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An Analysis of the Aller Barton and Uffculme landfill proposals, and waste management policy in Devon county

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Contents

1.	Introduction/summary	2
2.	Technical and policy background to landfilling waste	16
3.	Aller Barton Landfill Proposal...	...	...	...	...	23
4.	Uffculme Landfill Proposal	...	...	...	...	31
5.	Waste Policy in Devon	...	...	...	...	34
6.	Developing sustainable waste management policies	...	...	...	...	41
7.	Options for future waste management systems	...	...	...	...	58
8.	Conclusion	...	...	...	...	69
9.	References	...	...	...	...	70
	Appendix 1: Waste Management Strategy Assessment Model					72

1. Introduction/summary

This report considers various aspects of waste management and disposal in Devon, and in particular the applications by Haul Waste and Devon Waste Management to build landfill sites at Uffculme and Aller Barton. It has been commissioned on behalf of Friends of the Earth UK, and the local Friends of the Earth groups in East Devon.

Introduction

While the following sections look at each application in detail, this first section considers the general background, both in technical and national policy guidance terms, to the landfilling of waste.

Devon, with its long history of quarrying, has been landfilling its waste for many years. In fact the ease of landfilling is illustrated by the cheap costs of waste disposal in the County. On national assessments of the 38 county councils, Devon comes 22nd in terms of disposal costs at £15.38 per tonne - below the national average for county councils of £16.50.

However, because landfill has always been the norm, it does not necessarily follow that landfill must be carried on as a future means of waste disposal. While much attention has been focused recently on incineration and the emission of 'toxic' dioxins, there has been an equal but less well publicised debate in the waste management industry about the future viability of landfilling in its current form. This debate is driven by three issues:

- The problems of public opposition to the new - much larger scale - landfill sites;
- The problems of leachate management and groundwater contamination (the 'leaky' landfill issue);
- The problem of site completion - the new design methods exclude moisture so making degradation/stabilisation times much longer.

In our view these issues have not been adequately explored in relation to the two landfill proposals before the County Council at the moment. But it is particularly important that the problems with landfill are assessed at the County level as it will affect future policy decision. It also has an impact on how the County deals with its waste since at the moment around 90% of controlled waste goes to landfill.

Landfilling waste

At the moment, the 'acceptability' of landfill is judged in terms of national waste and planning guidance, and policy on groundwater protection. But an increasing body of evidence from the USA - where most research has been carried out - shows that the current 'best practice' given in the above documents may be flawed, and could potentially lead to landfill sites which will never be classed as 'complete', and perhaps even massive groundwater contamination from sites which were designed with 'impermeable' liners.

The main evidence on the risk of leakage from landfills can be summarised very simply. All landfills leak and can present a hazard to groundwater. It is important then that they are sited in geological strata which minimise the leakage. However because the timescales for landfill stabilisation are so long, it is not satisfactory to state that because a potential groundwater

aquifer has no active water abstractions then locating a landfill nearby presents no problems. It may be that in the future, especially with the threat of global warming/climate change, that currently 'un-economic' water sources may have to be developed as essential resources.

The US Environmental Protection Agency (US EPA) has paid for a series of engineering studies to find out the best way to make a landfill. They wanted to know what was the "*best demonstrated available technology*" (BDAT) for making landfills.

'Dry tomb' contained landfills can be made of a huge sheet of plastic underlain by ordinary soil, or it can be a just a layer of compacted soil (usually clay soil). The third combination, plastic liner and compacted clay soil, is called a "*composite liner*". A composite liner is not a double liner - it is a single liner made up of two parts. To create a double liner, you would use two composite soil liners together, separated by a layer of sand or gravel. Geoservices did not examine the first type of liner (plastic sheet on ordinary soil) because ordinary soil provides poor support for a plastic liner carrying many tonnes of weight, so they restricted their analysis to compacted clay liners vs. composite liners.

The EPA wanted to know which liners were the best ones available - compacted clay liners or composite soil liners. They employed Geoservices of Boyton, Florida, to tell them. The conclusion was that all liners perform worse than anyone suspected.

Geoservices didn't have much good to say about clay liners. Geoservices' calculations show that, with 12.5cm of water standing on the bottom liner, it will take 15 years for leakage to break through a 1 metre thick compacted clay bottom liner, but once break through has occurred, 1000 litres per hectare per day will pass through the liner continuously thereafter.

Geoservices study also reports that all plastic liners (also called Flexible Membrane Liners, or FML's) always have some leaks. A common misconception regarding FML's is that they are impermeable, that is, no fluid will pass through an intact FML. However, it is important to realize that all materials used as liners are at least slightly permeable to liquids or gases and a certain amount of permeation through liners should be expected. Additional leakage results from defects such as cracks, holes, and faulty seams. It is this concept in the minds of decision makers - that the liners are 'impermeable', which is leading to landfills being sited near or over major aquifers, and risking the future of that aquifer as a potable water resource.

