Department of
Environment and Conservation

RESOURCE RECOVERY MODELS

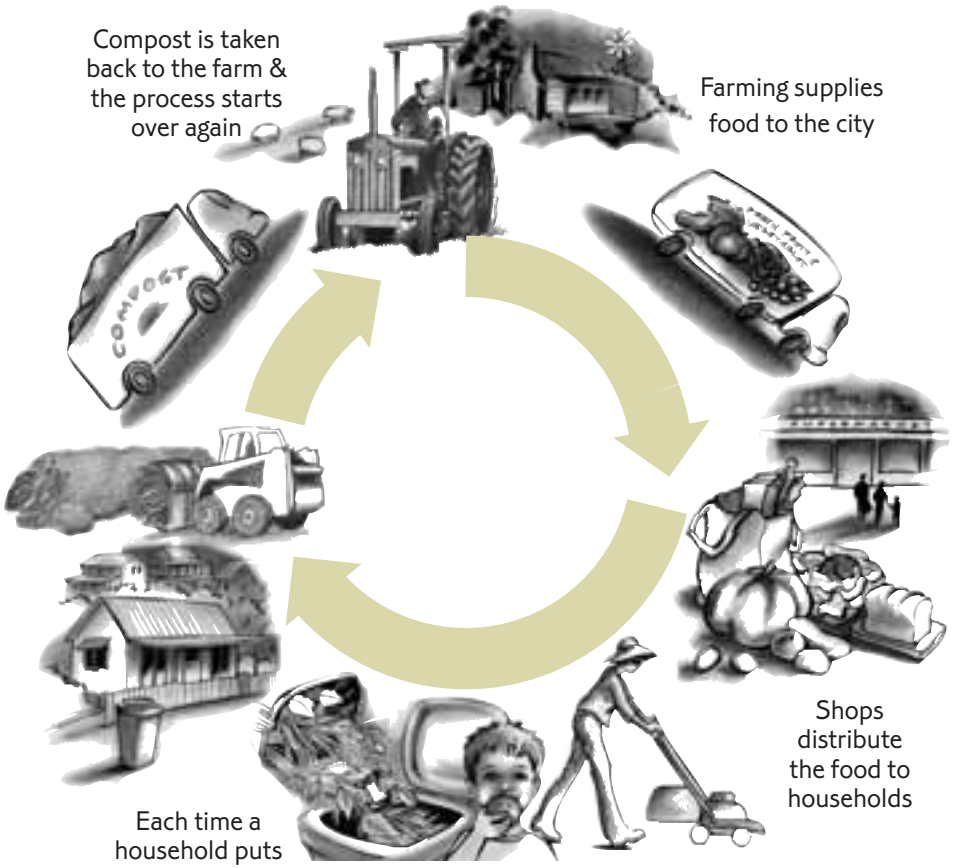
Development of markets for household collected organics

Queanbeyan

PROJECT REPORT

July 2004

the value cycle



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1 executive summary

A composting program from the collection of “green waste” or garden organic waste from households in Queanbeyan has been in operation since early 2000. The collected material is processed into compost. The practice reduces the payment of landfill fees, and contributes to the local economy by providing jobs in the community.

A research project was designed and undertaken in 2003 and 2004 on a property called “Mooncoin” to demonstrate that the marketability of compost products can be improved by sourcing garden organic waste of higher quality. The project aimed to identify potential benefits associated with on-farm application of compost. Dr Sara Beavis, Research Fellow at the Australian National University, designed a trial on a vineyard to evaluate the benefits of soil organic matter, moisture holding capacity, stability, soil biodiversity, soil biomass and net growth of vines.

The project also involved modifying the existing household garden organics collection system. This report deals with that part of the project, which was called “City to Soil”, and which was concerned only with studying and evaluating the benefits of a modified collection system that involved rewarding households that provided clean, uncontaminated garden organic wastes.

The project showed that rewarding householders for uncontaminated green waste could impact positively on behaviour. On-average contamination rates were lower by 40% (by weight) and 64% (by volume) in the trial area.

