanaway	June 2002
	-Transfer Station Operation (unsupervised)	• Council	-
	-Landfill Operation	• Council	-
	-Landfill Salvaging & Resource Recovery	• Blinks Chop & Chip Tree Recyclers • JJ Richards	Unknown
Townsville	-Kerbside Collection	• Citiwaste (Council) • Magnetic Waste (Magnetic Island)	August 2006
	-Kerbside Recyclables	• Cleanaway • Magnetic Waste	2003 August 2006
	-MRF	• Cleanaway	March 2003
	-Vantassel Street Landfill, Townsville	• McCahill Earthmoving	June 2001
	Landfills	• Council	-

16.7 Service Delivery Models

A number of service delivery models are available for waste management facilities including the following:

- in-house council operation;
- contracted operation of council facility;

- privately owned and operated;
- build, own, operate and transfer (BOOT).

16.7.1 In-house Council Operation

Under this arrangement a transfer station is operated as a financially independent service, owned and operated by Council. This arrangement allows greater control of the facility's operation in accordance with municipal and regional strategic directions. Quality assurance can be maintained and all profits (or losses) are retained by Council.

16.7.2 Contracted Operation of Council Facility

Under this type of contract, Council provides land and infrastructure with all operations under a contractual arrangement. Tendering of the contract should ensure a competitive market and maximise financial benefit to Council. The Council at the expense of the contractor could stipulate the quality assurance and control mechanisms introduced. Income from the sale of recyclable materials and gate fees typically remains with the contractor. Risk can be transferred to the contractor. The benefits received by Council depend on specific contract clauses.

16.7.3 Privately Owned and Operated

Council has no involvement with privately owned and operated facilities and hence there is a total shift of risk and liability to the private sector. Reliance on the facility in the long term may be uncertain but encourages a high level of private industry competition.

16.7.4 Build Own Operate and Transfer (BOOT)

A contract is let to build, own and operate a facility and at the end of the contract period relinquish ownership of the facility to Council. The main advantage is that private sector expertise can be utilised in the construction phase with minimal Council input in terms of administration time and up-front capital. At the end of the contract Council owns a facility with well established operational and management systems in place. The benefits received by Council depend on specific contract clauses. It is important that the contract specifies that the facility be well maintained so that Council retains ownership of a facility in satisfactory condition.

16.7.5 Summary

The optimum service delivery model is one that enables Council some degree of control over waste management, ensures that ratepayers will have access to a facility irrespective of the market and that also encourages private sector involvement.

It is Council's responsibility to ensure that ratepayers have access to a waste management facility. The major concern associated with private ownership of all facilities is that should a facility become vulnerable to market forces, Council could be exposed to establishment of a private sector monopoly. Council can protect itself from such exposure by retaining ownership of a facility.

Hence a combination of both 'contracted operation of Council facilities' and 'privately owned and operated facilities' maximises the benefits to ratepayers and Council offered by each option.

Table 16.2 compares the advantages and disadvantages to Council of each service delivery model.

TABLE 16.2 REVIEW OF MANAGEMENT OPTIONS

MANAGEMENT OPTION	ADVANTAGES	DISADVANTAGES
In-house Council Operation	▪ All profits to Council. ▪ Greater control over waste management. ▪ Quality assurance easily maintained. ▪ Stability and security provided to residents in an unstable market.	▪ All risk retained by Council. ▪ Council bears the cost of facility approval and construction funding.
Contracted Operation of Council Facility	▪ Maintains control over payment structure to encourage diversion of waste from landfill. ▪ Maintains control of service quality. ▪ Ensure a competitive market. ▪ Risk can be transferred to the contractor. ▪ Contractor incurs sales & marketing costs. ▪ OH&S costs incurred by contractor.	▪ Limited control over public relations and community education. ▪ Council bears the cost of facility approval and construction funding.
Privately Owned & Operated Under Council Contract	▪ Incentive to manage facility economically. ▪ Reduced management costs. ▪ Maintains control over payment structure to encourage diversion of waste from landfill. ▪ Maintains control of service quality. ▪ Contractor incurs sales & marketing costs. ▪ OH&S costs incurred by contractor.	▪ Volatility of industry may expose Council. ▪ Long term reliance uncertain. ▪ May not complement regional waste management planning. ▪ Establishment of sector monopoly.
Privately Owned & Operated	▪ Bears no financial or operational risk. ▪ Incentive to manage facility economically. ▪ Reduced management costs.	▪ Volatility of industry may expose Council. ▪ Long term reliance uncertain. ▪ Neglect of community education and public relations. ▪ Risk of poor environmental management. ▪ Risk of poor level of quality assurance. ▪ No control over pricing policies. ▪ May not complement regional waste management planning. ▪ Establishment of private sector monopoly. ▪ Difficult to manage objectives directed to waste minimisation.
BOOT	▪ Contract can be tailored. ▪ Risk is initially accepted by contractor. ▪ Organisational management of facility well established prior to transfer.	▪ Limited power of pricing policies. ▪ Input into design is minimal. ▪ Risk that a poor facility will be transferred at end of contract. ▪ Risk is transferred. ▪ Profits will not be obtained initially.