Geoservices looked at six case studies. Based on these six case studies, they drew the following "tentative conclusions"...

- An average of one leak per 30 feet of seam can be expected if there is no quality assurance program (quality assurance being a third party coming along behind with special equipment to check the adequacy of the seams).
- Even with good quality assurance, "an average of one leak per 300 metres of seam can be expected with reasonably good installation, adequate quality assurance, and repair of noted defects".
- Design flaws, poor construction practice, or poor quality assurance would result in larger holes, greater numbers of holes, or even large tears.

Geoservices then goes on through an elaborate mathematical analysis to figure out how much fluid will pass through a composite liner under the best possible conditions and under less than ideal (but still optimistic) conditions. They conclude that the "best demonstrated

available technology" (BDAT) for composite landfill liners will allow leakage rates somewhere between 0.25 and 11 litres per hectare per day. Thus they conclude that an average 25 hectare landfill site will have a leak rate somewhere between 6.25 and 275 litres per day, or between 2300 and 100,000 litres per year. And this is the "best demonstrated available technology" - the very best we can have when everything we do goes right.

One of the least-studied aspects of landfill design is how to make a leachate collection system that will work for many decades (much less many hundreds of years). The fact is, leachate collection systems can clog up in less than a decade and, when that happens, fluids begin to build up inside the landfill - a dangerous situation, as noted above.

Leachate collection systems fail in several known ways. First, they can clog up from silt or mud. Second, they can clog up because of the growth of micro-organisms in the pipes. Third, they can clog because of a chemical reactions leading to the precipitation of minerals in the pipes. Fourth, the pipes themselves can be weakened by chemical attack (acids, solvents, oxidizing agents, or corrosion) and may then be crushed by the tons of waste piled above them.

All these factors make 'modern', 'state of the art' landfills, very risky.

The Aller Barton Landfill Proposal

First and foremost we must note the small size of this site. Today, due in part to the requirement to include highly engineered leachate and landfill gas containment systems in landfill sites, the trend is for sites to get bigger. At 917,000m³, with a void space of 655,000m³, it is difficult to see how Devon Waste Management hope to develop this site as one of their key landfill assets in the coming years (all their other sites will close before this site is complete).

Within the application there seems to be a blind assumption that the lining of the site will prevent leakage of landfill gas or leachate, when the evidence from within the UK and the USA is that this is not the case. It is not clear whether the underlying mudstones are of sufficient quality to provide an adequate barrier to the migration of leachate. This puts the emphasis on the integrity of the 'flexible membrane liner'. In terms of recent work on liners and their behaviour in landfill sites, the liner can almost certainly be guaranteed to leak.

There is also little information in the environmental statement on the scale or effects of polluting emissions from the site, both liquid and gaseous. Given that the site will leak toxic materials into the local groundwater over the next tens or hundreds of years, and that either the landfill gas (LFG) flaring or energy generating systems will emit large quantities of airborne pollution, it would have been useful to have had some quantified assessment of the potential for pollution.

Taking recent research on the predictable leachate emanating from the 'average' landfill, it is possible to come up with an estimation of the type and magnitude of the pollutants which will be produced by the site. The results of this model, as compared to other sites, are not exceptionally large by virtue of its small size - but they are significant. For example...

- Over its lifetime the site could emit 6.4 tonnes of heavy metals to the leachate

collection system, and perhaps another tonne to groundwater if the liner is ineffective.

- The burning of landfill gas in flare stacks or engines produces combustion pollutants such as nitrogen oxides - 71 tonnes, as well as other more toxic compounds, for example volatile organic compounds (VOCs) such as phenol or chlorinated hydrocarbons.
- The combustion of landfill gas containing chlorine and organic compounds, in the presence of catalysing agents such as copper, will cause the formation of dioxin. This model estimates 0.2 grams, which does not sound very much, but given the safe limit for dioxin - if there is such a thing - could be as low as 6 picograms (0.000000000006 grams) per kilo of body weight per day, if evenly distributed it would equal 18,600 toxic doses.

Much of the pollution in the leachate will be purposefully pumped from the site in order to keep it dry. Therefore the point where this material emerges may be on site, or perhaps more likely off-site. The gaseous emissions should all occur on site. Of concern to the local planning authority must be the proposals for leachate treatment and discharge. This is governed by other authorities, but the principle of how exactly it is proposed to dispose of leachate should be precisely determined as part of the planning permission since it will effect the extent of treatment works necessary to process the leachate. There are four possible options for disposing of the leachate...

- Transport to a licensed facility for dealing with such material - unlikely in practice because of the cost;
- Disposal to a nearby foul sewer, if the local sewage works were capable of taking the additional load and chemical contamination;
- Transport to a nearby sewage works for discharge directly into the works;
- Following on-site treatment, treated effluent could be discharge to a nearby brook.