The project also showed that community awareness and understanding increased from December 2003 (before the trial) to May 2004. However, attitudes to a rewards system for providing clean organic garden waste were mixed. Many thought it would work, but also expressed reservations at the need for a rewards system, as environmental efforts should be motivated on ethical and moral grounds.

The project showed that a reward system to motivate householders to provide clean garden organic wastes can be achieved. However, “City to Soil” was not intended to be a model for the implementation of a large-scale community credit system focussed on value in agriculture, as it was achieved with relatively few resources and a high level of constraint.

Nevertheless, it should be noted that considerable system and social change was achieved at very little cost during the “City to Soil” project. Given an appropriate level of commercial support, such a system could achieve a great deal, both in terms of community participation, and agricultural economic outcomes.

The impact of applying community credits or rewards for resource recovery is an area of little current research. However, “City to Soil” has shown that reward systems can motivate higher levels of clean resource recovery.

2 introduction

The Queanbeyan City Council provides fortnightly collection of green waste from households. The collected material is processed into compost. The practice reduces the payment of landfill fees, and contributes to the local economy by providing jobs in the community.

A study in Queanbeyan in 2001 found that this composting program had a net economic benefit to the community of $35 to $46 per tonne (Appendix A). In recent years, this service has resulted in savings to the local Council through the reduced need for topsoil and fertilizer inputs and water for the city's parks and gardens. The composted products that the Council does not require are available for sale to the market.

A research project was designed and undertaken on a property called "Mooncoin" to demonstrate that the marketability of compost products can be improved by sourcing garden organic waste of higher quality. The project, which was carried out in 2003 and 2004 was developed to identify potential benefits associated with the on-farm application of compost.

Dr Sara Beavis, Research Fellow at the Australian National University, designed a trial on a vineyard to evaluate the benefits of soil organic matter, moisture holding capacity, stability, soil biodiversity, soil biomass and net growth of vines. Various applications of council compost and other treatments were used on vines to investigate changes in soil property and plant response.

A separate scientific report on the entire “Mooncoin” project has been prepared by Dr Sara Beavis (see Appendix B). The improved conditions created through the use of compost and the increased yield was given a dollar value (See Appendix J).

The project also involved modifying the existing household garden organics collection system. This report deals with that part of the project, which was called “City to Soil”, and which was concerned only with studying and evaluating the benefits of a modified collection system that involved a system of reward for householders who provided clean, uncontaminated garden organic wastes.

3 conceptual challenges

The "Mooncoin" project was developed around a broader notion of sustainability represented by the value of composted materials in social, environmental and economic terms. It was designed to conceptualise the benefits of a closed loop system where the value in one part of the system is transacted to assist in improving product quality and increasing the value in another part. [1] The project illustrates how the inherent value of garden organic wastes generated by households can be transferred to tangible financial and environmental benefits from the use of quality-composted product in agriculture.

3.1 Environmental aspects

Organic waste is unique in its potential benefits to soils because of its organic carbon content (Ringrose-Voase, 1997). Life cycle inventory studies of compost illustrate the potentially high value of compost (ROU, 2003). A substantial degree of the fertility value of a composted product is associated with high microbial activity (Vadakattu, 2002). However, garden organics wastes are also associated with substantial community cost and environmental liability when treated as a waste.

Appreciating the benefits of garden organics can be complex, as they must be considered from a broader sustainability perspective. It requires taking a perspective not normally associated with waste management, thus in many ways the appreciation of these values transgresses established traditional practices and systems. Often the value of organic material is perceived only in terms of savings of landfill space and costs. In the "Mooncoin" project, the benefits of using high quality products to improve soil conditions and yields and to conserve water were evaluated through a small on-farm study.

[1] In October 2003 the recycled Organics Unit (ROU) of the University of New South Wales and the DEC released a document ("Life Cycle Inventory and Life Cycle Assessment of Windrow Composting Systems") detailing the potential benefits of the use of recycled organic products in agriculture. (See www.recycledorganics.com/publications/reports/lca/lca.htm). "Mooncoin" demonstrated similar potential benefits to those listed in the post-application impacts in the document from the ROU.

