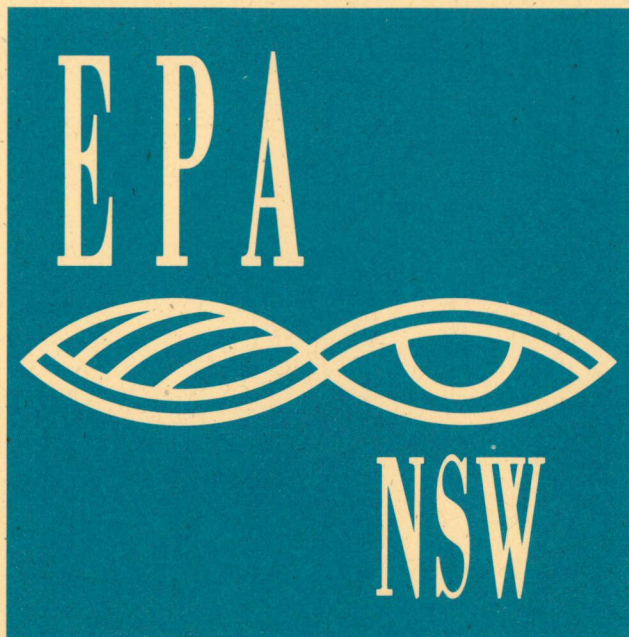


SER/NSWEPA 93/70



**WASTE MANAGEMENT
IN THE 1990s**

**EFFECTIVE WASTE
MANAGEMENT**

PAPERS FROM
A SEMINAR ORGANISED BY
THE LOCAL GOVERNMENT & SHIRES
ASSOCIATIONS AND THE
ENVIRONMENT PROTECTION
AUTHORITY

FRIDAY 30 JULY 1993

PAPERS

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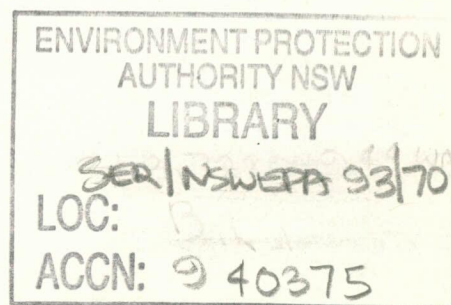
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Contents

SJ Moore, B Kung, S Tu, P Toong, B van den Broek Application of the National Solid Waste Classification System to NSW Database	2
J Kleinschmidt, D McNicoll The Recycle Maroochy Program	7
Russell Lloyd The Eastern Sydney Group of Councils Materials Recovery Facility Project	10
Bicky Rixon, Christina Grant Multi-Occupancy Recycling	14
Warren Knox The Future for Steel Can Recycling	20
Jenny Kent Processing of Green Waste — Costs and Benefits	22
John Denlay Composting — the Key to Meeting the 50 per cent Target	25
Ken Dick, Ron Glew Total Waste Management in the Concord Municipality	29
John Swift Manly — Sydney's Number One Recycler	36
Diana Roberts Lismore's Waste Management Strategy	39
Ken Wilson Councils Working Together: Grafton's Strategy	43
Philippa Major, David Russell Negotiating the Conditions for Best Practice — Siting a Controversial Waste Facility	45
Michael Antrum The Role of Litter Reduction in Overall Waste Management for Councils	48
Robyn Tucker The Earth Works Program	52
Maria Callinan Waising Worms is Wonderful	55



Application of the National Solid Waste Classification System to NSW Waste Database

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The opinions expressed in this paper are those of the authors, not necessarily those of the EPA.

Summary

The background to and need for a National Waste Database are outlined as an introduction to the objectives of the Classification System. The National Waste Database includes the establishment of a National Waste Classification system, a standard sampling and analysis protocol, and a computer database for storage of information on the generation of waste in Australia. The first stage of the project, to establish a draft uniform National Solid Waste Classification System, is essentially complete and is described in this paper. The application of the National System to NSW is also described. The draft Classification System will now be trialled until January 1994, at which time the comments of users will be taken into account in proposing the final National Classification System.

Introduction

Waste Policies

A series of waste policies at the Commonwealth and State levels have been announced or are currently being developed through a process of discussion papers and public submissions. These have been described in an associated paper (Moore et al, 1993) and in summary include:

- the National Waste Minimisation and Recycling Strategy (CEPA, 1992)
- the National Kerbside Recycling Strategy (1992)
- the Intergovernmental Agreement on the Environment (February 1992) signed by Commonwealth, State and Local Government clarifies their roles and responsibilities and provides a mechanism for a co-operative national approach to the environment. Included in the Agreement is the requirement to measure impacts associated with hazardous wastes and the re-use and recycling of used materials.
- the ANZECC National Packaging Guidelines (July 1991)

In addition to these documents, a series of policies developed by the Ecologically Sustainable Development consultation process in Australia, and Australia's participation in the development of Agenda 21 (UNCED, 1992) will require the establishment of national waste monitoring and database systems.

Project Aim and Objectives

An examination of the current state of waste data collection and reporting in Australia (CRCWMPC, 1992) has highlighted how inadequate current systems are in meeting the demands placed on them by new and developing waste policies. There is an urgent need to develop uniform methods of classification, data collection and storage so that the target setting and monitoring demands of these waste policies can be met.

The aim of the project is to establish a database on waste generation in Australia which can be used by State and Commonwealth environmental and waste management agencies, and other interested organisations to set and monitor the achievement of national waste minimisation targets.

To achieve this aim, the following objectives will need to be met:

- review and establish nationally agreed classification systems for various groups
- establish a protocol for sampling and characterising urban solid wastes
- establish a National Waste Generation Database to provide fundamental information on the generation of different types of waste by region and in relation to relevant parameters

This paper reports on progress to date on the first objective to establish a uniform National Solid Waste Classification System, and shows how this system will be implemented in NSW. Details of the National Waste Database project as a whole are described by the authors in an associated conference paper (Moore et al, 1993).

Solid Waste Classification Systems

The solid waste classification consists of two separate components: a waste stream classification system to describe the daily arisings of waste streams from different sources, and a waste component classification

system to describe the material components of any particular waste stream as determined by waste composition surveys. The proposed National Solid Waste Classification System is outlined in the remainder of this section.

Solid Waste Streams

The solid waste stream classification is composed of five fields, each describing a separate attribute of solid waste streams, as indicated in Table 1. Each of these attributes is now described in turn.

The waste disposal routes (see Table 1) include:

- recycling; including kerbside recycling, MRF recycling and direct recycling arrangements between the generator of the waste and the consumer of the material
- composting
- incineration
- landfill
- on-site, including landfill on the site of the generator

The waste streams are categorised according to the principal origin of the waste, as shown in Table 1, namely:

Urban Solid Wastes

- *municipal waste*: wastes arising from domestic premises and Council activities largely associated with servicing residential areas, such as street sweepings, street tree lopping, parks and gardens, and litter bins
- *commercial and industrial*: wastes arising from institutional, commercial, industrial activities (non-hazardous) and being disposed of to facilities owned by urban authorities
- *building and demolition*: wastes arising from demolition and building activities, including Council building and road works activities

On-site Disposal of Solid Wastes

These are non-hazardous wastes arising from mining, agricultural, mineral processing and power station activities, and which are disposed of to mono-fills (al-

Table 1
Draft Solid Waste Classification — Waste Streams

Proc./Disposal Route	Waste Stream	Sub-stream 1 Source	Sub-stream 2 Measurement/Transport mode	Sub-stream 3 Material composition
1 Recycling	A: Municipal Waste	1 Domestic waste	0 All, weighbridge	0 Mixed
2 Composting		2 Other domestic	1 Cars, station wagons	1 Paper/cardboard
3 Incineration		3 Other council	2 Utes. P/vans, sgl axle trailers	2 Food/kitchen
4 Landfill	B: Comm. & Ind.	O Unknown A Agriculture B Mining C Manufacturing D Electricity, gas & water F Wholesale & retail trade G Transport & storage HIJ Services sector K Community services (hlth,ed) L Recreation, tourism	3 Large utes, multiple axle trailers	3 Garden
5 On-site			4 Open trucks, gross wt <5t	4.1 Wood
			5 Open trucks, 5t<Gr wt <12t	4.2 Trees > 150 mm dia
			6 Open trucks, gross wt >12t	5 Tyres
			7 Compactors, bins <8m ³	6 Glass
			8 Compactors, bins 8-12m ³	7 Plastic
			9 Compactors, bins 19-32m ³	8.1 Ferrous - mixed
			10 Compactors, bins 19-32m ³	8.2 Ferrous - cars
			11 Compactors, bins >32m ³	9.1 Special - other
			12 Other	9.2 Special - sewage sldg
				9.3 Special - dusty waste
				9.4 Putrescible/Organic (K)
	9.5 Asbestos (N220)			
	9.6 Clinical & Pharm. (R)			
	10 Clean			
	10.1 Bricks			
	10.2 Concrete			
	10.3 Carpet			
	10.4 Plaster board			
	10.5 Non-ferrous - Al			
	10.6 Non-ferrous - other			
	10.7 Ceramics			
	10.8 Clean excavated mat'l			
	11 Other segregated			
	C: Building & Demo.	X Waste processing facility		

though mixed waste fills are often encountered) often on the site of the waste generator.

In order to provide a more detailed description of these major waste streams, a series of sub-streams has been defined, Table 1, to provide additional information on the aspects described below. These sub-streams will be used either in full when intensive surveys (lasting one day to one week) are undertaken, or selectively on a continual basis to suit local regional needs. The decision on which sub-streams to use, and the frequency of intensive gatehouse surveys, will remain with the local authority.

- **Sub-stream 1: Source** This provides a more detailed description of the waste generation source. For municipal waste, *domestic* waste refers to that waste put out by households in a range of bin sizes (55 – 240 L bins); *other domestic* includes large packaging that cannot fit into the domestic waste bin, clean-up waste, garden waste, and disused furniture; *other council* waste includes street sweepings, litter bin contents and street tree loppings.
- **Sub-stream 2: Transport Mode** Landfills not equipped with weighbridges and required to estimate through-put often do so through the use of vehicle counts applied to average weight of waste for each class of vehicle. The categories suggested have been taken from typical vehicle classes.
- **Sub-stream 3: Material Composition** Some materials such as garden waste and timber pallets are often segregated when they arrive at the landfill because of the nature of the waste generation activity. This segregation of waste is likely to increase, and to be extended to other wastes. This field enables data on these segregated streams to be entered into the National Waste Database (the data will already be collected for the purpose of separate charging).

A supporting manual will provide guidance of the use of the waste stream classification system, including examples. Each State will be developing a system which is derived from the national system, tailored to meet local needs. The system to be adopted in NSW is outlined in *NSW Waste Database* below.

Waste Composition

Currently there are no regulations to require, or incentives to encourage, the conduct of waste composition studies by the owners and managers of solid waste. Councils, waste authorities, industry associations and EPAs are undertaking these studies for their own benefit in terms of investigating the feasibility of material

recovery systems and monitoring the changes in waste composition over time. In most cases there is little commercially confidential information involved, and it is hoped that most organisations undertaking these studies will conduct them in a manner that is consistent with the national system and will then forward data on to the National Waste Database.

Waste composition should be expressed as:

- Material type and material detail as a percentage of the whole waste sample (and/or individual weights), with the weight of waste sample and number of samples analysed stated. Information on variance about the mean should also be supplied.
- Density of material type and material detail. Development of standard methods of measuring density is currently underway and will be documented in an accompanying manual.

The Waste Composition Classification System

Material type and material detail and associated sub-categories are listed in Table 2. (*P*) indicates the material detail is a packaging-derived waste. The waste composition classification system has been designed to be applied to all three major urban solid waste streams, not just the municipal waste stream.

The three fields of *material type*, *material detail* and *material detail sub-category 1* have been designed to satisfy the needs of the National Waste Minimisation Strategy and related documents at the Commonwealth and State level. *Material detail sub-category 2*, as yet undefined, will not be a formal part of the National Classification System but will be developed to suit regional-specific needs and project-specific needs by regional Authorities. Suggestions on alternatives for specific needs (eg. incineration, composting, recycling etc.) are being developed in a manual providing guidance on the conduct of waste composition studies. This manual will include guidance on sampling, equipment and OH & S procedures.

NSW Waste Database

Existing Waste Generation Data

In connection with implementation of the Section 29 Levy under the *Waste Disposal Act*, systematic collection of waste statistics has been carried out over the past two decades in the Sydney metropolitan region.

Table 2
Draft Solid Waste Classification System — Waste Composition

Material Type	Material Detail	Material Detail Sub-Category 1	Material Detail Sub-Category 2
Paper	Newspaper Magazine Misc. Packaging(P) Corrugated cardboard(P) Package board(P) Liquid Paper Containers(P) Disposable paper product Printing & writing paper (incl. books) Composite, mostly paper		Further sub categories can be developed to suit local needs and the purpose of the waste composition study. For example, glass non-deposit containers can be further split into colours if that is important to the use that the composition study will be put; paper can be sorted into contaminated and non-contaminated, depending on the reuse options being investigated (eg use of paper for pulping, hydromulch or composting will have a different definition of "contaminated")
Organic Compostable	Food / Kitchen Garden Other Putrescible		
Other Organic	Wood Textile/rags Leather Rubber Oils	furniture packaging, offcuts footware tyres, tubes engine, lubricating cooking oil	
Glass	Packaging glass /containers Misc/other glass	Deposit / refillable Nondep./Cullet Plate glass Other glass	
Plastic	1 PET 2 HDPE 3 PVC 4 LDPE 5 Polypropylene 6 Polystyrene 7 Other 8 Composite, mostly plastic	Package Non-package Package Non-package Package Non-package Package Non-package Package Non-package Package Foams - PU Foams - other Film Other	
Ferrous	Steel packaging other Composite, mostly ferrous	Cans other packaging white goods other appliances other car bodies other	
Nonferrous	Aluminium Other Composite, mostly non-ferrous, non aluminium	Cans other packaging composites copper other	
Household hazardous	Paint Fluorescent globes Dry cell batteries Car batteries H'hold chemicals	pharmaceuticals other h'hold chemicals	
Others	Ceramics Dust/ dirt/ rock/inert Ash Special	asbestos pathogenic, infectious	

This information has been widely quoted by waste industries and still remains one of the most reliable waste statistical databases in Australia. The waste stream classification used in the existing data is compatible with the proposed National Classification System and conforms to the preferred minimum data reporting to the National Waste Database. However, availability of the data is limited to the Sydney region only and currently there is no legislative or regulatory framework for data collection on a consistent and systematic basis outside the Sydney metropolitan waste disposal region.

Establishment of NSW Waste Database

With the formation of the EPA, there is a need to extend the statistical data coverage to the whole of NSW. Though the existing data format conforms to the minimum National Waste Database reporting requirements, it lacks essential fundamental information to deal with the increasingly complex waste management task in NSW. An extensive statistical base with a comprehensive classification system is needed for better understanding of waste generation. The establishment of the NSW Waste Database will both satisfy the EPA's obligation to both corporate and National Database reporting and support the long-term strategic direction in waste management.

Application of Classification System in NSW Waste Database

The proposed NSW Waste Database Classification System will be structured along the lines prescribed in the draft National Classification System. For the NSW Waste Database, an additional field is used to allocate the origin of municipal waste to individual local government areas generating the waste. This feature is particularly important in a situation where a number of councils are sharing a regional facility. Allocation of waste quantities to individual councils allows analysis using relevant demographic, social and economic parameters. Also, it has the capability of being used for related analysis such as the monitoring of kerbside recycling. The ultimate aim of the NSW database is to gather data relative to the production, transport and handling, re-use/processing and disposal aspects of waste to inform policy making and to assist in targeting reform and programs.

Conclusions

The establishment of a uniform national waste classification for solid waste is an essential first step in setting and monitoring national waste minimisation targets. A draft system for solid waste has been presented in this paper and it will now be trialled for a period of 12 months. Feedback from users will form the basis of preparing the final version in July 1994.

The other objectives of the National Waste Database can now be addressed and their implementation will lead to a substantial improvement in the understanding of waste generation and the impact of various policies aimed at minimising wastes. The National Waste Database should be seen as a foundation on which to build policy-oriented databases at State level.

Acknowledgments

The National Waste Database project is funded by the Commonwealth EPA and the CRC for Waste Management and Pollution Control Ltd, which has been established and supported under the Australian Government's Cooperative Research Centres Program. Substantial input has been provided by Authorities in each State in the development of the solid waste classification system described in this paper.

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The Recycle Maroochy Program

J Kleinschmidt

**Chief Environmental Health Officer
Maroochy Council**

D McNicoll

**Environment Officer
Maroochy Council**

Refuse rate	\$97 pa (includes recycling)
Participation	95%
Rates Rebate	\$375,000 92/93
Yield	3580.5 tonnes
Income	\$415,464
Expenses	\$371,848
Return	\$43,616
Council 50%	\$21,808

Introduction

After three years of careful planning and one year of operation, *Recycle Maroochy* hereby stakes its claim to the title of the most effective recycling program in Australia.

Recycle Maroochy has used state-of-the-art bin recognition technology to monitor accurately the success of the program and, more importantly, to provide a financial reward to residents who recycle (a world first).

This paper will provide an overview of the *Recycle Maroochy* Program and delegates are invited to contact the authors, Mr John Kleinschmidt on (074) 418 273 or Mr David McNicoll on (074) 418 275 for further details on any point.

Enquiries relating to the technical aspects of the bin recognition system should be directed to Mr Chester Lenard, Australian Manager, TIRIS (08) 255 2066.

Contractual enquiries relating to the collection and sorting of materials by Cleanaway, on behalf of Maroochy Council, should be directed to Mr A Baggio, Area Manager, Central Branch, Cleanaway Queensland (07) 205 2633.

Recycle Maroochy

Recycle Maroochy is a sub-program within Council's waste management program and consists of:

- kerbside recycling
- waste minimisation
- composting, mulching, woodchipipng, etc

This paper concentrates on the kerbside recycling service.

Recycle Maroochy's Kerbside Service

Residents have each been provided with a second 240 L dark green wheeled bin with a gold lid (hopefully these will become Australian recycling bin colours). All glass, steel cans, aluminium, HDPE and PET plastics and ice-cream containers are separated by the householders from their normal waste stream into the recycling bin.

Council's contractor, Cleanaway, collects the bins fortnightly and transports the material to a Materials Recovery Facility (MRF) at Nambour. The collected materials are sorted over a system of conveyors, into storage hoppers, from which they are compacted and baled and later transported to markets in Brisbane.

Why is the Recycle Maroochy Scheme Innovative?

- 240 L dual bin system
- SOLO collection vehicle (single operator)
- passive transponder (microchip technology)
- rates rebate for participants
- risk sharing between contractor and Council
- shared capital outlay for establishment

240 L Dual Bin System

Local Authorities in the southern states of Australia have been recycling for many years. Results have shown relatively low participation and less than satisfactory yields. Schemes have generally used cardboard cartons, plastic crates, bags or other means of storage and sorting has largely been done at the kerbside by private enterprise.

In order to determine the most efficient collection system, Maroochy researched the activities of the southern states, the extensive recycling programs under the *Recycling America* banner and leading programs in Germany. The most acceptable and convenient system for residents was a mobile bin. Maroochy chose a 240 L bin to enable additional recyclables to be included as and when markets became available.

SOLO Collection Vehicles

The single operator loaded operation has been utilised in recent years for garbage collection and has been in-

strumental in significantly reducing collection costs. In 1990, SOLO collection was introduced in Maroochy and our service costs fell from \$1.52 to \$0.72.

These reductions have enabled funds to be generated for the implementation of *Recycle Maroochy*. The refuse rate for 1993–94 includes a weekly 240 L garbage service and a fortnightly 240 L recycling service for \$97 pa.

The vehicles used for the recycling service are top-loading non-compaction vehicles.

Passive Transponder (microchip)

Prior to *Recycle Maroochy*, nowhere in Australia had a system that provided accurate data on service collections and identified the frequency of participation by separate households in a recycling program been used.

The search for this technology delayed the introduction of *Recycle Maroochy* for more than a year but it has been since proven to be a productive and worthwhile wait. The passive transponder is activated by a signal from the transmitter in the collection vehicle and then transmits a unique ten-digit code to the on-board reader on the vehicle. Data from the reader is downloaded at the MRF to a computer that matches the bin number with the property number. This process provides accurate data on the participation rate of any household in the scheme which in turn allows a rebate to be offered.

Transponders have a wider use with some modification. They could allow a payment by weight service for garbage or payment for service provided by a contractor.

Rate Rebate

Council did not desire to make the recycling service compulsory and yet the most important ingredient in successful recycling is maximum participation and yield. The rate rebate system was devised to effectively reduce the garbage service costs for those who recycle at the expense of those who do not. The cost of the rebate — \$376,000 — is covered as part of the garbage rate. Despite high numbers of holiday houses and retirees on the Sunshine Coast, our participation rate on each day of collection is about 80%. The following levels of rate rebates for recycling are offered:

- \$20 rebate for 20+ collections
- \$15 rebate for 15–20 collections
- \$10 rebate for 10–15 collections

The rate rebate is an example of the user-pays system in action.

Contract Arrangements

Council negotiated the introduction of the recycling program under provisions of the head contract for the garbage collection tender in 1990.

Council's negotiations were directed at achieving the lowest possible cost for the program and to achieve that it was considered necessary to involve the contractor in not only the conduct of the scheme or its promotion, but also its viability. Council agreed on a three part costing for the system:

- cost of collection of materials @ 21c per premises per week
- cost of recycling containers @ 27.7c per premises per week with no rise and fall
- sorting and sale of material collected (to pay for itself or return a dividend to contractor and Council)

It is the third element of the costing that is innovative. Council and Cleanaway arrived at a reasonable *price for service* arrangement that would guarantee the ongoing operation of the MRF. If yield from the scheme was higher than anticipated and price achieved for the sale of recyclables exceeded budget, then Council and Cleanaway would share those profits equally.