One of the suggested requirements of environmental statements is that alternatives to the proposal be identified. The attempt to justify this project within the environmental statement is woefully inadequate. The applicant's basic argument is that because waste is dumped in a landfill, we need more landfills. A similar analogy might be that the continued presence of elephants requires that we keep and maintain a supply of elephant guns - when in fact other options such as tranquilliser darts will work equally as well. It is not merely a matter of identifying an alternative to landfilling waste. For example, the environmental statement could specify alternative treatment processes for the waste prior to landfilling to make it more stable/less polluting in the site to prevent groundwater pollution, or to make it break down more quickly to prevent excessive gassing.

All in all, it is our considered view that this application is technically very weak, and relies heavily on the fact that the type of design chosen is 'current guidance' - little evidence is produced to demonstrate that the technology selected for this site is correct for the local situation.

The site is not allocated in the development plan for waste disposal, and the absence of a Waste Local Plan for Devon makes determining this application all the more difficult. In terms of the structure plan (both adopted and draft versions) there is minimal guidance of waste *management* developments - Policy PRW 12 relates primarily to landfill, and so cannot be considered up-to-date in terms of other *material considerations* since the publication of the White Paper on Sustainable Waste Management.

Given that a planning application must be decided primarily on '*material planning considerations*', it is curious that the application statement gives so little consideration to Town & Country Planning considerations. This, we believe, is a demonstration of the 'weak' position that this application has in terms of conformity with the development plan.

The Uffculme Landfill Proposal

Much of the criticism of the 'lined' site approach taken with the Aller Barton proposal is equally applicable to the Uffculme proposal. The exception would be that in the case of Uffculme the geological conditions are even more unsuitable for landfilling waste.

The information supplied with the application is much more detailed - and technically competent - than that supplied by Devon Waste Management for their application. However, this additional level of detail leads us to have greater concern about this site. There are three issues:

- The extent and form of the aquifer in the area to be developed as a landfill. As noted previously, the restrictions imposed by the Groundwater Directive prohibit the direct discharge of 'List 1' substances to groundwater.
- Exactly how stable the 'Christmas tree' liner will be on this site is not absolutely certain. Although the reports mention Biffa's Trecatti site in South Wales, that site itself has not had a successful history.
- As with the Aller Barton site, there has been little attempt to characterise and assess the possible scale of any leakage from the site, and what effect it may have on the groundwater. The emissions from this site are six times greater.

The environmental statement does include a risk assessment, but this primarily considers the likelihood of contamination causing problems at some distance from the site. Also, the concentration in terms of water resources is on the presence of water abstractions at some distance - and not the viability of the groundwater in that area as a water resource.

Unlike the Aller Barton application, consideration is given to 'relevant' planning policy issues in relation to the application. However, these primarily rely on Policy PRW12 of the structure plan.

In terms of the position of the application as a whole, there is a noticeable lack of consideration of national policy guidance, and in particular PPG23 on planning and pollution control. The applicant has quite simply put forward those parts of policy guidance which support their application, and have not spent any effort rebutting those arguments which might be applied as '*material planning considerations*' that would advise refusal.

As with the Aller Barton site, we do not believe that there are sufficient arguments and evidence to grant this permission with certainty, and so the precautionary principle should be applied and the application refused.

Waste Policy in Devon

In the past Devon has claimed to be one of the most foremost 'recycling' counties. While schemes have been developed to improve waste reclamation and reuse, and there have been moves to encourage waste minimisation, this appears to have had very little effect on the underlying philosophy of waste disposal as a whole. It is further confounded by the lack of an up to date Waste Disposal Plan (since April 1st, a matter no longer in the control of Devon County Council), a Waste Local Plan, or a detailed set of waste policies in the adopted Devon Structure Plan.

On top of this, the setting up of the Local Authority Waste Disposal Company (the LAWDC), required by law under the Environmental Protection Act 1990, has still not taken place some three years after the process should have been completed. This puts the County in rather difficult position with respect to the Aller Barton application since it has a financial interest in approving the proposal.

Taken together these factors make the management of waste in Devon somewhat chaotic - in terms of the public's position there is no certainty; and in terms of the waste industry one must question whether it is possible to commit capital to fund waste reclamation/disposal projects given this uncertainty. We find it difficult to see how the County can realistically address the problems of waste in the future given the current situation, especially with regard the development of long term, sustainable and viable waste disposal options.

On October 5th/6th 1995 I visited Devon Waste Regulation Authority (WRA) - which has since been absorbed into the new Environment Agency - to survey the records and produce a view on the state of waste regulation in the County.

Devon WRA, unlike others, has been progressive - for example specifying a level for what constitutes 'pollution of groundwater' (a level of pollution 2 standard deviations above background levels). Another example of good practice is the regular photographs taken of sites, which are then kept as visual records of how the sites are managed.

In my search through Devon WRAs licenses I selected from the 240 or so waste licenses those for the landfilling/incineration of putrescible waste, and any other site/transfer station licenses which had any prominent histories. This search produced information on a number of sites, for example:

- **Little Silver Quarry landfill:** Operated by a small company, sorting and depositing waste on site. Almost all of the site report for 1995 had a large number of the 'unacceptable' or 'not acceptable' boxes ticked. There is no apparent move to improve the standards on site, except for a letter informing them about the 'higher standards' required under the new waste licensing regime.
- **Deep Moor landfill:** On 19/7/94 there was a letter from the WRA requesting data on the leakage of "11,000 gallons" of leachate into a local stream. DWM response (3/8/94) stated that they needed time to consider the WRA's letter. Later DWM's response noted that the cause of the problem had been high rainfall. An excess of leachate had been stored in the lagoons. Subsequent sunny weather made the clay liner in the lagoons crack and 50 cubic metres (roughly equivalent to 11,000 gallons) of leachate escaped. Action had been taken to prevent leakage into the watercourse - the NRA were informed, and pumps were used to divert the flow of the stream back into leachate lagoons. According to DWM, "minimal" damage to the aquatic environment was caused. In October 1994 there were memos/letters

relating to leachate seeping into North Stream. Letters from Devon Waste Management (DWM) in October state that this had been stopped.

- **Molescombe landfill:** Site closed. Memo on 23/4/94 notes that there is a possible underground fire on the site. Also a problem with leachate escaping from the site, possibly due to ground saturation. Further notes on file of hot gases coming off north end of site in June 1994. Last site report on file, 20/11/94, noted that the ground was still very hot, although it was a cold Autumn day (methane 13% on spike test). Little in monitoring file - mainly gas data.
- **Heathfield landfill:** Asbestos and pharmaceutical containers were not being immediately covered - some drugs found scattered around the site. Letter from WRA of 7/3/95 notes problems with wind blown waste and sharp objects such as pallets and metal fence spikes being found on top of the plastic landfill - this is very serious since it could provide a large pathway for leachate to leak from the site.

Although to many people the catalogue of incidents and problems listed above may be shocking, it must be put into balance by noting that many similar incidents happen across the country. However, this is not to say that any other problems noted at the sites are acceptable.

Devon Waste Management and restoration/aftercare liabilities

Of particular concern to us at the moment is the continuing problem with the vesting of Devon Waste Management. In the reports to the County Council the failure to vest has been presented as a 'bonus' since waste disposal has been charged at cost and not at commercial rates.

However, the failure to set up Devon Waste Management properly as an independent waste company calls into question the whole basis of the relationship between Devon County Council and Devon Waste Management in relation to the Aller Barton Landfill application. The whole purpose of separating local authority waste disposal functions and waste disposal assets is to reduce the conflict between those developing waste facilities (the waste industry), and those needing to engage waste disposal contractors (the local authorities). This division is non-existent in this case.

Until now some people have speculated that the failure to vest the company has been because of problems within the County Council. Evidence we have obtained would suggest the contrary. While searching through the Waste Regulation Authority's records last October I came across a report detailing Devon Waste Management's outstanding liabilities. Such a document is commercially confidential and should not have been on the files. According to this report DWM's outstanding liabilities are in the region of £18,334,000.

If we assume that Devon Waste Management were able to make £4.50 profit on each tonne of waste disposed of, it is possible to calculate the income still to come in from each site. However, even at £4.50 per tonne profit Devon Waste Management's liability is still nearly £2.5 million. In fact, to erase the liabilities, the company must make just over £5.20 per tonne clear profit after operating costs in order to cover the liabilities.

This has an interesting effect on the determination by the County Council of the Aller Barton landfill application. Given that Devon Waste Management's existing liabilities are in effect

the liabilities amassed by the County Council because they made insufficient financial provision and kept waste disposal prices low, it may ultimately have to be the County Council who come up with the funds to cover the liabilities before Devon Waste Management is vested - in terms of recent Government privatisation what has been popularly called a 'sweetener'. The other option would be for the County Council to vest Devon Waste Management with sufficient new assets to cover the liability - for example planning permission for a new landfill site.

This generates an obvious conflict of interest between the County Council as ultimate owner of Devon Waste Management's assets, and the role of the County Council as waste planning authority. A conflict, it must be noted, which would not exist if the County Council had disposed of their waste disposal assets at the appropriate time.

A further complication could arise with the licensing of the site once planning permission has been granted. Waste Management Paper no.4 - "Licensing of Waste Management Facilities", sets out specific provisions with regard to the financial stability of disposal companies. Particularly in paragraph 3.70 it notes that the company's, "*financial provision should depend upon the site's capabilities for pollution and harm*". As noted by the survey of the WRAs files, some of Devon Waste Management's sites are already causing pollution. The level of their outstanding liabilities, and the potential for pollution, must therefore call into question the ability of the Environment Agency to continue to allow their operation should they be vested with only their current assets.

Developing sustainable waste management policies

Currently, waste materials have one of four fates:

- 'In house' recycling as part of a production process;
- Recycling of waste products after their useful life has finished as part of waste collection systems;
- Disposal to landfill;
- Disposal to incineration (with possible energy recovery).

All these routes have their benefits and disadvantages which need to be taken into account when considering the advisability of which route should be selected for which type of waste.

Recently, Government policy has been to look upon the burning of waste with energy recovery as 'renewable'. However, there is a growing body of evidence that waste incineration is not only a more expensive option, but when considering its wider effects it is more environmentally damaging than, for example, waste recycling.

From a purely chemical point of view incineration does not recycle materials - it degrades them. It takes materials which have an energy value and releases this energy through combustion. Once released, these materials cannot be recreated without a much greater input of energy than that recovered from them. The term 'energy recovery' must therefore be looked upon as being completely misleading.

Often, waste incineration is called 'waste to energy'. This implies that waste incineration is an effective means of generating electricity - it is not. If we compare incineration to other forms

of power generation, gas turbines cost around £1,500 per kilowatt of capacity. Waste incinerators, even with the subsidy of the Non-Fossil-Fuel-Obligation cost in excess of £2,500 to £3,000 per kilowatt of installed capacity.

What we have to ask is what is the primary purpose of an incinerator - to generate power or to dispose of waste?:

- If it is to produce power, there are other generation options with lesser environmental impacts, and an equal or smaller capital cost - e.g., wind, micro-hydro and wave/tidal devices;
- If it is to dispose of waste there are other options with lesser environmental impacts - e.g., anaerobic digestion, source separation of recyclable materials, or better still waste avoidance/minimisation;
- Another way to look at the issue - £50,000,000 (the cost of an average incinerator) would buy around 10,000,000 low energy bulbs, and would save 2.16 billion kilo-Watt hours of electricity - over twice the energy production of an average incinerator over 15 years. This of course does not include the cost to local authorities of feeding the incinerator with rubbish.

Recycling vs. incineration

Incinerators are expensive plants - even small plants burning around 100,000 tonnes per year cost upwards of £40,000,000. The designed lifetime of the average plant is between fifteen and twenty years, and over this time it must be fed with a mixture of combustible materials as homogenous as possible, with a calorific value of between 8 and 12 GJ te⁻¹.

This leads to some practical problems. Firstly, the incinerator operator will want a contract with the organisation supplying the fuel for the duration of the plant's life. In practical terms this means that a local authority will have to sign a fifteen or twenty year contract to supply the plant with waste. There will also be conditions in the contract relating to the calorific value of the waste supplied, which will mean restrictions on the types of waste which can be supplied.

The fact that the calorific value must be maintained leads to a conflict between materials recycling and incineration. The materials in the domestic waste stream with the highest calorific value are plastic (30 GJ te⁻¹), textiles (15 GJ te⁻¹) and paper (12 GJ te⁻¹). This must be balanced by amounts of putrescible and non-combustible matter in order to balance out the calorific value to between 8 and 12 GJ te⁻¹ - values outside of these limits cause problems with the operation of the incinerator plant. This means that the adoption of an incineration policy automatically precludes any large scale materials recycling schemes over the lifetime of the incinerator contract.

Another problem with the recycling side of things is that all materials have two economic values - one based on their value as recycled material, and one according to their potential to burn and produce electricity. From this perspective the burn value of glass and metal is negative - because they do not burn, and actually remove energy from the system as they heat up. Plastics and paper on the other hand have a great burn value. Balancing this, metal, glass, paper and plastics have a reclaim value.

The greatest problem with incinerators, and how incinerators affect other waste management options, is the contract the operator will require the local authority to sign. Waste contracts last

a long period - fifteen to twenty years. Over this period the authority will have to supply specified quantities of waste, with a specific composition. This means that at certain times of the year waste will still have to be sent directly to landfill - either because there is too much, or because it is the wrong composition (too much garden waste for example).

Landfill contracts with local authorities, although they may be for a shorter period, will normally also have some form of 'minimum tonnage' clause. This again could lead to problems if a local authority aggressively pursues waste minimisation and recycling since this could have a significant impact on the quantities of waste being disposed from the municipal waste stream. In practical terms it is more of a problem for local authorities rather than large companies - local authorities are subsidised to recycle through the payment of recycling credits, but as these credits only cover domestic waste, commercial/industrial waste producers have less incentive to reclaim material.

It has been stated in the local press that the solution to having the two proposed landfill sites will be to have incinerators instead. This is incorrect. Incinerators produce around a 60-80% volume reduction in the waste stream - but you still need somewhere to put the 20-40% of the waste. This may mean that sites last longer because volumes are smaller, but the additional toxicity of incinerator ash - particularly fly ash - means that higher levels of engineering are needed in the site, and in practice this can only be feasibly achieved by making the site larger to achieve saving due to economies of scale. In practice then, having incinerators does not remove the need for landfill, and it can mean that what landfills there are will be larger, and could potentially have much more toxic material leaching out of them over time.

Sustainable solutions

Rather than 1960s 'big' solution thinking, we need to think in alternative ways. The problem is that we have waste, and we have to do something with it. The best solution would be to stop making it. If making it is unavoidable, then in some way it should be directly reused, or its component materials recycled. No processes should be used which degrade the materials so that they are useless (e.g., incineration), or sterilise and contaminate them with other materials and toxic substances (e.g., landfill).

The move towards sustainably managing the waste generated in Devon involves five definite steps...

- Considering waste arisings as a whole - not just domestic waste;
- Concentrating on levels of per capita waste production;
- Improving levels of reuse and recycling;
- Processing the remainder of the waste stream by the 'best practicable environmental option';
- Minimising, and where possible eliminating, the amount of material going to landfill or incineration.

This is not as simple a matter as it appears. For example one response to the need to recycle more would be to encourage people to use 'bring banks' to deposit their waste in. But one of the main reasons to promote recycling is not only to save resources, but minimise the use of energy and emission of pollution creating or recycling resources. Any energy savings from waste recycling can be quickly negated if people drive their cars, laden with only a few kilos of materials, to their local recycling bank.

While materials like aluminium are very energy intensive to produce and so have a long critical distances, others such as glass are not so energy intensive to produce, and driving them short distances quickly removed the energy benefit of recycling. For example taking only five kilos of glass in you car more than half a mile erases the energy saving from recycling.

The alternative to this is to have 'segregated collection' of recyclable materials from the home, along with the normal refuse collection. Segregated collection uses, on this analysis, uses 1% of the energy saved by recycling. If we were to take a target of having a recycling bank an average of 2.5 miles from each member of the local population, then the use of the 'saved' energy by car transport would be 6.7% if 25kg were carried, 11.1% if 15kg were carried, 16.7% if 10kg were carried, and 33.5% if 5kg were carried.

The current situation

Before the model of the potential for alternative waste management systems can be practically used, it is necessary to construct a model representing the current situation as closely as possible (the 'validation model'). We can then look at other options and compare them.

In this report three other options to the current system are considered...

- Scenario 1: 400,000 tonne incinerator;
- Scenario 2: Medium recycling/minimisation;
- Scenario 3: High recycling/minimisation.

It is crucial that, following the problems surrounding the determination of the two landfill applications currently before Devon County Council, that steps are taken to update all statutory waste policy documents covering the County (the Waste Local Plan and the district Recycling Plans), and that the policy and practice of the County Council seeks to ensure that all future waste developments form part of a sustainable waste management programme.

From the results of the alternative models - each one chosen as a particular example of a particular outcome of a strategy, it is possible to see the potential for implementing a programme to reduce the need for waste *disposal* in Devon. The table below brings together results from each strategy...

	Valida- tion	Scen. 1	Scen. 2	Scen 3.
Cost, millions of pounds:	30.72	48.07	37.85	31.96
Landfill, million tonnes:	1.97	1.48	1.52	0.49
Waste reclaim, million te:	0.09	0.12	0.38	0.89
Pollution, million te:	0.08	0.43	0.10	0.47
Energy prod., million GJ:	1.13	1.52	1.11	1.38

These figures demonstrate quite clearly that waste reclamation can be achieved without excessive cost. The current problem is that waste recycling addresses such a small part of the

waste stream that it does not make any difference to the main costs in any waste disposal budget - the cost of landfill disposal. Until waste recycling and minimisation either prevent or remove 40-50% of waste arisings, they will not produce significant lowering of future landfill costs

Scenario 1 also shows the impact incineration has - not only in terms of cost but also in terms of polluting emissions. Although reclamation also produces pollution, what is important is the ratio between the reduction in the waste going to landfill, and the increase in polluting emissions - incineration produces a much greater impact for the amount of waste it 'reduces' going to landfill, and generates very little energy.

Until better data is available on waste arisings in the County, it is not possible to produce a completely detailed strategy for debate, but it is hoped that the results of these models show what could be achieved if the proper waste management systems were developed in the County.

Conclusion

It is clear from the evaluation of the planning applications and associated data supplied for the Uffculme and Aller Barton landfill sites that neither of the developments should be permitted:

- In the case of the Aller Barton site, Devon Waste Managements assessment of the site, and of the potential for pollution, is woefully inadequate - comparing it with the application from Haul Waste quite effectively demonstrates this;
- The Uffculme application poses a threat to groundwater, and the possibility of utilising groundwater resources in this area at a future date;
- For both applications, there is no reasonable justification for allowing these sites in terms of the policies contained in national planning guidance, or the local development plan.

Devon County Council should refuse these applications and proceed to examine the alternatives to further landfill provision as soon as possible. This review should concentrate upon:

- Considering waste arisings as a whole - not just domestic waste;
- Concentrating on levels of per capita waste production;
- Improving levels of reuse and recycling;
- Processing the remainder of the waste stream by the 'best practicable environmental option';
- Minimising, and where possible eliminating, the amount of material going to landfill or incineration.

Also, the County Planning Authority should begin as soon as possible the public consultation process on the Waste Local Plan.

Finally, the problems regarding the vesting of Devon Waste Management, its liabilities, and the potential problems arising from DWM's possible inability to manage their sites for the necessary aftercare period should be speedily investigated and resolved. However, the County Council should not rush into granting planning permissions for Devon Waste Management

solely on the basis of enabling them to become a viable company in order that the County Council can dispose of them.

Rather Devon Waste Management might provide the most convenient future private sector partner for the development of waste reclamation facilities in Devon - which by their nature have much less long-term liabilities than landfill sites, and they do not have the great initial capital costs of landfills.

2. Technical and policy background to landfilling waste

2.1 Introduction

While the following sections look at each application in detail, this first section considers the general background, both in technical and national policy guidance terms, to the landfilling of waste.

Devon, with its long history of quarrying, has been landfilling its waste for many years. In fact the ease of landfilling is illustrated by the cheap costs of waste disposal in the County. On national assessments of the 38 county councils, Devon comes 22nd in terms of disposal costs at £15.38 per tonne - below the national average for county councils of £16.50.

However, because landfill has always been the norm, it does not necessarily follow that landfill must be carried on as a future means of waste disposal. While much attention has been focused recently on incineration and the emission of 'toxic' dioxins, there has been an equal but less well publicised debate in the waste management industry about the future viability of landfilling in its current form. This debate is driven by three issues:

- The problems of public opposition to the new - much larger scale - landfill sites;
- The problems of leachate management and groundwater contamination (the 'leaky' landfill issue);
- The problem of site completion - the new design methods exclude moisture so making degradation/stabilisation times much longer.

In our view these issues have not been adequately explored in relation to the two landfill proposals before the County Council at the moment. But it is particularly important that the problems with landfill are assessed at the County level as it will affect future policy decisions. It also has an impact on how the County deals with its waste since at the moment around 90% of controlled waste goes to landfill.

2.2 Landfilling waste

At the moment, the 'acceptability' of landfill is judged in terms of Waste Management Paper (WMP) 26^[1], WMP 26A^[2], and WMP 26B^[3]. There are also other sources of guidance such as the NRA's policy on the protection of groundwater^[4]. But an increasing body of evidence from the USA - where most research has been carried out - shows that the current 'best practice' given in the above documents may be flawed, and could potentially lead to landfill sites which will never be classed as 'complete', and perhaps even massive groundwater contamination from sites which were designed with 'impermeable' liners.

In Devon, it is only in recent years that landfills have begun to be lined. This means that there is a significant legacy of sites which have no liner, and which consequently will be causing groundwater and surface water pollution (there is more detail about this in section 5). The danger in the future is that decision makers will be told that sites in sensitive locations will be 'safe' because the use of 'low-permeability liners' means that leachate can be controlled. Haul Waste's Uffculme application is a good example of such a promise. However, lined sites leak - both leachate and landfill gas, and so future sites in Devon may also be the source of serious groundwater pollution.

2.3 Analysing why all landfills leak.

To begin with, let us examine some of the latest evidence on the integrity of 'containment' landfills. The main evidence on the risk of leakage from landfills can be summarised very simply. All landfills leak and can present a hazard to groundwater. It is important then that they are sited in geological strata which minimise the leakage. However because the timescales for landfill stabilisation are so long, it is not satisfactory to state that because a potential groundwater aquifer has no active water abstractions then locating a landfill nearby presents no problems. It may be that in the future, especially with the threat of global warming/climate change, that currently 'uneconomic' water sources may have to be developed as essential resources.

The US Environmental Protection Agency (US EPA) has paid for a series of engineering studies^[5] to find out the best way to make a landfill. They wanted to know what was the "*best demonstrated available technology*" (BDAT) for making landfills. These studies reach some surprising conclusions. The consultancy employed to do this was Geoservices - a reputable US environmental consultancy company.

'Dry tomb' contained landfills can be made of a huge sheet of plastic underlain by ordinary soil, or it can be a just a layer of compacted soil (usually clay soil). The third combination, plastic liner and compacted clay soil, is called a "*composite liner*". A composite liner is not a double liner - it is a single liner made up of two parts. To create a double liner, you would use two composite soil liners together, separated by a layer of sand or gravel. Geoservices did not examine the first type of liner (plastic sheet on ordinary soil) because ordinary soil provides poor support for a plastic liner carrying many tonnes of weight, so they restricted their analysis to compacted clay liners vs. composite liners.

The EPA wanted to know which liners were the best ones available - compacted clay liners or composite soil liners. They employed Geoservices of Boyton, Florida, to tell them. The conclusion was that all liners perform worse than anyone suspected.

2.4 Clay liners

Geoservices didn't have much good to say about clay liners. The flow of liquids through a liner (the liner's permeability) is measured in metres per second (ms^{-1}). The EPA's (and the UK's) current requirement for a liner for a hazardous waste landfill is that it pass liquids through it no faster than $1.0 \times 10^{-9} \text{ms}^{-1}$. However, based on actual experience in the field, Geoservices concludes that this ideal permeability is often not achieved for a variety of reasons. Therefore, they assume that the actual permeability in the real world lies between 1.0×10^{-9} and $1.0 \times 10^{-8} \text{ms}^{-1}$. Geoservices concludes, possibly the most significant observation is that with compacted clay bottom liners leakage out of the landfill will be larger if there is leakage through the landfill cap, even in landfills meeting current EPA design requirements, including permeability of $1.0 \times 10^{-9} \text{ms}^{-1}$. By "large" leakage, Geoservices means nearly 1000 litres of fluid leaking through each hectare each day, or 10,000 litres per day leaking from a average 10ha landfill. Their calculations show that, with 12.5cm of water standing on the bottom liner, it will take 15 years for leakage to break through a 1 metre thick compacted clay bottom liner, but once break through has occurred, 1000 litres per hectare per day will pass

through the liner continuously thereafter. It won't take very long to contaminate a large drinking water supply if you pour 1000 to 10,000 litres of toxic leachate into it day after day, year after year. Thus Geoservices has shown that clay liners are an environmental liability - not a solution to landfill containment.

2.5 Composite liners

Geoservices reports that all plastic liners (also called Flexible Membrane Liners, or FML's) always have some leaks....

"A common misconception regarding FML's is that they are impermeable, that is, no fluid will pass through an intact FML. However, it is important to realize that all materials used as liners are at least slightly permeable to liquids or gases and a certain amount of permeation through liners should be expected. Additional leakage results from defects such as cracks, holes, and faulty seams."

It is this concept in the minds of decision makers - that the liners are 'impermeable', which is leading to landfills being sited near or over major aquifers, and risking the future of that aquifer as a potable water resource.

FML's often develop defects called "pinholes" during manufacture. These result from thin places ("fisheyes"), bubbles, foreign material, or lumps of carbon in the raw molten plastic from which the FML is rolled ("calendered") into sheets. Furthermore, when a large landfill liner is created by joining strips of FML together with glue or by welding, the resulting seams often leak. Geoservices provides some data on typical seam defect rates.

They look at six case studies. Based on these six case studies, they drew the following "tentative conclusions"...

- An average of one leak per 30 feet of seam can be expected if there is no quality assurance program (quality assurance being a third party coming along behind with special equipment to check the adequacy of the seams).
- Even with good quality assurance, "an average of one leak per 300 metres of seam can be expected with reasonably good installation, adequate quality assurance, and repair of noted defects". That is to say, under the best circumstances, you will get one leak per 300 metres of seam - if the landfill liner is made up of FML that are 7 to 10 metres wide, you can expect three or four defective seams in every hectare the liner covers.
- Based on actual data, Geoservices conclude that a "standard" leak in a FML has an area of one square centimetre, and that the "standard" number is two holes per hectare. They point out that the "standard" hole size and "standard" number per hectare are based on the assumption that "intensive quality assurance monitoring" will be performed during liner installation, so clearly we are talking about the best case, not the worst case, here.
- Design flaws, poor construction practice, or poor quality assurance would result in larger holes, greater numbers of holes, or even large tears.

Geoservices then goes on through an elaborate mathematical analysis to figure out how much fluid will pass through a composite liner under the best possible conditions and under less than ideal (but still optimistic) conditions. They conclude that the "best demonstrated available technology" (BDAT) for composite landfill liners will allow leakage rates somewhere between 0.25 and 11 litres per hectare per day. Thus they conclude that an

average 25 hectare landfill site will have a leak rate somewhere between 6.25 and 275 litres per day, or between 2,300 and 100,000 litres per year. And this is the "best demonstrated available technology" - the very best we can have when everything we do goes right.

2.6 Flaws in leachate collection systems

If a landfill begins to fill up with fluid, the weight of the fluid puts pressure on the bottom of the landfill, increasing the likelihood of bottom liner failure, so any fluid inside a landfill is a potential source of trouble.

To prevent fluid from causing problems, every modern landfill has a system for draining liquids out of the landfill. