Townsville City Council and The City or Thuringowa

Review of Kerbside Recycling Systems

Final Report

January, 2002

Ref: 4081-01

NOLAN-ITU Pty Ltd ACN 067 785 853 ABN 23 359 240 890

Suite 4, 11 Victoria Parade, Manly NSW 2095
Telephone: (02) 9976 5411 Facsimile: (02) 9976 5422

NOLAN-ITU PTY LTD

ACN 067 785 853
ABN 23 359 240 890

REF: 4081-01

Document History and Status

Issue	Status	Date	Project Manager	Reviewer
1-1	Final Draft	21/11/01	Euston Ling	Bert van den Broek
1-2	Final Report	23/01/02	Euston Ling	Bert van den Broek

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

1 EXECUTIVE SUMMARY

Townsville City Council and Thuringowa City Council provide kerbside recycling services to their residents under separate contracts with Cleanaway. The contracts expire in 2002 and the two Councils are considering the possibility of calling a joint contract for a new service. There are, however, a number of significant issues of concern to the Councils that need to be reviewed prior to calling tenders, including:

- Standardising the collection system to 240L mobile garbage bin (MGB) for garage and recyclables across the two Cities;
- Contamination levels of the collected recyclables as claimed by Cleanaway versus Councils' own audit figures;
- MRF efficiency in terms of materials recovery and the large proportion of recoverable materials disposed of as waste;
- Markets for recovered materials recovered from the MRF, particularly paper, and the availability of markets for these materials in the next contract term;
- Risk sharing arrangements in terms of performance incentives and equitable arrangements to optimise materials recovery.
- Cost and environmental effectiveness of providing kerbside recycling systems, which currently cost in the order of $1.8 million per year;

The Councils commissioned this study by Nolan-ITU to assist them in resolving these issues and to provide them with a sound basis for structuring any new contract.

The key findings of this study are as follows:

Contamination Levels

The contamination levels reported by the contractor are significantly overstated as a result of current MRF inefficiencies and a lack of appropriate incentives. Nevertheless, contamination levels in the collected recyclables are unacceptably high and this issue will need to be addressed through such measures as increased public education, should the Councils elect to proceed with a new recycling service.

MRF Efficiency

As a result of input material contamination, insufficient labour and the lack of incentives for maximising materials recovery, the MRF is not operated efficiently. Sometimes, truckloads of materials deemed to be excessively contaminated are diverted directly to landfill and some materials are apparently not being recovered at all ie., clear glass and coloured HDPE. During two site inspections, only four out of the five nominated sorters were present, leading to high levels of potentially recoverable materials being observed on the waste conveyor.

In addition, the current arrangement whereby MRF residue is disposed free of charge by the contractor provides little incentive for maximising resource recovery.

Markets for Recoverable Materials

The Contractor and Amcor confirmed that paper recovered from the MRF and transported to Brisbane is no longer required by Amcor and is disposed of to landfill. Amcor has advised Cleanaway that it will not accept paper from the MRF after expiry of the current contract.

The study has shown that alternative markets for recovered paper are available and that ongoing markets are expected to be available for the other recyclable commodities. Interest in recovered commodities has been shown by both Visy and Coca-Cola.

Risk Sharing Arrangements

The current risk sharing arrangements covered by Rise and Fall provisions are based on changes in commodity prices and quantities of materials collected. Therefore, administration of these provisions is extremely difficult given the lack of verifiable data relating to material quantities and returns to the contractor for the sale of sorted materials ie., net commodity revenue.

The contractual arrangements between the Councils and the Contractor, and those between the Contractor and the recyclers of commodities, are not structured to maximise materials recovery and utilisation. No incentives are provided to operate the MRF effectively and the current arrangement whereby the contractor is able to dispose of MRF residues free of charge is counterproductive to encouraging maximisation of materials recovery.

Environmental and Financial Performance

The study has concluded that the current recycling arrangements between Cleanaway, Townsville City and Thuringowa City Councils are ineffective in terms of material recovery rates, material utilisation and in achieving ESD objectives. The Key performance data for the two Councils is summarised in the tables below for the current domestic waste and recycling arrangements. The tables also compare the performance of the current systems with:

- **A minimum service** - abolition of the recycling system;
- **An improved recycling service** - fortnightly 240 L commingled recycling service with materials being processed at a state–of-the-art MRF under an incentive based recycling contract; and
- **A reduced recycling service** - a reduced number of recyclable materials being collected, sorted and reprocessed.

Townsville Performance Summary

Option Description	Materials Recovery Rate kg / hh / yr	System Costs: $ / hh / yr		
		Service Cost	Marginal Cost for Recycling	Environmental Benefit (Eco-Dollars)
Minimum Service	Nil	65.35	N/A	N/A
Current Service	66.1*	107.44	42.09	28
Improved Recycling Service	120.9	97.49	32.14	49
Reduced Recycling Service	50.4	95.95	30.60	21

* - Includes 49.8 kg/household/year of paper currently collected but not recycled

Thuringowa Performance Summary

Option Description	Materials Recovery Rate kg / hh / yr	System Costs: $ / hh / yr		
		Service Cost	Marginal Cost for Recycling	Environmental Benefit (Eco-Dollars)
Minimum Service	nil	72.40	N/A	N/A
Current Service	31.8*	73.36	0.96	13
Improved Recycling Service	126.3	104.59	32.19	50
Reduced Recycling Service	52.6	104.23	31.83	21

* - Includes 17.9 kg / household / year of paper currently collected but not recycled

The study also found that an improved recycling service, i.e. one that achieves similar materials recovery performance to the national average, would achieve greater recovery rates and enhanced ESD performance. It is expected that the cost of such services would be lower than the present system in the case of Townsville. However, it is likely that Thuringowa would incur additional costs. This is because Thuringowa's present one bin collection and recycling system is priced at an unsustainably low level and the more effective two bin system will be more expensive. It is important to note that these figures include estimates for collection costs and that actual costs established by tendering may differ from these estimates.

The net environmental benefit attributable to the current recycling systems is estimated at -$14 and +$12 per household per year for Townsville and Thuringowa respectively, assuming that recovered paper can be recycled. The net environmental benefit for the improved recycling system is estimated at $17 and $18 for Townsville and Thuringowa respectively. These benefits are considerably lower than the national average figures found in the NPCC study, i.e., $46 for urban areas and $29 for regional areas. A significant factor in the lower figures for Townsville and Thuringowa is the region's greater distance to commodity markets than the national study.

Compared with an improved recycling service which maximises the recovery of all commodities, there is little cost saving for the reduced recycling option which would only recover containers. The lack of cost savings is due to the ongoing requirement to dedicate similar infrastructure to a reduced service capturing lower tonnages, as for the full recycling service. As a willingness to purchase mixed paper and cardboard has been expressed by Visy, this option is not recommended.

Future Recycling Contract Recommendations

Should Townsville and Thuringowa Councils decide to proceed with the improved recycling service option, it is recommended that:

- Separate tenders be called for collection and processing; and
- Provision be made for ongoing community education to maximise the quantity and quality of recyclables presented at kerbside.

It is anticipated that this approach would allow the Councils to maintain maximum flexibility between material presentation, collection and sorting. This does not preclude the submittal of non-conforming tenders which might offer a combined collection and processing service.

It is also recommended that any tender and contract documents be structured to encourage the collection contractor to minimise inbound contamination and the MRF operator to maximise resource recovery by requiring the:

- MRF operator to pay for disposal of MRF residues;
- Collection contractor not to exceed a nominated collection density; and
- MRF operator to ensure recovered materials are recycled.

These contractual arrangements should build in flexibility as commodity markets change thereby helping to reduce risk levels and facilitate cooperative relationships. Furthermore, such mechanisms would be expected to promote greater resource recovery than the Rise and Fall Formula and Benefit / Risk Calculation Clauses within the present recycling contract.

It should be noted that many of the findings within this report rely heavily of data supplied by Cleanaway. Much of this data appeared to be of an arbitrary nature, reportedly assigned to Councils using a 60:40 (Townsville:Thuringowa) split according to population figures.

However, given population figures for the two Councils and typical national recyclables recovery rates, some of the supplied data appeared anomalous. To date, the monitoring of recycling performance has been difficult because of a lack of reliable data. In addition, the available data has at times been of questionable integrity. Therefore, it is recommended that the Councils install weighbridges to monitor the quantities of recyclables and waste collected. This will enable ongoing performance monitoring and greater accuracy in pricing disposal and recycling services.

Other Issues for Consideration

With the expiration of the collection and recycling contract between Cleanaway and Townsville and Thuringowa Councils, there are a number of issues that may be incorporated within a new contract in order to maximise efficiency gains. These include:

- Use of single pass collection vehicles to maximise kerbside collection efficiencies;
- Location of a MRF at a landfill to boost transport and disposal efficiencies;
- Use of day labour to collect domestic waste and recyclables, thereby capitalising on in-house expertise;
- Establishment of local value adding opportunities including commodities reprocessing to draw recyclate from other regional areas and creating economies of scale.

Other Ecologically Sustainable Projects

It is understood that the Councils have been considering other ways to enhance the ecological sustainability of the region. Accordingly, a number of ideas have been raised as to how this might be achieved. It is important to note that amongst the various options which have been put forward, the alternatives should be seen as complementing one another rather than competing interests. Some initiatives which have been put forward include:

- Development of a "Local Sustainability Framework";
- Use of alternative waste treatment methods;
- Landfill gas recovery and utilisation;
- Tree planting programs;
- Energy efficiency programs;
- Water conservation programs;
- Coastline protection measures; and
- More efficient utilisation of greenwaste;
- Development of a Local Agenda 21; and
- Joining of the Cities for Climate Protection TM program through the International Council for Local Environmental Initatives and Australian Greenhouse Office.

Some of the suggested programs will overlap eg, greenwaste utilisation, alternative waste technologies and tree planting. Hence, there will be a requirement for timetabling if some or all of these options are to be pursued. However, it may be seen that, properly coordinated, these programs will complement each other significantly, enhancing the region's sustainability above and beyond the implementation of a single program in isolation. Similarly, water conservation may have a coastal impact as people are encouraged to install low flow devices, repair drips etc.

2 BACKGROUND

The kerbside recycling systems introduced in Australia during the late 1980's and early 1990's have been seen as a cornerstone of environmental policy and municipal waste reduction. Strong community support has produced participation rates in excess of 85% and a substantial proportion of the domestic waste stream is being recovered for recycling.

Despite the significant role of kerbside recycling in public policy and its growth throughout the various states of Australia, there remains speculation and concern within some sectors that the costs of recycling may not be justified by the benefits.

In part, the ***national*** assessment of kerbside recycling carried out by Nolan-ITU for the National Packaging Covenant Council provides answers to these questions from a quantitative perspective but application of the methods is needed at the ***local*** level to ensure that ***local values*** and data are incorporated into the assessment. Whilst the environmental and economic assessment of kerbside systems can be identified, the weights or values which different groups within the community attribute to these variables has not been determined.

Townsville City Council and Thuringowa City Council provide kerbside recycling services to their residents under separate contracts with Cleanaway. The contracts expire in 2002 and the two Councils are considering the possibility of calling a joint contract for a new service. There are, however, a number of significant issues of concern to the Councils that need to be reviewed prior to calling tenders, including:

- Standardising the collection system: Townsville's recycling system is currently based on 240L bins for commingled recyclables, collected fortnightly; whereas the Thuringowa system is based on a divided 240L bin for garage and recyclables. The Councils consider it likely that a standardised collection system across the two Cities would be more cost effective .

- Contamination issues: The Contractor argues that contamination levels of the collected recyclables are unacceptably high, particularly the material collected from the divided bin system. Councils' own audit figures do not support the Contractor's position and there is a need to review this issue.

- MRF efficiency: The operation of the Contractor's MRF appears to be inefficient in terms of materials recovery and a large proportion of recoverable materials is disposed of as waste.

- Markets for recovered materials: The Contractor has advised that there are significant problems in the marketing of some materials recovered from the MRF, particularly paper, and that markets may not be available for this in the next contract term.

- Risk sharing arrangements: The current recycling contracts do not appear to provide adequate incentive for the Contractor to operate the MRF efficiently in terms of materials recovery. Any new contract would need to provide for equitable risk sharing arrangements and be structured to optimise materials recovery.

- Cost and environmental effectiveness: The combined cost to the two Councils of providing the kerbside recycling systems is of the order of $1.8 million per year. The Councils wish to review the cost and environmental effectiveness of the current systems and compare these with other options.

The Councils commissioned this study by Nolan-ITU to assist them in resolving these issues and to provide them with a sound basis for structuring any new contract.

Stage 1 of the study involved reviewing the effectiveness of the current kerbside recycling services provided by Townsville and Thuringowa Councils from financial and environmental performance perspectives, and comparing these systems with similar operations elsewhere. Comparative information has also been provided to evaluate these systems against alternative recycling systems and the "minimum service" option (i.e. no kerbside recycling).

Stage 2 involved a review of the preliminary findings with Council officers and a Councillor. The purpose of this review was to workshop and refine the options to be presented in the final report.

3 METHODOLOGY

3.1 Current Kerbside Collection and Recycling Systems

To determine the economic, environmental and social impacts of the existing recycling systems the following information was sought from the Townsville and Thuringowa Councils and the Contractor. Where information did not exist or was not made available, discussion was held with the relevant Council officers to produce best estimates for application within the study. The information sought included:

- Quantities of kerbside recyclables and garbage collected;
- Collection methods employed;
- Contamination levels and education programs;
- Ownership of materials;
- Contract price arrangements;
- Risk sharing arrangements;
- Price incentive methods; and
- Other relevant contract conditions.

To complete the assessment of kerbside systems within the region, information on the following variables was also sought:

- Collection and sorting technologies/infrastructure;
- Occupational health and safety;
- Economies of scale opportunities;
- Reprocessor details;
- Commodity markets and trends; and
- Impact of waste container and other collection systems on recyclables yields and costs of waste and recycling services;

In addition, independent inquiries were made to identify:

- Market conditions for recyclable commodities over the near future:
- Market barriers: and
- Other factors influencing the viability of kerbside recycling within Townsville and Thuringowa.

3.2 Alternative Kerbside Collection and Sorting Systems

Based on an understanding of the performance of the current kerbside systems in Townsville and Thuringowa, overall recycling trends and commodity markets, a number of alternative kerbside collection and sorting systems have been identified. The essential components for a sustainable kerbside recycling program are:

- Commodity Markets, including price trends and product specifications (contamination);
- Collection systems, logistics and technologies;
- Contractual arrangements between Councils and contractors;
- System auditing and information collection; and
- Public education and participation.

These components have been incorporated into the alternative systems.

The alternative systems adopted for review are in Section 6:

3.3 Establishing the Financial Costs

Based on Council records and our in-house resources, the following financial cost information has been determined for each Council's waste management system:

Cost of garbage collection and disposal: This value is measured in dollars and represents the cost of collecting and landfilling/disposing garbage. The system cost includes the value of trucks, fuel, bins provided, landfilling, haul costs and other associated expenditure.

Cost of recycling after collection, sorting and sale: This value is measured in dollars and represents the cost of collecting, sorting and/or treating recycled materials. It does not include the transportation of materials beyond a MRF, although it can include the delivery of sorted materials to a beneficiation plant or some other buyer. These secondary transport costs are reflected in the price per tonne offered for the recovered materials. This value also includes the cost of sorting and disposing of contaminated materials, which needs to be considered as part of the recycling process.