3.2 The social aspects

The "Who Cares About the Environment" report (NSW DEC, 2003) suggests that the broader community places a high value on the environment. However, technologically focused waste solutions also risk disengagement of the people from the system. A "heavy" technological approach can risk the loss of both environmental and economic potential and benefit, as the community could feel disassociated and disconnected from every-day opportunities to contribute to sustainability in a meaningful way.

A recent report from the Australian Bureau of Statistics (ABS, 2003) indicates that the community is highly motivated to recycle and purchase recycled goods in their everyday lives. The challenge for the "City to Soil" component of the "Mooncoin" project was to engage this community motivation, and build social capital to add to the social bottom line through increased motivation and awareness of the real value of environmentally sustainable practices in a wider context.

3.3 The economic aspects

Compost in agricultural application encounters substantial market barriers. In spite of nutrient application in Australian agriculture entering a stage of diminishing returns (Environment Australia, 2004) and causing soil degradation (NSW SoE, 2003), coupled with fears of heavy metals accumulation in soils (Ryle, 2002), the use of artificial fertilisers continues to receive across the board support. It is noteworthy that $4 billion worth of fertilisers were sold at the farm gate in Australia in 1998 (CSIRO 2001).

The "Mooncoin" project compared the true cost of landfill in the region where the project was conducted to the cost of manufacturing and transporting compost. Queanbeyan disposes of its wastes in Canberra's landfill. A review of Canberra landfill costs recently stated the true cost to landfill as $65 per tonne. However a local compost manufacturer could process compost to Australian Standards AS 4454 and transport it 200 km in any direction for about $50 including profit.

This means that it is cheaper in economic terms, to make and transport compost to the regional farm gate than it is to put it into landfill. The amount per tonne that the farmer then pays for the product is the value, which is returned to the community to pay for any system that rewards households and the community to provide a clean supply of organic garden wastes for the composting process.

The challenge for the “City to Soil” part of the “Mooncoin” project was to demonstrate that the concept of “tangible rewards” as a market instrument, which is already applied in areas as diverse as frequent flyer points and carbon credit trading, could be extended to creating higher awareness among households of the value and benefits of high quality compost products to agriculture. As will be seen later in this report, “City to Soil” demonstrates that a systems approach to environmental sustainability through resource recovery is feasible, by introducing the notion of “value” at the householder level, which controls the quality of the garden organics that is available for composting.

4 practical challenges

The “City to Soil” project aimed to demonstrate in a simple and low-cost way, how a whole of systems approach can deliver a win-win outcome in rewarding households that provide clean garden organics wastes for composting. However, existing systems of collection and processing are often poorly structured to identify and reward householders and only minimal adaptations could be made to the existing system.

Garden organic material is collected fortnightly, and composted by the local Council. The composting process is a low-tech operation, using windrow composting for processing. Household contamination and fluctuating quantities were significant barriers that needed to be overcome to assist in the broader marketing of the recovered garden organic wastes.

5 project description

5.1 Project design

5.1.1 Selection of trial area:

Having identified the product quality, collection system and Queanbeyan Council's internal review of the composting process, a trial at the property "Mooncoin" was established in March 2003.

It was now time to select a project area for the collection trial. The de-Salis sub-division of Queanbeyan (sometimes referred to as Cook's Estate) was chosen in consultation with the local Council for its socio-economic spread as a suitable trial area for "City to Soil". The area constituted the "Wednesday-A" run for the green waste collection contractor and was identified by Council's waste education officer as an area that sometimes had problems with green waste bin contamination.

5.1.2 Green waste collection and assessment:

A major barrier to agricultural use of compost made from garden organics recovered from households is concerns about contaminants (e.g., glass and plastic). The next step was to plan modifications to the local Council collection system to keep contaminants out of the garden organics waste stream.