Conversely, if the result was less than the agreed reasonable cost then both parties share the loss on a 50–50 basis.

This arrangement has guaranteed constant involvement in promotion of the scheme, efficiency in collection and pursuit of the highest price available for sale of materials, by both parties.

The first year of operation has returned \$415,464 with operational costs \$371,848. Total Profit = \$43,616. (\$21,808 for Council and \$21,808 for Cleanaway).

Capital Works

To achieve a low collection cost, Council negotiated to provide and fund the MRF and required equipment. This cost was in the order of \$500,000 and was financed entirely from the contract savings gained through the introduction of the SOLO garbage contract in 1990.

Council has the added benefit of owning all of the facilities and will be able to make them available to the same or a new contractor when the current garbage collection contract expires in the year 2000.

Publicity

Council formed a recycling implementation steering committee and invited representatives from the local newspaper (the *Sunshine Coast Daily*) and radio station 4SS to sit on that committee as a member. The balance of the committee was made up of elected representatives, Council staff, Cleanaway and community representatives. This committee made decisions on promotion as well as operating details and contributed much to the success of *Recycle Maroochy*.

At the outset, it was decided that no *big name* would be used in the promotion. Rather, the emphasis would be

on local people supporting the program. Three wheelie-bin creatures were made and they were taken to various public events by staff and used to disseminate pamphlets and the like.

Radio 4SS compiled a number of radio advertisements that were mostly played as a community service announcement. These were extremely effective for the radio audience.

The *Sunshine Coast Daily* provided a number of news articles, significant editorial comment and a variety of other advertisements. The newspaper produced a *Maroochy Recycling Guide* that not only explained details of the scheme but also what happens to each of the products collected. The guide has become a valuable educational resource for visitors and for our school children. Copies of the *Maroochy Recycle Guide* are available from the authors upon request.

Council produced a number of pamphlets that were distributed with rate notices before the scheme commenced and these were turned into news sheets and sent with rate notices after the scheme commenced to advise residents of the results and to encourage further participation.

The public relations campaign was very effective and cost Council less than \$30,000, thanks to the valued support of the recycling industry and our local media.

How Successful is Recycle Maroochy?

The success of the program can be measured simply:

- The average presentation rate is 78.7% per collection day.
- The participation rate of residents is over 95%.
- Although paper is not collected, the average recycling bin yields over 7 kg of material each collection.
- In the first year over 3,500 tonnes of recyclables have been collected, sorted and sold. That represents approximately 20% of the domestic waste stream.
- Rate payers have embraced the scheme with enthusiasm and Council receives virtually no complaints about the operation of *Recycle Maroochy*.

Conclusion

Recycle Maroochy has been a great success and has set the pace for recycling in Australia. The challenge ahead is to improve markets for recyclables, complete the recycling loop for more items, improve collection and sorting efficiencies and to develop *waste minimisation* as the normal response of each Australian.

The Eastern Sydney Group of Councils Materials Recovery Facility Project

Russell Lloyd

Acting Chief Engineer, Woollahra Council

Background

In April 1991 the Mayors of the Councils of Botany, Randwick, South Sydney, Sydney, Waverley and Woollahra agreed to form a Working Party to '... establish a regional strategy for recycling of domestic waste'. These six Councils are the clients of the Waterloo Process Plant (incinerator) which is jointly owned by Waverley and Woollahra Councils.

The Working Party had barely been established when in July, 1991 the then Waste Management Authority of NSW (WMA) invited expressions of interest for the development of one or more Materials Recovery Facilities (MRFs) in Sydney. The Authority indicated that submissions from interested organisations would be judged on the following criteria:

- the support of a number of Councils with a combined population of about 500,000
- availability/access to a suitable site and infrastructure
- relevant commercial and technical resources and skills
- an understanding of, and capacity to fulfil, the project's marketing requirements. These requirements include both securing the supply of mixed recycled materials and the sale of sorted products.

The Authority indicated that grant funding of up to \$750,000 would be available for selected project(s).

At the initiative of the Mayor of South Sydney the abovementioned Councils, together with Marrickville Council, agreed in principle to act together for the establishment of a regional MRF and for each of the Councils to support the use of such a facility and that the Working Party formed from officers of the Councils should prepare an expression of interest.

The detailed submission was prepared and submitted to the Authority on 31 July, 1991. It outlined details of the proponent Councils, the need for an MRF in the area, the Councils' commitment to materials recovery and their record to that time in recycling, the nature of the areas serviced by the seven proponent Councils, proposed industry involvement/support, preliminary siting identification, materials and processes envisaged, together with existing expertise and capacity.

On 31 March 1992, the then Minister for the Environment, Mr Tim Moore, MP, formally advised the Mayor

of South Sydney that the Group's application was successful and that of the \$750,000 in financial support committed by the NSW Government, the proposal would be eligible to receive up to \$700,000, conditional upon the Group meeting specific requirements. Following a meeting between officers of the Environment Protection Authority (EPA), (replacing the WMA) and representatives of the Working Party, it was agreed that proper planning and a two-stage feasibility study needed to be undertaken. Accordingly the Working Party sought submissions from organisations having relevant experience and expertise to assist in developing the project.

In May, 1992 Maunsel Pty Ltd was appointed to undertake the 1st Stage Feasibility Study with the funding for such works being from the grant offered.

The Feasibility Study

The following tasks were identified as needing to be carried out as part of the feasibility study work.

Task One:

Survey quantities of materials now collected

It was clear that insufficient data was held by the proponent Councils for systems specification or financial analysis on the quantity of various materials then being collected by each Council. It was determined that one of the first tasks would be to collect detailed data on the mass and type of the material collected, current participation rates and on any other features that would affect the design specifications of the process and/or the equipment which might be ultimately utilised.

Task Two:

Survey quantities of materials not collected

The need to undertake sample surveys of materials not separated by householders and identification of current wastes that could be included in an MRF process was identified, with the need to quantify materials that should be separated but which were and are still being disposed of as waste. It was also noted that data collected on waste quantities from the Waterloo Process Plant could be utilised to identify any correlation between per capita generation rates and the introduction of recycling schemes in the area over the previous five years.

Task Three:
Identify collection systems

This task recognised that existing collection systems within the area relied on resident separation of recyclables into material types. The possibility of experimentation into various forms of co-mingled collection was also identified. Consideration of the types of collection containers, ownership and financing of containers, ownership of collected materials, frequency of collection, length of contract (where appropriate) and integration with existing garbage collection systems were identified as issues needing to be addressed.

Task Four:
Estimation of future material quantities

From the preceding tasks, the need to prepare estimates of likely future quantities of each material type which could be utilised, to form estimates of the basis of sizing of systems and for estimates of cost and income was identified. Projections of future participation rates and possible new materials needed to be identified and estimates of quantities undertaken.

Task Five:
Estimate income from sale of materials

A critical issue in the feasibility study was the review of trends in prices for various materials and forecast of future income. A review of specifications of recyclable materials and identification of opportunities for increased revenue arising from different standards was needed. The income implications of alternative contractual arrangements needed to be considered, including day labour operation and the possibility of joint venturing with materials reprocessing companies. The need to estimate future rebates from State Government for recovery of materials was also included within this task.

Task Six:
Estimate of collection and disposal savings

The estimation of costs of collection for alternative collection systems and comparison/contrast was identified. This task also covered the estimate of overall cost savings in garbage collection costs arising from increased participation rates and/or recovery of a wider range of materials.

Task Seven:
Choose design loading

This task was to define the range of materials to be collected from each Council area, review projections of material quantities and identify hourly, daily and weekly peak delivery values for design purposes.

Task Eight:
Choose processing concept

This task required the review of alternative processes and equipment available for the preparation, separation, processing, and densification of the waste, and

identification of those processes most likely to be suitable and economical. It also required the identification of material specifications that may influence the choice of equipment and consideration of the financial implications of meeting those specifications. These aspects were to be coupled with the review of overseas data and the need to consider process flexibility.

Task Nine:
Site identification

This task looked at the preparation of an outline site plan for the chosen concept, a review of alternative sights for a MRF, and a determination of relative suitability.

Task Ten:
Community consultation

As part of the feasibility study it was agreed that definition of a community consultation program needed to be undertaken, with there being identified key community groups and stakeholders. The feasibility study work commenced in July 1992 and the final report was presented to the working party of the group on 24 December 1992.

At this stage I should record that the study took longer than anticipated with Tasks 1, 2 and 4, proving complex and time-consuming, partly because of the fact that there were seven organisations as *clients* and partly because notwithstanding the group has common boundaries and a homogeneous area, there is enormous diversity in the domestic waste characteristics throughout the area.

Feasibility Study Findings

The feasibility study must be seen in the context of the development of a total project which forms part of ongoing initiatives to address the full spectrum of waste management. It is therefore a preliminary exercise in the project development. The conclusions reached in the study report are as follows:

1 Each of the Councils in the region now uses some form of kerbside-sorted collection system for recyclables on a weekly basis. The group collect amounts varying from approximately 20 kg/person/annum to in excess of 80 kg/person/annum. The domestic waste generation throughout the seven Council areas varies from a low of 235 kg/person/annum to a high, in Woollahra, of 460 kg/person/annum. Soci-economic background appears to be the most significant factor in waste generation rates. The average quantity of recyclables collected in the group area is 43 kg/person/annum which is about 15% of the total amount of domestic waste presented for collection.

2 From the survey data collected the average potential recyclables available for collection within the region is about 98 kg/person/annum which is more than twice the current rate of collection, ie the area could double its rate of recycling. The following tables illustrate the above.

Existing Recycling Tonnages per Year

Council	Paper/Card	Glass	PET	Other Plastic	Al Cans	Steel Cans	Total
Botany	906.1	543.8	20.4	0.0	7.5	0.0	1,478
Marrickville	1,909.5	1,367.5	38.4	0.0	15.4	0.0	3,331
Randwick	2,478.8	1,339.9	27.4	0.0	64.3	0.0	3,910
South Sydney	1,303.9	1,232.1	21.5	0.0	19.2	0.0	2,577
Sydney	126.8	17.4	0.0	0.0	0.0	0.0	144
Waverley	1,956.6	1,096.6	17.5	0.0	19.4	0.0	3,090
Woollahra	2,537.8	1,783.2	23.9	0.0	7.1	0.0	4,352
Total	11,219.0	7,380	149	0.0	133	0.0	18,882

Potential Recyclables Tonnages per Year

Council	Paper/Card	Glass	PET	Other Plastic	Al Cans	Steel Cans	Total
Botany	798.0	860.7	61.0	331.8	41.0	168.3	2,260.8
Marrickville	1,789.0	1,492.9	107.0	752.3	114.0	468.0	4,723.2
Randwick	5,847.0	3,250.0	211.9	56.0	122.0	512.1	9,999.0
South Sydney	5,485.0	1,876.8	61.0	2.0	35.0	33.3	7,493.0
Sydney	200.2	225.2	2.6	0.0	58.1	0.0	486.0
Waverley	5,205.0	2,025.9	125.0	178.0	57.0	197.7	7,788.6
Woollahra	5,645.0	2,612.5	234.0	1030.8	75.0	439.2	10,036.0
Total	24,969.2	12,344.0	802.5	2,350.9	502.1	1818.6	42,787.2

3 The total tonnages of recyclables collected from households in 1992 by the seven Councils amount to 18,900. The maximum potential for the present range of recyclable materials is estimated at 38,000 tonnes per annum. However, the estimated potential tonnage of recyclables recoverable for a wider range of materials including HDPE, vinyls, LDPE, polypropylene, polystyrene, and steel cans amounts to 42,800 tonnes per annum.

4 Notwithstanding the fact that existing material sales remain the prerogative of collection contractors in all but two of the Council areas, the current average income is \$85 per tonne and mainly comes from paper and glass. Added to this figure must be the Government \$20 per tonne recycling rebate. In addition, the Councils within the area avoid having to pay waste disposal and waste levies of a further \$50 per tonne, bringing the gross benefits to \$155 per tonne. The Feasibility Study found that the average cost of gaining these benefits is about \$135 per tonne, giving a current net benefit to the sub-region of more than \$1.3 million per annum.

5 Importantly, during 1992 kerbside recycling within the Eastern Suburbs of Sydney covered its cost from sales and avoided disposal charges, but relies on the Government subsidy to provide economic incentive. If Councils increase their rate of recycling, greater bene-

fits will follow from both increased income and from reduced costs per tonne achieved through economies of scale in collection and sorting. The report concluded that a 50% increase would lift the net benefit to the region to about \$1.2 million per annum. This rate of recycling would still only be 75% of the maximum possible and should be readily achievable.

6 There remains a choice for kerbside selection of source separated recyclables — either to continue to sort them at the kerbside as at present, or collect the recyclables mixed together (co-mingled) and then to sort them at a central plant. The report concluded that the most economical choice between kerbside-sorted and co-mingled systems varies with the quantity and range of recyclables. At the yields currently being experienced, kerbside sorting is typically the most economical, however, if higher yields are to be obtained, then co-mingled collection becomes more beneficial, in that it can collect a wider range of materials more efficiently and achieves far better quality control, which in turn should lead to higher prices.

7 Co-mingled collection of recyclables requires a centralised MRF to sort items into separate groups, as well as to remove impurities and to consolidate those items for efficient transport. The report conclusion is that, as the quantity and the range of recyclable materials increase and as new buyers (ie re-processors) for recycla-

ble materials remote from the sub-region enter the market, central sorting of recyclables would become essential, regardless of the method of collection.

8 The report recommends that because of potential increased benefits to the sub-region from increased recycling, and because those benefits come from collecting a wider range of materials and maintaining high quality control, the Councils in the sub-region should convert their recycling systems to incorporate co-mingled collection and a MRF.

9 One MRF within the sub-region is recommended rather than several plants, as haulage distances are quite small and candidate sites tend to be clustered in the central and southern part of the sub-region.

10. Both paper and glass end-users are located within the sub-region and, as these two materials form about 90% of the recyclables at present, it would appear sensible to locate a MRF within close proximity, but the relationship between any regional facility and the end-users operations needs to be further clarified.

11 A single MRF for the region is estimated to cost in the order of \$2.5 million to construct, excluding the cost of land. The report further concludes that the plant should initially be simple in design with ample scope for increased mechanisation as new techniques are proven and that there should be ample room for modification as new materials find new markets. The design must recognise that initially not all material will be delivered by co-mingled collection and that in some instances, use of secondary sorting only and baling/weighing facilities would be utilised.

12 The report also concludes that the sale of recyclable materials is a risky and unstable business with the risk being related to the current process of evolution in the market, the uncertainty about future Government policy and pricing for waste disposal.

13 The long-term key to financial success in recycling depends on two major factors: namely the education and publicity provided to encourage recycling and the price that is charged for waste collection and disposal.

14 Significantly, the report concludes that risk analysis shows that the risk associated with capital and operating costs for either the MRF or for the introduction of

co-mingled collection systems is relatively small. However, the viability of the project is sensitive to whether a market for paper remains, although less sensitive to the actual price for that paper.

15 Change to the collection of a broader range of recyclable materials and the introduction of co-mingled collection can be phased, and the provision of a MRF can accommodate local differences in collection systems.

16 All available surveys of public attitudes to waste disposal clearly indicate that local communities want increased recycling.

The Outcome

I would like to be able to indicate that we have already built or are building a MRF and that the benefits and the returns are being obtained. This is however, not yet the case.

Each of the seven Councils considered a report on the feasibility study and all but the Sydney City Council resolved to move towards formulating an agreement to jointly proceed towards development of a MRF, the examination of funding aspects and need to agree to a co-ordinated regional approach to recycling including the setting of targets.

This last-mentioned aspect is seen as a critical task and will require further study so that the options available to meet specified materials recovery targets and the benefits identified in the feasibility study can be set in a such way that they can be achieved.

The Councils within the sub-region have also recognised that the projected development of a MRF must be meshed with the recent decision of the Regional Organisation of Councils (which covers the areas of the seven Councils involved plus five others) to develop a Regional Waste Management Strategy and that the Joint Parliamentary Select Committee's report will have a significant bearing on all local government areas.

Finally, I believe that with patience and continued co-operation between each of the Councils and the State Government the initiative will bear fruit.

Multi-Occupancy Recycling

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The opinions expressed in this paper are those of the authors, not necessarily those of the EPA.

Introduction

This paper reports on a research project which investigated recycling efforts in home units across nine local government areas in Sydney. It suggests there are several equally important issues which councils need to address in order to implement effective recycling in multioccupancy buildings. The paper concludes that councils with a proportion of multi-occupancy buildings should give special attention to residents in home units because doing so will significantly increase the volumes of recyclables which can be collected in their area.

The research project, which was funded by the Litter and Recycling Research Association, was conducted by the Waste Management Branch of the NSW Environment Protection Authority. The research period was from July 1992 to May 1993 with a break during the Christmas period to avoid seasonal distortion of data.

Background and Study Approach

The term *multi-occupancy dwellings* covers a number of dwelling types, including nursing homes, welfare homes, private hospitals, motels, private hotels and caravan parks, but the vast majority in most Sydney municipalities are home units. Listed below is the percentage of multi-occupancy dwellings in Sydney council areas:

Table 1

Multi-occupancy Dwellings in Sydney

LGA*	F/A†	MOD‡*	LGA	F/A	MOD
	%	%		%	%
North Sydney	59	75	Waverley	50	66
South Sydney	47	65	Woollahra	43	60
Manly	41	57	Randwick	45	56
Mosman	41	55	Ashfield	42	53
Botany	39	48	Lane Cove	36	46
Marrickville	30	44	Canterbury	32	42
Drummoyne	30	41	Kogarah	23	39
Burwood	27	38	Rockdale	27	38
Leichhardt	23	36	Willoughby	25	35
Hunters Hill	20	35	Ryde	24	34
Warringah	20	32	Strathfield	22	32
Parramatta	20	31	Auburn	21	29
Hurstville	17	26	Liverpool	16	25
Sutherland	14	24	Holroyd	14	21
Blue Mountains	3	20	Concord	9	20
Fairfield	12	19	Hornsby	10	18
Ku-ring-gai	8	17	Hawkesbury	3	17
Penrith	6	14	Bankstown	6	13
Wollondilly	1	12	Blacktown	3	11
Camden	2	11	Campbelltown	2	9
Baulkham Hills	1	9			

*LGA Local Government area

†F/A Flats/apartments only

‡MOD All types of multi-occupancy dwellings

Source: 1991 Census figures for dwellings other than those which are *separate houses, semi-detached terraces or townhouses*.

The project was inspired by a number of reports from local councils, residents and owners which suggested that there were problems associated with multi-occupancy recycling. These problems appeared to be quite distinct from those experienced in kerbside collection from single dwellings.

The reported problems with recycling in multi-occupancy dwellings fell into two main groups, those associated with the type of container used for storage of recyclables and those associated with the characteristics of home unit dwellers.

It was considered that there was a need to better understand whether recycling behaviour in multi-unit dwellings was a function of:

- tenancy versus ownership
- ethnicity

- income
- length of occupancy

IT IS IMPORTANT TO STATE HERE THAT THE RESEARCH DOES NOT SUPPORT A STEREOTYPE PROFILE OF POOR RECYCLERS.

Project Aims

The aim of the research project was to establish which current recycling systems gave the best results in terms of quantities and quality, and whether there was a resident-characteristic pattern which was more likely to result in higher participation and lower contamination of the recyclables.

It was anticipated that the outcome of the project might therefore be a prototype system model which could be recommended to all councils and/or provide the basis of guidelines for councils to assess which multi-occupancy buildings in their area were likely to provide sufficient recyclable materials to warrant the associated expenses.

Research Parameters

Initial research revealed that all the various methods used across Sydney were represented in nine council areas. The range of resident characteristics listed earlier was also represented across the nine councils.

The nine councils thus selected were:

Botany	Ku-ring-gai	Liverpool
Mosman	North Sydney	Randwick
Rockdale	Warringah	Waverley

The buildings in each council area were selected to ensure that all the identified resident characteristics were represented and that all existing container systems would be investigated. The project officers also introduced a new container system into two buildings.

The types of containers investigated are listed below:

- large wire crates (approx. 70 litres)
- plastic crates (27 and 50 litres)
- MGBs (240, 140 and 120 litres)
- plastic garbage bins (55 litres)
- woolpacks

In addition, some garbage rooms had shelves which were used for collecting newspapers only.

As can be seen from the list below, all of the nine councils collected the common materials, paper, glass, aluminium cans and PET bottles while two councils collected a wider range of materials.

Materials collected for recycling

Newspaper/cardboard	9 councils
Glass	9 councils
Aluminium cans	9 councils
PET bottles	9 councils
HDPE	2 councils
PP	1 council
V	1 council
Steel cans	1 council
Aluminium trays*	2 councils
Oil*	2 councils

* Councils list these items as recyclable but no evidence was found during the project that residents take advantage of these services.

The multi-occupancy dwellings chosen for the research project varied in size as can be seen from the list below:

Home unit block sizes

- 5 blocks with less than 20 units
- 4 blocks with between 20 and 45 units
- 2 blocks with between 46 and 50 units
- 5 blocks with between 51 and 100 units
- 3 blocks with over 130 units

Of all the units included in the project, 60% were tenanted and 40% owner-occupied. The percentage of owner-occupancy ranged from 0% in three blocks to 83% in another block. The average owner-occupancy in the buildings included in the project was 46%.

Interviewers assessed whether interviewees were first-generation Australian by detecting whether English was their first language. The figures obtained this way corresponded closely with figures for non-English speaking background obtained for the local area from the Bureau of Statistics. The percentage of recent arrivals was 24% overall and in individual locations it varied from 0–50%.