Total cost of garbage and recycling services: This value is the aggregation of the recycling and garbage disposal costs.

Estimated cost if only garbage service offered: This value is in dollars and represents the cost of providing a weekly 240 L garbage service only. The usefulness of this value is that it determines the extra cost of providing recycling services. This is, nominally, the minimum service option possible.

Real (marginal) cost of recycling service: Having established the cost of providing the garbage and recycling services and the cost of providing the minimum garbage service, it is possible to estimate the real extra cost of the recycling, that is, the difference between these two totals. As a minimum, it is useful to compare the overall marginal cost of each option rather than considering the total cost of recycling or garbage independently of each other.

3.4 Establishing the Environmental Costs and Benefits

The methodology for undertaking this evaluation was Life Cycle Assessment (LCA). LCA is the analytical technique specified within the ISO 14000 series for the purpose of comparing the environmental impact of alternative products or processes. The environmental assessment used existing LCA data to provide an indicative assessment of the total impact of the recycling and product systems under study. Specific LCA studies for the Townsville/Thuringowa region were not conducted, as the cost of such work would have been prohibitive. Rather, existing available data from other sources was applied to provide comparative environmental impacts.

3.4.1 Environmental Indicators

Environmental indicators used to assess the options include:

- Resource use (abiotic and biotic depletion potential);
- Global warming potential;
- Pollution to air and water; and
- Solid waste.

3.4.2 Boundary and scope of study

The environmental impacts defined for:

The Kerbside System:

- Product life credits arising from recycling of all materials;
- Transport loads associated with the kerbside system for all materials;
- Impacts associated with reprocessing materials - where they are known or known to be significant;
- Impacts associated with landfilling materials; and
- Impacts associated with treatment and collection options to be defined during system characterisation.

The Product Life System:

For all materials within the kerbside system:

- The extraction and refining of raw materials; and

- Product manufacture.

Transportation:

- The life cycle impacts associated with fuel production; and
- The life cycle impacts associated with vehicle use (the data quality will report on the presence or absence of road infrastructure and tyre use).

Electricity:

- The life cycle impacts associated with electricity production.

4 KERBSIDE MATERIALS AND COMMODITY MARKETS

The quality and quantity of recyclables captured by kerbside recycling systems is highly dependent upon both the collection receptacle used and collection frequency[1] as is demonstrated by the different collection systems for Townsville City Council and Thuringowa City Council. Currently, Townsville City Council contracts Cleanaway to run a fortnightly commingled recyclables collection service. The receptacles used are 240L mobile garbage bins (MGB). In contrast, Thuringowa City Council contracts Cleanaway to run a weekly collection service. The receptacle used is a 240L MGB divided into two compartments for domestic waste and recyclables materials. The ratio of the bin split is 2/3 (160L) for domestic waste and 1/3 (80L) for commingled recyclables.

This section provides a characterisation of recyclate capture quantity and quality for each Council under the two collection systems. This information has been drawn from monthly reports provided to the two Councils by Cleanaway, contracted to sort the collected material at their MRF in Townsville. These figures are compared with percentage projections based upon the recyclables contamination audits conducted by Sinclair Knight Merz (SKM) in July 1999 for Thuringowa and December 1999 for Townsville. It should be noted that the SKM audits represent "snapshots" of the recycling stream and may therefore vary from the current total recyclate composition. Typical capture rates for major commodities throughout metropolitan Australia are also detailed along with indicative market trends.

4.1 Paper / Cardboard

Paper and cardboard consumption in Australia amounts to an estimated 3.7M t/yr, of which 2.7M t/yr is produced domestically. On balance, Australia appears to receive more than it exports, with the bulk arriving as packaging for imported manufactured goods, and printing and writing papers. Approximately 1.7 – 1.8M t/yr of paper products are recovered in Australia. This represents a recovery rate of around 50 %, which is higher than average recovery rates achieved in the US.

Approximately 1,962 t/yr of mixed paper is recovered at Townsville MRF. This material consists of the entire paper and cardboard stream from Townsville and Thuringowa and is mainly made up of old newsprint (ONP) with small amounts of old corrugated cardboard (OCC). These types of recovered paper generally have short fibre lengths and therefore low strength properties. In addition, the mixed paper is often contaminated with food scraps, garden waste and other matter. Mixed paper generation and recovery rates for Townsville and Thuringowa are detailed in Table 4.1.

[1] Nolan-ITU Pty Ltd, SKM Economics for The National Packaging Covenant Council, 2001, Independent Assessment of Kerbside Recycling in Australia, January 2001.

Table 4.1: Mixed Paper Generation & Recovery Rates

Paper / Cardboard Recovery	Townsville Fortnightly 240L MGB kg/household/yr	Thuringowa Weekly 240L Split Bin kg/household/yr
Cleanaway	49.8	17.9
Projection based on SKM Audit	47.5	64.2
National Packaging Covenant Council	71.1	57.0

Mixed paper is baled at Townsville MRF, transported to Amcor's reprocessing plant in Brisbane and subsequently consigned to landfill. Although paper was recycled by Amcor at the beginning of their contract with Cleanaway, several factors have led to Amcor ceasing to utilise the mixed paper, including:

1. A shift in market focus by Amcor towards packaging resulting in changes to feedstock requirements;
2. Inappropriate feed material for production of Amcor's finished product along with increasingly tight packaging specifications both in Australia and overseas;
3. Fluctuating markets for mixed paper; and
4. Shortcomings within existing contractual arrangements.

As a result of these developments, Amcor has indicated to Cleanaway that it will no longer accept the sorted kerbside material when the present contract expires.

In contrast, Visy has indicated a willingness to accept recovered paper and cardboard, reporting that the commodity price for paper and cardboard is relatively stable in comparison to other commodity prices. Market fluctuations have been mainly associated with the cleaner grades of newsprint (No.8 and No.6 grades).

Subject to possible contract negotiations between Visy and a MRF operator, Visy has indicated a delivered price of $93 per tonne for paper and cardboard. This arrangement is likely to be subject to a policy of +/-10% to minimise the effect of dramatic increases or decreases in the market. An alternative arrangement is the delivery of separated product to Visy's local agent in Townsville.

Internationally, the price for recycled paper generally follows the cyclic trend of pulp prices with a lag of approximately three months. Presently, the waste paper market is in reasonable balance and prices have risen above those of 1998 and 1999, varying according to contract periods, quantities and other factors. In 1995, an abnormal price spike occurred due to a worldwide shortage of pulp. 1998 was a low point in the price cycle. It is anticipated that pulp prices will continue to rise before levelling off by late 2001 or 2002.

Five large companies and a few smaller producers of tissue papers dominate the paper industry in Australia. The five industry leaders are Amcor (Australian Paper Division), Norske Skog (formerly Fletcher Challenge Paper), Carter Holt Harvey, Kimberley Clark Australia and Visy Paper.

4.2 Glass

Along with paper, glass is one of the two main materials recovered in kerbside recycling schemes. Typically, glass constitutes around 35% of material collected by weight.

Approximately 520 t/yr of clear and coloured glass is recovered at Townsville MRF. Based upon the audit conducted by Sinclair Knight Merz and National Packaging Covenant Council (NPCC) figures, it is estimated that the residents of Townsville and Thuringowa generate in excess of 1,200 to 1,500 t/yr of potentially recoverable glass. Total glass generation and recovery rates for Townsville and Thuringowa are detailed in Table 4.2.

Table 4.2: Glass Generation and Recovery Rates

Glass Recovery	Townsville Fortnightly 240L MGB kg/household/yr	Thuringowa Weekly 240L Split Bin kg/household/yr
Cleanaway	10.7	9.6
Projection based on SKM Audit	24.7	32.7
National Packaging Covenant Council	37.9	24.3

It is understood that recovered glass is currently transported to ACI in Brisbane. The price for this material is reported by Cleanaway to be $92/t at Brisbane, with transport costing $46/t. Visy has indicated a willingness to accept glass at a price of $65 per tonne. This material would be delivered into their Wacol plant, with an alternative of delivery to their local Townsville agent.

In the early 1990s, ACI Glass Packaging, the only major producer and recycler of glass containers in Australia, set the cullet buy-back price equivalent to the raw material price in each State. By 1995 it had standardised the price nationally to $90/t. Since then, the price has been gradually lowered. In 1999, ACI Glass Packaging converted in excess of 360,000 t/yr of old glass jars and bottles into new glass containers[2]. ACI Glass Packaging has indicated it has the capacity to receive as much cullet as can be provided from the domestic waste stream.

[2] ACOR (2000); Recycling Brief. Member profiles.

New automated sorting equipment installed in Melbourne and (in the foreseeable future) Sydney will enable increased glass recovery from kerbside systems as material previously going to landfill (predominantly "glass fines" from MRFs) is recovered.

Current secondary markets for used glass packaging are construction/road aggregates and abrasive media. Potential secondary markets for used glass packaging discussed in industry circles are filter media and tile manufacturing.

4.3 PET

PET (Polyethylene Terephthalate), recognised by the No 1 symbol embossed on containers, is manufactured and recycled by Coca Cola Amatil (CCA), Continental PET and Visy Plastics. PET is generally sorted into two streams; clear and coloured. Most people now recognise the rocket bottom soft drink and fruit juice bottle. Australia is reliant on overseas supply of PET, and imports up to 60,000 t/yr of resin for bottle production. Prices for recyclable PET are linked to the virgin polymer market worldwide.

An estimated 80 t/yr of PET is recovered at Townsville MRF. Based upon the audit conducted by Sinclair Knight Merz and National Packaging Covenant figures, it is estimated that the residents of Townsville and Thuringowa generate in excess of 190 t/yr of potentially recoverable PET. Total PET generation and recovery rates for Townsville and Thuringowa are detailed in Table 4.3.

Table 4.3: PET Generation and Recovery Rates

PET Recovery	Townsville Fortnightly 240L MGB kg/household/yr	Thuringowa Weekly 240L Split Bin kg/household/yr
Cleanaway	1.7	1.2
Projection based on SKM Audit	2.5	6.6
National Packaging Covenant Council	4.0	4.0

Packaging Trends

There has been considerable industry discussion about the development of barrier technologies for PET bottles, including multi-layer bottles with nylon layers and a range of coatings.

Some of these are currently being introduced. A modified PET bottle is the container of choice for brewers moving to plastics. Conventional PET packaging is not suitable for beer because oxygen gets entrained in the bottle during manufacture and external oxygen continues to enter the bottle.

Even if one of these technologies predominates in the market, processors may be forced to adjust. For example, removing an epoxy-amine coating requires a heavy-duty caustic wash containing surfactants which, apart from the additional costs involved for separation and washing, may impact on the resultant resin quality [3].

Some market analysts believe that beer in plastic will capture a good share of the market. Others believe that beer in PET will be aimed at niche markets.

The Influence of Design

Worldwide, sorters and reprocessors of PET are facing problems with recovering newly introduced, less suitable forms of PET packaging. The problems are varied. Labels made of PVC are being used. Newly introduced colours create sorting problems and can result in contamination of recycled PET. Some new labels sink or bleed in the wash cycle. Metallicised labels are increasingly being used. A major reclaimer in the US recently said: "The use of design for recycling concepts is slipping" [4]. CCA[5] and BIEC[6] have launched an extensive education campaign in Australia to limit these problems. The National Packaging Covenant will require brand owners to examine packaging design which will assist in controlling the problems outlined above.

4.4 HDPE

High Density Polyethylene (HDPE), recognised by the No 2 symbol embossed on containers, is also collected through kerbside collection programs. It is produced as both clear and coloured packaging. The most common clear HDPE product is milk containers. Coloured HDPE (copolymer) is used in juice bottles, household chemical bottles, oil bottles, buckets and rigid agricultural pipe.

Currently, post-consumer HDPE is reprocessed into a variety of products including co-extruded blow moulded packaging, agricultural pipes and garbage and recycling bins and crates. For most applications, the recycled content is limited by the loss in strength experienced with the HDPE polymer currently used for dairy and juice bottles.

Approximately 75 t/yr of HDPE is recovered at Townsville MRF. Based upon the audit conducted by Sinclair Knight Merz and National Packaging Covenant figures, it is estimated that the residents of Townsville and Thuringowa generate in excess of 145 t/yr of potentially recoverable HDPE. Total HDPE generation and recovery rates for Townsville and Thuringowa are detailed in Table 4.4. It should also be noted that coloured HDPE was not observed to be recovered by Cleanaway, resulting in a lower capture rate of this stream.

---

[3] Powell, J.(1999); Resource Recycling, October 1999.

[4] Container Recycling Report (August 1999), a publication of Resource Recycling.

[5] CCA "Bottle-to-Bottle" Campaign promotional material. Booklet "PET Recycling Story"; undated.

[6] BIEC (May 2000), *Recycling Guide for Beverage and Food Manufacturers Marketing in PET Containers.*

Table 4.4: HDPE Generation and Recovery Rates

HDPE Recovery	Townsville Fortnightly 240L MGB kg/household/yr	Thuringowa Weekly 240L Split Bin kg/household/yr
Cleanaway	1.6	1.5
Projection based on SKM Audit	1.1	6.9
National Packaging Covenant Council	3.0	3.0

Australian Plastic Reprocessing (APR), based in St Marys, has developed a new technology that allows the separation of different plastics with similar densities. As a result, Coca-Cola Amatil (CCA) now has the capacity to accept fully commingled loads of plastic (1-6), including reprocessable industrial plastics. CCA then retrieves the PET for use in new beverage containers and other plastic grades are available for other markets.

CCA has reported that the delivered prices for HDPE and PET plastics have fallen from $400/t to approximately $300/t over the past 6 months. The price for total mixed plastics is said to range from about $250-$400 per tonne dependent upon market conditions. Visy also confirm that the plastic market has recently slumped with prices falling dramatically.

Visy has indicated a willingness to accept PET and HDPE at a delivered price of $150 per tonne. Due to recent market fluctuations, this arrangement would likely be subject to a policy of +/-10% to minimise the effect of dramatic increases or decreases in the market.

4.5 Other Plastics

In Councils that collect all plastic containers, those made from plastics other than PET or HDPE amount to only a minor proportion of the kerbside recycling stream.

4.6 Aluminium

Currently, in the order of 45 t/yr of aluminium is recovered at Townsville MRF. Based upon the audit conducted by Sinclair Knight Merz and National Packaging Covenant figures, the residents of Townsville and Thuringowa generate an estimated 50 - 100 t/yr of aluminium which may be potentially recoverable. Total aluminium generation and recovery rates for Townsville and Thuringowa are detailed in Table 4.5. It is understood that this material is currently on-sold at a price of $1560/t to Simsmetal, the local metal dealer.

Table 4.5: Aluminium Generation and Recovery Rates

Aluminium Recovery	Townsville Fortnightly 240L MGB kg/household/yr	Thuringowa Weekly 240L Split Bin kg/household/yr
Cleanaway	0.9	0.8
Projection based on SKM Audit	2.5	2.4
National Packaging Covenant Council	1.0	1.0

The price paid for recyclable aluminium from bulk suppliers (i.e. not cash-for-cans centres where the price is lower) is based on the 60% of the aluminium price quoted on the London Metal Exchange (LME). The industry is recommending a move away from this spot price system and promoting formula-based long-term contracts.

KAAL Australia Pty Ltd is the largest recycler of aluminium in Australia. KAAL currently pays $850 to $1500 /t for collected aluminium cans, subject to the quantity, quality and location of the can supply. There is a current downward trend in world metals prices which is likely to lower recyclable aluminium can prices, although demand is sufficient to ensure recycled material is reprocessed.

4.7 Steel Cans

Steel cans including aerosol, food, beverage, powder, milk, oil and empty or dry paint cans, are collected and sold to a number of scrap metal reprocessors. The main buyer is BHP. Other steel accepted by BHP includes bottle tops and jar lids. Most councils now include steel in their recycling programs.

BHP's development of finer grades of rolled steel may provide the capacity to develop steel beverage cans to compete with aluminium cans in the beverage container market. BHP is currently assessing the potential of this expansion. Steel cans are already used for some beverage packaging in both Europe and the US and have the potential advantage of being cheaper per unit than aluminium.

Steel consumption in Australia is about 6.5 million tonnes a year with recycling of post consumer scrap at about 1.7 million tonnes per year[7].

[7] Australian Bureau of Statics - (1996) *Australians and the Environment*

Approximately 60 t/yr of steel is recovered at Townsville MRF. Based upon the audit conducted by Sinclair Knight Merz and National Packaging Covenant figures, the residents of Townsville and Thuringowa generate an estimated 220 - 400 t/yr of steel which may be potentially recoverable. Total steel generation and recovery rates for Townsville and Thuringowa are detailed in Table 4.6. As with aluminium, it is understood that this material is currently on-sold at a price of $55/t to Simsmetal, the local metal dealer.

Table 4.6: Steel Generation and Recovery Rates

Steel Recovery	Townsville Fortnightly 240L MGB kg/household/yr	Thuringowa Weekly 240L Split Bin kg/household/yr
Cleanaway	1.4	0.9
Projection based on SKM Audit	7.9	8.5
National Packaging Covenant Council	5.0	4.0

4.8 Transport

Due to the geographic distance to reprocessors, the economics of recycling is heavily impacted by transport costs. Both CCA and Visy have indicated that commodity prices are somewhat lower for regional centres. In spite of this, both companies have expressed interest in regional recycling programs.

Visy has indicated a freight rate from Townsville ranging from $38 - $45 per tonne depending upon the hauler of the material. All material except glass would require baling to maximise transport efficiencies.

5 CURRENT KERBSIDE COLLECTION AND RECYCLING SYSTEMS

The current recyclables collection and sorting system characteristics of both Councils are presented in Table 5.1 below. The figures supplied to Council by Cleanaway show that some 3,697 t/yr and 2,974 t/yr of recyclables are presented for sorting by the residents of Townsville and Thuringowa respectively. Projection of National Packaging Covenant Council figures for identical population sizes would yield the figures of 5,038 t/yr and 2,349 t/yr respectively.

Table 5.1: Current Recyclables Collection & Sorting System Characteristics

Current Kerbside Collection Characteristics	Townsville City Council	Thuringowa City Council
Approximate No. of households	Townsville: 32,000 Magnetic Is: 1,363	16,900
Quantities of recyclables collected*	3,697 t/yr	2,974 t/yr
Quantities of garbage collected	32,271 t/yr	16,055 t/yr
Recyclables collection method	240L MGB	240L Split MGB (2/3 Waste, 1/3 Recyclables)
Collection frequency	Recyclables: Fortnightly Domestic Waste: Weekly	Recyclables: Weekly Domestic Waste: Weekly
Recyclables contract price arrangements	Collection: $1.36 /house/service Mag Is Collectn: $1.85 /hh/service Sorting: $84,000	Collection & processing of recyclables, collection of waste: $1.06 / house / service
Ownership of sorted recyclable materials	Cleanaway	Cleanaway
Risk sharing arrangements	Unders & Overs Clause within current contract.	Nil
Price incentive methods	Nil	Nil

* - Based upon figures supplied to Council by Cleanaway

The Councils present a combined total of 6,670 t/yr of recyclables or 90% of the 7,387 t/yr projected by NPCC figures. Of particular note is the high recyclables presentation rate of Thuringowa, based on the Council's population size in comparison to Townsville. This disparity in figures highlights the difficulty in tracking material quantities in the absence of a weighbridge. A breakdown of the total recyclables recovered and projection of household generation rates is presented in Table 5.2 below.

Table 5.2: Recyclables Recovery and Household Generation Rates

Stream	Cleanaway Recovery kg / household / yr		Sinclair Knight Merz Audits kg / household / yr		National Packaging Covenant Council kg / household / yr	
	Townsville	Thuringowa	Townsville	Thuringowa	Townsville	Thuringowa
Paper / Cardboard	49.8	17.9	47.5	64.2	71.1	57.0
PET	1.7	1.2	2.5	6.6	4.0	4.0
HDPE	1.6	1.5	1.1	6.9	3.0	3.0
Steel	1.4	0.9	7.9	8.5	5.0	4.0
Aluminium	0.9	0.8	2.5	2.4	1.0	1.0
Glass*	10.7	9.6	24.7	32.7	37.9	24.3
Recycling Contamination	44.7	144.1	24.5	54.6	29.1	45.8
Domestic Waste**	967.3	950.0	967.3.5	950.0	936.0	712.4

* - Glass figures include both clear and coloured glass.
** - Domestic waste includes Magnetic Island.

Most significant in the above table is the proportion of contamination within the recyclables presented for sorting at Townsville MRF, particularly that of Thuringowa. The contamination levels for both Councils are significantly higher than the figures projected from the Sinclair Knight Merz contamination audits conducted in July 1999 for Thuringowa City Council and December 1999 for Townsville City Council. It should be noted that the audits conducted by SKM should be viewed as contamination "snapshots" at a particular given time. Thus the comparatively high audit figures for PET, HDPE and glass for Thuringowa may indicate either an anomaly or a greater volume of "waste" being presented with recyclables.

SKM's overall figures would appear to suggest that contamination levels are somewhat lower than those reported by Cleanaway. Further, SKM's audit figures appear to support those determined by an Independent Assessment of Kerbside Recycling in Australia completed for the National Packaging Covenant Council in January 2001.

5.1 Current Townsville Kerbside Collection System

Townsville City Council has a contract with Cleanaway for the collection of recyclables. Three trucks collect recyclables in one part of the city on each weekday, covering the entire Council area over a fortnightly period.

During the course of each day, the Cleanaway trucks are filled more than once. Once full, the trucks transport their load to the Cleanaway MRF located at Garbutt. At the MRF, recyclables are sorted into fractions for transportation to a reprocessor.

The residents of Townsville are supplied with 240L mobile garbage bins (MGB) for the presentation of recyclables. These MGB are fitted with a yellow lid and enable residents to recycle:

- PET (Polyethylene Terephthalate);
- HDPE (High Density Polyethylene);
- Paper and cardboard;
- Steel cans;
- Aluminium cans; and
- Clear and coloured glass.

Although each household is supplied with a bin for recyclables, the audit conducted by SKM noted that "there is less than a 100% presentation rate at the footpath". The percentage recovery and generation rates of each recyclable stream for Townsville are detailed in Table 5.3 and presented graphically below as Figure 5.1.

Upon arrival at Townsville MRF, the trucks proceed directly to feed conveyors, onto which loads are tipped for sorting. Observation by Nolan-ITU of the fully commingled recyclables presented for sorting revealed significant inbound contamination. Contaminants observed included bags of rubbish, garden waste, food, toys, polystyrene, pots, paint tins and other miscellaneous materials. One particular load contained a large amount of sawdust. It is not know whether the tipped loads originated from Townsville or Thuringowa. The inbound recyclables contamination may be due to a number of factors, including:

- Lack of concern by residents;
- Lack of understanding of which materials are recyclable;
- Requirement for additional disposal capacity; or
- A combination of the above.

Table 5.3: Percentage Recyclable Recovery Rates for 240L MGB Fortnightly Services

Stream	Cleanaway Reported Recovery	SKM Audit December 1999	NPCC Report January 2001
Paper / Cardboard	44.9%	42.9%	47.1%
PET	1.5%	2.3%	2.6%
HDPE	1.4%	1.0%	2.0%
Steel	1.3%	7.1%	3.3%
Aluminium	0.9%	2.3%	0.7%
Glass*	9.7%	22.3%	25.1%
Recycling Contamination	40.3%	22.1%	19.3%

* - Glass figures include both clear and coloured glass

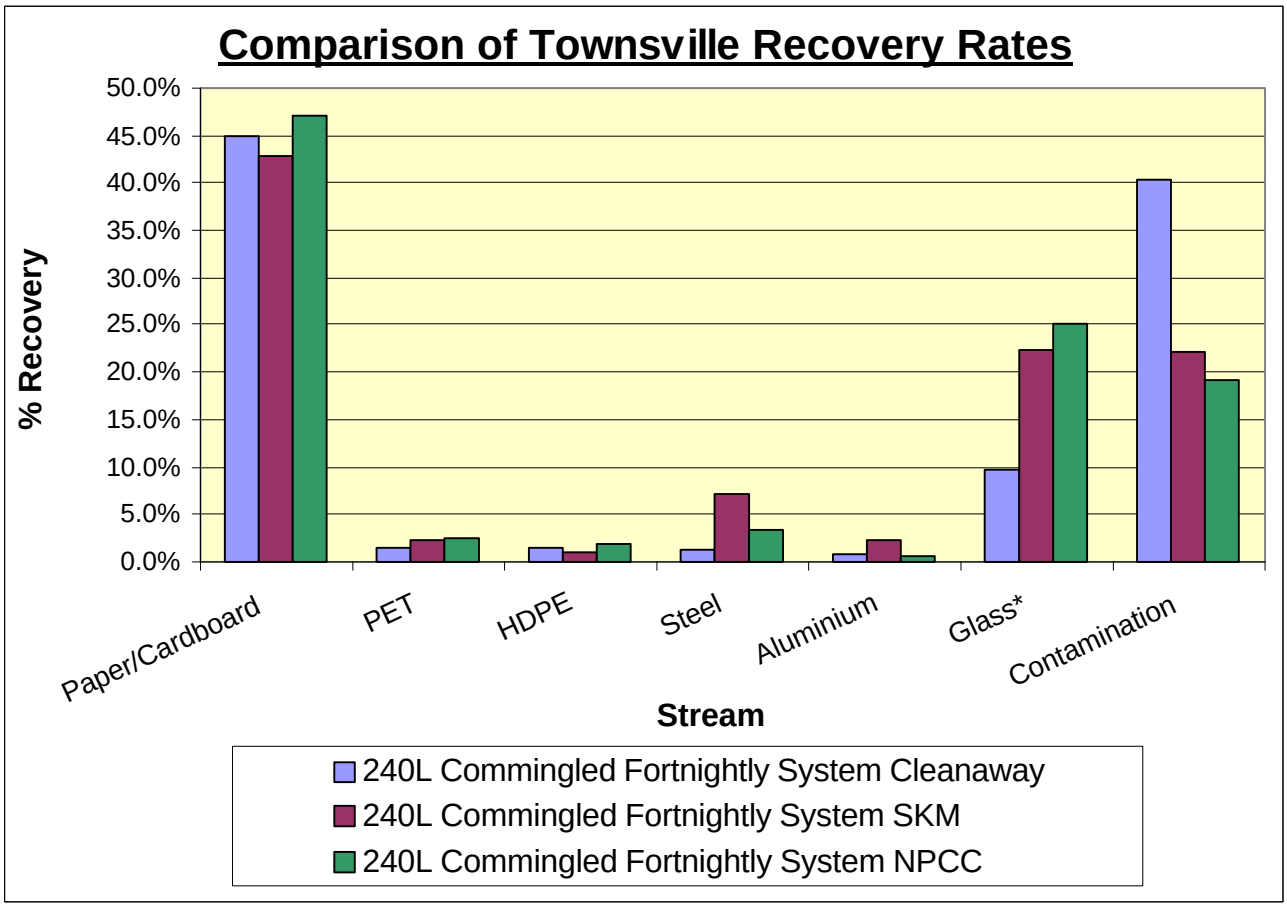

Figure 5.1: Comparison of Townsville Generation and Recovery Rates

In general, the recovery rates at the Cleanaway MRF are lower than the potentially recyclable material proportions reported by SKM, particularly for steel and glass. In addition, a high proportion of recyclable material appears to be lost to the waste stream resulting in the high contamination figures quoted by Cleanaway. This is partly due to the observed shortage of sorters at the MRF. Although the current MRF contract specifies five sorters, Nolan-ITU staff generally observed only four hand sorters. Two of these sorters were located at the end of the trommel to remove contaminants from the paper stream and recover containers passing through the trommel. The other two sorters were located on the containers line to separate glass and plastic containers. A fifth sorter appeared for a short period during one of Nolan-ITU's two visits to the MRF.

During both observations by Nolan-ITU, a significant amount of potentially recyclable material was observed on the "waste conveyor". In addition, clear glass was not being recovered as no skip bin was placed at the end of the clear glass line. When questioned by Nolan-ITU over the number of sorters and clear glass recovery, Cleanaway reported that one of their sorters was ill and that clear glass was not being recovered for that reason.

In terms of stream yields, it should be noted that the SKM audit figures generally correlate to the NPCC figures. The only stream to differ significantly was steel, where the SKM figure was more than double that of the NPCC. Therefore, it may reasonably be expected that Townsville will be able to achieve better than national recovery standards through various recycling system improvements.

5.2 Current Thuringowa Kerbside Collection System

Thuringowa City Council has a contract with Cleanaway to collect both general waste and recyclables from the city. Four dual payload trucks collect waste and recyclables from part of the city on each day, covering the entire Council area every five days.

During the course of a day, the waste compartment of a split truck may fill be filled a number of times whilst the recyclables compartment is generally filled only once per day. Thus, split collection vehicles may make several trips to the landfill whereas recyclables are held until completion of the daily service run when they are taken to Cleanaway's MRF located at Garbutt.

The residents of Thuringowa have been supplied with a split 240 L mobile garbage bin (MGB) for the presentation of garbage and recyclables. These MGB are fitted with a divider which provides for two separate compartments with:

- 160 L for household garbage; and
- 80 L for fully commingled recyclables.

These bins enable residents to recycle:

- PET (Polyethylene Terephthalate);
- HDPE (High Density Polyethylene);
- Paper and cardboard;
- Steel cans;
- Aluminium cans; and
- Clear and coloured glass.

Due to the shape of the recyclables compartment within the split bin, material presented for recycling is often jammed tightly into the bin. This can lead to problems with the emptying of bins or the "adherence" of different materials to each other. When split bins are emptied, the waste and recyclables fall into separate compartments within the collection vehicle. The loading hoppers of the collection vehicle are designed to prevent ingress of household garbage into the recyclables compartment of the truck. The percentage recovery and generation rates of each recyclable stream for Thuringowa are detailed in Table 5.4 and presented graphically below as Figure 5.2.

Upon arrival at Townsville MRF, the trucks proceed directly to feed conveyors, onto which loads are tipped for sorting. Observation by Nolan-ITU of the fully commingled recyclables presented for sorting revealed significant inbound contamination. Contaminants observed included bags of rubbish, garden waste, food, toys, polystyrene, pots, paint tins and other miscellaneous materials. One particular load contained a large amount of sawdust. It is not know whether the tipped loads originated from Thuringowa or Thuringowa. The inbound recyclables contamination may be due to a number of factors including:

- Lack of concern by residents;
- Lack of understanding of which materials are recyclable;
- Requirement for additional disposal capacity; or
- A combination of the above.

Table 5.4: Percentage Recyclable Recovery Rates for 240L Split MGB Weekly Services

Stream	Cleanaway Reported Recovery	SKM Audit July 1999	NPCC Report January 2001
Paper / Cardboard	10.1%	36.5%	41.0%
PET	0.7%	3.8%	2.8%
HDPE	0.8%	3.9%	2.1%
Steel	0.5%	4.8%	2.8%
Aluminium	0.5%	1.4%	0.7%
Glass*	5.4%	18.6%	17.5%
Recycling Contamination	81.9%	31.1%	33.0%

* - Glass figures include both clear and coloured glass

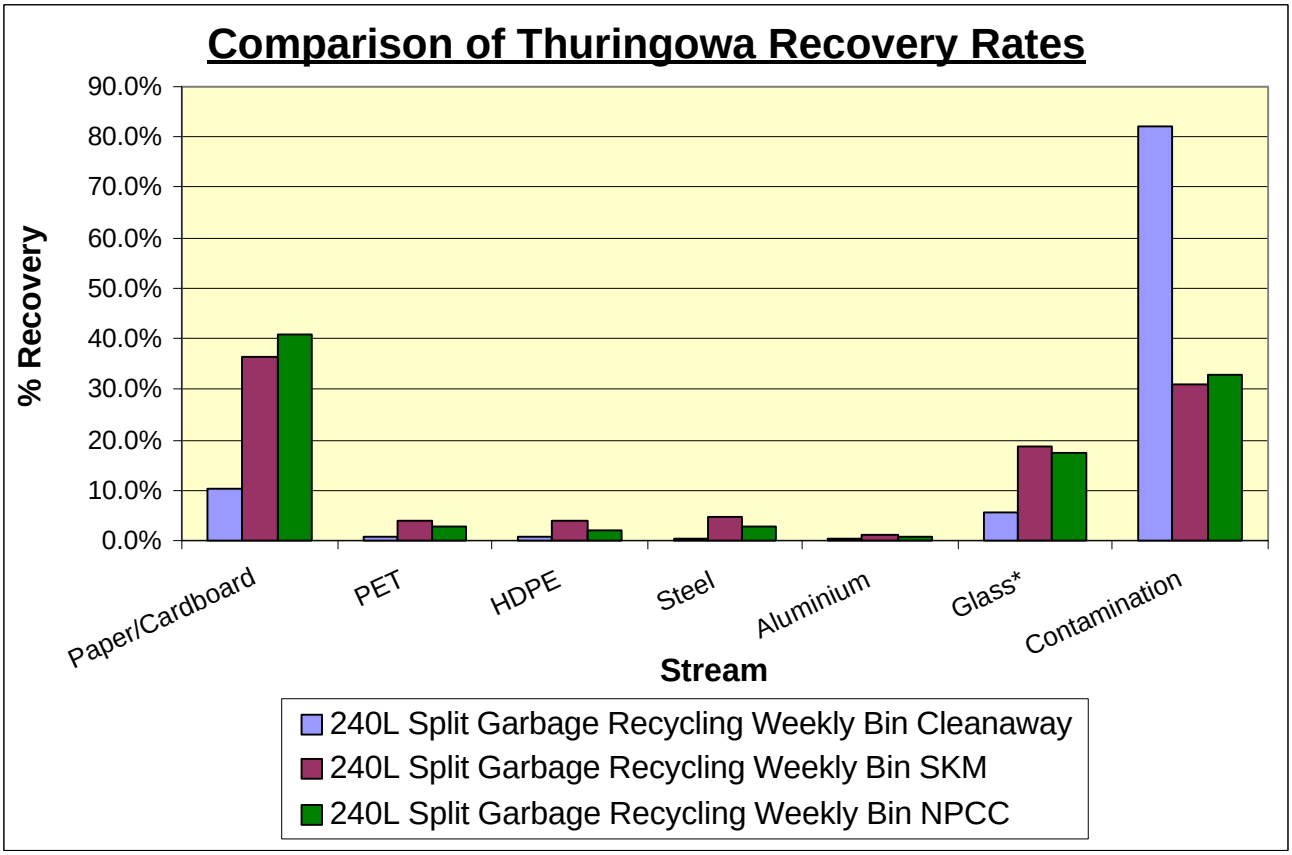

Figure 5.2: Comparison of Thuringowa Generation and Recovery Rates

All recovery rates at the Cleanaway MRF are lower than the potentially recyclable material proportions reported by SKM, particularly for paper/cardboard and glass. In addition, a high proportion of recyclable material appears to be lost to the waste stream, resulting in a high reported recyclables contamination rate. This is partly due to the observed shortage of sorters at the MRF. A significant amount of potentially recyclable material was observed on the "waste conveyor". In addition, clear glass was not being recovered on both occasions with no skip bin placed at the end of the clear glass line.

In terms of stream yields, it should be noted that the SKM audit figures generally correlate to the NPCC figures. Therefore, it may reasonably be expected that Thuringowa would be able to achieve or better national recovery standards through various recycling system improvements, including a two bin system for the collection of household waste and fully commingled recyclables.

5.3 Current Recyclables Sorting System

Cleanaway's MRF operations are located at Garbutt, Townsville. This facility utilises both mechanical and automated separation techniques. The facility generally operates from about 6:00 am to 2:30 pm five days per week, processing on average 8-11 truck loads per day or 2,250 240 L bins of recyclables.

Here, incoming commingled recyclables are tipped directly onto large feed conveyors. The stream of recyclables then proceeds to the trommel where the material is "fluffed up" and paper is separated out. The paper proceeds directly through the trommel to a paper baler after any contaminants and containers are removed. A bounce adherence conveyor removes any paper which has passed through the trommel apertures and isolates any containers recovered from the paper line. The containers then pass under a magnet where ferrous metals are removed. The metal then proceeds to a ferrous metal baler.

The remaining containers are then manually sorted into the following streams:

- HDPE;
- PET;
- Clear Glass
- Coloured Glass; and
- Aluminium.

The glass is conveyed to skips for transport whilst HDPE, PET and aluminium cans are blown through ducts to large holding cages. These cages utilise a common baler which is located at the end of a feed conveyor leading from the holding cages. In general, four manual sorters were observed at the MRF. Two sorters were stationed at the end of the trommel to recover containers and remove paper contaminants while the other two sorters were located along the container line to positively sort material i.e., pick out recyclables.

Remaining material then proceeds to a skip dedicated to waste. This includes any contaminants, heavily soiled recyclables, bagged material and any commodities not being recovered for any reason, for example poor spot market prices.

The configuration of the MRF is given as Figure 5.3.

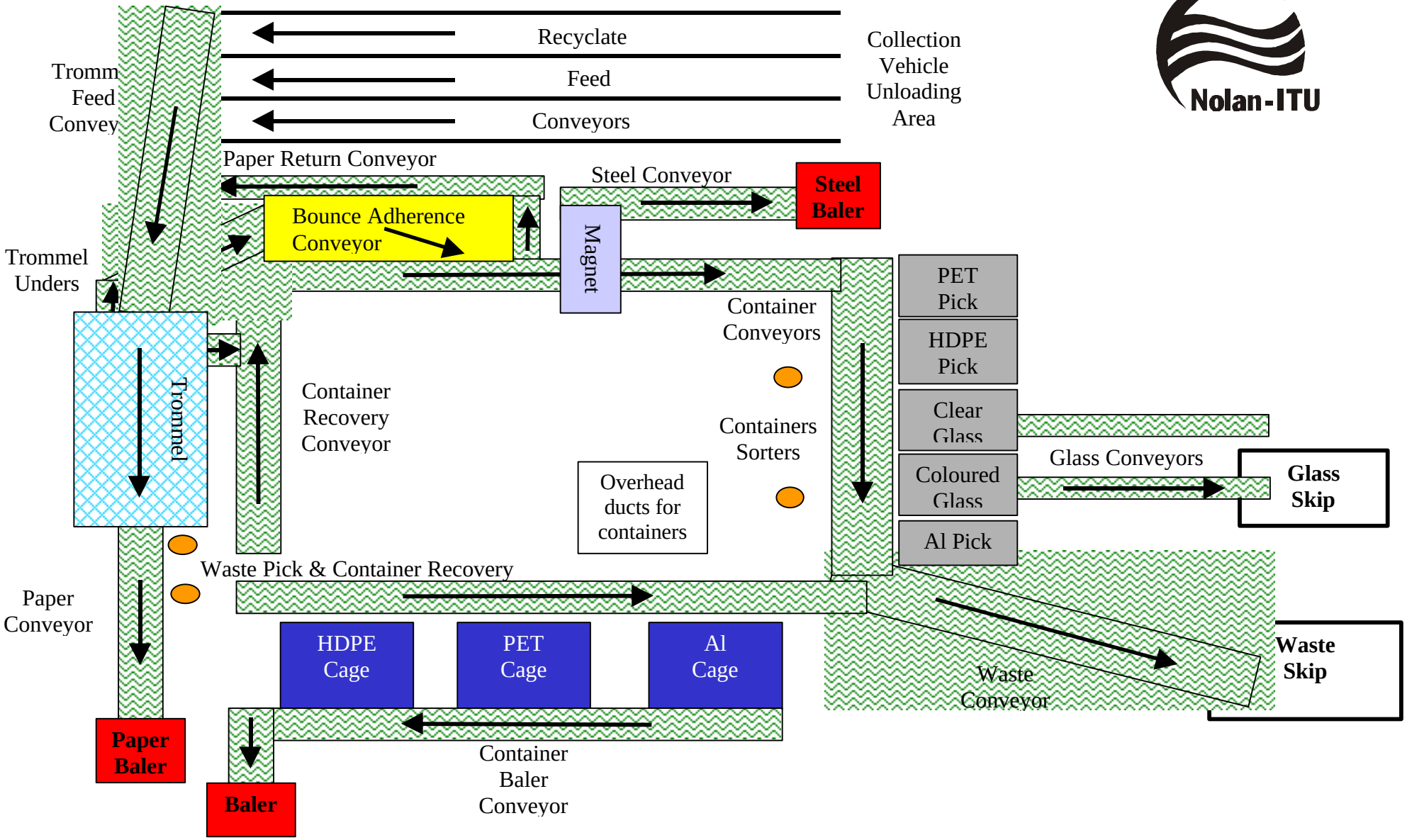

Figure 5.3: Cleanaway MRF Configuration

5.4 Essential Technical Components for Service Sustainability

The following issues have been identified as causes for poor resource recovery and commodity recycling:

- High input contamination levels;
- Insufficient labour provision at the MRF;
- Unsatisfactory commodity marketing arrangements;
- Lack of performance incentives for the MRF contractor; and
- Lack of accurate data and auditing mechanisms.

5.4.1 Input Contamination

The high input contamination levels at the MRF appear to be the result of the combination of collection system problems and a lack of community education. In the case of Thuringowa City Council, high recyclables contamination rates have been associated with their 240 L split bin system. The July 1999 contamination audit of Thuringowa City Council's recyclables conducted by Sinclair Knight Merz found that contamination rates ranged between 23% and 35% by weight. This finding is supported by the NPCC's January 2001 Independent Assessment of Kerbside Recycling which found that contamination levels for 240 L split bin systems are generally around 35%.

Similarly, the December 1999 SKM audit for Townsville City Council found contamination levels to be in the range of 17% to 23.3%. This is supported by the NPCC study, which found contamination levels for 240L fully commingled bins to be 20%. Taking population figures into account, it may be reasonably expected that the overall recyclables contamination level for the two Councils might lie in the range of 30% by weight. It should be noted that weight based contamination levels generally appear higher than volumetric contamination due to the relatively high densities of glass and metal in relation to contaminants.

Research in both the US and U.K. has found that intensive, sustained public awareness and education programs underpin high recycling participation rates. However, researchers have been largely unable to conclude how much must be spent in order to achieve a particular level of participation as public behaviour is influenced by many factors. It is estimated that Councils dedicating some 2% - 3% of their annual waste budgets to community education campaigns are likely to enjoy effective recycling participation rates.

5.4.2 MRF Labour

One factor relating to poor commodity recovery rates is the observed shortage of sorters at the MRF. Although the current MRF contract specifies five hand sorters, Nolan-ITU staff generally observed only four hand sorters. Two of these sorters were located at the end of the trommel to remove contaminants from the paper stream and recover containers passing through the trommel. The other two sorters were located on the containers line to separate out glass and plastic containers. A fifth sorter appeared for a short period during one Nolan-ITU's two visits to the MRF.

As a result, a significant amount of potentially recyclable material was observed on the "waste conveyor". Materials being lost to waste included PET, HDPE, glass, steel and paper. In addition, clear glass was not being recovered on either occasion with no skip bin placed at the end of the clear glass line. When questioned by Nolan-ITU over the number of sorters and clear glass recovery, Cleanaway reported that one of their sorters was ill and that clear glass was not being recovered for that reason.

It is believed that the placing of a sorter (in additional to the five required by the present contract) on the waste line to recover recyclables would greatly increase the overall recovery rates at the MRF. This would result in a total of six sorters under the present system.

5.4.3 Commodity Marketing

The current contract with Cleanaway does not require Cleanaway to ensure that recovered commodities are actually recycled. Presently, paper and cardboard recovered at Townsville MRF is sent to Amcor in Brisbane where it is subsequently landfilled. Therefore, in the absence of actual recycling clauses and suitable contract flexibility in the face of changing market conditions, it is not possible to ensure that ESD performance is maximised by the contractor.

In order to ensure recycling of recovered commodities, it is essential that commodity markets are monitored and links with processors maintained. This is particularly the case where market conditions are volatile. This may be achieved through a number of mechanisms including:

- A requirement within a sorting contact for the recycling of recovered materials;
- Contracting with a reprocessor for the sorting of material; or
- In house selling of recovered commodities.

5.4.4 MRF Performance Incentives

As with the absence of listed recycling requirements within the current MRF contract, there appears to be a lack of performance incentives structured to ensure that maximum recyclables are recovered from the incoming material. In addition, the absence of a disposal fee on MRF waste provides a mechanism for the contractor to dispose of high volumes of potentially recoverable material as waste.

Contractual performance incentives should be meted with more appropriate risk and profit sharing arrangements associated with input material quality and quantities of recovered material. That is, the MRF contractor should be provided with assurances that the incoming material will be of a suitable quality and compacted to a specified level during transportation to the MRF. Such assurances combined with contractual recycling requirements can ensure that optimal resource recovery takes place, along with profitable commodity sales.

5.4.5 Accurate Data and Auditing Mechanisms

A significant issue for both Townsville and Thuringowa City Councils is the inability to audit information provided by Cleanaway and therefore monitor their MRF performance. This is largely due to the absence of a weighbridge at Cleanaway's MRF to provide specific data on incoming waste and recyclables.. If more accurate data is to be produced and a performance monitoring mechanism incorporated into future contracts, a weighbridge will constitute an essential component of a performance / incentive based contract.

In addition, the establishment of weighbridges will enable the Councils to better gauge incoming waste as well as recyclables, thereby increasing the accuracy of their pricing mechanisms for both disposal and recycling services.

6 ALTERNATIVE KERBSIDE COLLECTION AND SORTING SYSTEMS

Based upon Cleanaway's reported monthly tonnage figures and waste collection calculations, it is estimated that Townsville and Thuringowa households produce an average of 1,078 kg/yr and 1,126 kg/yr of waste material respectively. Of these quantities, Townsville households produce an average 66.1 kg/yr of recyclate whilst Thuringowa households produce an average of 31.8 kg/yr. These generation rates are compared to national figures in Table 6.1. As the Townsville and Thuringowa figures are largely based upon volumetric calculations, it is difficult to determine the accuracy of these figures.

Table 6.1: Current Generation Rates Based on Reported Figures Vs. National Figures

Current Recycling System	Townsville kg / house / yr	Thuringowa kg / house / yr	NPCC 240L MGB kg / house / yr	NPCC 240L Split Bin kg / house / yr
Recyclate Capture	66.1	31.8	121.9	93.2
Recyclate Contamination	44.7	144.1	29.1	45.8
Domestic Waste	967.3	950.1	936.0	712.4
Total	**1,078.1**	**1,126.0**	**1087.0**	**851.4**

6.1 Improved Recycling System Option

The improved recycling system is based on a fortnightly 240 L commingled recycling service for both Councils, covering the current range of recyclables. Recyclables presented at kerbside would be processed at a state–of-the-art MRF under an incentive based recycling contract. This option is consistent with the recommendations proposed in the North Queensland Waste Management Strategy, recently adopted by HESROC-NQ and would be underpinned by an ongoing public awareness and education campaign. Under this system it is expected that capture rates will improve to achieve similar rates to those recorded nationally within the NPCC study. The expected capture rates for the improved recycling system are detailed in Table 6.2.

Table 6.2: Improved Recycling System Capture Rates

Improved Recycling System	Townsville kg / household / yr	Thuringowa kg / household / yr
Recyclate Capture	120.9	126.3
Recyclate Contamination	28.9	30.2
Domestic Waste	928.3	969.5
Total	**1,078.1**	**1,126.0**

Accordingly, it is anticipated that household generation rates for individual commodity streams would be similar to those detailed in Table 6.3.

Table 6.3: Improved Recycling System Annual Household Commodity Generation Rates

Stream	Commodity Stream Percentage	Townsville kg / household / yr	Thuringowa kg / household / yr	NPCC kg / household / yr
Paper / Cardboard	47.0%	70.6	73.6	71.1
PET	2.6%	3.9	4.1	4.0
HDPE	2.0%	2.9	3.1	3.0
Steel	3.3%	4.9	5.1	5.0
Aluminium	0.7%	1.0	1.0	1.0
Glass*	25.1%	37.6	39.3	37.9
Recycling Contamination	19.3%	28.9	30.2	29.0
Total	**100.0%**	**149.8**	**156.4**	**151.0**

* - Glass figures include both clear and coloured glass

The improved recycling service option assumes separate contracts for the collection of recyclables and MRF operations. This however does not exclude the possibility of contractors submitting non-conforming tenders that bundle the collection and MRF operations. This option also assumes the incentives such as risk and reward-sharing mechanisms are built into any future contracts.

6.2 Minimum Service Option

The minimum service option or base case considers the consolidation of kerbside services to the sole provision of a domestic waste disposal service, ie. all material collected from households is disposed of as waste. The expected household disposal rate is detailed in Table 6.4.

Table 6.4: Minimum Service Option Waste Quantities

Minimum Service	Townsville kg / household / yr	Thuringowa kg / household / yr
Recyclate Capture	-	-
Recyclate Contamination	-	-
Domestic Waste	**1,078.1**	**1,126.0**

Townsville and Thuringowa City Councils have no immediate shortage of landfill space and this minimum service option has been modelled to demonstrate the base financial and environmental costs for comparison with the other options.

6.3 Reduced Recycling Service Option

The "reduced recycling service" option is based upon a reduced number of recyclable materials being collected, sorted and reprocessed. This option has been formulated to redress the current situation whereby paper and cardboard presented at the kerbside is sorted and baled at Townsville MRF, sent to Amcor in Brisbane, and subsequently consigned to landfill.

As a result, this option incorporates household paper and cardboard into the domestic waste stream, with the collection of recyclables restricted to containers only. Based upon current reported generation figures and National Packaging Covenant Council figures, it is expected that the following annual household quantities would be generated Table 6.5:

Table 6.5: Reduced Recycling Service Generation Rates

Reduced Recycling Service	Townsville kg / household / yr	Thuringowa kg / household / yr
Recyclate Capture	50.4	52.6
Recyclate Contamination	12.0	12.6
Domestic Waste	1,015.7	1,060.8
Total	**1,078.1**	**1,126.0**

If this option were adopted, collection frequencies for recyclables might be reduced to every three or four weeks, further reducing costs. However, the timeframe between collections may negatively affect capture rates significantly. In addition, this option may prove politically unpalatable. Therefore, ongoing fortnightly collections have been modelled for this option.

7 EVALUATION OF CURRENT SYSTEMS AND ALTERNATIVES SYSTEMS

The recycling options generated by Nolan-ITU have been assessed according to their financial, environmental and social benefits. The financial assessment considers the actual dollar cost of providing kerbside recycling services to the community whilst the environmental assessment considers the environmental impact of each option, as well as providing a notional dollar value of the environmental benefits. Some social aspect considerations of providing a kerbside recycling system are also provided, as opposed to the provision of a garbage service only.

7.1 Townsville Financial Assessment

7.1.1 Current System

Based upon the financial information provided, it is estimated that the current cost to Townsville City Council of providing the current kerbside recycling services is close to $1.47 M per annum. Based on 33,362 households, this amounts to a service cost of approximately $46.04 per household per year. Under the current system, the annual cost of providing domestic garbage disposal services amounts to some $1.96 M per year or $61.40 per household per year. Thus Townsville's total cost of providing waste disposal and recycling services is in the order of $3.44 M per year or $107.44 per household per year. Although no landfill disposal charge is applied under the current contract for wastes considered to be "contaminated recyclable refuse", it is estimated that Council forgoes a notional annual income of $20,135 for MRF waste disposal. These figures are detailed in Table 7.1.

7.1.2 Improved Recycling System

Under the improved recycling system it is estimated that some 4,996 tonnes of recyclate would be captured annually at a cost of $967,439, based on a collection cost of $1.10 for Townsville households and $1.48 for Magnetic Island households. However, it is thought that a more realistic MRF operating cost would be in the order of $174,877 or $35.00 per tonne based on other typical MRF contracts, which incorporate risk and benefit sharing arrangements. Such arrangements would also contain performance incentives such as a waste disposal rebate estimated at $12,500 bringing the total cost of Townsville's improved recycling service to $1.23 M per year or $38.56 per household per year.

Assuming an increased capture rate from an improved recycling system, it is anticipated that some 30,972 t/yr of household waste would require disposal. At a collection fee of $0.87 for Townsville and $1.15 for Magnetic Island households, the household waste collection would cost an estimated $1.47 M, incurring a disposal cost of $418,116 or a total of $58.93 per household. This would bring Townsville's total cost of providing domestic waste disposal and recycling services to approximately $3.12 M per year or $97.49 per household per year. Note that an annual education component of $3.12 per household has been built into the total service cost. These figures are detailed in Table 7.1.

It is important to note that these figures include estimates for collection costs and actual costs established by tendering may differ from these estimates.

7.1.3 Minimum Service

In line with the current reported generation rate, it is estimated that 35,968 tonnes of waste would require disposal annually. Thus Townsville's total collection costs would be expected to amount to some $1.61 M based on a collection fee of $0.87 for Townsville and $1.15 for Magnetic Island households. This waste would be disposed of at a cost of approximately $485,568 bringing the total cost of this service to $2.10 M per year or $65.35 per household per year. These figures are detailed in Table 7.1.

7.1.4 Reduced Recycling Service

Under the reduced recycling system it is estimated that some 2,082 tonnes of recyclate would be captured annually at a cost of $835,515, based on a collection cost of $0.95 for Townsville and $1.27 for Magnetic Island households. It is thought that the more realistic MRF operating cost of $35.00 per tonne would still apply bringing the sorting cost to around $72,869, once risk and benefit sharing arrangements are incorporated. Such arrangements would also include performance incentives such as a waste disposal rebate estimated at $5,197 bringing the total cost of Townsville's reduced recycling service to $1.01 M per year or $31.48 per household per year.

Due to the incorporation of paper within the domestic waste stream, it is anticipated that some 33,886 t/yr of household waste would require disposal. At a collection fee of $0.87 for Townsville and $1.15 for Magnetic Island households, it is estimated the household waste collection would cost in the order of $1.61 M, incurring a disposal cost of $457,461 or a total of $64.47 per household. This would bring Townsville's total cost of providing domestic waste disposal and recycling services to approximately $3.07 M per year or $95.95 per household per year. Note that an annual education component of $3.12 per household has been built into the total service cost. These figures are detailed in Table 7.1.

As with the improved recycling system option, it is important to note that these estimated figures would require market testing during the tendering phase.

Table 7.1: Townsville Cost Assessment

Service Option		Collection Frequency	Annual Capture (t)	Collection ($)	Processing ($)	Disposal ($)	Total ($)	Cost / household/ year ($)
1	**Current Recycling System**	Fortnightly	3,697	1,389,300	84,000	(20,135)	1,473,300	46.04
	Current Domestic Waste Service	Weekly	32,271	1,529,128	-	435,659	1,964,786	61.40
						Total	**$3,438,086**	**$107.44**
2	**Improved Recycling System**	Fortnightly	4,996	967,439	174,877	-12,473	1,233,932	38.56
	Domestic Waste Service	Weekly	30,972	1,467,553	-	418,116	1,885,669	58.93
						Total	**$3,119,601**	**$97.49**
3	**Minimum Service**	Weekly	35,968	1,605,584	-	485,568	**$2,091,152**	**$65.35**
4	**Reduced Recycling Service**	Fortnightly	2,082	835,515	72,869	-5,197	1,007,276	31.48
	Domestic Waste Service	Weekly	33,886	1,605,654	-	457,461	2,063,116	64.47
						Total	**$3,070,392**	**$95.95**

7.2 Thuringowa Financial Assessment

7.2.1 Current System

Based upon the financial information provided, it is understood that the current cost to Thuringowa City Council of collecting domestic waste and recyclables, and subsequent sorting of recyclables, is $0.93 M. Based upon 16,900 households, this amounts to a service cost of $55.12 per household per year. Also under the current system, it is estimated that the annual cost of Council's domestic disposal costs amounts to some $0.31 M per year. Thus Thuringowa's total annual cost of providing waste disposal and recycling services is in the order of $1.24 M or $73.36 per household per year. Although no landfill disposal charge is applied under the current contract for wastes considered to be "contaminated recyclable refuse", it is estimated that Council forgoes a notional annual income of $46,774 for MRF waste disposal. These figures are detailed in Table 7.2.

7.2.2 Improved Recycling System

Under the improved recycling system it is estimated that some 2,643 tonnes of recyclate would be captured annually at a cost of $483,340, based on a collection cost of $1.10 per household. In place of Thuringowa's present recycling arrangements, it is thought that a realistic MRF operating cost would be in the order of $92,519 or $35.00 per tonne based on other typical MRF contracts, where risk and benefit sharing arrangements are incorporated. Such arrangements would also include performance incentives such as a waste disposal rebate estimated at $9,785 bringing the total cost of Thuringowa's improved recycling service to $618,802 per year or $36.62 per household per year.

Due to a reduction in the amount of contaminants within the recyclate capture, it is expected that there would be a corresponding increase in the amount of waste collected. Thus it is estimated that some 16,386 t/yr of household waste would require disposal. At a collection fee of $0.93 per household, it is estimated the household waste collection would cost in the order of $834,114, incurring a disposal cost of $314,620 or a total of $67.97 per household. This would bring Thuringowa's total cost of providing domestic waste disposal and recycling services to approximately $1.77 M per year or $104.59 per household per year. Note that an annual education component of $3.12 per household has been built into the total service cost. These figures are detailed in Table 7.2.

It is important to note that these estimated figures would require market testing during the tendering phase.

7.2.3 Minimum Service

In line with the current reported generation rate, it is estimated that 19,029 tonnes of waste would require disposal annually. Thus Thuringowa's total collection costs would be expected to amount to some $858,148 based on a collection fee of $0.93 per household. This waste would be disposed of at a cost of approximately $365,376 bringing the total cost of this service to $1.22 M per year or $72.40 per household per year. These figures are detailed in Table 7.2.

7.2.4 Reduced Recycling Service

Under the reduced recycling system it is estimated that some 1,101 tonnes of recyclate would be captured annually at a cost of $417,430, based on a collection cost of $0.95 per household. It is thought that the more realistic MRF operating cost of $35.00 per tonne would still apply bringing the sorting cost to around $38,551, which would incorporate risk and benefit sharing arrangements. Such arrangements would also include performance incentives such as a waste disposal rebate estimated at $4,077 bringing the total cost of Thuringowa's reduced recycling service to $504,632 per year or $29.86 per household per year.

Due to the incorporation of paper within the domestic waste stream, it is anticipated that some 17,928 t/yr of household waste would require disposal. At a collection fee of $0.93 per household, it is estimated that waste collection would cost in the order of $912,606, incurring a disposal cost of $344,226 or a total of $74.37 per household. This would bring Thuringowa's total cost of providing domestic waste disposal and recycling services to approximately $1.76 M per year or $104.23 per household per year. Note that an annual education component of $3.12 per household has been built into the total service cost. These figures are detailed in Table 7.2.

As with the improved recycling system option, it is important to note that these estimated figures would require market testing during the tendering phase.

Table 7.2: Thuringowa Cost Assessment

Service Option		Collection Frequency	Annual Capture (t)	Collection ($)	Processing ($)	Disposal ($)	Total ($)	Cost / household/ year ($)
1	**Current Recycling System**	Weekly	2,974	310,509		(46,774)	310,509	18.37
	Current Domestic Waste Service	Weekly	16,055	621,019	-	308,272	929,291	54.99
						Total	**$1,239,800**	**$73.36**
2	**Improved Recycling System**	Fortnightly	2,643	483,340	92,519	-9,785	618,802	36.62
	Domestic Waste Service	Weekly	16,386	834,114	-	314,620	1,148,734	67.97
						Total	**$1,767,536**	**$104.59**
3	**Minimum Service**	Weekly	19,029	858,148	-	365,376	**$1,223,524**	**$72.40**
4	**Reduced Recycling Service**	Fortnightly	1,101	417,430	38,551	-4,077	504,632	29.86
	Domestic Waste Service	Weekly	17,928	912,606	-	344,226	1,256,832	74.37
						Total	**$1,761,464**	**$104.23**

7.3 Environmental Assessment

Recycling is widely regarded to be environmentally beneficial although the true impacts and benefits of kerbside recycling have not previously been defined for the Townsville and Thuringowa regions. Nationally the benefits of recycling have been held to include resource savings, decreased demand for landfill and reduced impacts associated with energy and materials use during the product life cycle.

What is less recognised is that the collection of materials for recycling has its own environmental impacts, including the energy used in collection and sorting, and impacts arising from the reprocessing and use of the recovered materials in the new products. In order to assess the environmental costs and benefits, it is necessary to examine the resources and energy used as well as emissions generated for each system.

The life cycle environmental impacts associated with recycling and waste management systems in Townsville and Thuringowa have been assessed for this study. The findings have incorporated a large range of local parameters such as yields, transfer distances and material mix collected.

7.3.1 Methodology

This environmental assessment has involved the application of Life Cycle Assessment (LCA) data to the recycling systems of the Townsville and Thuringowa local government areas.

The assessment has involved:

1. Characterisation of the kerbside and product systems;
2. Application of existing LCA data[8] for recycling;
3. Life cycle impact assessment;
4. Data interpretation.

a) Characterisation of Kerbside and Product Systems

Characterisation of waste management systems included the entire kerbside system from collection at point of discard through to disposal or end use. The end use for recycled materials is assumed to be closed loop recycling and hence the product system is included in the assessment in order to credit recycling for avoided production from virgin materials extraction and associated manufacturing steps. The product and kerbside systems are depicted in Figure 7.1.

[8] Nolan-ITU (2001) Independent Assessment of Kerbside Recycling in Australia, National Packaging Covenant Council

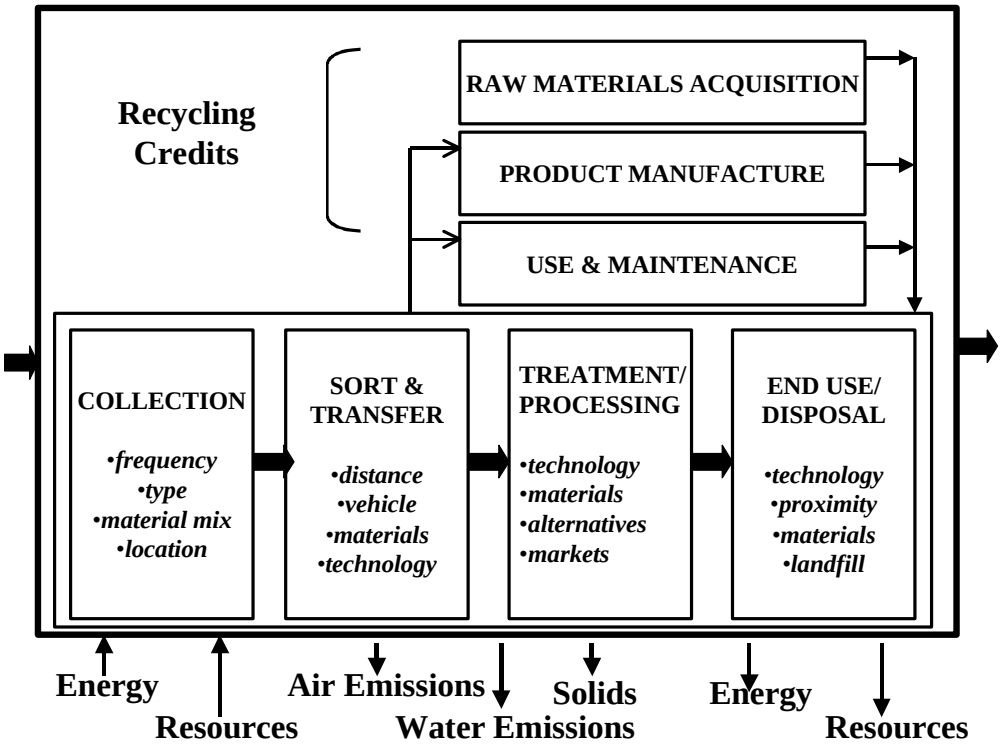

Figure 7.1: The Kerbside and Product System

For the purpose of this assessment, the collection system and recycling systems have been grouped. These comprised as:

- The Collection System - includes all significant environmental impacts associated with: the collection of garbage and recyclables; material sorting; bulking and transfers to materials reprocessing facilities, transfer stations and landfill.
- The Recycling System - includes all significant environmental impacts associated with: transfer to reprocessing facility; beneficiation; cleaning reprocessing; residual management; and credits from avoided manufacture from virgin materials.

Variables incorporated in the modelling of the system include:

- frequency of collection;
- material mix and demographics; and
- impacts arising through the sorting and transfer of materials which are influenced by transport distances, material density, truck capacity and type.

The modelling assumes:

- Paper is recycled under the current recycling system;
- An average resource value per tonne of mixed recyclables is applied for the resource use impact category rather than a composition specific value;

- Average transport of recyclable materials is 2000 km;
- Landfill (based on average Australian standards for landfill); and
- Kerbside Recycling of the common materials: newspaper, mixed paper, glass, aluminium, PET, HDPE and steel cans (based on average Australian mix).

b) Potential Discrepancies Between Local System and LCA Data

Modelling assumptions have been necessary in order to comply with the study scope. Previous experience suggests that while some of the assumptions do not accurately reflect the local system, the impact of these assumption on the final results is less than 5% of the system performance. These assumptions include:

1. Use of best available, publicly accessible national average data for landfill;
2. Use of a set commodity mix per tonne for the calculation of resource use ecovalues; and
3. Processing yields as per the national average from 1999 [(2).]

c) Application of Existing LCA Data [(2)] for Recycling

Due to the large number of parameters that must be included if the assessment is to be comprehensive, Life Cycle Assessment data has been used.

Life Cycle Assessment (LCA) provides a systems-based method of analysis which enables all the input and output flows associated with the system to be quantified. The assessment technique studies the environmental aspects throughout the broader system including the life cycle of products and systems under study. This approach ensures that indirect but related impacts, such as the mining and combustion of fossil fuels for energy inputs or the recycling savings associated with avoided extraction of virgin materials, are incorporated in the final assessment.

For this study, Life Cycle Inventory Data has been applied to the kerbside and product system in order to develop a comprehensive set of the environmental loads associated with recycling so that these may be aggregated by environmental impact category.

The LCA work has involved quantification of the resource inputs and pollutant loads for over 50 substances associated with each processing step for the configuration of the waste system. Once these releases are identified, scienific principles are used to assign the loads to impact categories.

Impact Categories are used to indicate the relative performance of the system in regard to:

- Global warming potential - measured as CO_2 equivalents;
- Air emissions - measured as the critical volume of air required to dilute pollutant loads to regulatory standards (the category is divided into toxic and general pollutants);
- Water emissions - measured as the critical volume of water required to dilute pollutant loads to regulatory standards (the category is divided into toxic and general pollutants); and

- Resource depletion - measured in eco dollars and based on environment economic valuations of the land use and resource scarcity effects of resource use.

Systems Boundary and Assumptions

The same systems boundary is applied to all options. The study boundary is from the point of waste receival, through mechanical processing units and all subsequent unit processes including gas and effluent treatment, through to end-product recovery.

This includes credits for any impacts associated extraction, transport and refining of virgin products which may substituted by the recycled material. For landfill, the analysis is based on the short surveyable time of 100 years[9].

The Functional Unit

The "functional unit" is the function that the systems must fulfil in order to be comparable. For the purpose of this study, the functional unit is recycling services per household per year.

7.3.2 Findings

a) Current Systems

Because impacts are assessed using different units of measure for each impact category, the environmental performance cannot be compared across impact categories without the use of valuation techniques. This would require the development of a common unit of measure. Figure 7.2 may only be used only to compare the environmental performance between the current recycling systems in Townsville and Thuringowa.

[9] Finnveden, G,. Treatment of Solid Waste in Life Cycle Assessment – Some Methodological Aspects, Workshop on LCA and Treatment of Solid Waste September 1995. Swedish Environmental Research Institute, Stockholm, Sweden.

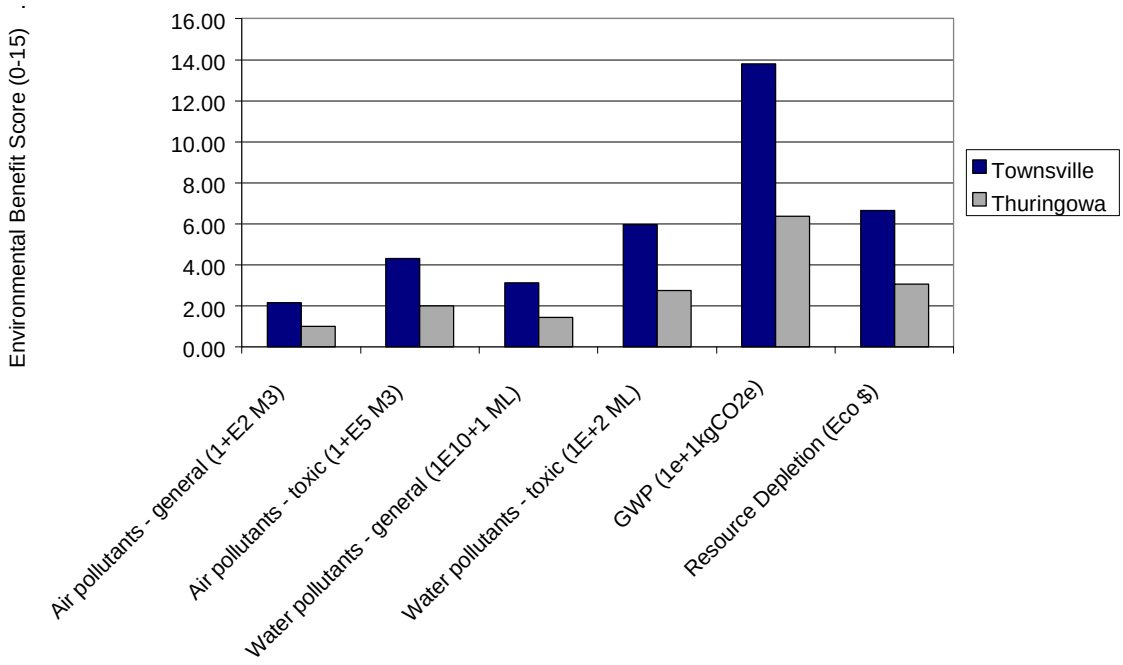

Figure 7.2: Current Systems

Figure 7.3 and **Figure 7.4** illustrate the relative scale of the environmental costs and benefits of the *recycling system* compared with *landfilling only* for the recycling, collection and materials transport components of the system.

The impact categories in the two figures are presented in different units can therefore not be added. Global warming potential - measured as 10kg CO_2 equivalents; Air emissions - measured as the dilution volume for toxic and general pollutants; Water emissions - measured as dilution volume for toxic and general pollutants; and resource depletion – measured in eco dollars.

It is clear from the figures that the benefits of recycling dramatically outweigh the impacts of collection and materials transport. As detailed within this section, these benefits are achieved despite the long haul assumption that the average transport distance from bulking point or MRF to reprocessing is 2000kms. Further justification for this is provided in below.

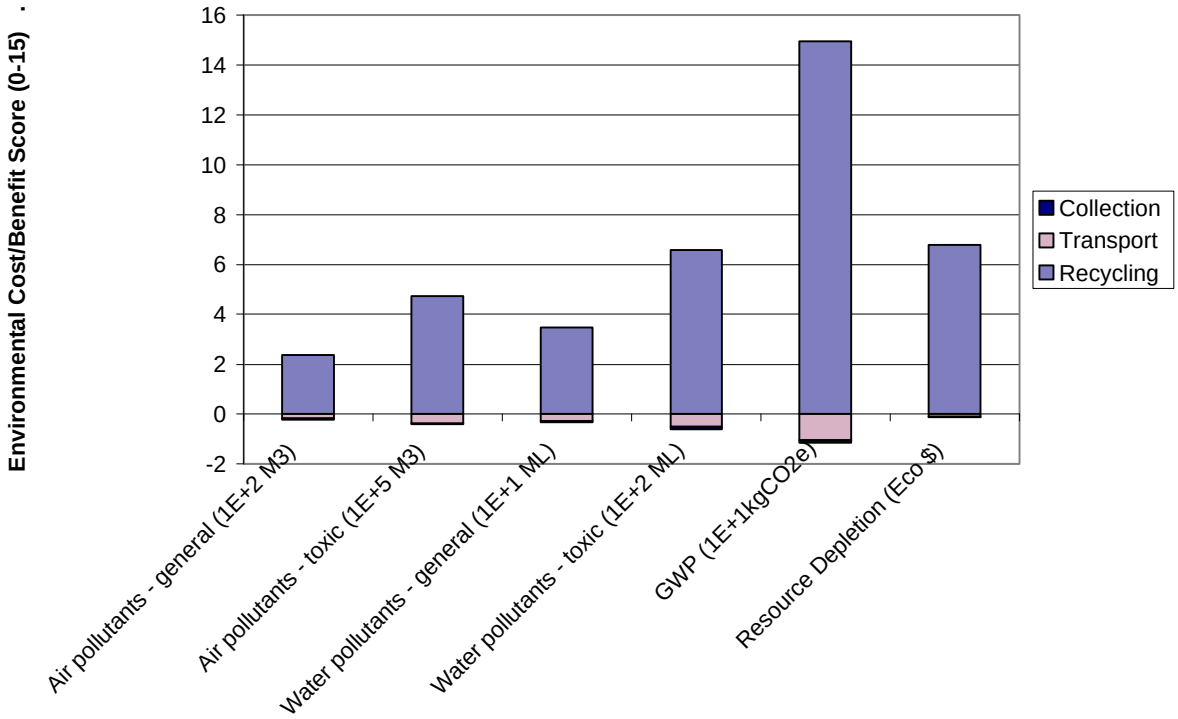

Figure 7.3: Current System Townsville – Recycling, Transport and Collection

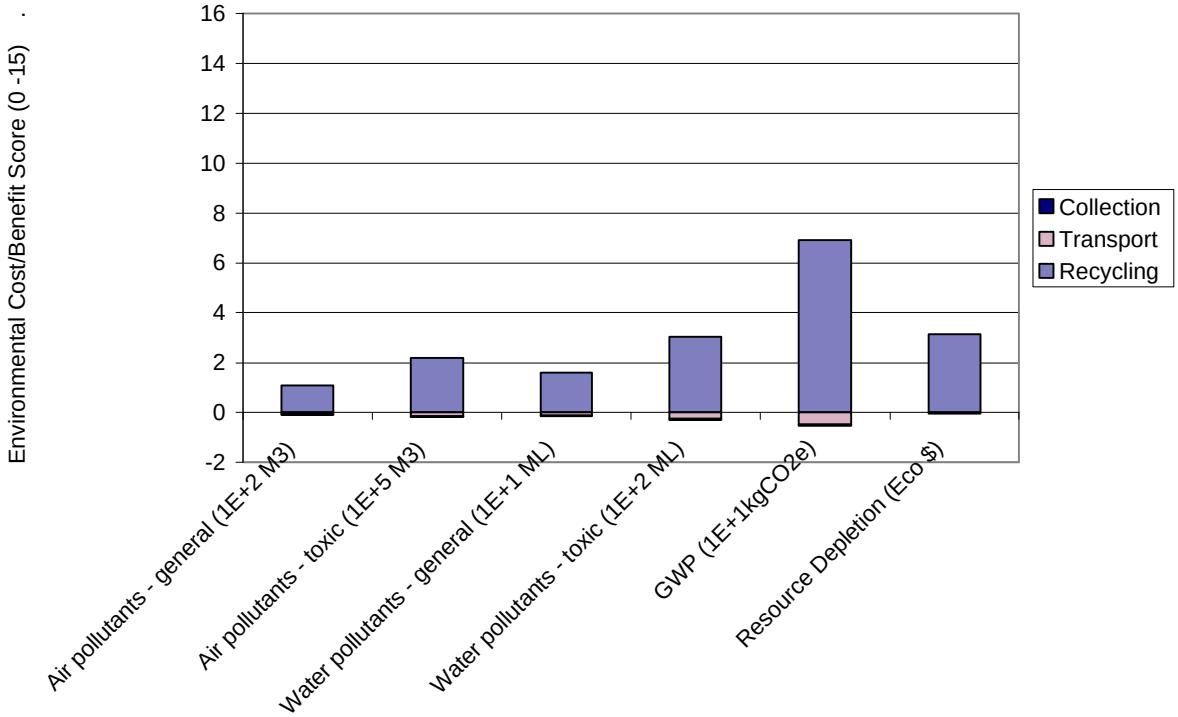

Figure 7.4: Current System Thuringowa – Recycling, Transport and Collection

b) Alternative Systems

Figure 7.5 and Figure 7.6 show the relative environmental performance of the three waste management options for Townsville and Thuringowa respectively. It is clear from the analysis that the improved recycling scenario provides environmental benefits in every impact category. The impact categories are presented in different units and can therefore not be summed. Presentation of the data in the cumulative bar chart is used to enable a vast amount of information to be condensed in one diagram.

The analysis for the current system assumes that recovered paper is recycled. As discussed in Section 4.1, paper is currently disposed of to landfill by Amcor, and this would reduce the environmental benefits shown in Figure 7.5 and Figure 7.6 for "Current Recycling".

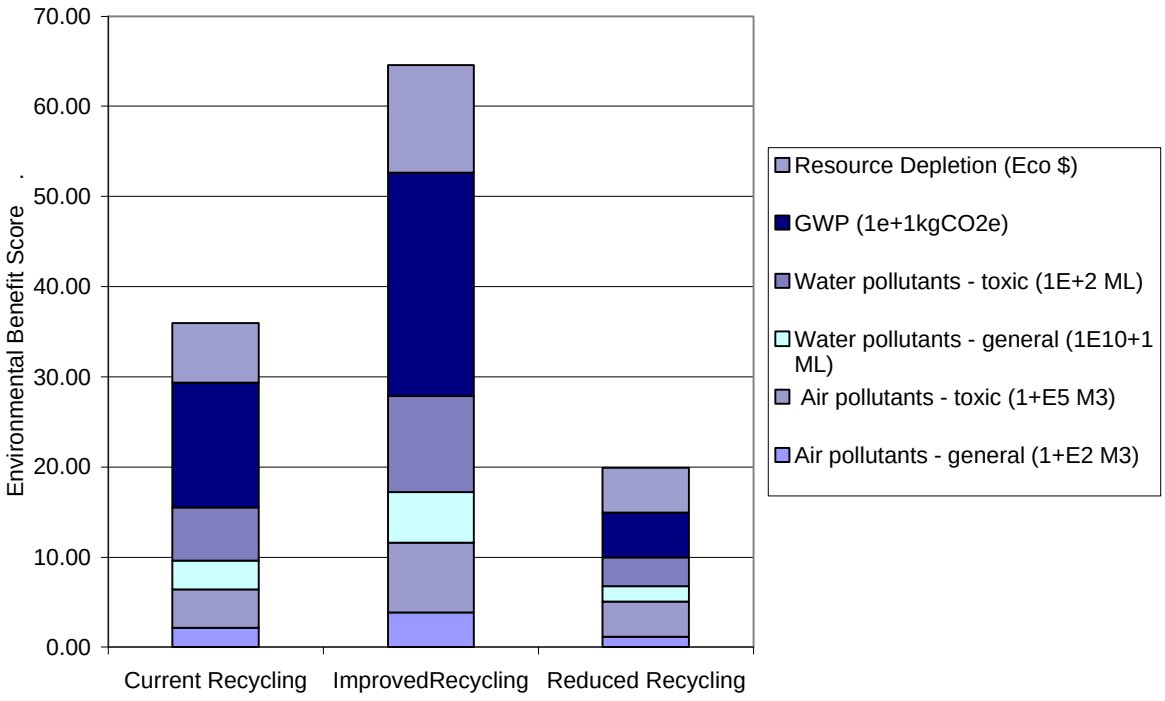

Figure 7.5: Recycling Options for Townsville

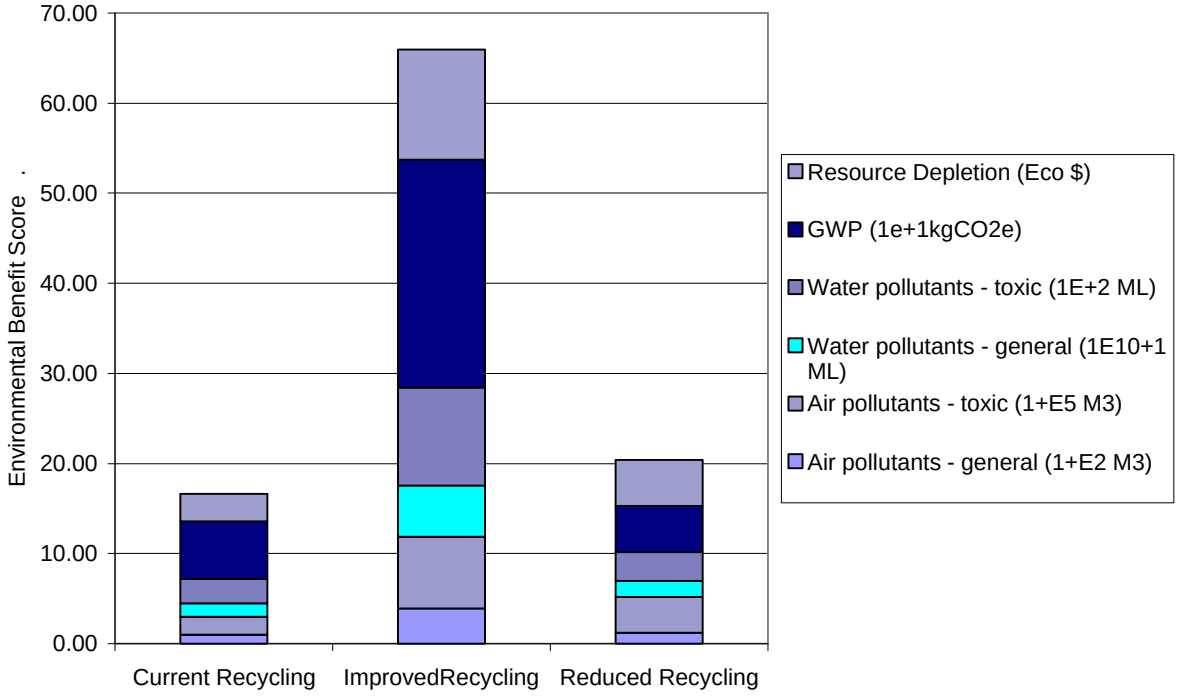

Figure 7.6: Recycling Options for Thuringowa

c) Comparison of Findings with National Average

Eco valuation Indicator of Systems Performance

The environmental performance of the recycling systems is most objectively reported in the units used by the analysis including:

- Global warming potential - CO_2 equivalents;
- Air emissions – Dilution volume of air for toxic and general pollutants;
- Water emissions - Dilution volume of water for toxic and general pollutants; and
- Resource depletion –eco dollars based on land use and resource scarcity.

In order to compare these impacts to the financial costs of the service, it is possible to provide an indicative economic valuation of the impacts.

Based on the analysis conducted for the National Packaging Council in 1999/2000 and the data collected and modelled for this study an eco-valuation of the recycling options was conducted. The estimates shown in Table 7.3 show the eco-valuation of the benefits of the various recycling options over the minimum service case of disposing all materials to landfill.

Table 7.3: Eco valuation of recycling

Recycling Option by Region	Recycling Valuation ($/hhld/yr)
National average	$68
Regional average	$56
Townsville - current	$28
Thuringowa - current	$13
Townsville - improved	$49
Thuringowa - improved	$50
Townsville - reduced	$21
Thuringowa - reduced	$21

The table below presents the average net costs and benefits of kerbside recycling in metropolitan areas and regional areas. As can be seen from the table, the average overall benefit in regional areas is $29/hhld/yr compared with $46/hhld/yr in metropolitan areas.

Table 7.4: National Average Performance of Metropolitan versus Regional Recycling Systems ($/hhld/yr),

	Net Financial Costs	Net Environmental Benefits	Overall Benefit
Metropolitan	25	72	46
Regional	28	56	29
Source: Table 7.5: Metropolitan versus Regional System Performance ($/hhld/yr), Nolan-ITU (2001) Independent Assessment of Kerbside Recycling in Australia, National Packaging Covenant Council			

The NPC Report asked the question 'how far away from reprocessing centres can materials be collected at kerbside before transport costs reach or exceed the level of the overall benefit'? As indicated in the above table, transport costs could increase by up to $29/hhld/yr before the average regional system delivered no net benefit.

The report identified for regional areas at yields of 130 kg/hhld/yr that long distance transport costs increase between $2/hhld and $2.60/hhld per 100 km. The theoretical additional transport distance to reach the break even point is therefore between 1,000 and 1,500 km. The average distance of regional areas from metropolitan areas incorporated into the costings associated with the national study were 300 km. The total threshold distance was concluded to be between 1,300 and 1,800 km for road transport.

In Townsville and Thuringowa, the environmental assessment has assumed an average transport distance of 2000km. However, actual transport costs are already incorporated in the financial analysis and these have proved to be lower than the national average used to derive the threshold transport distance of 1,300 – 1,800 km.

The NPC report states that there is a need to assess the merits of kerbside recycling on a case-by-case basis. The revised costing for the Townsville and Thuringowa regions is based on local conditions and the assessment incorporates transportation costs in order to derive an average recycling cost of $39 and $37 /hhld/yr for Townsville and Thuringowa respectively. The environmental benefits of the improved recycling system for both regions are higher than this cost at 49 and 50 $/hhld/yr for Townsville and Thuringowa respectively.

7.4 Social Considerations

Kerbside recycling has generally become a standard service for most Australian residents, particularly in major towns and cities. Over the past 15 years community support for kerbside recycling has reached the level that Australians are now viewed as world leaders in recycling participation. It is acknowledged that taking part in recycling is one of the most identifiable actions that a person can make to help the 'environment'.

7.4.1 Support for Kerbside Recycling

Kerbside recycling is strongly supported by all levels of government, industry and the community and there is ongoing investment in infrastructure, markets and local employment as a result.

a) Federal Government Support

Federal government addressed the importance of waste reduction and the need for sustainable kerbside recycling services by introducing a framework to encourage industry to assist in propagating the recycling industry. The National Packaging Covenant (NPC) is the Government's tool for providing incentive for participants in the packaging industry to actively pursue sustainable packaging, including provision for improvements in kerbside recycling in Australia.

b) Packaging Industry Support

High participation rate in the National Packaging Covenant demonstrates industry is addressing the importance of recyclable packaging. As a signatory, a company is required to make a scheduled financial contribution to fund the improvement of kerbside recycling at a national level, and to also address their use and consumption of packaging, aiming to improve sustainability and recyclability. NPC projects are ongoing and there are now over 420 industry signatories that are working to improve kerbside recycling through commitments outlined in individual action plans.

c) Consumers / Residents

A recent survey conducted in 2001 found that 97% of respondents agree or strongly agree that kerbside recycling is an essential service. Furthermore:

- Based on paper recycling, nationally 85% of households participate in recycling, (ABS, 2000)[8];
- When asked what they do to help the environment in the house, 74% of respondents spontaneously cited recycling (ABS, 2001)[9];

The 2001 survey also identified that 92% of people believed that it is important to cut down on the amount of waste going to landfill, which is reflected in consumers purchasing. In 2001, the purchase of refillable containers was the most common form of environmental purchase (51%), whilst purchasing recycled paper was a close second (48%) (ABS, 2001).

7.5 Education

Regardless of the waste management practices Councils choose to adopt, community and industry education is essential to ensure support for Council initiatives. The importance of a comprehensive education program can not be overlooked to promote waste avoidance, to maximise separation at source and minimise contamination of recyclables. Providing people with information to make them more aware of waste related issues and how they fit into the scheme of things will enhance their commitment to local waste management. Even a well-planned and adequately funded recycling program will not run smoothly without community understanding and support.

An education strategy needs to have a multifaceted approach to reach people with differing levels of technical knowledge and attitudes to waste and resource recovery. For a regional program to be effective, it will need to be adequately resourced, researched and funded. It is recommended that an education program be developed to support kerbside recycling, and undertake the following:

- Research related programs and existing resources that can be utilised to avoid duplication of effort developing new resources;
- Research and prioritise local education needs to ensure a more targeted education approach is adopted, therefore gaining maximum results per dollar spent on education;
- Develop and maintain a database of existing programs and resources that can be tapped into;
- Research local media and communication networks that can lend support to a communication strategy;
- Keep up to date with new initiatives outside the region, keep Councils informed and 'piggy-back' on other state and national programs where appropriate;
- Consult widely with community and industry groups on waste related issues to seek feedback and input;

- Maintain community involvement in waste minimisation and kerbside recycling initiatives;
- Prepare local educational resources where applicable;
- Extend Council education budget by working with community groups, schools and industry to implement education programs; and
- Maintain dialogue Council staff and related stakeholders.

7.6 Other Issues for Consideration

With the expiration of the collection and recycling contract between Cleanaway and Townsville and Thuringowa Councils, there are a number of issues that may be incorporated within a new contract in order to maximise efficiency gains. These issues include:

- Use of single pass collection vehicles;
- Location of a MRF at a landfill;
- Use of day labour to collect domestic waste and recyclables; and
- Establishment of local value adding opportunities.

It is possible that the implementation of some of these options may span more than a single contract period of approximately 7 years, however, longer term they are likely to optimise collection economics whilst maximising environmental sustainability of waste and recycling services.

7.6.1 Use of Single Pass Vehicles

Dual Application Refuse Trucks or single pass vehicles are dual payload collection vehicles which have a "mono divider valve' enabling materials to be selectively discharged into either the upper or lower vehicle body chambers. These chambers may be sized according to collection quantities in addition to having varying compaction forces depending upon the material being loaded. This is achieved using dual paddle packing heads.

The use of these vehicles is usually as part of a mixed fleet ie., single payload domestic waste collection vehicles and dual payload vehicles. It is estimated that the use of single pass vehicles can increase collection vehicle efficiency by around 15% or greater, depending upon residential density and the travel distance between a landfill and MRF.

7.6.2 Location of MRF at Landfill

The location of a MRF at a landfill will have a number of benefits. One of the main benefits will be avoidance of infrastructure duplication, particularly in the case of establishing such features as weighbridges which may be used for waste transactions as well as materials auditing. In addition, transport economics will be optimised through the minimisation of MRF residue transportation. This will be further enhanced if single pass collection vehicles are used as the discharge destinations for waste and recyclables will be the same.

7.6.3 Day Labour Collection of Domestic Waste and Recyclables

In addition to the use of day labour for the collection of domestic waste, the Councils could consider the use of day labour for the collection of recyclables. Particularly in the case of Townsville Council, this will enable Citiwaste to capitalise on the in-house expertise in collection logistics. This will also enable the closer tracking of waste / recyclables quantities. It is understood that Thuringowa City Council has prepared a detailed business case for the day labour collection of waste. This business case may be extended to include day labour collection of kerbside recyclables.

7.6.4 Local Value Adding Opportunities

One significant hurdle for regional commodity markets is the issue of transportation, in particular the distance to reprocessors of high volume, low weight commodities such as plastics. As a result, opportunities for local value adding opportunities should be sought. Such moves would not only serve to stimulate local economies and employment but could see the establishment of significant regional industries by drawing materials from other outlying regions.

7.7 Other Ecologically Sustainable Projects

7.7.1 Other Sustainability Initiatives

It is understood that the Councils have been considering other ways to enhance the ecological sustainability of the region. Accordingly, a number of ideas have been raised as to how this might be achieved. It is important to note that amongst the various options which have been put forward, the alternatives should be seen as complementing one another rather than competing interests. Furthermore, the Councils may choose to develop a development plans which demonstrate adherence to the principles of ESD. This would serve not only to lay down guidelines for the ongoing development of the region but also to prioritise and timetable development, thereby maximising the Councils' sustainability in an timely and financially responsible manner. Some of the ideas which have been put forward include:

- Development of a "Local Sustainability Framework";
- Use of alternative waste treatment methods;
- Landfill gas recovery and utilisation;
- Tree planting programs;
- Energy efficiency programs;
- Water conservation programs;
- Coastline protection measures; and
- More efficient utilisation of greenwaste.

Some of the suggested programs will overlap eg, greenwaste utilisation, alternative waste technologies and tree planting. Hence, there will be a requirement for timetabling if some or all of these options are to be pursued. However, it may be seen that, properly coordinated, these programs will complement each other significantly enhancing the region's sustainability above and beyond the implementation of a single program in isolation. Similarly, water conservation may have a coastal impact as people are encouraged to install low flow devices, repair drips etc.

7.7.2 Local Agendas 21

In recognition of the critical role that local governments play in building sustainable societies, and as a follow-up to the UN Conference on Environment and Development (UNCED) "Earth Summit" in 1992, the International Council for Local Environmental Initiatives (ICLEI) launched an international action research programme on sustainable development planning in 1994. This program called the Local Agenda 21 Model Communities Programme was designed to aid local governments in implementing Chapter 28 of Agenda 21.

In response to international recognition of climate change Townsville and Thuringowa Councils may choose to join the 17 other Queensland Councils including Brisbane City and Gladstone who are participating in the Cities for Climate Protection TM program (CCP^{TM}). This program is delivered by the ICLEI in collaboration with the Australian Greenhouse Office (AGO). To become a CCP^{TM} Australia participant, Councils will need to adopt a resolution that commits the Council to a structured Milestone program that:

- Establishes and inventory and forecast for key sources of greenhouse emissions in Council and community;
- Set an emissions reduction goal;
- Develop and adopt a local greenhouse action plan to achieve those reductions;
- Implement a local greenhouse action plan; and
- Monitor and report on greenhouse gas emissions and implementation of actions and measures.

Although participation in this program involves a nominal one-off participation fee, assistance is available from the AGO. In order to receive assistance, Councils must complete the inventory component within 6 months of signing a funding agreement with the AGO.

8 CONCLUSIONS AND RECOMMENDATIONS

Cost and Environmental Effectiveness

The current recycling arrangements for Townsville and Thuringowa are ineffective in terms of materials recovery rates, materials utilisation and in achieving ESD objectives. Table 8.1 and Table 8.2 summarise the key performance data.

Table 8.1: Townsville Performance Summary

Option Description	Materials Recovery Rate kg / hh / yr	System Costs: $ / hh / yr		
		Service Cost	Marginal Cost for Recycling	Environmental Benefit (Eco-Dollars)
Minimum Service	Nil	65.35	N/A	N/A
Current Service	66.1*	107.44	42.09	28
Improved Recycling Service	120.9	97.49	32.14	49
Reduced Recycling Service	50.4	95.95	30.60	21

* - Includes 49.8 kg/household/year of paper currently collected but not recycled

Table 8.2: Thuringowa Performance Summary

Option Description	Materials Recovery Rate kg / hh / yr	System Costs: $ / hh / yr		
		Service Cost	Marginal Cost for Recycling	Environmental Benefit (Eco-Dollars)
Minimum Service	nil	72.40	N/A	N/A
Current Service	31.8*	73.36	0.96	13
Improved Recycling Service	126.3	104.59	32.19	50
Reduced Recycling Service	52.6	104.23	31.83	21

* - Includes 17.9 kg / household / year of paper currently collected but not recycled

The low recovery rates are attributed to a number of factors, as discussed below.

Standardising the Collection Systems

With expiry of existing collection contracts in 2002, there is an opportunity to standardise collection systems for the two Councils. This provides an opportunity for achieving economies of scale and, in the case of Townsville, the possibility of reducing collection costs for recyclables.

Contamination Levels

The contamination levels reported by the contractor are significantly overstated as a result of current MRF inefficiencies (see below) and a lack of appropriate incentives. Nevertheless, contamination levels in the collected recyclables are unacceptably high and this issue would need to be addressed through such measures as increased public education, should the Councils elect to proceed with a new recycling service.

MRF Efficiency

As a result of input material contamination, insufficient labour and the lack of incentives for maximising materials recovery, the MRF is not operated efficiently. Sometimes, truckloads of materials deemed to be excessively contaminated are diverted directly to landfill and some materials are apparently not being recovered at all ie., clear glass. During two site inspections, only four out of the five nominated sorters were present, leading to high levels of potentially recoverable materials being observed on the waste conveyor.

Markets for Recoverable Materials

The Contractor and Amcor confirmed that paper recovered from the MRF and transported to Brisbane is no longer required by Amcor and is disposed of to landfill. Amcor has advised Cleanaway that it will not accept paper from the MRF after expiry of the current contract.

The study has shown that alternative markets for recovered paper are available and that ongoing markets are expected to be available for the other recyclable commodities. Interest in recovered commodities has been shown by both Visy and Coca-Cola.

Risk Sharing Arrangements

The current risk sharing arrangements covered by Rise and Fall provisions are based on changes in commodity prices and quantities of materials collected. Therefore, administration of these provisions is extremely difficult given the lack of verifiable data relating to material quantities and returns to the contractor for the sale of sorted materials ie., net commodity revenue.

The contractual arrangements between the Councils and the Contractor, and those between the Contractor and the recyclers of commodities, are not structured to maximise materials recovery and utilisation. No incentives are provided to operate the MRF effectively and the current arrangement whereby the contractor is able to dispose of MRF residues free of charge is counterproductive to encouraging maximisation of materials recovery.

Other Conclusions and Recommendations

An improved recycling service ie, one that achieves similar performance to the National average, would achieve greater recovery rates and enhanced ESD performance. It is expected that the cost of such services would be lower than the present system in the case of Townsville. However, it is likely that Thuringowa would incur additional costs. This is because Thuringowa's present collection and recycling system is priced at an unsustainably low level.

The net environmental benefit attributable to the current recycling systems is estimated at -$14 and +$12 per household per year for Townsville and Thuringowa respectively, assuming that recovered paper can be recycled. The net environmental benefit for the improved recycling system is estimated at $17 and $18 for Townsville and Thuringowa respectively. These benefits are considerably lower than the national average figures found in the NPCC study, i.e., $46 for urban areas and $29 for regional areas. A significant factor in the lower figures for Townsville and Thuringowa is the region's greater distance to commodity markets than the national study.

Compared with an improved recycling service which maximises the recovery of all commodities, there is little cost saving for the reduced recycling option which would only recover containers. The lack of cost savings is due to the ongoing requirement to dedicate infrastructure towards a reduced service in spite of a lower capture tonnage. In addition, a willingness to purchase mixed paper and cardboard has been expressed by Visy. Therefore, this option is not recommended.

Should the Townsville and Thuringowa Councils decide to proceed with the improved recycling option it is recommended that:

- Separate tenders be called for collection and processing; and
- Provision be made for ongoing community education to maximise the quantity and quality of recyclables presented at kerbside.

It is anticipated that this approach would allow the Councils to maintain maximum flexibility between material presentation, collection and sorting. This does not preclude the submittal of non-conforming tenders which bundle collection and processing. However, it does provide additional confidence for those companies that specialise in either collection or processing that they will be able to provide the required services in a cost effective and competitive manner.

It is also recommended that any tender and contract documents be structured to encourage the collection contractor to minimise inbound contamination and the MRF operator to maximise resource recovery by requiring the:

- MRF operator to pay for disposal of MRF residues;
- Collection contractor not to exceed a nominated collection density; and
- MRF operator to ensure recovered materials are recycled.

These contractual arrangements should build in flexibility as commodity markets change thereby helping to reduce risk levels and facilitate cooperative relationships. Furthermore, such mechanisms would be expected to promote greater resource recovery than the Rise and Fall Formula and Benefit / Risk Calculation Clauses within the present recycling contract.

It should be noted that many of the findings within this report rely heavily of data supplied by Cleanaway. Much of this data appeared to be of an arbitrary nature, reportedly assigned to Councils using a 60:40 (Townsville:Thuringowa) split according to population figures.

However, given population figures for the two Councils and typical national recyclables recovery rates, some of the supplied data appeared anomalous. To date, the monitoring of recycling performance has been difficult because of a lack of reliable data. In addition, the available data has at times been of questionable integrity. Therefore, it is recommended that the councils install weighbridges to monitor the quantities of recyclables and waste collected. This will enable ongoing performance monitoring and enable greater accuracy in pricing disposal and recycling services.

9 REFERENCES

1. Meinhardt (NSW) Pty Ltd, 2000, *North Queensland Regional Waste Management Strategy* for The Health & Environmental Services Regional Organisation of Councils - North Queensland, September 2000.

2. Nolan-ITU Pty Ltd and SKM Economics, 2001, *Independent Assessment of Kerbside Recycling in Australia - Revised Final Report - Volume 1,* for The National Packaging Covenant Council, January 2001.

3. Sinclair Knight Merz, 1999, *Contamination Levels in Recyclable Material - Audit of Contamination in Recyclables*, for Townsville City Council, December 1999.

4. Sinclair Knight Merz, 1999, *Contamination Levels in Recyclable Material - Audit of Contamination in Recyclables*, for Thuringowa City Council, July 1999.

5. The City of Thuringowa, 2001, *Business Case - Provision of Council Day Labour Waste Collection Service*, October 2001.

6. Residua Limited, 2001, *What Does It Cost To Recycle Household Waste - Optimising Recycling*, Warmer Bulletin, January 2001

7. Residua Limited, 2000, *Recycling Achievements in Canada and the USA*, Warmer Bulletin, September 2000.

8. Australian Bureau of Statistics (ABS), 2000, *Environmental Issues: Peoples Views and Practices.*

9. Australian Bureau of Statistics (ABS), 2001, *Environmental Issues: Peoples Views and Practices.*

10. EcoRecycle Victoria, 2001, *Community Attitudes Survey*.

Appendix A

Key Assumptions and Calculations

Townsville

No. of households - Townsville	32,000	
No. of households - Magnetic Island	1,362	
Cleanaway Collection Cost - Townsville ($/service)	$1.36	As supplied by Citiwaste
Collection Cost - Magnetic Island ($/service)	$1.85	As supplied by Citiwaste
Total Collection Costs	$1,389,300	As supplied by Citiwaste
Recyclables Collection Frequency (times per year)	26	
Recyclables Collection Tonnes	3,697	Based on Cleanaway Figures
Recyclables Contamination Tonnes	1,492	Based on Cleanaway Figures
Recyclables MRF Sorting Fee ($/yr)	$84,000	As supplied by Citiwaste
Typical Australian MRF Sorting Fees ($/t)	$35.00	Assumption
Garbage Collection Frequency (times per year)	52	
Garbage Collection Rate - Townsville ($/service)	$0.87	As supplied by Citiwaste
Garbage Collection Rate - Magnetic Island ($/service)	$1.15	As supplied by Citiwaste
Collection Overhead Increase Due to Recycling Termination	1.05	
Garbage Collection Tonnes	32,271	6 x 18 & 1 x 9 cu.m Trucks, 2 & 3 Runs Per Day, 260 d/yr, @ 0.65 t/cu.m
Waste Density (t/cu.m)	0.50	Assumption
Waste Disposal Cost ($/cu.m)	$6.75	As supplied by Citiwaste
Magnetic Island Surcharge	1.34	
Fully Commingled Recyc Collection - Townsville ($/service)	$1.10	Assumption - As run through Council day labour
Fully Commingled Recyc Collection - Magnetic Is ($/service)	$1.48	
Recyclable Containers Collection Cost - Townsville ($/servic	$0.95	Assumption - As run through Council day labour
Recyclable Containers Collection Cost - Townsville ($/servic	$1.27	
Public Education Component ($/service)	$0.06	Assumption - 3% according to international practice

Option	Description	Collection Frequency	Annual Capture Quantity (t)	Collection ($)	Processing Cost ($)	Disposal Cost ($)	Total Cost ($)	Cost per Household per Year
1	Current Recycling System	Fortnightly	3,697	1,389,300	84,000	(20,135)	1,473,300	$46.04
	Current Domestic Waste Service	Weekly	32,271	1,529,128	0	435,659	1,964,786	$61.40
							$3,438,086	$107.44
2	Improved Recycling System	Fortnightly	4,996	967,439	174,877	-12,473	1,233,932	$38.56
	Domestic Waste Service	Weekly	30,972	1,467,553	0	418,116	1,885,669	$58.93
							$3,119,601	$97.49
3	Garbage Service Only	Weekly	35,968	1,605,584	0	485,568	2,091,152	$65.35
							$2,091,152	$65.35
4	Reduced Recycling - Containers Only	Fortnightly	2,082	835,515	72,869	-5,197	1,007,276	$31.48
	Domestic Waste Service	Weekly	33,886	1,605,654	0	457,461	2,063,116	$64.47
							$3,070,392	$95.95

Note: Recycling contamination included in recycling capture
Public education cost of $104,089.44 built into total recycling costs for Options 2 & 4

Thuringowa

No. of households	16,900	
Collection Frequency (times per year)	52	
Annual Council Collecction, Recycling & Disposal Charge	$97.00	As supplied by Thuringowa
Recycling Collection & Sorting Service Cost ($/service)	$1.06	
Recyclables Collection Tonnes	2,974	Based on Cleanaway Figures
Recyclables Contamination Tonnes	2,436	Based on Cleanaway Figures
Improved Recycling Collection Frequency (times per year)	26	
Typical Australian MRF Sorting Fees ($/t)	$35.00	Assumption
Day Labour Garbage Collection Rate ($/service)	$0.93	As supplied by Thuringowa (includes 17,500 bin purchase @ $50)
Household Annual Waste Generation Rate (tpa)	0.95	As supplied by Thuringowa
Garbage Collection Tonnes	16,055	
Collection Overhead Increase Due to Recycling Termination	1.05	
Waste to Recyclables Ratio	0.67	As supplied by Thuringowa
Waste Administration Cost	$301,000	
Public Bin Overhead	$19,000	
Public Area Litter Collection	$79,500	
Current Waste Disposal Cost ($/t)	$19.20	
Fully Commingled Recyclable Collection Cost ($/service)	$1.10	Assumption - As run through Council day labour
Recyclable Containers Collection Cost ($/service)	$0.95	Assumption - As run through Council day labour
Public Education Component ($/service)	$0.06	Assumption - 4.25% for change in service

Option	Description	Collection Frequency	Annual Capture Quantity (t)	Collection	Processing	Disposal	Total	Cost per Household per Year
1	Current Recycling System	Weekly	2,974	310,509		(46,774)	310,509	$18.37
	Current Domestic Waste Service	Weekly	16,055	621,019		308,272	929,291	$54.99
							$1,239,800	$73.36
2	Improved Recycling System	Fortnightly	2,643	483,340	92,519	-9,785	618,802	$36.62
	Domestic Waste Service	Weekly	16,386	834,114	0	314,620	1,148,734	$67.97
							$1,767,536	$104.59
3	Garbage Service Only	Weekly	19,029	858,148	0	365,376	1,223,524	$72.40
							$1,223,524	$72.40
4	Reduced Recycling - Containers Only	Fortnightly	1,101	417,430	38,551	-4,077	504,632	$29.86
		Weekly	17,928	912,606	0	344,226	1,256,832	$74.37
							$1,761,464	$104.23

Note: Recycling contamination included in recycling capture
Public education cost of $52,728.00 built into total recycling costs for Options 2 & 4