Alterations to the collection system were made in consultation with Council and the contractor. The side-loading collection vehicle was replaced with a rear-loading vehicle with one extra operator. In addition to emptying the bin, the second operator would assess green waste bins according to the criteria in Appendix C, and scan conforming bins for entry into a reward lottery. Collections with the rear-loading vehicle started two months before the project to allow for any behavioural change associated with the use of a rear-loading vehicle and to minimise potential for interference with the data.

An important step in the process was to ensure that there was a method to identify green waste bins that were free of contamination. This was done by fixing barcodes to the rear of the bins, below the handle and out of the

weather. The bar code numbers related the bin to the household from a property list provided by Council. To protect privacy, properties were known to staff by bar code and street number only, with no reference to the owner or resident's name or other personal details. The bar coding of the bins was done progressively over one month.

5.1.3 Engaging the community:

Engaging the community commenced after consultation with the Council, in the first instance it took the form of a newsletter delivered to all households (Appendix D) to promote the idea that what we do in urban areas has importance for the wider environment, and it is the wider environment, which sustains urban life. An identity was developed, including a logo and a song.

The value of clean source-separated product was highlighted in all aspects of the campaign from collection to on-farm use. The value of the product was reinforced to households by distributing information in the trial area about the project, and the introduction of direct rewards.

The newsletter drop was followed up by directly engaging with the community over two weekends in December 2003. Staff from DEC and the local Council travelled each street in the trial area and handed out promotional material consisting of an information note delivered in a mini wheelie bin in the same colours as the green waste bin, together with a 50 gram cellophane bag of Council compost identified as such, a promotional seed card from DEC with native bottlebrush seeds, and a brief explanatory note (Appendix E).

The aim was to forge a positive idea that the materials usually thought of as a waste and therefore without value, in actual fact has important value, especially for agriculture, to produce the food and fibre that we need to sustain our urban life.

The reward system was designed as a lottery for households presenting clean green waste bins. The lottery prizes were drawn every two weeks, coinciding with the green waste collection, throughout the trial period, and

two households where randomly chosen by computer from the scanned green waste bin bar codes to receive a $50 hamper each. The hampers consisted of a basket of fresh fruit and vegetables, and products made from these, such as conserves.

Two more newsletters were delivered to keep the community informed about the project's progress in February and May 2004 (Appendices F and G), and a final note was sent in June 2004 thanking the community for their effort and participation.

5.1.4 Project cost:

Budget allocation for "City to Soil" for FY 2003/04 was $50,000. This included cost of survey activities, campaign and marketing activities and operation. Data monitoring and project management was undertaken in-house by the regional office in Queanbeyan of the Sustainability Programs Division of DEC.

5.2 Data gathered during the project

5.2.1 Community attitude survey:

Two short attitude surveys were conducted for the project. One in December 2003, before the trial started, and one in May, a month before the trial was due to terminate. The surveys were designed to collect data about householder attitude and understanding of the issues associated with green waste bin collection. The area has approximately 800 households, and 200 households were surveyed prior to any external project activity. A further 200 households were surveyed towards the end of the trial, in May 2004.

5.2.2 Volumes of material and contamination rates:

The contractor weighed materials collected and DEC staff performed contamination audits after the materials were delivered to Council depot for processing. Contaminating materials were extracted by Council staff and deposited into wheelie bins. Each bin was assessed by weight and volume and the contamination rate for the overall load was calculated.

The contamination rate data was used to measure variations in contamination rates over the trial period. Contamination data before the communications campaign was collected. In addition, contamination data for a similar area of Queanbeyan not subject to the trial but similar in urban composition, was also collected. This area, referred to as the "Tuesday-A" area, was serviced on alternate weeks to the "City to Soil" area.

5.2.3 Bin presentation rates:

On each morning of collection from the trial area, DEC staff counted the number of green waste bins presented for collection. The number of presented bins in each street in the trial area was recorded.

5.2.4 Observation of operators:

One structural element in the system was to monitor the quality of green bin assessment for contamination, which was considered to be very important to the credibility among households of the reward system. It would have been detrimental to the system if a non-complying bin had been scanned and won one of the prizes. The collection operators were consulted on methods for bin assessment, and a simple assessment process was formalised (Appendix C).

Table 1: Contamination audit data from the de-Salis trial area, and comparative audit data from the non-trial area.

Date	Total weight (tons)	Contamination weight (kg)	Contamination rate	Total volume (m3)	Contamination volume (m3)	Contamination rate (volume)
18.09.03	8.26	99.65	1.21%	24.78	1.20	4.84%
07.01.04	7.54	-	-	-	-	-
21.01.04	8.00	57.60	0.72%	24.00	0.56	2.32%
04.02.04	8.58	43.30	0.50%	25.74	0.46	1.79%
18.02.04	8.26	41.50	0.50%	24.78	0.37	1.49%
03.03.04	7.26	31.00	0.43%	21.78	0.24	1.10%
17.03.04	7.26	54.00	0.74%	21.78	0.30	1.38%
31.03.04	7.60	45.80	0.60%	22.80	0.36	1.58%
14.04.04	6.40	44.60	0.70%	19.20	0.30	1.56%
28.04.04	7.48	49.60	0.66%	22.44	0.32	1.41%
12.05.04	5.52	47.60	0.86%	16.56	0.43	2.58%
26.05.04	5.02	29.00	0.58%	15.06	0.22	1.43%
09.06.04	6.16	18.10	0.29%	18.48	0.19	1.04%
23.06.04	3.80	8.60	0.23%	11.40	0.07	0.63%
Non-Trial area (Tuesday A-run)						
06.04.04	6.5	90	1.38%	19.50	0.60	3.08%
20.04.04	7.1	70.1	0.99%	21.30	0.69	3.22%
04.05.04	6.4	82.3	1.29%	19.20	0.49	2.56%
18.05.04	5.52	48.8	0.88%	16.56	0.41	2.46%
01.06.04	5.06	45.5	0.90%	15.18	0.38	2.53%
15.06.04	6.3	62	0.98%	18.90	0.37	1.97%

*Audit preformed pre-trial and “City to Soil” campaign.

6 discussion of project findings

6.1 Major findings

6.1.1 Attitude surveys:

The two surveys sought to establish if the community could be persuaded that their green waste disposal practices are of consequence, and how this might be expressed in attitudinal change during the project. The surveys showed that community awareness and understanding had increased from December 2003 (before the trial) to May 2004. Residents reported that they have indeed changed their practices.

Attitude to the rewards system were mixed. Many thought it would work, but expressed reservations at the need for a rewards system. A possible interpretation is that the concept is somewhat novel and it clashes with the dominant notion that environmental efforts should be motivated on ethical and moral grounds. Further findings of the surveys are reported in detail in Appendices H and I.

6.1.2 Contamination audits:

Audits of contamination were conducted at every collection in the trial area. Further audits for comparative reasons were conducted at an equivalent non-trial area (the “Tuesday A” run).

Figure 1 illustrates the difference in rate of contamination between the trial and the non-trial areas. Please note that the data for 18 September 2003 was obtained before the project and “City to Soil” communication campaign in the de-Salis area.

Average rates of contamination at the end of the trial period were 0.6% by weight and 1.61% by volume for the project area. Average rates of contamination for the non-project area were 1.07% by weight and 2.65% by volume (April to June 2004).

6.1.3 Bin presentation rates:

On the morning of each fortnightly collection, the rate of green bin presentation was noted. The principal impact of presentation rates was on the quality of the garden organics waste presented. Higher frequency of presentation lowers the risk of the material breaking down in the household bin and becoming anaerobic and odorous. This had been identified by Council in previous years as a serious problem, particularly using rear-loading vehicles for collection.

Figure 2 shows the bin presentation rate in the de-Salis area throughout the trial. The diminishing rate is most likely due to seasonal variation and low rainfall. Interviews with operators found no problem with material going anaerobic. They estimated that they were doing more lifts than before the trial, and that more often a bin would be presented for collection even though it only had a small amount of material in it.

6.1.4 Observation of Operators:

It should be noted that in any future contract to expand on the "City to Soil" project, any broadly based community credit system could be of considerable value. It would be in the interests of the contractor, council and community to have in-built contract management processes that ensure a fair and equitable award of credits and rewards.

6.1.5 Seasonal variations:

Due to drought conditions rainfall data was not collected. However, normal seasonal variations are expected to correlate with bin presentation rates and the quantities of collected material.

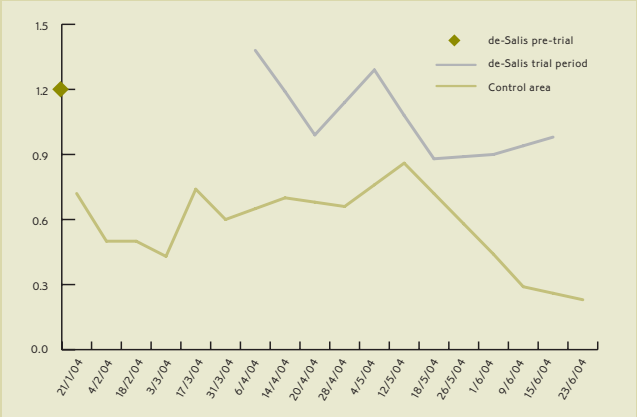


Figure 1: Rate of contamination in household collected green waste from de-Salis (pre-trial and trial period), and from non-trial area (Tuesday A-run).

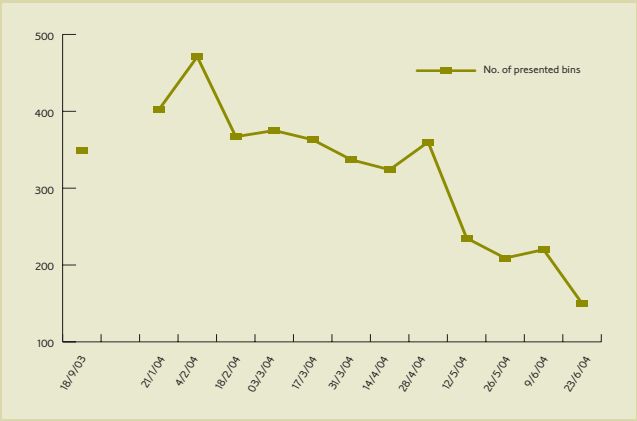


Figure 2: Bin presentation rate in de-Salis, of a total of 706 bar-coded bins.

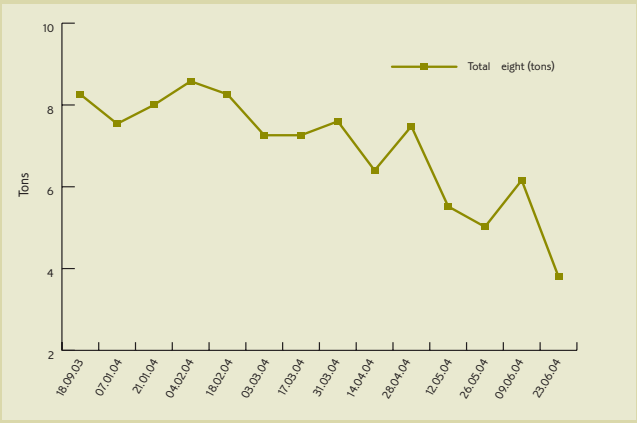


Figure 3: Total weight of materials in de-Salis, non-trial and trial period.

7 conclusions

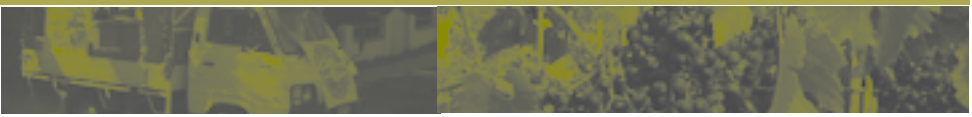
7.1 Application of rewards

Indications from “City to Soil” are that the introduction of rewards for householders for uncontaminated green waste has impacted positively on household behaviour. This is represented by an on-average 40% by weight, 64% by volume, lower contamination rate in the trial area.