16.8 Community Employment

Improvement in waste management services provides many local employment opportunities. Expansion of recycling services will create positions in collection, sorting and marketing of recyclables. Currently unsupervised transfer stations and drop-off facilities will require staffing.

Improved waste management will require coordination and education. Personnel would be required to coordinate and implement education campaigns.

Closure and rehabilitation of landfills and development of transfer stations will generate local employment in the earthworks and construction sector. Development and maintenance of large regional landfills would also generate employment.

With respect to collection contracts, Councils could consider incorporating contract specifications that provide prospective bidders with the contact details of smaller contractors in the region. Tenders could specify that the creation of local employment will be a selection criteria, and recommend that bidders seek to include smaller contractors in their bids.

17. REGIONAL STRATEGY

The Regional Waste Management Strategy provides a set of guidelines and proposed actions to achieve waste minimisation and environmental outcomes for the entire HESROC-NQ region. This regional strategy incorporates all recommended elements of waste management infrastructure and waste minimisation strategies outlined in the previous sections.

The recommended time frame for implementation has been assessed in line with short term goals (5 years) and long term waste planning objectives (20 years). The implementation time frame is subject to availability of funding and the long term community acceptance of the proposed scheme.

The recommended Regional Waste Management Strategy is summarised in Table 17.1.

TABLE 17.1 REGIONAL STRATEGY

ACTION	SHORT TERM	LONG TERM
COLLECTION:		
Extend waste collection and recyclables contracts to align expiry dates, allowing opportunities for regional or sub-regional collection contracts to be entered into.	✓	
Investigate options for development of a pay-by-use collection service with waste minimisation incentives available to residents.	✓	
Encourage contractors and Councils to provide waste and recycling receptacles constructed of recycled material to support the recycling industry.	✓	
Contract specification should include awareness initiatives on recycling to encourage community participation in recycling.	✓	
Extend existing collection districts to include nominated areas not previously receiving a service and properties on route between towns.		✓
Investigate the feasibility of introducing a fortnightly garden waste collection service to residential areas.		✓
Putrescible domestic garbage collection systems employed throughout the region should be based on containers with a maximum weekly garbage capacity of 120L.		✓
Recyclables collection system employed throughout the region should be fortnightly service with 240L containers.		✓
Intra-regional collection system options should be market tested through the tender process.		✓
INFRASTRUCTURE:		
A pay-by-use system should be phased in at all facilities across the HESROC-NQ region to recover the costs associated with landfilling waste.	✓	

ACTION	SHORT TERM	LONG TERM
Upgrade existing landfills not expected to close in the short term to comply with best practice benchmarks. These landfills are: • Charters Towers: Stubley Street • Dalrymple: Greenvale • Hinchinbrook: Warrens Hill • Thuringowa: Ross • Townsville: Vantassel Street.	✓	
Close and remediate landfills at: • Burdekin: Kirknie Road, Ayr • Dalrymple: Balfes Creek, Homestead, Mingela, Pentland, Ravenswood and Sellheim • Hinchinbrook: Forrest Beach • Townsville: Cungulla, Majors Creek	✓	
Upgrade existing transfer stations to comply with best practice guidelines. These transfer stations are: • Burdekin: Ayr, Clare, Giru and Home Hill • Hinchinbrook: Halifax • Thuringowa: Bluewater, Toomulla.	✓	
Remove bulk bin facilities at the following locations: • Cordelia • Cooks Lane • Four Mile Road • Macknade.	✓	
Encourage waste segregation and resource recovery throughout the region through provision of appropriate infrastructure at all landfills.	✓	
Investigate the feasibility of establishing a southern regional waste-to-energy facility to incorporate treatment facilities for organic waste and Regulated Waste.	✓	
Establish transfer stations at the following locations: • Hinchinbrook: Forrest Beach, Ingham • Thuringowa: Jensen, Ross • Townsville: Majors Creek/Woodstock, Picnic Bay, Vantassel Street Transfer stations should be designed to meet best practice guidelines and consider the expected annual waste throughput over the next 20 years.	✓	
Make provision for separation and stockpiling of garden waste at all landfills and transfer stations throughout the region.	✓	
Close and remediate landfills at: • Hinchinbrook: Ingham • Thuringowa: Jensen • Townsville: Picnic Bay, Magnetic Island		✓
Further rationalise the number of landfills in all Council areas to result in 3 regional landfill sites to service the northern, southern and western areas.		✓

ACTION	SHORT TERM	LONG TERM
Install (or provide access to) weighbridges at regional landfills and equip with machinery capable of achieving a waste compaction of at least 800 kg/m^3.		✓
Review bulk bin provision with a view to removal of those close to transfer stations/landfills and where residents receive collection services. This includes: • Bemerside • Braemeadows • Christies Road • Gairloch • Gangemis Road • Mount Gardner Road		✓
Consider establishing a regional organic waste processing facility at the proposed southern regional facility. Consider incorporating industrial organic waste and biosolids into a regional processing facility.		✓
OTHER:		
Establish a Regional Waste Management Body to implement and review the Strategy.	✓	
Appoint a Regional Waste Officer to devise and implement waste minimisation and litter education programs through the region.	✓	
Encourage the development of specialist recycling facilities within the North Queensland region in conjunction with local industry.	✓	
Participate in an agricultural chemical container collection service in conjunction with drumMuster. Encourage the use of agricultural chemicals packaged in refillable containers.	✓	
Establish recycling bins adjacent to litter bins in public places, and encourage the use of recycling bins at public events.	✓	
Establish a regional waste exchange and encourage use of the Queensland and national waste exchange networks by industry.	✓	
Implement a 'smarter shopping' campaign to encourage the use of appropriate packaging, reusable and refillable products and products made of recyclable materials and packaging.	✓	
Promote litter control across the community through education and enforcement.	✓	
Promote and enforce the requirement that loads arriving at landfills and transfer stations are properly secured and covered.	✓	
Coordinate a series of regional mobile campaigns at schools, shopping centres and public events.	✓	
Utilise Council newsletters, direct mail, local papers and/or other media to promote waste minimisation and changes to existing services.	✓	
Review on an annual basis the progress made by member Councils towards achieving regional goals. Review Regional Waste	✓	

ACTION	SHORT TERM	LONG TERM
towards achieving regional goals. Review Regional Waste Management Strategy on five year cycle.		
Develop a central database to record the amount and types of waste and recyclables collected at kerbside and received at waste management facilities to determine effectiveness of recycling programs. The system should include trackable Regulated Wastes.	✓	
Establish a purchasing policy to encourage the use of products with recycled content and that are recyclable. Encourage adoption by member Councils.	✓	
Investigate future opportunities for waste minimisation throughout the region and encourage local industry to take an active role in avoiding waste and reusing and recycling recyclable material.		✓
Develop public awareness of the total cost of waste management.		✓
Formalise sharing of regional facilities between member Councils by establishing a Deed of Agreement.		✓

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GLOSSARY

ABS	Australian Bureau of Statistics
ANZECC	Australia and New Zealand Environment and Conservation Council
BIEC	Beverage Industry Environment Council
Biosolids	Stabilised organic solids derived from wastewater treatment processes
C&D	Construction and Demolition
C&I	Commercial and Industrial
Commercial Waste	Waste generated from commercial premises other than garden waste, recyclable waste or waste discharged to a sewer.
Compost	The controlled biological decomposition or treatment of an organic part of a material to a condition sufficiently stable for safe and beneficial use in land applications.
Diversion Rate	The amount of recyclable material diverted from the waste stream
Domestic Clean-up Waste	Non-putrescible, dry and inoffensive waste (other than garden waste or recyclable waste) resulting from general clean-up of any residential premises
Domestic Garbage	Domestic waste from kerbside collection service (includes putrescible waste)
Domestic Waste	Waste resulting from the ordinary domestic use of residential premises other than domestic clean-up waste, garden waste, recyclable waste or waste discharged to a sewer.
EMOS	Environmental Management Overview Strategy
EPA	Environmental Protection Agency
EPP	Environmental Protection Policy
ESD	Ecologically Sustainable Development
Garden Waste	Refers to grass cuttings, trees, bushes, shrubs, loppings of trees, plant and leaves
GHG	Greenhouse Gas
Groundwater	Water located beneath the land surface
GST	Goods and Services Tax
HDPE	High density polyethylene (plastic)
HESROC-NQ	Health and Environmental Services Regional Organisation of Councils – North Queensland

IDAS	Integrated Development Assessment System
Industrial Waste	Waste derived from industrial sources
LAWMAC	Local Authority Waste Management Advisory Committee
LF	Landfill
LDPE	Low Density Polyethylene
LRAP	Landfill Remediation Assessment Program
MGB	Mobile Garbage Bin
MRF	Material Recovery Facility
MW	MegaWatt
MWh	MegaWatt hours
NEPM	National Environmental Protection Measure
NPV	Net Present Value
NQLGA	North Queensland Local Government Association
PCBs	Polychlorinated biphenyls
PET	Polyethylene Terephthalate (plastic)
RARE	Resource and Recovery Education program
Recyclable Material	Clean and inoffensive material which can be reused and reprocessed into a product, includes, paper, glass, some plastics, aluminium, steel and cardboard
Regulated Waste	Non-domestic waste outlined in Schedule 7 of the *Environmental Protection Regulation 1998* (whether or not it has been treated or immobilised), including, for an element, any chemical compound containing the element; and anything that has contained the waste.
SBMP	Site Based Management Plan
SCRAP	School Communities Recycling All Paper program
TS	Transfer Station