Length of residency

Less than 6 months	19%
6-12 months	18%
1-3 years	15%
3-5 years	10%
over 5 years	38%

Collection Methods

The collectors engaged by the local councils included one who collected paper in a co-mingled paper bin, and glass, cans and PET bottles in a co-mingled container bin. The company has automatic bin-lifters fitted to the trucks to enable automatic lifting and emptying of mobile garbage bins. The recyclables collected by this company were sorted at a mini materials recovery

facility. The collection companies engaged for the other eight councils sorted at the kerbside.

All collectors had a schedule to collect weekly from the multi-occupancy dwellings.

Research Methods

A number of methods were employed to ensure that all relevant information was collected and considered. The methods are explained below:

- Audits of recycling bins to collect data on types of recyclables, quantities and contamination rates. At least three audits were conducted in each of the 18 locations and, where possible, within hours of the scheduled weekly collection time.
- Audits of waste bins to collect data on types of waste and recyclables, and the quantities.
- Interviews with residents, using a standard questionnaire but with interviewers encouraged to solicit additional information. Interviews were conducted with 30% of all the residents. In small blocks all residents were interviewed while in the largest blocks only a quarter of residents were approached. The questionnaire sought information about:
 - relevant purchasing habits
 - awareness of recycling program
- Unstructured interviews with collectors and their supervisors/owners of the collection companies to uncover any special problems faced by this group.
- Interviews with caretakers/cleaners.
- Observations at ten properties in Meadowbank and ten properties in Eastwood which have no containers provided for the unit residents in order to assess the impact of residents not being given a container.
- Census data was obtained from Australian Bureau of Statistics and information about average per person recycling rates in the nine municipalities was gained from the EPA's *Kerbside Quarterly* newsletter.

Findings

A vast amount of quantitative data was collected and analysed. The most important quantitative data is reproduced in Tables 2–4 below. The waste audit resulted in information about which recyclables had been thrown out as garbage as well as the composition of what could not be recycled. This information is useful in establishing which products should be targeted for waste minimisation action in future.

Table 2

Residual Waste Composition by Kilograms

Approximate kg per week for 18 buildings

Items	Proportion by kg
Organic waste	1,485
Paper	452
Glass	259
Soft plastic	153
Nappies & hygiene	123
Plastic containers	111
Steel cans	65
Liquid paper board cartons	37
Batteries	35
Aluminium cans	27
Kitty litter	18
Aerosol cans	9
Syringes	0.3

Table 3

Residual Waste Composition by Volume

Cubic metres per week for 18 buildings

Items	Proportion by m ³
Paper	108
Organic waste	82
Soft plastic	46
Plastic containers	44
Liquid paper board cartons	18
Glass	16
Aluminium cans	11
Nappies & hygiene	9
Steel cans	7
Aerosol cans	2
Batteries	2
Kitty litter	0.5
Syringes	0.3

Table 4

Total Recyclables (kg)

	Recycling bin	Waste bin	Total
Paper*	3,015	1,607	4,622
Glass	1,145	538	1,682
Aluminium	37	60	97
PET	74	58	132

* Not all the paper in the waste bins would have been recyclable

Contamination

Non-recyclable materials placed in recycling bins were counted as *items of contamination*. The contamination figures also include recyclable items in incorrect bins, eg where separate paper and drink container bins were provided, glass bottles in the paper bin would be counted as contamination.

The total weight of recyclables examined during the recycling audits was 6,594 kg and there was a total of

915 items counted as contamination. That is equivalent to 14 items per 100 kg. The lowest number of contaminants was two in 100 kg of recyclables. The container used was the wire crate. The highest number of contaminating items was 61 items in 100 kg, however, this was found in colour-coded recycling bins where a green bottle dropped into a clear bottle bin counted as contamination. Non-recyclable items in colour-coded bins were few except in one place where the recycling bins were conveniently placed near the door while the waste bins were much further away in the car park.

Knowledge Level

Interviewees were asked to list the materials which could be recycled from their building. The interviewees were asked not to provide any prompts.

The results show that 86% of interviewees knew that paper can be recycled from their building, 78% named glass as a recyclable, PET was mentioned by 63% but less than half of the people interviewed stated that aluminium cans could be recycled from their building.

There is often a difference between what people say they do and what they actually do. This was borne out in the comparison between what the unit dwellers stated they bought on a weekly basis and the items found in the recycling bins and the waste bins as summarised in Table 5 below.

Table 5

Consumer Information

Items purchased*	Amount per ten units per week
Newspapers	34
Drink in cans	4
Drink in glass bottles	15
Drink in PET bottles	14

Items discarded†

Items discarded†	Amount per ten units per week
Newspapers	48
Cans	17
Glass bottles	14
PET bottles	11

* As per interviews with residents

†As found in recycling bins and residual waste bins

Recycling Rates

For each building a recycling rate which represented the total amount of recyclables in the recycling bins compared to the total amount of recyclables in the residual waste bins was calculated and named *overall recycling rate*. The rate for individual buildings ranged from a high of 87% of all recyclables placed in the re-

cycling containers to a low of only 16% put out for recycling. The building results are listed below in descending order by the code name devised for this project.

Table 6

Overall Recycling Rate

L1 87,	N1 82,	RO2 74,	KR1 72,
N3 72,	KR2 67,	M1 63,	N2 61,
R01 61,	L2 58,	W1 55,	N4 46,
M2 44,	R2 43,	B1 40,	W2 33,
WA2 26,	R1 26,	WA1 16.	

The results were also analysed to ascertain recycling rates for the various materials. Table 7 below shows the rate of recycling per material in descending order, ie green glass bottles were most successfully recycled. The figures correlate well with the figures for unprompted listing by interviewees of the materials which can be recycled (see findings on knowledge level above).

Table 7

Materials Recycling Rates

Green glass	82%
Brown glass	77%
Paper*	73%
Clear glass	60%
PET	52%
Aluminium cans	42%

* Paper recycling rates were determined on total paper in the two streams, ie notepaper, envelopes, cereal packets, boxes etc rather than newspapers only.

To determine how the recycling effort of residents in home units compared to the average recycler, the total amount recycled per person in home units was compared to the average for residents in the same area as published in *Kerbside Quarterly*. As can be seen in Table 8 below, residents in three blocks of units were better recyclers than the average person living in their council area.

Table 8

Recycling Rate per Person per Annum

L2 197,	W1 149,	KR2 108,	R1 82,
RO1 82,	N1 69,	WV2 63,	R2 63,
KR1 55,	RO2 55,	M1 44,	N3 40,
B1 30,	L1 27,	W2 22,	M2 21,
N4 20,	WA1 18,	N2 3.	

Deductions

Below are some of the significant deductions from our data analysis:

- A significant number of Sydney residents live in multi-occupancy dwellings.
- Recycling rates cannot be predicted on the basis of resident characteristics such as single dwelling versus multiple occupancy residents, owners versus tenants, transient population versus long-term residents, income level, formal education level or size of buildings. The lack of relationship between good recyclers and owner-occupation was also evident in the survey North Sydney Council did before employing waste educators.
- There was a strong correlation between recycling rates and residents' knowledge of recycling. Indeed it seems that of all the options for improving recycling rates in units immediately available to councils and body corporates, providing better information is the optimum. Clear labelling of bins is one of the more effective means of informing residents of what to recycle.
- Familiarity with the English language does not seem to be a major factor in the level of knowledge about recycling. On average 34% of residents from non-English speaking background could list all the recyclables collected from their building. The average for residents who spoke English well is less than 10% more. It is worth noting that in both cases less than half of the residents had the most basic knowledge of what to recycle.
- 37% of residents became aware of the recycling service by noticing the recycling containers/bins. Only 31% became aware of the service through council leaflets, 11% became aware of the service by word-of-mouth and 7% saw it on the notice board.
- Some of the residents in single units produced more recyclables than the average householder in a single dwelling. Collectors stopping at such unit blocks, no matter how small, benefit from the economies of scale by gathering more than the average yield per stop. Even in the unit blocks with the lowest participation rates in this study, the amount of recyclables exceeded that of an average single dwelling if there were 12 or more units in the block.
- Recycling performance in blocks with recycling containers of any kind other than their own cardboard boxes is vastly superior to blocks with no containers provided by councils or the body corporate. The type of containers provided did not make a noticeable difference to the quantity of recyclables retrieved.
- Blocks of home units with garbage rooms performed better than units without. Seven of the top

eight buildings with overall recycling rates ranging from 61% to 87% had garbage rooms.

- Positioning the garbage bins far from the recycling bins results in low participation rates.
- Buildings with caretakers and/or cleaners and/or members of the body corporate taking a co-ordinating role have a higher participation rate and a lower contamination rate than buildings without a co-ordinator. No building with a co-ordinator had recycling rates of less than 55% and the average was 68%.
- Kerbside sorting from mobile garbage bins is awkward because of their depth.
- Some collectors' crews are unaware of the total range of recyclables they are supposed to collect and incorrectly reject some items, resulting in confusion amongst residents.
- Residents become dispirited about recycling if collection schedules are so erratic that bins overflow.

Conclusions

In order to achieve the 50% waste reduction target most councils will need to promote recycling in multi-occupancy dwellings.

Provision of a recycling container is very important for effective recycling from multi-occupancy dwellings. The type of container is less important because container type does not affect yield nor contamination. Yield is affected by the positioning of the recycling containers and by the presence of a recycling co-ordinator.

The assumptions that recycling performance can be predicted on the basis of resident characteristics proved unfounded, as did the assumption that blocks with many units would perform worse than smaller blocks.

A strong link between residents' awareness of recycling and yields was established and there were clear indications that training of collectors warrants attention.

Critical Success Factors

On the basis of the results of this research project the following critical success factors have been determined. The factors are in priority order but we believe they all are critical to the success of a recycling program for multi-occupancy dwellings.

- information flow to residents
- provision of recycling containers
- designated areas for recycling containers
- recycling co-ordinators

The Future — Discussion Points

It is the opinion of the people closely involved in this research project that education of residents in units and the economics of collecting from units would be greatly assisted if there was no variance in the type of materials collected from one council area to another. The transient population in units would not need to be re-educated every time they move and recycling companies which collect from more than one municipality would find it easier to train staff. Especially in the case of kerbside sorting, truck design could be standardised so vehicles could be used without the need for additional woolpacks to be attached to the back. Cost of recycling services could more easily be compared from one council area to another. Recycling companies would have better information on which to base their tenders.

References:

1991 census figures supplied by Australian Bureau of Statistics.
Kerbside Quarterly Vol 2, No 3, December 1992, Published by NSW Environment Protection Authority.

The Future for Steel Can Recycling

Warren Knox

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Introduction

Steel is one of the world's most recyclable industrial products, with approximately 425 million tonnes of steel scrap being recycled into new steel products each year.

In Australia the steel scrap recycling infrastructure is well developed, with approximately 70% of the major categories of available scrap being recovered for recycling.

The picture has not been so bright for steel packaging products (steel food and pet food cans, aerosol cans, paint cans etc) as, because of their relatively low tonnage and wide distribution, recovery through the normal steel scrap recycling infrastructure has not been economic. To address this problem, the industry, through BHP Steel and the major canmakers, under the auspices of the Canmakers' Institute of Australia, (BJP-CMIA) has developed a program to increase the recovery of used steel cans.

Before I go on to describe this program in more detail, I would like to answer a couple of commonly asked questions.

Are Steel Cans Recyclable?

Yes, they are. In common with all other steel products, cans are able to be recycled indefinitely without any degradation of properties or quality.

They can be either used directly or de-tinned prior to re-melting in the steelmaking furnaces. To facilitate de-tinning, a new state-of-the-art de-tinning plant has been built at Port Kembla by Australia Metal Recovery Pty Limited, which for the first time, provides the capability of de-tinning large quantities of used cans.

Steel's unique magnetic property makes it the easiest package to remove from the waste stream for return to the steelworks for reprocessing.

Most importantly, there is a ready market for all collected cans as BHP's steelworks could use all the cans consumed in Australia if they were recovered for recycling.

What Types of Steel Cans are Recyclable?

All types of steel cans and containers commonly used in the home are recyclable. These include:

- food and pet food cans — should be rinsed and clean

- aerosol cans — should be empty with plastic caps removed
- paint cans — should be empty and dry with lids removed
- miscellaneous containers — should be empty and clean eg. edible oil, coffee cans etc.
- lids and closures — these should be placed inside a can and the top squeezed closed eg. jam jar lids, bottle tops etc.

To gain maximum benefit from including steel cans in a kerbside recycling program, householders should be encouraged to recycle all the above steel packaging products.

Steel Cans Recycling Plan

In late 1991 CMIA-BHP submitted a recycling proposal for used steel cans to the National Kerbside Recycling Task Force. This plan, subsequently accepted by the Australia and New Zealand Environment and Conservation Council (ANZECC) provides:

- Support for both kerbside collection and waste processing plants. For reasons that will be explained later, our current emphasis is on the former.
- An assured market for all collected cans provided they are compacted into bales.
- An assured floor price of \$40.00 per tonne free on truck at the recycling facility for all collected and baled cans.
- Assistance with infrastructure where appropriate.
- Assistance with appropriate educational and promotional material where used steel cans are included in the recycling programme.

The agreed targets for steel can recovery under this plan are 25% by the end of 1996 and 40% by the year 2000.

Current Status

Waste Processing

Central waste processing or treatment plants (incineration, waste to energy, mixed waste processing etc) are considered to be the most efficient means of collecting and recycling used steel cans as it is a simple matter to magnetically extract the steel either pre- or post-

treatment. Many billions of steel cans are recycled in this manner each year in those countries where these facilities are well-developed. It is interesting to compare Australia's performance in this regard with other countries around the world.

Country	% Waste	
	Landfill	Treatment
Australia	95	5
Singapore	20	80
United States	72	28
United Kingdom	81	19
France	49	51
Germany	50	50
Netherlands	44	56
Japan	29	71

Source: International Iron & Steel Institute

The current economics of waste disposal in Australia do not favour the establishment of waste processing facilities of this type and the only operating plant is the Waverley-Woollahra Incinerator in Sydney. We are currently negotiating with the operators of this plant to install magnetic extraction and scrap treatment equipment and are confident of being able to recover approximately 5,000 tonnes of used cans and other small steel each year.

We will continue to support the concept of central waste processing, as facilities of this type offer the opportunity to efficiently recover relatively large quantities of used steel cans.

Kerbside Collection

As the development of waste treatment in Australia is obviously a longer-term proposition, we have been concentrating our efforts on encouraging the addition of steel cans to the range of recyclable materials included in kerbside collection programmes as the means of achieving our recycling targets.

Kerbside collection techniques have developed rapidly in Australia over the last couple of years with the widespread adoption of co-mingled collection of recyclables with subsequent sorting at Materials Recovery Facilities.

Additionally, we have seen the emergence of systems using two MGBs (one for garbage, one for recyclables) with automatic pick-up and, latterly, the trialling of a number of split bin/split truck combinations, all designed to improve the efficiency of collection.

These developments have facilitated the inclusion of used steel cans in kerbside programs and steel can collections are now a fact in all mainland States. Although used steel cans are a relatively low-value commodity and collection as a stand-alone product is certainly not viable, they can complement a properly costed comprehensive recycling service developed as part of an overall waste management strategy. Their

unique magnetic property enables them to be separated automatically without the need for additional labour.

It has been encouraging to see the rapid development of steel can collections through kerbside programs as evidenced by the fact that, in 1990-91 only 227,000 people had access to programs including steel cans. By 1992-93 this had expanded to 1.4 million and we estimate this will be 3.7 million in 1993-94. Looked at from another perspective, in 1990-91 only two local government areas were involved in steel can recycling. This had grown to 27 in 1992-93 and we estimate it will be 64 in 1993-94.

Conclusion

The steel packaging industry is committed to achieving the ANZECC steel can recovery targets. This is a task that cannot be accomplished alone and requires the co-operation of all those involved, including state and local government, recycling contractors and, most importantly, the community at large.

The steel can recycling plan provides the assurance of a market and minimum price for all cans collected for the life of the recycling contract. This allows all parties to plan and implement steel can recycling with confidence.

We have been encouraged by the degree of involvement and commitment to date and look forward, with confidence, to this continuing throughout the next seven years.

Processing of Green Waste — Costs and Benefits

Jenny Kent

Marketing Consultant, Waste Service

The Waste Recycling and Processing Service, NSW (Waste Service) formerly the Waste Management Authority (WMA), is the State Government's integrated waste management service. Our main business is the cost-effective and environmentally sound recycling, processing and disposal of Sydney's waste. Currently, the Waste Service operates five landfill depots and five transfer stations within the Sydney region. As such, the Waste Service is the largest operator of waste disposal facilities in New South Wales — currently over 60% of Sydney's household, commercial and industrial waste is disposed of at our facilities.

Although the responsibility for the regulatory functions relating to waste was transferred to the EPA in March 1992, the Waste Service is committed to taking an active role in recycling, processing and materials recovery. The Waste Service can no longer be the *disposers* or *sole managers* of waste.

The adoption of the 50% reduction target (on a per capita basis) for landfilled waste by the year 2000 currently provides the driving force for waste management policy and planning decisions within Federal, State and Local government. The Waste Service is committed to this reduction target and has investigated the amounts and types of materials which will need to be diverted from landfill.

50% Waste Reduction by 2000:

A Waste Division Scenario (Tonnes diverted per annum)

Material	Council & Community	Commercial/Industrial	Demolition	Total Diversion	Total Waste Stream
Newsprint	73,000	—	—	73,000	103,000
Paper	181,000	254,000	—	435,000	621,000
Glass	104,000	—	—	104,000	138,000
Metal	72,000	141,000	8,000	221,000	356,000
Plastic	69,000	101,000	—	170,000	307,000
NDS (i)	—	—	238,000	238,000	340,000
Timber	—	—	51,000	51,000	85,000
Garden	272,000	152,000	—	424,000	666,000
Food	163,000	37,000	—	200,000	714,000
Other (disposal)	—	—	—	—	510,000
Total	934,000	685,000	297,000	1,916,000	3,840,000

(i) Non-degradable solids (eg concrete, bricks etc)

If we look at the type of waste diversion scenarios required to meet the reduction target a number of issues are immediately apparent. Firstly, that the organic fraction, (for example food, garden, timber waste) forms a large part of the material to be diverted and that secondly, to achieve this diversion rate and maintain a commercially viable operation will be extremely challenging.

Green Waste

Green waste is a term used to classify a group of materials primarily made up of grass clippings, leaves, prunings, tree branches and other garden waste. It is readily recognised that this material can be mulched or composted to produce a range of horticultural products.

At our landfills and transfer stations, however, we also receive a range of other wood-based materials that can be processed and treated in a similar way to the green waste portion — these include sawn untreated timber, pallets and crates. Together we term these materials *wood waste*.

The total estimated amount of wood waste in the Sydney region is greater than 500,000 tonnes per annum. According to an EPA study into wood waste in the Sydney region, 110,500 tonnes of this total is produced from the wood and wood products industry. The remaining approximately 400,000 tonnes of wood waste would be expected to consist largely of green waste.

The Waste Service currently provides facilities for wood waste processing at three of our landfill facilities — Eastern Creek, Jack's Gully and Lucas Heights. Separated loads of clean material are accepted at \$18.60 per tonne compared to the mixed waste disposal cost of \$32.80. We have recently introduced a trial for the separate collection of vegetation waste at Rockdale Transfer Station on weekends. New transfer stations (such as Seven Hills, opened on July 1st) provide a dedicated pit for the collection of this material. The Waste Service's ultimate aim is to provide Sydney with a regionalised service for the drop-off of processable wood waste material.

The Waste Service currently processes approximately 10,000 tonnes of wood waste each year. Some Council depots also process this material (for example,

Kimbriki) but in total it is likely that less than 10% of the total available wood waste is currently diverted from landfill.

The Waste Service's customer groups consist of small vehicles (householders and small commercial operators), commercial/industrial users and Councils. Currently, little or no green waste is derived from our Council customers who contribute approximately 60% of the waste landfilled at our depots. It is evident that to meet the 50% reduction challenge the Waste Service will need to work with Councils to recover green waste material from the waste stream.

Assessing Green Waste

The major issues associated with assessing green waste are the separation and costs of collection and processing. A number of Councils have trialled kerbside collection and processing of green waste. However, the costs associated with such a system currently prove prohibitive.

In fact, kerbside collection may well prove not to be the most cost-effective method to retrieve green waste from the waste stream. In the USA, approximately 3,000 regionalised yard waste composting programs provide facilities for yard trimmings — leaves, grass and brush.

The incentives to develop and generate these facilities are probably the stricter environmental requirements for landfill (subtitle D of *Resource Conservation and Recovery Act* to be introduced October 9, 1993), increases in landfilling costs, landfill disposal bans for yard materials and cheaper disposal costs for yard wastes as these facilities are required to meet less stringent landfill permitting and operating conditions.

The benefits of a regionalised drop-off facility are that the cost of collection and separation are negligible and that fees for use of the facility generally cover the processing cost. There is also a greater amount of control over the types of materials received for processing and therefore a higher quality product would be expected. The community would become familiar with these types of facilities and the products produced could be provided for sale at the site. If composting is carried out on site, the price penalty for transport of processed material would be negated.

In fact the Waste Service's experience with the acceptance of wood wastes at landfill has indicated that a number of processing streams may be required — for pallets and timber waste; tree loppings and branches; and lawn clippings, leaves and fine materials.

The separation of these streams at source for kerbside collection may act as a disincentive to participation in a recycling program.

The potential for accessing green and other types of wood waste is therefore high. The benefits of removing

this material from the waste stream lie in its relatively easy accessibility and the potential for a significant increase in landfill volume currently filled by this material. The greatest threat to green waste utilisation lies in the areas of quality control and market development.

Markets

The two main products developed from wood waste are wood chip and compost. Considerable pressure is mounting on these markets. Competition for the re-use of wood wastes lies in ready sources of forestry and wood manufacturing by-products (for example sawdust and pine bark) and the increasing amount of sewage sludge and other organic wastes entering these markets.