7.2 Practical feasibility

A reward system can be achieved. However, “City to Soil” was not intended to be a model for the implementation of a large-scale community credit system focussed on value in agriculture, as it was achieved with relatively few resources and a high level of constraint.

Nevertheless, it should be noted that considerable system and social change was achieved at very little cost during the “City to Soil” project. Given an appropriate level of commercial support, such a reward system can provide useful incentives and program profile, thereby achieving a great deal, both in terms of community participation, and agricultural economic outcomes.



7.3 The wider context

"City to Soil" has met the community's high expectation for a better environment, resulting in an expansion of social capital. Although the community's awareness of sustainability may be incomplete and "patchy", the project confirms that more adaptive community behaviours can be achieved.

The project demonstrates that it is possible to return to the urban community some of the financial benefits generated by applying compost on farms where the compost inputs are produced. This in turn provides that community with an additional return on their 'rates investment' in waste management services provided by the Council.

The "City to Soil" project begs the question; 'Is it possible for communities to invest their waste management dollars with a focus on a different outcome and receive far greater financial return?'

The results of the "Mooncoin" project and the beneficial findings of the "Life Cycle Assessment for Windrow Composting"(ROU, 2003) demonstrate that economic and environmental bottom lines can be strongly linked. Applying compost results in better soil properties, improved moisture retention, higher yields, and is coupled with less damage from potentially environmentally degrading practices.

The complementary results of the "City to Soil" Project provide the key linkage between the economic and environmental benefits which can be achieved, and the social benefits through community engagement, the third pillar of sustainability.

8 where to from here?

8.1 Better systems design

Waste and recycling collection systems are often designed with a cost focus rather than with the potential overall benefits of the total "value chain" from collection through processing and application of organics in mind.

"City to Soil" demonstrates that by focusing less on cost and more on total value and return to the community, positive outcomes, greater benefits and higher returns can be achieved.

This reflects the underlying value of a system focused on resource recovery rather than disposal, and develops a notion of 'highest and best use' that takes into account all benefits of the collected material in agricultural applications.

"City to Soil" was not conceived nor designed as the optimal system for delivering rewards and/or achieving better outcomes. Rather, it was designed to illustrate that rewards can work, both in terms of concept and in practice.

An alternative approach could be to offer a similar reward system to households to keep problem materials out of the waste stream in the first place, thus minimising the need for extensive 'end-of-pipe' treatment. This could be particularly suitable for efficient removal of toxic or hazardous materials.

The application of professional design and marketing skills should be capable of building on this early success to deliver more robust and effective reward and incentive systems models.

8.2 Further social research

The impact of applying community credits or rewards for resource recovery is an area of little current research. However, this trial has indicated that systems providing rewards will motivate higher levels of clean resource recovery.

9 references

A larger scale extension of "City to Soil" could measure any community shift in resource awareness. In addition it could also quantify all values and benefits of such a system and compare these benefits to the to the initial cost of collection.

Such a trial would reveal the full economic, social and environmental value of systems change and could engender an attitudinal change in resource management.

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10 appendix (on cd)

(A) Calculation of True Cost of Landfill: Adding Value: Models for Resource Reuse in the South East Region (Simone Annis)

(B) Using household collected organics as soil conditioner in cool climate viticulture. Final report (Dr Sara Beavis)

(C) Assessment of content in collected garden organic bin ("Green Waste bin")

(D) Household newsletter (October 2003)

(E) Campaign note (December 2003)

(F) Household newsletter (February 2004)

(G) Household newsletter (May 2004)

(H) Green Waste Collection Service Survey. Survey Findings (Strategic Economic Solutions)

(I) Green Waste Collection Service Follow-up Survey. Survey Report (Strategic Economic Solutions)

(J) Waste Diversion Benchmarking (Phil Hawley & Associates)

(K) "City to Soil" video

(L) "City to Soil" song recording

(M) Lyrics for the "City to Soil" song

(N) Electronic version of the "City to Soil" report

(O) "City to Soil" - A Critical Analysis - Carl Carlsund