The major threats to the development and continued markets for processed wood wastes are price, quality of end-product and product specification.

Price

Prices of recycled product — wood chip and compost, have fallen over the last few years. The entry of large quantities of these materials on existing markets will continue to force down prices and the economic feasibility of recycling these materials will then fall into doubt.

The maximum value of processed wood and timber wastes is about \$30 per tonne. This does not compare favourably with other recycled materials such as aluminium cans and glass.

Quality

Poor product quality threatens the sustainability of wood chip and compost markets. There is currently no suitable minimum standard for these materials. The development of suitable quality standards for the industry is seen as a high priority.

Product Specification

The acceptance of recycled material into the horticultural and landscape markets is dependent on the development of favourable specifications. Large markets for recycled products could be created by the development of such specifications and by the revision of existing government purchasing policies in this area.

New Markets

Market creation will be vital for the large amounts of processed wood wastes that will be produced. The potential for power generation from wood-burning furnaces (waste to energy) and development of new product ranges will need to be explored.

Conclusion

The Waste Service has a commitment to achieving a 50% reduction target in waste landfilled by the year 2000. To achieve this target, large amounts of material will need to be diverted from landfill. Green waste represents a large fraction of the waste stream which can be segregated and processed into a useable commodity. However, the Waste Service's experience has been that there is a high cost in labour and equipment to produce a quality product. Processing costs alone can range from \$50 to \$100 per tonne. Some mechanisms to be explored to ensure that the processing of this material remains viable include:

Separation of Wood Waste

- Changes to the Waste Service's pricing differential for wood waste so that access to Councils' green waste is ensured.
- Extension of the Council Recycling Rebate Scheme to include the kerbside collection of green waste.

Collection and Processing

- Continued development of regional Waste Service facilities for the acceptance and processing of green waste.
- The banning of wood waste from landfill needs to be investigated.
- Long-term policy development needs to address the costs of collection and processing of green waste.

Market Development

- Research into existing markets and development of new markets for recycled green and wood wastes.
- EPA, Waste Service and industry to develop guidelines on quality control, market development and product specification through the EPA's Working Group on the Recycling of Wood Waste.
- The State Government should adopt a mandatory purchasing policy which favours recycled products including wood waste (Recommendation from the Waste Service's response to the Government's Green Paper).

Composting — the Key to Meeting the 50 per cent Target

John Denlay,

National Waste Minimisation Spokesperson, Friends of the Earth

Acknowledgement

This paper is based on a recently released Friends of the Earth report *Guidelines for Recycling Organics in Australia*. Copies of this 40 page report can be ordered by contacting Friends of the Earth (Sydney) on (02) 281 4070.

Much of the information contained in the report and this paper was gained from a 1992 Winston Churchill Fellowship to study composting in Europe and North America.

The author is deeply indebted to the Winston Churchill Memorial Trust for the many opportunities that have resulted from the fellowship, and to the many European and North American government, industry and community group representatives who gave their time to discuss their composting programs during the study tour.

Introduction and Summary

The Australian and New South Wales governments, and a growing number of councils have taken on the essential challenge of halving waste levels by 2000, yet the important question of how this is to be achieved has not been answered. One thing is for certain — the recycling of organic, the largest component of Australia's waste stream, must play a major part.

Considerable barriers exist in NSW to the expansion of composting. Low disposal charges provide little incentive. Lack of standards and quality control offer little confidence to end-users of the reliability of compost. Further, a lack of clear guidelines on the siting and operation of composting facilities discourages their establishment.

The main challenges with composting are not in developing collection and processing systems for organics. Decades of overseas experience exist in these. Strong government leadership and market creation programs are the key to the successful establishment of composting on a large scale in NSW.

This paper will detail a strategy for NSW that has the following components:

- a target of banning the disposal of garden materials by 2000
- a market creation strategy based on a market potential assessment
- legislated government purchasing of compost products
- Australian Standards certification of compost products
- NSW EPA guidelines for planning and establishing composting facilities
- Waste Service involvement in planning and siting of composting facilities

These components of the strategy should be co-ordinated by the wing of the NSW Government responsible for waste minimisation (at present, the NSW EPA), and named the *NSW Bio-Waste Action Program*, based on the existing Dutch program's name.

The strategy has been prepared from overseas composting strategies. Case studies of overseas programs are used to provide more detail of the strategy's components. Much of the overseas information was gained during a 1992 Winston Churchill Fellowship to study composting in Europe and North America.

Composting — the Only Choice We Have

To halve waste levels by 2000, the NSW EPA identifies that two thirds of garden and wood materials from all sectors of the waste stream and a third of food materials will need to be recycled. The marketing of such large quantities — over 676,000 tonnes of organics per year in Sydney alone — will require a high-quality compost to be produced that has reliable properties.

With highly contaminated compost as the legacy of 1970s attempts to produce compost from mixed waste, many European countries have now established contaminant standards to ensure only clean compost is produced. Numerous studies have found that clean compost can only be produced from source-separated feedstocks.

NSW has little choice but to embark on an extensive program of composting, and as the success of this will be highly market driven, it is of utmost importance that organics are collected separately to produce clean compost.

Marketing

The long-term success of composting critically relies on developing stable markets. This involves the challenging tasks of identifying new markets and breaking into entrenched existing markets.

NSW Government's commitment to market creation can be the make-or-break of composting in NSW. The government can develop markets through a market potential assessment, and State and Local Government purchasing legislation.

Case Study:

Washington State Market Potential Assessment

A market analysis is an essential tool in developing a marketing strategy for compost products. The analysis can be used to identify potential markets for compost products (both new and substitution markets) and barriers that exist to tapping into these markets. Those markets with the lowest barriers can be prioritised and strategies developed to target these.

An excellent model for a market analysis is the 1990 Washington Compost Market Assessment. It was conducted using the following methodology:

- definitions of organic materials
- generation levels of each type of organic materials
- current utilization of each type of organic materials
- factors that could influence current utilization
- cost of composting programs
- phone survey to assess compost product markets
- estimation of market potential in traditional and new market areas
- total market potentials determined from estimates
- prioritising of compost markets based on a range of factors
- formulation of marketing strategies and recommendations

The findings of the market assessment were grouped into three categories: potential markets; priority markets and recommendations. The public sector as a market for compost products was given particular attention as its purchasing patterns can be regulated through procurement policies and standards.

Case Study:

Washington Government Procurement Legislation

State and Local Government can provide a significant market for compost products. Washington State Senate Bill 5143 requires state departments, by 1993, to spend 25% of their annual soil improver budget on compost products. The figure is to increase to 60% by 1997. Education is to be provided to departments.

The Bill allows state and local government departments to develop preferential price purchasing policies

for recycled products. King County has a 10% price preference for compost products, and Seattle is considering the same. Percentage requirements may also be imposed if price preference is not enough.

Quality Control and Standard

Attempts to market poor quality compost products can have a devastating effect for the industry, which, in NSW, is very much in its infancy. Yet there are currently no standards for quality control for compost products in NSW.

The growing interest in diverting garden materials from the waste stream has seen some councils commence mulching programs for household garden materials. Without any formal quality control requirements, there is a real risk of exotic weed seeds or plant pathogens being propagated through such mulch.

With regard to composting, there is no end of opportunists who claim they can produce compost in a matter of weeks, or produce compost from mixed waste. Quality control is urgently needed to ensure that the only compost sold is fully mature, free of pathogens, and has minimal contamination.

The Washington State Market Potential Assessment found that potential users had concerns over quality and reliability of compost products. If a contaminated product was allowed on the market then this could seriously erode potential users' confidence in compost products, and jeopardise an entire market creation strategy.

Regretfully, this damaging situation has already occurred in Sydney.

Case Study:

TNT Oasis Potting Mix

A front page headline of the *Sydney Morning Herald*, on 5 February 1990, read: 'How a Breakthrough in Recycling was Wasted'. The article reported on a 1989 NSW Supreme Court compensation case over TNT selling a compost product, made from wood and grease trap materials, that caused the death and poor growth of hundreds of thousands of nursery plants. Poor quality control by TNT allowed the product to be sold before it had reached maturity, resulting in ammonia toxicity.

In the *SMH* article, Simon Leake of the Sydney Environmental and Soil Laboratory summed up the impact of this: 'I think this case has put people's confidence in the vital technology of recycling waste back by five years'.

Such reports are the worst fears of a market creation program. One firm skimping on quality control may be all that is needed to undermine an industry that can provide significant environmental benefits.

Standards and quality control are essential to gain the support of potential end-users for compost products.

The basis for standards and quality control should be the double objectives of ensuring a high-quality product and diverting large quantities of organic materials from the waste stream.

Contaminant standards are needed for environmental protection. Quality control is needed to ensure a highly marketable product. In Germany compost producers and end-users together developed a certification, labelling and independent testing system for compost. German users can purchase certified compost products knowing that they meet their required performance criteria.

Case Study: Bundesgutegemeinschaft Kompost e.V.

In Germany, the quality criteria for compost were determined by a committee of representatives from relevant compost producers, user industries and highly regarded academics. The philosophy of the quality criteria was to achieve a good price for compost based on its high quality, which would see a strong demand for the product.

Involving compost producers and users in the quality standards process ensures that the producers can meet the standards and that compost meeting the standards also meets the needs of users. The German Government monitored the process to ensure that the quality standards met their requirements for environmental protection.

The parameters tested for certification are:

- hygiene and exclusion of germinable particles
- impurities such as metals, plastic and glass
- presence of stones
- plant compatibility
- degree of decomposition (maturity)
- water content
- loss of organic matter
- heavy metals limits
- parameters that must be declared at the time of sale

The Bundesgutegemeinschaft Kompost e.V. (Federal Compost Quality Assurance Organisation) was established to monitor the quality of compost. It awards certification to compost producers that meet its compost quality criteria.

An important aspect of this certification process is independent monitoring of the compost quality. This is performed by laboratories that themselves are certified by the Bundesgutegemeinschaft Kompost. For a compost producer to receive certification, its compost is independently monitored four to eight times a year.

Planning and Siting of Composting Facilities

There is a need for the NSW EPA to develop clear guidelines for the establishment and operation of composting facilities.

Composting facilities can be difficult to site. Local communities have concerns of noise, odour, pests, vehicle movements and leachate problems. The successful siting of composting facilities relies on community and government involvement.

In the same way as it has sited waste facilities in metropolitan Sydney, the State Government, through the Waste Recycling and Processing Service (Waste Service), should embark on establishing the necessary capacity of composting facilities.

The Waste Service, as the Waste Management Authority, has a poor reputation in siting waste facilities, mainly due to its inability to involve the community in the planning of its proposals. Planning and siting must be transparent to the community and within the context of a waste minimisation strategy. The community must also have confidence in NSW EPA siting and operation guidelines, and the EPA's ability to enforce these.

Government Policy and Leadership

The success of overseas composting programs has relied on strong leadership from all spheres of government. In NSW, there is an urgent need for the 50% waste reduction target to be converted into an implementation strategy.

The Dutch Government has established a Bio-Waste Action Program to achieve the objective of phasing out the disposal of organics. The Action Program is involved in ensuring collection systems, processing and markets are in place to meet the objectives. In particular, the Bio-Waste Action Program has facilitated standards and quality control similar to that in Germany, and extensive research and development.

Case Study: Dutch Bio-Waste Action Program

The Dutch Bio-Waste Action Program is run by the Dutch Environment Ministry. The first stage of the Action Program involves ensuring all households have access to a separate organics collection by 1994 and that sufficient processing capacity and markets exist for the collected organics. The disposal of household organics is to be banned in 1994. Preparation of the second stage of the Action Program, dealing with recycling organic materials from commercial and industrial sources, commenced in 1992.

The Action Program maintains a supervisory and coordinating role by monitoring quantities of organics collected, processing capacity and markets to identify

potential problems and work towards solutions. It supports industry by providing subsidies for research and establishment of new facilities, and by providing information transfer.

The Action Program facilitated the establishment of the Waste Processing Association. It supports the following activities carried out by the Waste Processing Association:

- compost certification — based on the German model
- market potential analysis
- the development of marketing plans and sales co-operatives
- publicity campaigns
- pricing policy co-ordinating
- application research

Recommendations

Barriers to the expansion of composting in NSW will remain until the NSW Government provides strong leadership. A Bio-Waste Action Program, based on the Dutch model, should be established. The Action Program should be based around the target of banning the disposal of garden material by 2000.

Immediate tasks for NSW Bio-Waste Action Program are to set in place standards, a quality control process for compost products, a market potential assessment, and government purchasing legislation.

The NSW EPA should develop clear guidelines for the establishment and operation of composting facilities, and the Waste Service should become actively involved in establishing the composting capacity needed for the Action Program target.

At NSW and Local Government levels, waste disposal pricing can be used as a source of funding to provide research and development, pilot programs and direct financial support for composting programs.

The likelihood of NSW meeting its 50 % waste reduction target is dependent on the contribution that organics can play. Strong government leadership is urgently needed to set in place programs that will achieve the banning of disposal of garden materials by 2000 and eventual phasing out of the disposal of all organic materials.

Timetable For Action

The following timetable details activities of NSW Bio-Waste Action Program:

1993

- Formation and development of Action Program timetable.

- Commence process of developing standards (18 months' duration).
- Commence quality certification process (18 months' duration).
- Commence guidelines for planing and operating facilities (1 year duration).
- Commence market potential assessment (1 year duration).
- Plan pilot garden material programs (6 months' duration).
- Prepare for pilot programs at local government level (6 months' duration).

1994

- Commence certification of composting facilities.
- Commence market creation promotion campaign (6 years duration).
- Establish pilot garden material collection programs (1 year duration).
- Develop necessary capacity of garden material composting facilities.
- Plan and prepare pilot to include kitchen organics in collection (1 year duration).
- Plan and prepare pilot to collect commercial kitchen organics (1 year duration).
- Develop procurement policy based on market potential assessment findings.

1995

- Expand pilot garden material programs to full scale.
- Establish pilot kitchen organics collection programs (1 year duration).
- Establish pilot commercial kitchen organics collection programs (1 year duration).
- NSW and Local Governments to adopt procurement policy.

1996–2000

- Full scale garden material collection programs in all local government areas.
- Full scale commercial kitchen collection programs.

2000–2005

- Household organics collections expanded to include all household organics.

Total Waste Management in the Concord Municipality

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The opinions expressed in this paper are those of the authors, not necessarily those of the EPA.

1. Overall Concept

This review of waste in the local government area (LGA) of Concord is intended to stimulate discussion about better ways of achieving waste reduction within this area of Sydney.

The paper suggests there are advantages in establishing a more efficient regional infrastructure for collection and processing of all wastes generated within the Concord area. This would involve one collector performing all the commercial waste collection services in the region.

The efficiency of domestic waste collection contracts for municipal areas is generally regarded as proven. The proposed single collection system for commercial waste would similarly have the advantages of having a concentration of customers within a small area rather than scattered across Sydney. At present, we estimate that there are ten commercial waste companies, five recycling collectors, two transport companies backloading cardboard and ten bin collection companies operating within the Concord LGA. The demands of recycling could easily double the number of truck movements within this area by the end of the decade if 50% waste reduction is to be achieved and collection is not rationalised. Minimising transport distances for both the collection and the delivery of the waste allows a greater range of different services to be provided in an efficient manner. The need for sorting and processing of numerous materials suggests the advantages of large scale operations in order to justify capital investment in suitable specialised equipment such as balers, trommels and screens. A regional domestic Materials Recovery Facility (MRF) or an integrated MRF for a smaller region may provide the best option.

2. Study Area

The Concord LGA has a population of 23,600 residing in 8,300 dwellings. The dwellings are predominantly detached houses with only 10% residing in home units or town houses. Concord LGA is undergoing considerable change. Industrial areas are being updated by offices, warehouses and residential properties. This is

particularly so in the factory areas adjacent to the Parramatta River and Homebush Bay.

Concord Council introduced a combined domestic waste – recycling collection service in 1991 and, although ranked only 14th of 42 councils participating in the Council Recycling Rebate Scheme (First Quarter, 1993), ratepayers participate enthusiastically in this service. This enthusiasm was demonstrated by the large numbers of ratepayers who took the time to complete a recent survey and deliver their responses to Council's offices. The information from the survey and field research was used to estimate all waste sources within the LGA for the purpose of this paper.

3. Waste Audit

Quantity

The characterisation of the components of municipal solid waste in the study area is summarised below:

Council collected waste	9,400 tonnes
Domestic waste removed by small vehicle (non demolition waste, clean-up only)	400 tonnes
Industrial waste	5,800 tonnes
Commercial waste	6,800 tonnes
Construction & demolition waste	7,300 tonnes
Total	29,700 tonnes

3.2 Domestic Waste

In this paper *domestic waste* refers to all wastes generated by normal domestic activity. It does not include construction and demolition waste or wastes generated by businesses in residential areas such as corner shops.

Garbage collected at kerbside in garbage bins	7,675 tonnes
Council at-call clean-up	200 tonnes
Ratepayer transported clean-up waste	400 tonnes
Total	8,275 tonnes

3.3 Council Operations Waste

Premises	25 tonnes
Parks and Gardens (mainly re-used on parks)	25 tonnes
Engineering (concrete and bitumen recycled)	1,375 tonnes
Street sweepings & public places cleansing	100 tonnes
Total	1,525 tonnes

3.4 Commercial and Industrial Waste

We estimate that 12,600 tonnes of commercial and industrial waste are disposed of annually from within the Concord LGA. This waste is predominantly from premises involved with manufacturing (50%) and wholesaling (22%). We estimate, that in addition to this amount of waste for disposal, there is approximately 1,000 tonnes of cardboard collected from these premises for recycling.

We believe that approximately 30 tonnes of glass is also recovered annually from clubs, hotels and restaurants within the Concord LGA.

3.5 Construction and Demolition Waste

Apart from the recently completed office construction projects in Concord West, the bulk of construction/demolition waste within the LGA is derived from residential maintenance and renovation.

A review of building applications revealed the following totals for construction expenditure requiring building applications (BAs). Also included below is an estimate of the construction activity not requiring a BA based on the surveys that were undertaken:

Activity	Value (\$ Million)
House demolition and replacement	2
Unit or town house construction	2
House extensions	4
House renovations not requiring a BA	4
<i>Total Residential</i>	12
Factory construction (including warehouses)	5*
Office construction	1.5
Building renovation requiring a BA	5
Small renovation not requiring a BA	5
<i>Total Commercial</i>	16.5
Total Expenditure on Construction	28.5

* This figure may require review due to the completion of a significant number of projects and the likelihood of residential development in other former factory areas.

The tonnages of construction and demolition waste are estimated as:

Domestic	Construction	2,800 tonnes/yr
	Renovation	1,400 tonnes/yr
Commercial	Construction	2,200 tonnes/yr
	Renovation	900 tonnes/yr
Total		7,300 tonnes/yr

The quantities shown do not include excavation material because for the purpose of this paper it is not deemed to be waste. The demolition waste generated is largely composed of voluminous items such as wood, plasterboard, carpet and soft fittings etc.

Each of the separate waste streams was examined by survey, site inspections and discussions with members of the waste, manufacturing, commercial and demolition industries.

3.6 Composition

Table 1 below shows in summary form the significant components in the different waste streams in Concord:

Table 1
Major Components of the Total Solid Waste Stream

Waste Stream	Putrescible	Paper/Cardboard	Recyclables*	Soft Vegetation	Wood	NDHS†	Other	Total
Council	3,000	1,000	1,000	3,000	500	1,000	600	9,800
Comm/Ind	3,000	5,000	1,200	100	1,800	300	800	12,600
Demolition	—	—	—	—	2,800	3,000	1,500	7,300
Totals	6,000	6,000	2,200	3,100	5,100	4,300	2,900	29,700

* Glass, plastic, steel etc

† Non degradable hard solids (dirt, rock, rubble etc.)

4. Waste Management Options

When first introduced, the Mobile Garbage Bin (MGB), like its commercial equivalent the 3m³ bin, was an answer to everyone's waste disposal problems. These systems provide a clean and efficient mixed waste storage and collection service to the community. The bins did, however, encourage the *find something to fill it up with because I am paying for it to be taken away anyway* attitude in the community.

The same attitude causes problems when council provides a recycling, vegetation and clean-up service. The ratepayers now find that their MGBs are half-empty and so look for other wastes to dispose of. This includes construction wastes and so in some cases the weight of waste in the MGB actually increases because low-density items are being replaced by high density items such as rock and soil.

In general it would seem appropriate if every effort were made to minimise the putrescible waste stream by preventing non-putrescible waste from being mixed with it. For MGB collected wastes, this may mean charging by weight or charging a much higher rate for those who insist on keeping a 240 litre bin in preference to a smaller bin.

4.1 Domestic Waste

Putrescible Waste Recycling

The composition of the 7,700 tonnes of putrescible waste currently being removed in residents' garbage bins each year has been estimated and is listed below.

Also listed is an estimate of the quantity of recyclables that are potentially recoverable from the current garbage stream. This is in addition to the quantity that is currently recycled:

Table 2
Domestic Waste

Material	Currently Recycled (tonnes)	Current Garbage (tonnes)	Achievable Recycling Potential (tonnes)
Paper/ cardboard	1,060	1,000	400
Food Wastes	—	2,200	not available
Garden Wastes	—	2,500	not available
Glass	310	250	150
Steel Cans	not collected	300	*100
Non-ferrous	10	25	15
Plastic	20	550	200*
Wood	—	100	n/a see composting
Fabric/ leather/ rubber etc	—	250	n/a
Ceramic/ dirt/ ash/ rock	—	500	n/a
Totals	1,400	7,675	865

(Source: Metropolitan Waste Disposal Authority, 1988)

* Increases in the quantity of currently collected materials would not result in increased cost to Council. However, the collection of additional plastics and steel is likely to increase costs.

Collection of glass and newspapers for recycling does not have a big impact on the available space in the MGBs but does significantly reduce the weight of garbage for disposal.

The high volume of materials such as PET bottles and cardboard, on the other hand, leads to a significant reduction in the volume of waste in the MGB when these materials are recycled. The increase in space in the MGB is even more notable in areas such as Hornsby where plastic milk bottles are collected. The effect of the vacant space will need to be considered when plastics collections are expanded. Whether the additional material which fills the vacant space in the bin would have been disposed of elsewhere or whether it would have been allowed to bio-degrade on garden beds, is not known.

Should the 865 tonnes of recycling potential stated above be achieved, then the total quantity recycled per annum would be 2,265 tonnes. This recycling rate represents 25% of the total waste collected in MGBs. Approximately 1,460 tonnes or 65% is paper/ cardboard and there is some concern about the price stability of the market for this commodity. To achieve the proposed level of waste reduction, markets must be obtained for the paper/ cardboard component.

Putrescible Waste — Compostables

The establishment of a collection service for compostables is clearly necessary to achieve the 50% reduction in waste to landfill. In times of severe waste paper glut, the option to re-direct paper into compost may be worth examining. This option may offer materials handling advantages but it also relies on price stability of the end market. At this stage markets are yet to be found.

A trial collection of green waste was undertaken over the last quarter of 1992 using a trial zone of 2,300 houses (28% of the LGA). Based on this trial it is estimated that Concord Council would collect 65 tonnes of green waste per week during the summer months and 15 tonnes per week during winter, giving a total of 2,000 tonnes per year. By weight, this material is estimated to be 80% soft vegetation such as grass and 20% woody branches and prunings. The woody component may be suitable for chipping and disposal on Council's own parks, but the cost of separation of this component makes it an unlikely option. Cost estimates tend to support the case for mixed vegetation collection.

Domestic Waste Disposed of by Small Vehicle

The tonnages of waste being delivered by ratepayers to the nearby Waste Recycling & Processing Service (Waste Service) Transfer Station at Auburn is a component of the domestic waste stream that requires more accurate quantification. The results of a survey of the vegetation collection trial area suggest that approximately 400 tonnes of vegetation and clean up materials

from the LGA are disposed of by small vehicles to the Waste Service depot or other depots each year.

In order that a 50% waste reduction be achieved there is a need to ensure that the disposal costs at these facilities reflect the true cost of receiving that material. The Waste Service has gone to some effort to make its transfer stations user-friendly to small vehicle traffic. This has been an additional expense in terms of additional tipping area, recycling facilities and the additional labour required to process many small transactions. These loads consume large tip volumes per weight compared to putrescible waste because of the type of materials. If there is to be a disincentive for domestic waste to be taken in small vehicles to transfer stations, then the true cost of providing the service should be reflected in the price, ie, it should be higher than the price per tonne of council collected domestic waste.

Cost Implications of Comprehensive Domestic Waste Management Services

The following costings have been simplified by disregarding possible waste increases due to space becoming available in MGBs when additional recyclable materials are removed. Recyclable materials which are not currently collected, such as plastic milk bottles and steel cans, are not part of these cost calculations. It is also assumed that there is no change in the cost of collection of the reduced putrescible waste stream.

All figures are in 1990 dollars to enable comparisons.

The 1970s Big Bin Approach Free Monthly Recycling Service

	\$
Garbage tonnage	8,300
Recycling tonnage	400
Garbage collection costs	360,000
Clean-up collection costs	10,000
Tipping fees (\$34.20/tonne)	284,000
Total Waste Management Costs	= 654,000

The Waste/Recycling Collection Service

Garbage tonnage	6,700
Recycling tonnage	— paper 1,500
	— glass 450
	— plastic/Al 50

	\$
Garbage collection costs	360,000
Clean-up collection costs	10,000
Tipping fees (\$34.20/tonne)	230,000
Total garbage costs	600,000
Recycling collection costs	61,000
Total waste management costs	661,000

Waste/Recycling/Composting Collection Service

Garbage tonnages	4,700 tonnes
Recycling tonnages	2,000 tonnes
Compost tonnages	2,000 tonnes
	\$
Garbage collection costs	360,000
Clean-up collection costs	10,000
Tip fees (\$34.20/tonne)	161,000
Total Garbage Costs	531,000
Recycling collection costs	61,000
Compost collection costs (\$62.40/tonne)	125,000
Compost transfer fees (\$13/tonne)	6,000
Gate charges (Growmix \$9/tonne)	18,000
Total compost costs	169,000
Total waste management costs	761,000

It is clear that the waste/recycling/composting collection service will cost Council more unless the cost structure changes, eg through increased waste disposal charges. If we assume a 10% increase in total wastes collected due to increased bin space (see above), the increased total cost to Council is approximately \$150,000. Although a significant expense for Council, this only represents an additional cost of \$18.00 per household per year.

4.2 Council Operations Waste

The 1,525 tonnes of Council Operations Waste forms a large component of the total Council controlled waste stream. The dominant part of this is 1,375 tonnes of waste generated by Council's road and other civil engineering works. Council currently operates a small landfill for its own engineering wastes and consequently the disposal costs are too low to justify reprocessing at present. In the near future this waste stream will be reduced to minimal levels.

4.3 Commercial/Industrial Waste

It is believed that recycling can achieve the 50% waste reduction in the commercial/industrial waste stream in Concord due to the predominance of businesses that produce only dry waste. Arnotts Biscuits is an excep-

tion. The factory is located in the western part of the Municipality. This site was examined and found to be a much smaller waste generator than anticipated, due mainly to waste minimisation practices on the production lines. Unfortunately, the waste produced is a mixture of engineering wastes, floor sweepings, lunch scraps and spoilt packaging materials and therefore not easy to recycle.

The composition of the total commercial/industrial waste stream in Concord was estimated earlier in Table 1. The major components are paper/cardboard (40%), recyclable plastic and glass (10%) and wood (14%) which together constitute 64% of the total commercial/industrial waste stream.

The first consideration for commercial/industrial waste cardboard recycling is the availability and stability of markets for the recovered material. If we assume that markets exist, then the major barrier to higher levels of cardboard recycling is that the small to medium sized premises have insufficient cardboard to justify a collection service using the existing infrastructure. In many cases, particularly with small premises, the introduction of cardboard recycling as a source separated item for separate collection produces no cost savings. This is due to the fact that despite a reduction in waste the garbage collection service is kept at its previous volume due to being a minimum service.

One option for the premises that generate mainly dry waste is the provision of a 240 litre MGB collection for putrescible waste and those materials that are not readily recyclable, such as carbon paper, foamed plastic, cloth, dirt and waxed paper. A 3m³ bin would then be used to transfer the bulk of the recyclable waste to a Materials Recovery Facility (MRF) for recovery.

The collection cost could have a bin rental fee, a volume-cleared fee and a weight-of-contents fee incorporated into the total charge. The weight charge would ensure a user pays policy for items such as wood, which is more expensive to process and dispose of than cardboard, based on a volume basis. The volume charge would need to have some variation options based on contents since a bin filled with purely cardboard would be easier to recycle than a bin of identical weight filled with various plastics, wood and cardboard. This is a user-pays charge, based on the cost of sorting, marketing the recovered contents and disposing of the waste residue.

It is believed that these separate collection services could be operated at a cost similar to the current 3m³ mixed waste collection and disposal costs. These costs being:

240 Litre MGB	\$45/tonne collection, \$35/tonne disposal
3m ³ bin	\$80/tonne collection and disposal

An estimate of the number of services needed for the 180 dry business premises is 400 MGBs to be distrib-

uted according to need and 200 3m³ bins distributed in the following way:

Premises	No of 3m ³ bins	Collection pattern
105	1	once weekly collection
40	1	twice weekly collection
25	1	daily collection
4	2	daily collection
4	3	daily collection
2	5	daily collection

Total collected waste is estimated to be 1,380m³ per week or 200 tonnes per week. This adds up to 10,000 tonnes per year from dry premises. The other 2,600 tonnes are regarded in the first instance as being wet waste suitable only for garbage collection. Of the 10,000 tonnes it is estimated that 1,000 tonnes would be collected in the MGBs for disposal. Of the 9,000 tonnes collectable in a dry service, it is estimated that 6,000 tonnes could be recovered, leaving a residue of 3,000 tonnes for disposal. As the difference between the cost of disposal and recovery becomes greater, the added incentive is likely to increase this recovery to 7,000 tonnes with a residue of only a 2,000 tonnes.

The composition of the Commercial/Industrial waste that could be expected to be recovered and the amount of non-recovered material is estimated as follows:

	tonnes
Putrescible or non-readily recyclable waste (Existing style of mixed waste collection from wet premises)	2,600
Putrescible or non-readily recyclable waste (240 litre MGB garbage collection from dry premises)	1,000
Reject material from the MRF	3,000
Recovered materials — paper	1,000
— cardboard	3,000
— wood	1,200
— metal	300
— plastic	500
Total	12,600

An additional advantage of this low cost, two bin collection infrastructure is its ability to deal with an unreasonable collapse in the cardboard market. Should this happen, then the low-technology MRF could merely become a non-putrescible transfer station and haul the waste to a suitably licensed disposal or composting facility. The concentration of collection in a smaller area allows such greater flexibility.

This infrastructure could also be adapted by co operation with neighbouring Councils to collect compostables from vegetable retailers or restaurants when

compost markets are established. This collection would involve the compostables being in the 3m³ bin with the non-compostables being disposed of in the MGBs for collection with the putrescibles.

4.4 Construction/Demolition Waste

The 7,300 tonnes of construction and demolition waste generated per year within the Concord Municipality is an insufficient quantity to justify the establishment of a demolition waste MRF of any complexity. This tonnage throughput would only justify scavenging through the waste and stockpiling the non-degradable hard solids component for screening or crushing at regular intervals. This would suggest there are advantages if a regional demolition waste MRF accepted construction and demolition waste from a region considerably larger than Concord Municipality. The multiplicity of operations and the necessity to gain approval for operations such as crushing and screening suggests the need to establish a long term MRF rather than a MRF for the duration of the landfill sites life. This would justify the investment in plant, equipment and site works. This becomes a necessity when we consider the need for this MRF to become a wholesale and retail outlet for recovered construction materials and components. A regional MRF for the inner west could be expected each year to be selling 200,000 tonnes of naturally excavated materials and 50,000 tonnes of recovered construction and demolition waste materials. This MRF would also need to act as a transfer station for the estimated 50,000 tonnes residue remaining at the end of the recovery process.

The Croydon Brick Pit owned by Burwood Council has potential as a regional MRF although the proximity of residences may limit its operations. The 50% waste reduction target could readily be achieved in this waste stream, however, the availability of low-cost demolition waste depots on the perimeter of Sydney tends unfortunately to favour the transfer of this waste rather than its recovery. A government policy in France requires all waste to be taken to a transfer station where materials recovery takes place and only the residue from this process is accepted at a landfill. In the opinion of the authors this type of policy could readily achieve the 50% waste reduction required by the year 2000. The following is a composition estimate of the bin wastes generated in established areas such as Concord.

Table 3

Composition Estimate of Construction & Demolition Waste Bins

Material	Heavy Material (700 kg/m ³)		Light Material (200 kg/m ³)	
	% present	% of total recoverable	% present	% of total recoverable
Dirt & fines	50	50	20	20
Bricks, tiles, rocks	30	30	10	10
Wood products	10	2	30	6
Vegetation	6	0	30	6
Metals	1	1	1	1
Floor coverings	3	0	9	0
Potentially recoverable waste		83		37
Residue		17		63

This means that the non readily recoverable residue in a light bin is 126 kg (63% of 200 kg) while that of a heavy bin is in fact 119 kg (17% of 700 kg).

This comparison of the composition of construction and demolition waste bins displays the odd feature that it is easier to reduce the mass of waste requiring disposal in a waste bin generated from heavy building work than from lightweight refurbishment. The residue remaining from each bin load type has a similar composition.

Source : 1992 First National Hazardous and Solid Waste Conference — Gerstle & Dick

5. The Benefits of Regional Operations

5.1 Domestic Wastes

The need to satisfy markets for a range of different materials leads, in the authors' opinion, to a situation where there are advantages in having a regional MRF. These additional market requirements currently include marketing old newsprint and cardboard separately in an international marketplace. In the future, there will be a need to deal with the recovery, sorting, baling, marketing and transportation of plastics. The same may also be true of vegetative wastes depending on their eventual market. This multiplicity of activity is not easily accomplished at the kerbside so a processing facility may be needed.

5.2 Council Operations Wastes

The vast majority of council operations wastes is engineering wastes. The Parks and Gardens staff of councils usually dispose of nearly all their wastes onto their own gardens. The engineering wastes generated by councils are readily recyclable but due to the small size of many councils' separate engineering waste streams this often does not occur except for concrete and bitu-

men. There is a need for any regional demolition waste facility to also act as a regional facility for these materials.

5.3 Commercial/Industrial Waste

There are clear and obvious advantages to the operation of an integrated waste recovery facility that has a larger collection area than the tiny Municipality of Concord. A combination of only the small councils of Concord, Burwood, Ashfield and Strathfield would constitute enough Commercial/Industrial waste (63,000 tonnes) to justify a fleet of five or six front-lift trucks and thus allow for optimum efficiency. Establishing a seven-year contract would allow consideration of optimum collection systems to provide the multiplicity of services necessary with recycling. The greatly reduced haulage distances would make options such as the 240 litre MGB side-loader and 3m³ front lift hybrid manufactured by Formark for country councils viable in the city. Three of these vehicles would be sufficient to collect all the Commercial/Industrial garbage (wet waste) within this four council area.

One other possible advantage that regionalisation has for this little group is that the Sydney Produce Markets at Flemington offer a concentration of compostables that could be utilised to develop a composting collection infrastructure. As the cost of waste disposal rises, the wet waste component of the region may be able to be collected for composting, using the concentrations at Flemington as a collection point for transfer to a composting facility.

5.4 Construction and Demolition Waste

The cost of establishing a construction and demolition waste recovery facility can only be justified on a regional basis. Because of the need to screen materials, process wood and crush rocks, bricks and concrete to recover the various components of the waste, significant site and equipment expenditure is required, eg stockpiles of unprocessed and processed stock would necessitate a reasonably large site compared to a waste transfer operation.

A recovery facility differs greatly from the type of scavenging that recovers items for their value as building components such as sinks, doors etc. The latter operation is clearly more environmentally sound because it extends the useful life of an item such as bricks which may be re-used as commons rather than crushed to be used as roadbase.

The proposal that councils include in their building approval process the requirement that a waste management plan for construction and demolition waste be prepared was put forward in the Kinhill Report on Demolition Waste released by the then Waste Management Authority in 1991. If this approach were to be followed, then the recovery potential contained in the residue could only be realised at a materials recovery facility, since the re-useable building items would have already been removed.

The councils that are within reasonable transport distance of Burwood were examined to estimate the quantities of construction/demolition waste they generate. These estimates are based on the average level of building activity during the past decade and are shown in Table 4. These could be regarded as the maximum potential input to the Burwood Depot from the region.

Table 4

Demolition Waste Sources Within Reasonable Distance of Burwood

Council	Construction and Demolition Waste Tonnages
Ashfield	1,600
Auburn	7,100
Bankstown	23,000
Burwood	4,400
Concord	7,300
Canterbury	2,600
Drummoyne	4,600
Leichhardt	11,500
Marrickville	4,700
Ryde	15,900
Strathfield	5,700
Sydney City	62,000
Totals	150,400

6. Conclusion

The Sydney community collectively pays approximately \$250 million per year for the collection and disposal of solid waste.

The collection system that currently exists was developed to efficiently collect and dispose of mixed waste in a particular set of circumstances. Initially there were numerous disposal facilities and then, as landfills tended to become located on the perimeter of the city, the collection system adjusted by organising collection runs in a pattern radiating outwards. This transport infrastructure consists of three separate waste collection systems. These are:

- putrescible waste collected on a Council area basis
- commercial/industrial waste collected on a Sydney-wide basis
- construction and demolition waste collected as construction occurs in various places across Sydney.

The authors consider that the new challenge is to recover materials for delivery to markets in various places, both inside and outside Sydney, as well as dispose of the residue to different types of disposal facilities. In order to respond to this challenge it does seem appropriate to review the suitability of the current infrastructure. There is little doubt that the future for waste management does not lie in the past experiences of low cost mixed waste disposal. The future is a waste industry infrastructure that resembles a manufacturing and distribution network in reverse.

Manly — Sydney's Number One Recycler

John Swift

Municipal Engineer, Manly Council

Manly Council

Manly Council services an area to the north of Sydney. The area is 16 km² and has approximately 35,000 residents. It is predominantly residential with three main shopping centres and a small industrial area. The Council provides a domestic and commercial garbage — recyclables collection service utilising day labour.

In recent times, Manly has had the highest recycling rate on a kilogram per capita basis of any Council in Sydney.

Background

For many years the Council provided a basic service to its ratepayers of a single 55 litre garbage bin picked up twice per week. It also provided a recycling service for paper and glass, first by contractors and then by day labour.

The change to day labour for the recycling collection occurred some time ago in order to provide a more reliable service. This was successful.

At that time residential ratepayers could have multiples of the basic service (ie. 2 x 55 litre bins twice per week) by paying the same multiple of the basic rate in advance.

Commercial ratepayers were also entitled to the basic service (or multiple thereof) or to go onto a container service utilising MGBs or steel containers of varying sizes. These were emptied on a regular or needs basis and charge at a set rate per lift. Recyclables, if separated, were collected free, again on a needs basis.

As a result, there was a monetary incentive for commercial operators to recycle. This incentive was not available to the majority of residential ratepayers.

In response to anticipated rising tipping costs, dwindling landfill sites and environmental concerns, Council late in 1991 resolved to radically change its basic service.

The new basic service, which was to have a significant impact on residential ratepayers, reduced the bin pickup to one 55 litre bin once per week. To go some way to compensate for this, the fortnightly recycling service was to be increased to weekly with two recycling tubs being provided free to each household. Additional garbage could be picked up, but only on the same night as the normal service and only if payment was made in advance either by an annual charge for a

regular service or the purchase of stickers from the Council which were then attached to the additional bin/s for a needs-based service.

The effect of this new system was to provide a real incentive (previously missing) for residential ratepayers to recycle.

The new service was introduced in August 1992. A detailed account of the events leading up to this change, and how it was sold to the ratepayers is contained in a paper I presented to last year's seminar. A Recycling Committee, consisting of elected representatives, staff from the Manly Environment Centre and Council staff co-ordinated the introduction. This Committee continues to play an active role.

Introduction of the New Service

In the final planning stage for the introduction of the new service we had two major concerns.

We believed that our main problem would be an increase in dumping and disposal of household garbage in be-tidy bins. Whilst this was expected to be short-lived, it was seen as a threat which could give ammunition to our detractors if it got out of hand.

Another concern was increased weight in the garbage bins which could cause a problem to our men, and result in, amongst other things, increased workers' compensation claims. As twelve stickers for a second, as needed, collection were to be issued to each household (three months' worth) we felt however, that there would be a gradual transition which would give us time to address and solve any particular problems.

What happened however was quite different!

- The new system was adopted by most of the residents immediately.
- There was a negligible increase in illegal dumping or illegal use of be-tidy bins. We breathed a sigh of relief.
- The bins got heavier overnight. We began to closely monitor the incidence of injury.
- Recyclables collected dramatically increased. We obviously expected this to happen but also expected it to taper off after a couple of weeks when people realised that for the most part they could cope with just one bin per week without separating every scrap of recyclable material. Therefore we had no initial concerns.

Our staff reported that there was an increase in the number of bins being emptied but this increase was not being matched by the number of stickers being used. Some people were cheating, but again we thought this would settle down.

After Introduction

Although there was an increase in bin weight, our staff were coping and there was no real cause for concern.

More and more material for which there is currently no market (particularly plastics) was being put out. It had earlier been decided that all material marked *recyclable* would be collected even if there was no market for it. In practice, we extended this to all plastic containers, but drew the line at other plastic items such as toilet seats.

The recyclable collection rate did not drop off or plateau as anticipated. As a decision had been made to utilise kerbside sorting for the new system, this meant that sorting was taking longer than anticipated, and the Thursday/Friday collections were running into Saturday/Sunday. This was a real cause for concern. The residents were losing confidence in us and our overtime bill was skyrocketing. After consultation with the staff, a decision was made to go to central sorting using a Materials Recovery Facility, (MRF) and provision was made for this in the 1993 budget.

Our Present Operation

In order to further increase our recycling rate and to reduce costs, residents now do not have the option to pay for additional services twelve months in advance. Additional bins must now have a pre-paid sticker attached for each service. If there is no sticker, the bin is not picked up.

The MRF, supplied and installed at Council's depot by Denlar Pty Ltd Queensland is also now in operation. As there is an investigation currently underway into a possible rationalisation of all depot facilities, it has been housed on a temporary basis in a converted garage building. Whilst the layout is not ideal, cost savings in the order of \$5000 per week are being achieved with central sorting.

All recyclables, other than paper, are collected in compactors of open-bodied trucks and delivered to the MRF for sorting and storage in bulk containers/holding areas until delivered straight to the mill. This operation will change shortly due to the requirement to have paper sorted. The sorting will be done via the MRF and not kerbside.

Council currently collects kerbside and sorts the following materials:

- paper
- glass

- PET
- other plastics
- aluminium
- steel cans

A recycling centre is also available to residents on the weekend. In addition to the materials collected kerbside, this centre also accepts:-

- oils
- batteries
- clothes
- garden clippings

Tonnages for the October – December 1993 quarter of the major items compared to the same period in 1992 are as follows:

	1991	1992	% Increase
Paper	68.07	102.98	51.3
Glass	31.90	46.33	45.2
PET	0.51	0.71	39.2
Other plastics ¹	—	—	—
Aluminium	0.05	0.66	1,220
Steel cans ²	—	—	—

Source: *Kerbside Quarterly* published by the EPA
Notes

1. HDPE is now being disposed of as a recyclable item.
2. Steel cans are now being sorted for disposal.

It is costing Council approximately \$142 per tonne to pick up, sort and deliver the marketable recyclables based on current tonnages and including both direct and indirect costs.

(Due to the uncertainty of the paper market, an income figure has not been calculated.)

The Future

In terms of recycling there are few options left for improvement. Some fine tuning can be done and the operation of the MRF can and is being improved. Council recently called public tenders for its garbage/recycling service. Our staff, with the assistance of a consultant also submitted a tender. All tenders received were assessed by another independent consultant and our staff are deemed to have the winning bid. Whilst there will be some operational changes resulting in cost savings, it is expected that the basic service will remain unchanged. At the time of writing the final outcome has not been reported to Council.

Vegetation-only clean-ups will most certainly be introduced with the changes. Markets or lack thereof, and market prices concern Council. Unfortunately, the more successful we and other Councils are, the greater

the chance of a reduction of prices. The recent drop in paper prices is a good example. Government intervention appears to be the only answer to this problem, although the activities of the Local Government Recycling Co-operative, of which Manly Council is an active member and supporter, will have a significant impact. I believe however, that the chance of Councils ever running their recycling operations at a profit is remote and that there will always be a nett cost which will have to be borne by the ratepayer.

Recycling is only part of the equation. It is not the complete answer. In order to achieve further reduction in waste, the concepts of recycling, reusing, and composting must be embraced. Manly Council and the Manly Environment Centre are actively promoting these.

Conclusion

Manly Council is Sydney's Number One Recycler due to the success of its new garbage/recycling system. this success could not have been achieved without the full co-operation and support of the elected representatives, residents and staff.

That co-operation and support was given with enthusiasm and is continuing.

Lismore's Waste Management Strategy

Diana Roberts

Councillor, Lismore City Council

This presentation is based on the proposal prepared by Stuart White, Waste Management Advisory Committee Lismore City Council, for a waste minimisation strategy for Lismore, adopted by Lismore City Council in February 1993. Since adopting this strategy Council has employed several people to work on different aspects of the proposal and I will outline our findings and decisions to date.

Summary and Recommendations

Following the approval of the Minister for Local Government of the \$12.50 increase in the garbage rate in 1993, there is an urgent need to develop a Waste Minimisation Strategy for Lismore to ensure that the maximum value is obtained on behalf of the Lismore City Council ratepayers. The proposal outlines the objectives, scope and necessary elements of such a strategy. The recommendations below are based on the proposal.

Recommendation One

That the objectives, scope and elements of the Waste Minimisation Strategy be as outlined in the proposal. In particular that the central feature of the Strategy is a commitment to waste minimisation and reducing the volume of compacted waste going to landfill.

Recommendation Two

That Lismore City Council allocate additional resources to develop and implement a Waste Minimisation Strategy as outlined in the proposal. That funds for this be allocated from the revenue raised by the \$12.50 levy on the garbage charge in 1993. That the allocation of resources for the development of the Strategy to point of implementation be to a maximum of \$20,000.

Recommendation Three

That the overall direction of the Waste Minimisation Strategy be subject to the Waste Management Advisory Committee through the Kerbside Recycling Working Group. That all initiatives will be subject to a report to full Council.

Recommendation Four

That the first task in the development of the Strategy is to ensure that the following information is obtained and clearly presented:

- As accurate as practicable assessment of the composition of the total waste and recyclables stream by volume, weight and proportion including identification of major waste sources.
- The volumes, projections, costs and operational details of the Wyrallah Road landfill, and the existing household and CBD collection service.
- An assessment of the technical and financial merits of all the options considered at the October public meeting. These options include:
 - kerbside collection of containers
 - separate collection of same bin
 - partitioned bin collection
 - dual-bin collection, pay-by weight
 - home composting
 - drop-off points for recyclables
- An assessment of the viability of municipal scale composting, possibly including paper, and collection strategies for organic wastes and waste paper.
- A plan for meeting the recycling needs of villages, rural areas, and the CBD. Particularly, a plan for dealing with organic waste in the CBD.
- A plan for community consultation and public education.
- Investigate possible sources of outside funding or support for the development and implementation of the Strategy.
- Other issues as determined by the Waste Management Advisory Committee and Council.

Establishing the Objectives

To develop a Strategy, the first task is to define the objectives of such a strategy. The following is a proposed list of objectives for a Waste Minimisation Strategy for Lismore.

- To reduce the waste being disposed of to landfill by at least 50% by the year 2000, based on 1990 figures.

This is a target adopted as part of the Federal government's *National Waste Minimisation and Recycling Strategy* (CEPA 1992). The target was reached in agreement with the States and is also incorporated in the *NSW Waste Management Green Paper* (NSW Government 1992). A complementary target is to reduce domestic waste by 50% per capita by the year 2000.

- To establish clear and measurable performance criteria for the Waste Minimisation Strategy to enable evaluation of the elements of the Strategy.

This is a fundamental management objective. Currently, any management objectives and performance criteria for the Garbage Fund are informal and mainly relate to financial performance. However, if a broader set of objectives is to be pursued there will need to be new and more formalised criteria. The public meeting held to discuss the proposed increase in the garbage rate passed a resolution that the funds should be expended in a way that maximises the diversion of material from landfill. If this is to be respected there will need to be a process for evaluation of the Strategy based on this criterion.

- To introduce a pay-by-weight or pay-by-volume charging system for all waste.

This reform is recommended by the national and state waste strategies. The current flat rate for garbage removal offers no incentive for ratepayers to reduce the amount of waste they dispose of, and is almost certainly a regressive tax against pensioner households where household size and predisposition to recycling and re-use is higher. The introduction of 240 litre mobile garbage bins to replace the 55 litre service also generally increases the amount of waste collected. There are many possible methods whereby pay-by-weight or pay-by-volume charging could be introduced which need to be further investigated as part of the Strategy.

- To develop a strategy that is acceptable to the community.

Waste is an issue that affects everyone in the community, and the reduction of waste will involve everyone in the community. It is essential therefore to develop a strategy that has wide community acceptance.

- To integrate waste minimisation and disposal activities into an overall strategy.

Currently, in most local government areas including Lismore, *recycling* is seen as a separate activity to *waste collection and disposal*. This is most clearly shown by the separate consideration of a recycling levy which is usually charged to pay for a separate collection of cans and bottles. If targets for reducing waste going to landfill are to be achieved, then it is legitimate and necessary to integrate consideration of collection, disposal and waste minimisation activities under the same financial and management umbrella.

- To anticipate, and ensure reserve funds are available for future developments in technologies, regulations or community expectations.

The issue of waste management is one that is undergoing rapid development in every respect. To

be aware of current and future developments is very important for good management. It is particularly important in order to ensure that major expenditure items do not preclude future possibilities.

- To minimise the use of resources and impact on the environment, and to move as far as possible up the *waste management hierarchy*, ie. first reduce waste, then re-use, then recycle and lastly dispose.

The motivation for implementing a Waste Minimisation Strategy is not merely financial. The waste of resources that is represented by landfill disposal is also an important consideration and one which is likely to be regulated in the future. The *waste management hierarchy* recognises this, as well as recognising the adverse environmental consequences of landfill disposal, regardless of the standard of operation.

Scope of the Strategy

The area of waste management is so broad that there is an advantage, at least at first, in limiting the scope of the Strategy. Therefore, the Strategy aims to cover the collection, minimisation, recycling and disposal of solid waste in the Lismore local government area. It will not involve sewage waste except insofar as sewage sludge may be used in co-composting with solid waste. It will, in due course, address intractable, toxic and hazardous waste. It will address recycling in rural areas and unauthorised tipping in rural areas and will encompass the Nimbin recycling and transfer station operation and management of the Nimbin landfill site.

Developing the Strategy

Having established the objectives and scope of the Waste Minimisation Strategy, the next task is to develop the Strategy itself. This will require at least the following elements:

Information Gathering

More information is needed about a large number of issues including:

- the composition of the waste stream (see *What Goes to Landfill?*)
- the projected volumes and costs of landfill
- accurate costing of the various kerbside collection options
- the experience of other areas in more ambitious aspects of the Strategy (eg. composting)
- the state of the markets for various materials

This information will be essential in developing the Strategy.

Community Consultation

At the public meeting held to discuss the imposition of an addition to the garbage charge in October 1992, a commitment was given by the Waste Management Advisory Committee that the public would be kept informed of the progress of the Committee's work and that the community would be consulted on major initiatives. Newspaper articles and notices, leaflets and a public meeting are considered to be minimum requirements, and the Committee will work on developing and undertaking more substantial measures, for example, policy juries, questionnaires, polls or focus groups.

Landfill management Plan

The long-term management of the landfill site is an integral part of the Waste Minimisation Strategy. Costs of operation of the landfill, present and future environmental controls, costs of augmentation and so on are all issues that need to be explored.

Financial Plan

All aspects of waste collection, recycling and disposal need to be costed and a detailed financial plan developed. One end result of this will be the ability to determine the net present value of diverting (say) one cubic metre of waste from landfill. This will enable more accurate appraisal of the financial benefits of waste minimisation and recycling.

Education

Providing accurate and well-presented educational material to the public is fundamental to the success of the Strategy. The public needs to be kept informed of the initiatives that arise from the Strategy and what is expected of them, and more generally of the need for waste minimisation in the interests of the whole community.

Trials

Some initiatives which arise out of the Strategy may be innovative, and involve a reasonably large commitment from Council or a private contractor. For example, composting on a Council-wide scale, or collection of waste in a partitioned bin. There would be strong advantages in being able to conduct trials of such options, both to sort out technical and financial issues, but also to generate publicity for such options and assess the level of public support.

Implementation

Options which are recommended as part of the Strategy will have to be implemented, which will require co-ordination of the financing, timing, calling for and letting of tenders, education and other aspects. Options which may need to be implemented include:

- kerbside collection of recyclable materials

- a system for pay-by-weight or pay-by-volume charging
- establishing collection points for recyclables
- composting on a Council-wide scale

Lobbying

Many waste management issues which impact on local government are within the jurisdiction of the state and federal government. For example, local government generally foots the bill for disposal or recycling (via subsidised collection) of packaging (glass, aluminium, steel and plastic containers, wrapping material and so on). The packaging industry benefits financially from this cross-subsidy, despite the fact that the *National Waste Strategy* (CEPA 1992) explicitly states that the *polluter-pays* principle should guide the strategy. In order to help redress the economic imbalance, continued lobbying of state and federal governments is necessary directly and through the Local Government Association.

Outside Support

There are a number of possibilities for financial and in-kind support in developing and implementing the Strategy from outside Council, eg. from state and federal government agencies, industry and other organisations. These avenues will need to be investigated as early as possible.

Evaluation

At the October public meeting, a commitment was given that there should be a performance review of the initiatives arising from the Committee's work. This is part of a necessary evaluation process for the Strategy as a whole. Once the objectives of the Strategy are agreed upon, an evaluation process needs to be developed which can, as objectively as possible, measure the actual achievement of those objectives. For example, in the case of the objective relating to reducing waste going to landfill, it is a simple matter to measure the reduction each year. An improvement on this is to establish an index which shows the cost of reducing the volume going to landfill as a function of that reduction, eg. in dollars per cubic metre.

What Goes to Landfill?

If the Waste Minimisation Strategy is to effectively reduce the volume of waste going to landfill then it is important to know what is in the waste stream. Estimates by Council staff suggest that the breakdown (by volume) is approximately 300m³ of uncompacted waste per week from each of the three categories below:

- Council trucks
- Richmond Waste and other private contractors
- general public

Data from Gold (1989) suggest that the sources of waste are as shown in the table below.

Table 1
Sources of Waste Delivered to Wyrallah Road Landfill in 1988.

Category	Tonnes	Percent
Domestic waste (12,500 homes)	9,800	25
Trade waste	19,800	50
Trade waste delivered privately	3,000	7
Small vehicle waste	7,000	18
Total	39,600	100

Data from Gold (1989)

A successful Waste Minimisation Strategy would need to address each of the categories shown above. The first step would be to compile accurate figures regarding the weight and volume of material currently being disposed of and the composition of waste within those categories, as is shown for the domestic waste stream below.

What's in Household Waste?

If we take the view that landfill space and garbage compactor space are to be optimised, then the composition of household waste by volume, rather than by weight, is important. Unfortunately there are very few studies to base this on, and the proportions vary from place to place and throughout the year. The most reliable data is based upon a comprehensive measurement by BHP at the Lucas Heights landfill. (The available data has been compiled into Annexure A, available from Pat Skinner at the EPA).

While there are some quite large discrepancies in the results from BHP's study, some significant conclusions can be drawn:

- Food and garden wastes are the largest single component by volume or weight in all results. Mixed waste paper is the second largest component.
- By volume, organic waste (food and garden) and paper together comprise 60% of the domestic waste stream. The two results agree on this.
- By volume, all metal and glass together comprise 7.6% (BHP measurement) or 18.6% (LCC estimate).

Based on these results, any Strategy must address the organic and paper components. Conversely, a Strategy which addressed only the metal and glass would not have a significant impact on reducing waste going to landfill.

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Councils Working Together: Grafton's Strategy

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During the past 18 months, Grafton City Council, along with the adjoining Councils of Copmanhurst, Nymboida and Ulmarra, have put aside their parochialism, their rivalry and their concerns with amalgamations, to work together, with the aim of improving the quality and efficiency of solid waste management practices within our region.

By working together and by working as a region and achieving economies of scale not available as individual Councils, significant improvements have been achieved in a relatively short period of time.

Grafton City is a relatively small rural City located on the North coast of NSW, some 700 km north of Sydney. The City has a population of 17,100 and is perhaps best known as the Jacaranda City or the City of Trees.

Adjoining Grafton City are three rural-based Councils known as Copmanhurst, Nymboida and Ulmarra. These four Councils, along with Maclean Council, make up the region known as the Clarence Valley. The total population of Grafton, Copmanhurst, Nymboida and Ulmarra Council areas is 30,650 and there are approximately 9,200 garbage services.

The Regional Approach

The regional approach was initiated in late 1991, when Grafton City Council commenced a review of solid waste management practices operating within the City. There were three main issues that prompted this review:

- the existing waste collection contract would expire on 30 June 1993
- the existing landfill site was nearing completion
- the desire to improve recycling services within the City

Due to Grafton City's boundary limitations that meant the siting of any new landfill would most likely be within one of the adjoining Councils, along with the assumption that economies of scale would make waste management, particularly recycling and landfill operations, more cost-effective, the review was expanded to include, with their co-operation, the adjoining Councils.

The review, which basically documented existing practices, clearly showed a lack of consistency in both cost

and level of service provided, particularly with regard to recycling. It also revealed that there were 14 landfills serving the area and only one, the Grafton landfill, was receiving adequate maintenance. It was quite obvious that the smaller Councils were not in the position to maintain their landfills to an environmentally acceptable level.

After considering this report, each Council acknowledged the issues and the financial and environmental costs of failing to manage solid waste in the future. As a result, Councils agreed to form a working party, consisting of one elected representative and the relevant Environmental Health Officer from each Council. The aim of the working party was to develop a consistent, cost effective and environmentally responsible waste management strategy that could be implemented on a regional basis, while also maintaining the autonomy of each Council.

The working party proceeded to prepare and consider a wide range of reports on waste management issues considered relevant to the region. These included:

- domestic/commercial garbage collection
- contaminated medical waste disposal
- waste minimisation
- recycling
- landfills
- trade wastes
- transfer station
- funding, etc

In August 1992, the working party released for public comment a draft Regional Solid Waste Management Strategy.

The most significant recommendations included in the strategy were

- to close the majority of existing landfills
- to develop a regional landfill operated by Grafton City Council, but funded on a pro-rata basis by participating Councils
- to standardise the level of waste collection services throughout the region, including the introduction of a weekly kerbside recycling service

- to call tenders on a regional basis for a single contractor to provide waste collection and kerbside recycling services
- to develop a materials recovery facility in Grafton to service the region
- to introduce various waste minimisation initiatives

Following the public exhibition stage, the strategy was reviewed and submitted to each Council for consideration.

Current Status

As can be appreciated, in the present economic climate, to convince one Council to significantly change its practices and introduce new services is hard enough, let alone to convince four! It is therefore not surprising that Nymboida Council has yet to resolve to implement the scheme. However, I am more than confident that Nymboida will shortly join with Grafton City, Copmanhurst and Ulmarra Councils, which are now well down the path of fully implementing the strategy.

The implementation phase has involved the drafting of a standard regional waste collection contract, the joint calling and acceptance of tenders to provide waste collection and kerbside recycling services, the construction of an \$825,000 refuse transfer and recycling facility, the purchase and delivery of mobile garbage bins (MGBs) and recycling crates and a comprehensive promotion and education program.

The new garbage collection service commenced on 5 July 1993 and the kerbside recycling service will commence on 2 August 1993.

Benefits

Apart from the obvious benefits from a more comprehensive, modern and efficient waste collection service, the regional approach, with its economy of scale, has already produced significant financial benefits for participating Councils. At almost every point, there have been savings in both staff time and costs, the drafting of a single contract rather than three, the single tendering process, the bulk purchase of MGBs and recycling crates, the education and promotion campaign and, of course, I am certain that the larger service area was reflected in the tenders for the supply of waste collection services.

Recycle NSW has also recognised our regional approach, when it awarded a grant of \$1,000 under its Rural Grants Scheme.

Although not established at this point, the proposed regional landfill is expected to not only result in environmental benefits from the closure of the poorly maintained existing landfills, but the more effective

utilisation of plant and staff should produce significant financial benefits.

One important aspect that cannot be appreciated in economic terms is public support. Perhaps it is partly due to national media exposure of waste management issues, but I am certain that the interest from the local media — television, radio and print, right throughout the development and implementation of the strategy, along with the education and promotion campaigns undertaken by the Councils, has been such that there would be few residents of the region who are unaware of and do not support, the initiatives that have been taken.

Future Activities

There is no intention of disbanding the working party once implementation of the strategy has been completed. The working party will continue its role of reviewing and monitoring the performance of the strategy. It will also be a forum where new initiatives in waste management and waste minimisation will be promoted. The working party has already expressed the desire to investigate in more detail large-scale mulching, composting and worm farming ventures.

Avenues will also be explored into ways of expanding the regional approach, perhaps on a North Coast basis, for regional education and promotion campaigns on recycling and waste minimisation or maybe the purchase and operation of large mulching equipment.

In conclusion, I would recommend to other regional areas, whether larger or smaller than the Clarence Valley, that when reviewing waste management issues, pursuing a regional approach should be considered, as there could be benefits in both economic and environmental terms and it is also possible to maintain autonomy for each participating Council.

Negotiating the Conditions for Best Practice — Siting a Controversial Waste Facility

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Background

The following is a case study currently being conducted in the Sutherland Shire. It concerns the siting and management of a scientific research unit that will further develop and test a controlled natural technology for the conversion of household organic matter into household fertiliser. The proponent of this technology is a Co-operative Research Centre, the CRC for Waste Management and Pollution Control Ltd. The suggested site for this unit is alongside the Lucas Heights Waste Depot.

The siting of this research unit at the Lucas Heights location, and not at another existing tip site, is to allow ANSTO environmental science staff (ANSTO is a partner in the CRC) easy access to the research facility.

The residents of Lucas Heights say it stinks by day and glows by night. The waste depot is currently used by 23 councils and is directly opposite ANSTO where the renowned Australian Nuclear Reactor is located. This research is being conducted in the midst of high community outrage. This outrage is primarily directed towards government agencies. Any development proposal that is perceived to have the potential to further reduce the quality of life of those in the community or cause harm to the environment, quickly attracts intense opposition.

There is certainly no guarantee that the Sutherland community will say *yes* to the proposal but there is a possibility that they will say *maybe*.

The Social Ecology of Water & Waste Management team has undertaken to work with both the proponent of the technology, the CRC, and the Sutherland community in developing a strategy for a negotiation around the siting and management of this research unit.

Siting a Controversial Facility

Many factors make siting this facility controversial. A history of the proposed location shows how the community of Sutherland Shire have had to fight to prevent a whole range of additional waste facilities being sited in their community. The Lucas Heights Mega-tip was a proposal by the Waste Recycling and Processing Service (Waste Service) to extend the existing tip.

When this tip was opened in 1987, it was to accept waste from seven Councils for 30 years. Within one month of opening, it was accepting waste from 23 Councils, and there are claims now that the current site will be full by 1997.

The Sutherland community is acutely aware of its image to outsiders, and does not want to be known as the community that glows and stinks. There has been a proposal by Lucas Heights residents to change the name of their suburb to one that will not be automatically associated to the Nuclear Reactor.

The characteristics of the proposed research unit and its capabilities are fuzzy enough to warrant concern in any community. It is a research unit, so the realities of how it will operate are still to be determined. What odour emissions will there be? How will waste be carted and removed? Who will own the finished product? and so on.

This community is acutely aware of the damage being inflicted on its environment daily by the existing land-fill operation and it is desperately trying to prevent further damage. It does not want heavy trucks on its suburban roads, or to have to accept other suburbs' rubbish, why should it? Any proposal to make changes or additions to the existing site brings an immediate outcry from the community, *why us?*

Alternatives

There are a number of possible alternatives to the way in which the siting and management of this research unit could be implemented.

1 The proponent (CRC) could make the decision that Lucas Heights was the only possible site for the unit and site it there without any consultation or community input. This is the way many agencies have operated in the past and has caused much of the outrage within Sutherland to date.

2 The CRC could seek input from the Sutherland community in a way that has a pre-determined outcome in mind. There are many of these community consultation models in existence and history has shown that they often lead to more scepticism within the community rather than support and acceptance of the proposal.

3 The third alternative and the one that this research is proposing is the development of a strategy where the community can negotiate with the CRC to look at the costs and benefits of siting and managing such a unit.

Solutions

1 The first alternative is not a possibility because the CRC lists in its mission statement that it is committed to: 'research, development, education, and commercialisation of innovative approaches to protect and enhance the natural environment and the social and economic well being of Australia'. In no way can the CRC be seen to be putting its reputation in jeopardy.

The Social Ecology of Water & Waste Management is the only project within the overall CRC that is researching how best to involve the community in decision-making around all issues to do with water and waste management. All other projects within this CRC are technology-based. It is planned that the research findings of this project will provide the CRC with the knowledge of how best to bring all stakeholders in the decision-making process to the negotiation table.

2 Alternative two has been shown not to work. An example of this is the RTA community consultation process conducted in Sutherland in 1990. There is strong evidence to suggest that the RTA chose to consult with *dummy* community groups within the region that were not in existence before the RTA proposal was put forward. Local resident action groups accused the RTA of consulting with dummy groups to show support for their case, while not consulting with long-established groups¹. There is still high community outrage towards the RTA.

The new reactor for ANSTO is another case in mind. Sutherland Shire Council is vehemently opposed to the new reactor as are many local residents and action groups. ANSTO however has a very strong belief that the reactor cannot be economically sited anywhere else in Australia and it appears that it is with this agenda that community consultation is proceeding.²

The Lucas Heights Mega-tip proposal was one that united the Sutherland Shire and resulted in a victory for all residents. The proposal was to expand the existing tip to nearly three times its size. Through ten months of intense campaigning and at seven public meetings, Shire residents together with their Council, Environment Centre, and Federal and State MPs maintained unanimous opposition to the tip's expansion. The residents believe that the turning point was when the State government *got the message* that to proceed with the expansion proposal would endanger Govern-

ment-held seats. The message was delivered by a series of unanimous Shire rejections of the proposal.³

3 The strategy that this research is proposing is the formation of a Community Monitoring Committee (CMC) where genuine community involvement in decision-making can take place.

For the Sutherland community to have a meaningful involvement in the decision-making process, it is judged that the following principles be the foundation for a series of concrete actions:

- The literature suggests that there is no burning desire by the general community to participate in every or even any public decision. But what the community is increasingly insisting on is that all critical decisions are made in public (not necessarily by the public in any direct sense). at the moment, this is simply not happening.

As a means of addressing the scepticism that has built up in the public's mind, industry and government need to have their decision-making processes as transparent as is practically possible.

- Expert, and government agency people in general, send the local residents into a state of outrage by the way they manage the initial events. Better to begin by presenting all the information that is currently at hand and by acknowledging the areas of uncertainty where they exist. Stonewalling is to be avoided at all costs.
- The community perceives risk (a potential danger; a threat to future generations) according to different parameters than does the scientist or engineer. This reality needs to be taken into account when establishing two-way communication channels.

As a means of incorporating the above principles into operating strategies, the formation of a CMC is being proposed.

The CMC would have the specific brief to be a negotiation team to sit down and bargain with the proponent of the research unit (the CRC) about:

- which technical parameters need to be monitored?
- how this monitoring will be done? At this stage the most appropriate mechanism would be to use independent experts via a small technical grant.
- what restrictions will be imposed on the operation of the research unit? (eg. sorting of rubbish, transport, noise)
- why the negotiation process is of importance

This proposed CMC is now the basis for on-going discussion with local residents.

1 *The Leader* 18 October 1990

2 *Menai District Progress Association Newsletter* No 5 1992

3 *The Sutherland Environment Centre Newsletter* No 3 September 1992

Conclusion

Our research is to develop a blue-print for the successful siting and management of controversial facilities. As outlined above we plan to do this by setting up a process for negotiation between the proponent of the facility and the community where the facility is to be sited. We are using the formation of a CMC to do this. We have yet to bring the CMC and the proponent of the research facility (the CRC) to the negotiation table. That is the next step in this case study. To date our role has been to design the functioning of the CMC in a way that will meet the needs of both parties.

The local residents have found the clarity of the specific functions of the proposed CMC to be a breath of fresh air. The CRC with some *natural* reluctance, has acknowledged the value and importance of independent monitoring and meaningful participation by the community.

There is no guarantee that this community will say *yes* to the proposal, but we believe there is the possibility that they will say *maybe*.

The above case study is one of a number of studies in which this research unit is currently involved.

The Role of Litter Reduction in Overall Waste Management for Councils

Michael Antrum

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The opinions expressed in this paper are those of the author, not necessarily those of the EPA.

I have checked the programme, and the title of my talk — *The Role of Litter Reduction in Overall Waste Management for Councils* — is the longest one there, so you know that this is going to be important.

Firstly — there is a role for litter reduction in any waste management plan. I'm not sure what difference the *overall* makes to any such plan, but I will assume it suggests a comprehensive and embracing approach to managing waste. Viewed simply, litter is wasted energy — it is rarely recycled or reused, and increases energy consumption when it has to be cleaned up, or where it blocks pollution traps etc. All of which is not best practice in waste management. In a paper last year, I said that litter had *gone off the boil* as an environmental issue around the world. Once one of the major environmental issues, litter had been subsumed by greenhouse effects, toxic pollution, and species endangerment. I did point out however that councils, closer to the community opinion coal face, still regarded litter, along with recycling, as environmental priorities.

But interestingly, litter seems to be staging something of a comeback. By that I do not mean that more people are littering more often, but as an issue of importance, it is gaining renewed prominence. The growing database of information relating to the effects of plastics and other littered items in the sea has refocused attention on the incidental, yet, in many circumstances, catastrophic practice of littering. For example, at least 80 of the world's 280 species of seabirds are known to ingest small pieces of floating plastic, mistaking them for food such as plankton or fish eggs¹ and it is common knowledge that birds, fish and sea mammals are injured and killed by becoming entangled in, or ingesting plastic.

Back on land, most beef farmers will be able to relate stories to you of the damage that one plastic bag can do to the gut of a cow. The members of the Wildlife Information and Rescue Service literally have their hands full tending to injured and disabled wildlife as a direct result of litter. And I need not go into the flooding, the fires, the detriment to water quality, the threat to agricultural crops, the adverse impacts on public

health and road safety that litter is associated with. In the US, where statistics are more readily available, it is estimated that 500 – 1,000 people are killed each year in vehicles swerving to avoid litter on highways, and every 12 minutes a home is destroyed or damaged by a fire starting in rubbish and litter². The economic impact, quite apart from the cost of cleaning it up, is a huge drain on public and private resources.

But this is a seminar with a local government focus, and our own surveys have shown that I don't have to remind Local Government that litter *is* a big problem out there. So how does it fit within the increasingly complex waste management responsibilities of local councils? With litter, you have a problem entirely different in complexion from recycling and domestic waste disposal. For a start, the activity of littering is completely illegal, and therefore *exponents* of this art are more difficult to identify. Counts and tonnages of the stuff are conducted from time to time in some areas, however the results are, at best, an indication only of the proportions of the problem. The difficulties are compounded by the fact that litter is not located in any one receptacle or at any one point.

These difficulties have prompted our most common responses to litter problems — public education, and legislation. These are adequate responses, and success depends on good planning and commitment to follow through. The message I want to put today is that we need to build on this base. Waste management plans must include litter control and litter reduction. Litter is not kids' stuff. To reduce it requires more than colouring sheets in schools, more than the occasional clean-up, and more than pretty pictures on billboards, although each of these may be a component in a litter reduction campaign. At times, fighting litter can be a demoralising experience, it is a social malaise that is evident everywhere. The depths of the Swansea Channel look like a ghostly Woolworths' aisle, complete with shopping trolleys, and the highest rubbish tips in the world that were once the base camps below Mount Everest are testament to the human craving for immediate convenience.

But the problem is not indomitable. And there are other reasons why litter reduction should be an envi-

1 California Marine Debris Action Plan, The Centre for Marine Conservation, June 1990 citing Sievert et al, p12

2 Freeman Associates, *Public Service Advertising for the Division of Litter Control*, Presentation to the Virginia Litter-Control Board, Richmond 1977

ronmental priority for councils and communities. Litter represents a problem that we can all take personal action on to reduce its physical presence in our immediate environment, and improve our environment. Environmental improvement goals can be readily achieved, and it has flow-on benefits in terms of community building, and the development of public environmental consciousness. This is not New Age speculation. Many councils and community groups have discovered the very positive social benefits that can arise from clean-ups, or other litter reduction programs. And looking after our local environment by doing what we can allows us to develop a better practical attitude towards other waste management programs that require a degree of personal responsibility for the problem.

I'd love to see a headline scream 'Wingecarribee Reverses Ozone Depletion', or 'Taree Discovers Biodiversity Secret', but in the meantime, there are things we can do. I once said to delegates at another conference that if I ever heard another speaker say 'Think globally, act locally' I would probably sue them for gross overuse of an environmental phrase, so I absolutely refuse to say that the phrase is very apt here. Councils can lead their communities towards a litter-free environment, and they can use that positive experience to encourage other environment protection behaviours in their areas. It is well documented, for example, that by generating some *ownership* in something, it is more likely to be cared for, and protected. A stretch of roadway, a public park, a strip of bushland — visible litter programs where people are involved invests a *de facto* ownership — it reminds the public that as the public, they are in fact custodians of these public assets. In this way then, litter reduction programs, as part of your overall waste management plan, serve a dual role — reducing litter, with all of the attendant environmental and economic benefits that that entails, and the motivating effect of seeing a local environment improve rapidly, and as a result of local action.

There are some new directions in litter reduction in this State. For a start, the Commonwealth EPA has agreed to fund the establishment of the National Litter Index, a project that the NSW EPA has been pushing for quite some time now. This database will provide everyone who has an interest in litter reduction with a rigorous statistical profile of litter in NSW, and in Australia. Essentially, it will tell us, over time, whether our programs are working or not.

Another new development is the establishment of the NSW Litter Reduction Action Committee, which will bring together all of the groups that are working to-

wards a litter-free NSW. Local Government is an important member of that Committee.

I have always emphasised a practical approach to litter reduction, however it is useful to see what the behavioural scientists say about our methods. Some of the methods I am about to describe have come out of the series of community roadside litter forums we held throughout 1992 and the earlier part of this year.

Posted feedback is a phrase that psychologists use to describe a process where a target group is provided with visible feedback on the results or outcomes of a particular activity that is being monitored. It is an idea that can be readily applied to litter reduction programs. Where you have a litter hot spot, or an appropriate entrance to a population centre, you could erect a sign that provides an indicator of current litter levels — similar perhaps to the daily bushfire danger readings. At regular intervals let your target group know what the current litter rating is. It could, for example, be a score out of 10, with the score being determined by a count of items at selected sites. The score could be accompanied by a message like 'This month's litter level is 7/10. Last year the average was 6/10. We are working towards a perfect 10/10. Thank you for doing the right thing.' Potential litterers are thereby reminded that their illegal activity is being monitored, and that they could be part of the solution. Studies in the past have shown good results with this method. Talking of solutions brings me to another hackneyed phrase that I will not, under any circumstances use — John F. Kennedy's 'If you're not part of the solution, you're part of the problem'³.

Over the past 12 months we have sold a lot of the \$200 on-the-spot fine signs, and I am happy to report that the psychologists are on our side here too. According to Reiter and Samuel, anti-litter signs had the overall effect of reducing the litter rate, but this effectiveness increased where the viewer had previous exposure to the sign⁴. Interestingly, in this particular experiment, they found that prohibitive signs worked just as well as co-operative signs (for example *Do the Right Thing*). The same study also demonstrated that there is some substance to the belief that a clean environment is less likely to be littered than a previously littered one. So clean-ups and beautification do have a part to play in litter reduction.

In another experiment, Geller looked into how bin design might influence littering rates⁵. He concluded that prominent bin design could lead to greater use of that bin, and a reduction in misplaced waste. In this study, he used a bin that had the word *Push* painted on the flap of the bin, and when it was pushed, the word

3 See *Prompts and Posted Feedback: In Search of an Effective Method of Litter Control* — Dixon, Knott, Rowsell, Sheldon and Moore, Behaviour Change, Vol 9, No 1, 1992, pp2-7

4 *Littering as a Function of Prior Litter and the Presence of Absence of Prohibitive Signs* — Reiter & Samuel, Journal of Applied Social Psychology, 1980, 10 pp 45-55

5 *Waste Receptacle Designs as Interventions for Litter Control*, Geller, Brasted & Mann, Environmental Systems, Vol 9 (2), 1979-80, Baywood Publishing Co

Thanks rose from the top of the bin. O'Neill endorsed this view and found that an experimental bin he used at football games that tipped a hat to anyone using the bin recovered up to three times more rubbish⁶. (At our own racetracks and football games, might I suggest you paint the letters TAB, or BAR on the bin to encourage use.) There is a bit of a trade-off here however, as prominent can often mean obtrusive, and the trend in bin design in NSW has been towards unobtrusive and appealing designs. There may have to be some consideration of place and circumstance, but nevertheless, street bin design deserves serious consideration, and it is another area in which councils can influence littering rates.

While I'm dwelling within the psychology area, I might also point out not only is it perilous to characterise the average *litterer*, but that very few behavioural studies have been undertaken which give us a picture of your everyday litterer. In one study in 1971, Heberlein handed pamphlets to 7,000 persons walking down a street in Wisconsin, and of the 58 people who were observed to litter, more were males than females, more were younger than older, and more were single than married. However, other studies have contradicted the sex bias, with women and men littering at approximately equal rates, with men simply admitting more often to littering. What is affirmed in most studies, is that younger people are more likely to litter. In NSW, I wonder whether this would be true given that it is the more recent generations that have been exposed to the *Do the Right Thing* campaign.

Point-of-sale promotion is an area we should exploit more. It doesn't take much to put up a poster and in our experience, shopkeepers and business managers are only too happy to assist with litter reduction initiatives. Some councils have asked their health inspectors to distribute these materials during their rounds, or have co-ordinated community groups to distribute them in their local areas. Council officers usually have a very good idea of where most of the litter is first purchased, and it is not unreasonable to approach these places and encourage their greater participation in litter reduction programs. Managers and shopkeepers are generally very sensitive about their products and packaging on the ground, and are delighted to assist in attempts to reduce it. Incidentally, we have developed a *roadside litter buster* symbol which we would like to see more widely applied and recognised throughout NSW. There will be one with your seminar papers.

I note that the program also says that I am to discuss the *effectiveness of community participation*. Let me say this — community participation is effective. We invited hundreds of people to our roadside litter forums, and they represented a diverse range of organisations and interests. Some suggested it could be a recipe for mayhem, but on the contrary, we ended up with an ex-

citing smorgasbord of ideas that ensured that each seminar was a dynamic exchange of information, and not just *some suit* preaching to a passive audience. Until the forums, I was largely unaware that grain and cotton blow-off were significant litter problems in some areas. I was unaware that many communities felt very strongly about the eyesores that some works depots constitute. I was educated quite comprehensively on the ins and outs of truck tyre blowouts, and we discovered some aspects to the on-the-spot legislation that we had never considered. We were quite unprepared, if you will excuse the pun, for the deluge of hostility felt towards dirty nappies littered by our roadsides.

The important thing about community participation is that the commitment to it must be there throughout the entire process. Trying to rewrite agenda or outcomes after there has been community participation will not be successful. Remember also that participation is different from consultation. Participation is more active. For example, some of the outcomes were not necessarily what we might have decided in terms of establishing community programs. However, the sense of ownership of those ideas is a valuable asset when trying to motivate local organisations and more valuable than any benefits that we perceived in our own ideas of how the initiatives should be handled. Communities may make mistakes, but having a real and respected input is motivating, and it can provide valuable support to councils in their operations to reduce littering.

As soon as we walked into the room at the forums, bearing great advice, a free lunch and some money, we were asked at the first break what the real agenda was. Despite our protestations that all the cards were on the table, not all were convinced. The trick here is to act quickly on your promises: we promised an accurate report on each forum to each participant — with all the *sticky bits* included — within two weeks of the event. We undertook to forward materials where requested — this was done immediately on our return to the office. We acted on complaints quickly, and we especially acknowledged outstanding contributions to the forums. These short-term responses alleviated much of the cynicism that unfortunately sometimes surrounds government initiatives. I am confident that we will be able to say at the end of this year that we also met our longer-term commitments.

These commitments however were never one-way — we were getting something as well. One of the rules of our roadside litter community programs is that we will never go where we are not supported, we will never go where we are not wanted, and we will never go where we think broad community backing does not exist. Community participation in any of these circumstances is a farce, and the success of those programs

6 *The Use of Stimulus Control over Littering in a Natural Setting* — O'Neill, Blanck & Joyner, *Journal of Applied Behaviour Analysis*, 1980, Number 2, pp 379–81

will depend on a constant stream of money, rather than the much more efficient co-operation of communities.

And who is the community anyway? For our litter forums we invited small business, the girl guides, the scouts, church groups, the Country Women's Associations, the local council, the Department of Agriculture, the RTA, the Keep Australia Beautiful Council, the Tourism Commission, the Western Lands Commission, green groups, the police, Healthy Cities groups, shop proprietors, school children, wildlife groups, regional EPA staff, politicians, industry organisations, chambers of commerce, and interested citizens. As I said earlier, it looks like mayhem on paper, but in practice, it works very well and it is very gratifying to watch new networks develop.

In finishing I am very pleased to see many councils, particularly in the country, embracing a creative approach to litter reduction programs. A spirit of innovation is required in this area, and we have been careful not to impose standard operating procedures or programs. All waste management plans must be different to take into account the unique characteristics of geography, consumer patterns and population. Likewise, what works in Ku-ring-gai to reduce litter will not necessarily work in Wilcannia.

I would reiterate that there is an important role for litter reduction in any waste management plan, and that now, more than ever, litter reduction is an environmental imperative. The nature of the problem, its dispersion over a large area, and its incidental character, require either a lot of money to address, or co-ordinated community participation. I believe the latter option is more efficient, more realistic, and more effective.

The Earth Works Program

Robyn Tucker

Environment Protection Officer, EPA

The opinions expressed in this paper are those of the author, not necessarily those of the EPA.

Overview

Earth Works is a program designed and developed by the Environment Protection Authority NSW (EPA) to encourage waste reduction, including recycling and home composting.

Throughout 1993, the Pilot Project will trial *Earth Works*.

The Program has been established to address the need within local governments and the community for education and practical training in waste reduction and composting.

Earth Works is based on the Seattle Master Composter Program, which has been successfully running for five years. The development of the *Earth Works* program has been modified to suit the Australian people and environment.

It is essentially a *train-the-trainer* program where members of the community are thoroughly trained, by subject specialists to become *Earth Works trainers* with knowledge of, skills in and positive values about waste reduction, including recycling and composting. The trainers then work within their community, educating friends, neighbours and co-workers about waste reduction, recycling, and home composting. These Program trainers train others to bring about behavioural change in their homes and workplaces which will reduce the amount of waste currently disposed and encourage a healthy environment.

The strength of such a program is that members of the community interact with their peers within their homes, workplaces, schools and neighbourhoods *teaching* and initiating change.

Successful reduction in waste quantities is not guaranteed with the provision of recycling collection services alone. However, in conjunction with a program requiring people to rethink their attitudes towards waste and to make changes in their daily lives, this goal will be met. *Earth Works* recognises that informal, person-to-person contact reaches people where other public relations campaigns may not. The trainers, with the practical experience they have gained and the changes they have made to their own lives are powerful examples for others to follow.

Environmental education is at the forefront of educational policy and this model of education could be of tremendous value in many areas of education. This participatory approach to environmental education reflects and progresses research and development both here and overseas

Aims

The aims of the program are to:

- increase community *knowledge* of what waste is, how it is produced, where it goes
- increase household *skills* in waste reduction, recycling and composting
- promote new *values* and facilitate behavioural change to decrease the amount of waste, promote a healthy environment and support a sustainable culture.

Earth Works contributes to achieving the target established by ANZECC to reduce waste to landfill by 50% by the year 2000.

About 50% of the domestic waste stream is compostable material — garden waste and food scraps. Another 35% of household waste is recyclable. This combined proportion of the domestic waste stream is what *Earth Works* is targeting.

Earth Works supports the efforts of other government agencies, and the aspirations of the NSW community to reduce total impact of human activities on the environment and to conserve resources. *Earth Works* responds to council initiatives to improve waste minimisation performance and to maximise the efficiency of existing recycling schemes.

There is a pronounced upswing in community interest in undertaking environment protection and waste minimisation activities at the household level. *Earth Works* is timely in respect to the significantly increasing environmental awareness within the community. Many people are motivated to act as they see the need to do something but are often unsure of the what, the where and the how. *Earth Works* provides an opportunity for community members to translate their interest in environment protection and their environmental commitment into practical activity.

Earth Works Training

Each *Earth Works* Training Program involves:

- one or two introductory evenings to locally promote the program and to enlist the support of volunteers to complete the program and commit to spending some of their own time taking the waste reduction and composting message out to others in their community
- five evening theory sessions on waste reduction, composting, communication and *outreach* planning
- a practical composting day and a waste field-trip
- one or two informal gatherings of *Earth Works* trainers following completion of the Training Course to support them in their *outreach*, plan and discuss activities.

The EPA and supporting councils provide 25 hours of face-to-face training to *Earth Works* trainers in exchange for 40 hours of outreach activity.

This training is carried out with audio-visual and written resources developed for the program. There are many small group activities to foster a team-work approach to finding solutions and planning outreach activities.

Earth Works Outreach

This is where volunteers really make a difference by moving out into their community with their environmental messages and action plans.

The *Earth Works* trainers, with the practical experience they have gained and the changes they have made to their own lives, are powerful examples for others to follow.

After 25 hours of training, the Trainers spend time in their community passing on the waste reduction and composting message. Outreach activities result in behavioural change within the community and may encompass:

- setting up and maintaining waste reduction, recycling and composting projects with community groups and schools
- presenting videos to and leading discussions with friends, co-workers and neighbours
- guiding tours of demonstration sites
- holding waste reduction, recycling and composting workshops and demonstrations for neighbourhood groups, school children etc
- staffing portable displays at community events
- attending school and community fairs and fetes
- highlighting the benefits of composting through the media

As part of a growing and expanding network of people, Trainers reach out into their community in a self-determined but structured outreach program. Each Trainer agrees to complete 40 hours of outreach activity after graduating from the training program. These 40 hours can be lots of fun and are supported by the growing network of committed people.

Pilot Progress

The Pilot is proving to be very successful and exciting work is being done by the *Earth Works* Trainers in their outreach activities.

The Pilot Project of the *Earth Works* program began in February 1993 and will continue for one full year. It is hoped that the *Earth Works* program will be on-going and formally launched in the first half of 1994.

As expected, refinements to the educational model and to the course content were made as a result of the experience gained from the first training course. Since then a rigorous program has been established.

Earth Works Training Programs have been held with the support of Canterbury, Wingecarribee and Manly Councils. To date, 82 *Earth Works* Trainers have graduated from the Training Component of the *Earth Works* program and several of the Trainers have completed at least 40 hours of outreach.

There are plans for the latter half of 1993 to work with Lismore, North Sydney, Camden and the St George Councils.

Evaluation of all parts of the Pilot Project is an essential and integral part of the overall *Earth Works* program in order to determine the success of the Pilot Project and to guide further developments.

Independent evaluation will consist of a benchmark survey to determine people's attitudes towards and behaviours in waste reduction, including recycling and composting, and questionnaires are being given to trainers before and after participation in the training component of the program and after their outreach activities. The results of the benchmark survey and questionnaire components of the evaluation will be presented by November 1993. On-going evaluation by the EPA will assess training sessions. Trainers are requested to carry out self-evaluation of their outreach and these activities will also be independently evaluated using focus group meetings later in the Pilot year.

Outreach activities have proved to be even more varied and much more creative than first realised. Every group of *Earth Works* trainers has had its own strengths and passions. This proves that innovation can be one of the hallmarks of the *train-the-trainer* approach. Strong linkages are developed between people participating in the *Earth Works* program and some of the preliminary outcomes are listed:

- Canterbury *Earth Works* trainers are working with the Adult Migrant Education Service; a group of teachers is preparing a kit for primary schools to learn about and practically implement composting; and many of the local Neighbourhood Watch and gardening groups have benefited from presentations and practical demonstrations from other Canterbury trainers.
- Wingecarribee *Earth Works* trainers are holding monthly stalls at the local Robertson and Bundanoon Markets; a working system demonstrating waste reduction and composting on a commercial basis has been set up at one of the local guest houses; others in the group are trialling a system of community-based composting; and some of the Trainers are incorporating an emphasis on composting in the permaculture courses they run.
- Manly *Earth Works* trainers are holding demonstrations at Balgowlah every weekend in July and August; and *party-plan* waste reduction and composting sessions are held

The level of dedication and enthusiasm shown by all Trainers is exceptional and shows on a very real level the variety of approaches available for social and environmental change.

Waising Worms Is Wonderful

Maria Callinan

Recycling Education Officer, Lake Macquarie City Council

The Project

The Worm Farm Project was devised as a natural development of the household composting program in Lake Macquarie. The original program began on World Environment Day 1991, and this year World Environment Day highlighted a renewal of the original program and the initiation of a new aspect — composting and waste minimisation involving work farms.

Rationale

One of the easiest, cost-effective commodities to recycle from the household waste stream is organic matter suitable for composting. Lake Macquarie has a successful program underway to promote household composting and is now contemplating going one step further and providing assistance with worm farms suitable for the home environment. In addition, investigations concerning the feasibility of the establishment of large scale vermiculture operations are currently in progress.

Soils in the City vary according to the underlying geology and/or development that has occurred. In general, away from the alluvial deposits, they are of poor quality for domestic gardens, especially where clays are close to the surface. Council, therefore, sees this project as a viable extension of the composting program.

Aims

The aims of this project are to:

- promote vermiculture in Lake Macquarie
- provide all residents with an easy method of
 - propagating worms to handle break down of wastes such as vegetable scraps
 - reducing rich organic material for use as food for potted plants or garden
 - practising composting in situations where a bin is unsuitable

For the purposes of the trial, the target audience, which will widen as the program progresses, is a selection of local schools in Lake Macquarie City. It is expected that the influence will spread from the schools to the local community. Council has also investigated the feasibility of purchasing commercial worm farms for resale to residents as in the case of the current compost bin program. Pamphlets indicating how *home-made* worm farms can be constructed and maintained have also been prepared.

Background to the Project

The project was originally devised in 1992 as a means of furthering environmental education in Lake Macquarie schools. This had the added advantage of developing closer community links, which would then enable the concept of vermiculture to gradually spread to the wider community.

Earthworms are among the most beneficial organisms known. Until recently, vermiculture has not been widely practised because a convenient apparatus for home use has not been readily available.

Some schools and residents had already developed *backyard* worm farms to assist them in their composting efforts. In an attempt to make the prospect more attractive, Council is trialling two commercial worm farm concepts, in addition to the more simple approach as developed by Cooranbong Community School (see diagram).

The worm farm has several advantages; it can provide school students with a variety of learning experiences as well as generating material suitable for the school gardens. Another advantage of the worm farm lies in its ability to break down material in places where people are unable to compost due to lack of space or facilities.

Funds to conduct a trial in 1992 were not available and the only available equipment was basic. Further contact with Boyd Lancashire of WORMS. (NSW) confirmed that his proposed vermiculture kit had been developed for sale. Reln Plastics also produced a prototype worm factory, which meant that a variety of equipment for conducting a suitable trial had become available by early 1993.

In order to ascertain the value of each of the commercial packages in relation to effectiveness, price and ease of use and distribution, Council has purchased sufficient numbers to be placed in selected schools and residences throughout the city. Depending on the results of this trial, Council will purchase larger quantities for resale to residents at cost, as has been done with compost bins. This is scheduled to coincide with *Hunter Environfest* in September.

Description of the Project

Commercial products, such as the Reln Worm Factory and the Worm Composting Kit from WORMS. have been included in the trial. In addition to these, instructions for a *do-it-yourself* style worm farm have been pro-

vided so that it can be compared with the commercial products.

Each year the City's Southern Cluster of schools holds a *Green Day* in conjunction with Council's *Environfest*, and this year the group held an environmental in-service day for teachers to assist with practical ways of extending the requirements of the *Environmental Education Statement* in and beyond the classroom. Worm farming was a major topic on the agenda, and the schools agreed to become part of the trial project as part of an extension of their environmental education program. Council provided a Reln Worm Factory kit to assist these schools and those from other zones who wished to participate.

A simple evaluation sheet was developed for registering progress and providing feedback as to the:

- ease of operation
- degree of success
- problems encountered with the equipment
- estimated rate of production of the worms
- marketability of worms as both a fund raiser and awareness raiser

Schools will be encouraged to develop more extensive reports as part of their *integrated education* approach to the program. This should provide valuable data for Council, while increasing the students' knowledge of vermiculture, scientific method and practical experiment.

Other schools have been advised of the trial and expressions of interest have been requested which will indicate the level of commitment of a particular school to participation in the project. Other worm farm designs will be used for this stage of the project. Data for the construction of the larger do-it-yourself kits will also be provided. A small number of non-school sites have also been chosen.

This year the Schools' competition held in association with Council's annual *Hunter Environfest* includes an earthworm research project. Schools have also been encouraged to submit their research for the national *Earthworm Environmental Awards* for science.

Supporting Documentation

A pamphlet outlining *How to Make Your Own Worm Farm* has been developed so that a do-it-yourself style worm farm based on various successful methods can be compared with the commercial products.

A general information brochure has been prepared to supplement the instructions accompanying the kits. Should the initial trial prove to be successful, this brochure advocating the use of worm farms will be widely circulated throughout the community, and extensive use made of the support provided by the local media for Council's efforts to promote any form of waste minimisation and recycling. A variety of other

promotional techniques will be employed to keep the project before the community.

Implementation of the Project

The trial period was expected to be eight to twelve weeks from the establishment of the farm. This is the average time it takes for worms to double their population under suitable conditions. It also approximates the school term, which is usually ten weeks in duration, so that most of the work can be carried out with little interruption.

Evaluation and Measurement of Results

The nature of this project is such that several simple indications can be used to identify its success in regard to a longer-term venture. The key to the project, especially with schools, will be its simplicity, low maintenance, productivity and application to the curriculum. The results from the evaluation sheet should reflect these needs.

The final results will be collated and tabled to provide an overview. From experience, it is expected that the do-it-yourself farms will continue to be successful. The previously untried commercial kits may require closer scrutiny before Council could promote these or others on a large scale. However, should they eventually prove satisfactory, it is the intention of Council to provide this equipment at virtually cost price so as to encourage community participation.

Regular monitoring of the sites after the trial period ends will be made to ensure a continued successful future of this venture in the light of the nature of the program.

The increased awareness among the community of the issues involved, should indicate that this approach taken by Council to promote waste minimisation and recycling will also prove a successful addition to the existing program or a suitable alternative for those unable to participate in other composting programs.

Resources Required for the Project

The following materials have been included in the project:

- Reln Worm Factories @ \$33 each (plus 10% sales tax = \$36.30 each if sold)
- Worm Composting Kits from WORMS
- the possible provision of starter kits, including worms
- material to assist in evaluation of project

Personnel required for this project include:

- teachers, students and parents from selected schools
- selected residents and/or groups

- Council personnel: eg. purchasing department, store, Recycling Education Officer

Capital and Operating Cost

The estimated costs for the establishment of the initial trial project with 24 worm farms was \$1,250. However, there are over 90 schools in the City, and Council has endeavoured to provide each participating school with the equipment, or has subsidised the materials so as to assist in the ongoing education program. This required a further amount of about \$3,000.

Depending on the outcome of the research, Council would expect to make an initial outlay of \$5,000 for the purchase of the equipment for re-sale to residents. As in previous schemes of this nature, the materials would be sold at virtually cost-price so as to encourage residents to participate in the program. The funds regained through resale enable further purchase of the equipment as required.

Council will continue to promote the use of the successful equipment as part of an integrated approach to recycling in the city through *Hunter Environfest*, media advertising and promotion, schools and community groups, displays and demonstrations.

Interim Results

Initial feedback indicates that although there are many positive aspects of the unit, there may be some unexpected problems associated with using the Reln Worm Factory for the first time. Castings, which are produced by the worms, can be retained more readily by using a sheet of newspaper in the lowest working tray before setting up the farm. This does not always allow moisture to drip through to the base tray and the paper becomes soggy. The worms eat through the paper and they can fall through to the liquid in the base tray.

At times the worms do not *know* that they are supposed to migrate upwards through the feed to the next tray, which means they can be trapped in the lower tray with diminishing food supply. The base tray can be drained quite easily through the tap, but the unit has to be tilted to remove all the liquid. With a little practice and monitoring, the system works quite well.

It takes time for the worms to adapt to new food. At this stage they do not seem to be capable of consuming what would be the normal household rate of disposal of vegetable scraps in a unit this size. A compromise where the worms feed on half-matured compost, while organic wastes are placed in a compost bin or heap, appears to produce good compost.

Maintaining the correct moisture level takes practice both in the Worm Factory and in the case of some of the do-it-yourself farms, where the immediate danger lies in the pits drying out. Some schools have altered their designs to make more suitable pits for easier

maintenance and worm comfort. Other units, such as that developed by WORMS. (NSW) are yet to be trialled.

Should Council decide to market worm farms, the methods of distribution to the public have to be determined. It is likely that the farms would be marketed without worms or starter material. Information concerning the availability of these commodities would then be provided.

Conclusion

Lake Macquarie City Council has had to rely on a variety of interim solutions to the overall waste minimisation problem. The Worm Farm Project is another form of recycling that will not only assist in the reduction of organic waste going to landfill, but will also provide a beneficial addition to the local environment. The initial trial will hopefully confirm this. It also will enable Council to continue to participate in a pro-active manner in the schools' environmental program.

This waste management and minimisation campaign is:

- innovative
- cost effective — once established it should fund itself
- is compatible with the existing integrated recycling program — especially composting
- is expected to have considerable beneficial impact on the initial target group
- is able to be measured, albeit somewhat subjectively
- is able to provide a firmer infrastructure for more effective recycling

Thus, in the long term, the community will be able to make a positive contribution to the overall welfare of the City.

Other Programs

Since undertaking the development of its own vermiculture project, Lake Macquarie City Council has become aware of many others who have established a variety of programs. These include Bankstown City Council, which has agreed to the use of the Reln Worm Factory for sale to residents as well as advocating its use in schools. Kiama Council has also recommended that residents use the Worm Factory to recycle organic wastes from the household.

There are commercial worm farms available from which Councils can seek assistance for any vermiculture project undertaken. It is best to use local producers as the worms are more likely to be suited for the area in question. Advice concerning a national net-

work of farmers is also included in the *ReIn Worm Factory* booklet.

In the Hunter and Central Coast regions there are several commercial worm farms. These include Eranridge Worm Farm at Wingen, and the Central Coast Worm Farm at Kincumber. Both have been pro-active in their support for Councils to be involved in the use of the earthworm in recycling organic wastes. At this year's Agricultural Field Days at Tocal, demonstration lectures were given on earthworms for farm and household use.

Tallaganda Shire Council

The aim of the Tallaganda Shire Council (Braidwood) project is to establish the viability of worm farming and recycling at any landfill site. A twelve-month trial commenced in October 1992 in which an older composting process is used in an effort to reduce the organic fraction of the waste stream through feeding the material to earthworms.

Currently in this larger-scale vermiculture program, several tonnes of garbage are devoured monthly by earthworms in large pits. The resulting castings, which are valuable as a potting mix, soil conditioner or fertiliser, can be bagged and sold at profit as well as contributing to the non-chemical fertilising of local properties. The castings can help regenerate the worm population in the soil and increase its fertility.

Initially in the Braidwood trial, two beds — each of six cubic metres, were constructed from old bridge timbers, filled with a feeding mixture of sewage sludge and sheep manure which were readily available and produced rapid results. More recently a mixture of newspaper, cardboard, sludge and grass clippings has been trialled.

Large volumes of worms are required for the processing of bulk materials and approximately two tonnes of tiger and red worms were placed in the mixture. Each bed processes about 4 tonnes of organic waste down to 2.5 tonnes of casting in approximately eight weeks. The resulting fertiliser or soil conditioner is sold to farmers and gardeners in the local area. By including processing of organics in the recycling program, Tallaganda has been able to more comprehensively handle the waste stream at the tip.

Although Braidwood has a comparatively small population of 1,200, Mr Rod Diacono who has developed the project with a worm farmer and the local recycler, believes that the idea can be implemented in places with larger populations so as to reduce the waste going to landfill, to provide an environmentally safe fertiliser and to secure an income to maintain the recycling program. Tallaganda Shire has demonstrated that the establishment of recycling in conjunction with worm farming at a Council landfill site will have the following results:

- reduction in landfill
- improved water quality
- reduced leachate levels
- reduction in chemical fertiliser use
- reduction in chemical fertiliser imports.

Tallaganda has dramatically reduced its waste going to landfill and is currently extracting 50% of its household waste stream as recyclables. The worm farming program is expected to increase this level to 75%. This value adding process treats waste as a raw material that can be converted to a valuable product.

Large volumes of worms require expert management. Care needs to be taken to avoid the development of anaerobic conditions; to process the material so that castings are produced quickly; to avoid poisoning the worms by toxic material; to maintain optimum temperature conditions.

The worm farmer and recycler operate under the same name — *Knot Waste* and are available as consultants.

Logan City Council

In Queensland, Logan City Council has also developed a program involving worm farming on a large scale in conjunction with the Landsborough Worm Farm. About twelve million worms are involved in the research program being undertaken there. The project includes several experiments using a control and a variety of other mixtures, and is carefully monitored by a resident scientist. It should be remembered that worms are livestock, and as such, are subject to a variety of influences including weather, which can affect the rate of breeding.

Councillor Dawson (Logan City) believes that the program, which involves the use of sewage sludge, mulched green waste, newsprint and cardboard will help solve major waste disposal problems in the City. Sufficient land space and time is required for such large scale projects but the benefits from reducing waste to useful, recyclable and saleable products can be rewarding. Markets for the resulting compost include market gardeners and turf farmers. All schools are being supplied with Worm Factories as they seem to work better than compost bins. An information and audio-visual package will be available later in the year outlining the project.

Large Scale Management: One Example

Mr Tom Williams of Waste Organics Recycling Management Systems has been working with several Councils in eastern Australia, including Melbourne, Fairfield (NSW), Logan (Qld) and Townsville (Qld), to reduce large amounts of organic wastes through the use of earthworms. The aim of this system is to provide the full number of worms from the beginning, which eliminates the need for Councils to become *worm farmers* and they can concentrate on the business

- creation of local employment

of waste management. Ultimately, the mixture employed will include putrescible waste, newsprint, cardboard, lawn clipping and mulched green waste.

Included in the initial outlay, which varies according to the size of the operation, is access to a national castings marketing agent who will mix and bag the batch for sale, and an on-site manager to monitor the progress of the project and separate the worms from the castings. A guaranteed minimum price is given for the product in the first twelve months of operation. Overall returns are shared between the Council and the operators. It is expected that returns will be sufficient to cover the costs of the initial outlay within a feasible period of time.

Acknowledgments

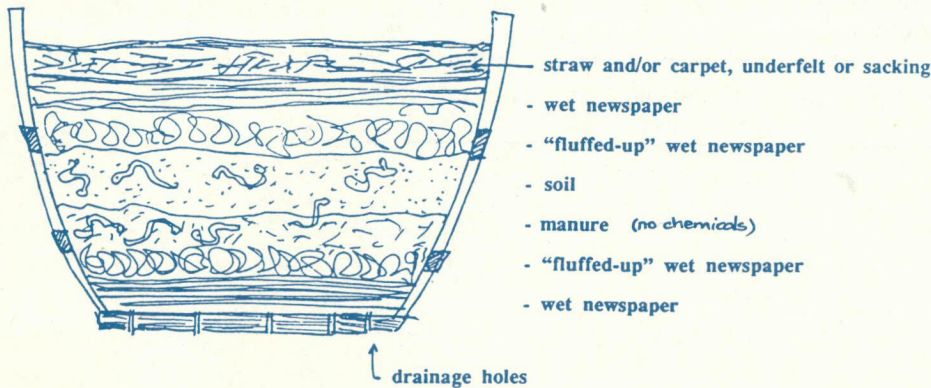
- Cooranbong Community School/Peter Rutherford. (049 77 1122)
- N & E Young, Eranridge Worm Farm, Wingen NSW. (065 450 300)
- Mr K Hoy: Segenhoe Field Study and Environmental Education Centre (065 451 666)

- Mr S McLachlan: ReIn Plastics — The Worm Factory (02 603 5266)
- Mr R. Diacono: Tallaganda Shire Council (048 422 225)
- Knot Waste: P.O. Box 166, Braidwood. NSW. 2622
- Newsletter: South East Region Recycling Group. Vol, 2 No 1. Canberra. 1993
- Mr G Gillespie: South East Region Recycling Group (06 207 5335)
- B & J Lewis: Landsborough Worm Farm Qld. (074 941 512)
- Ald E Dawson: Logan City Council (07 209 0209)
- Mr T Williams: WORMS Heathcote Vic (018 107 297)
- G & H Reddie: Central Coast Worm Farm, Kincumber NSW (043 683 380)
- Mr K Howard: Bankstown City Council (02 707 9400)
- Mr B Lancashire: WORMS Forbes and Sydney (068 593 514 or 02 360 7755)
- Earthworms for Gardeners and Fishermen* CSIRO Division of Soils: Soils Series (Reprint 1992)
- The Tallaganda Worm Farm Trial* NBN 3 News Report: May 1993

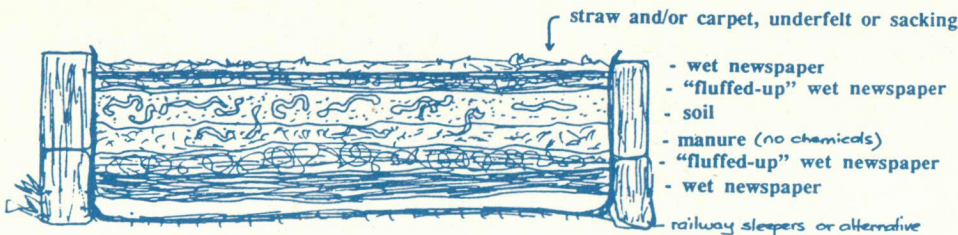
“Do-It-Yourself” Worm Farms

based on ideas courtesy of

Cooranbong Community School and Peter Rutherford



Feed the worms with lettuce and other vegetable scraps.



- plastic liner with drainage holes - (liner not essential)

Lake Macquarie City Council Worm Farm Project	
Stage 1	Initial approach to schools seeking interest in participation; Report prepared for Council outlining trial project
Stage 2	Approach other schools seeking interest in participation; Finalise pamphlets, evaluation chart and other print material; Identify non-school sites; Environfest promotional materials
Stage 3	Purchase equipment required and distribute Participate in inservice workshop Provide initial instruction Media promotion
Stage 4	Regular follow up visits and/or visit on request Check progress reports Media promotion
Stage 5	Evaluation - to be based on breeding results; reports from sites; suitability as a recycling program; recommendations from teachers as to effectiveness as school project; Media promotion
Stage 6	Recommendation to Council as to further development of the project. If results positive, then arrange for extension of program to all schools and wider community. Media promotion
Stage 7	Development of large scale vermiculture program for the City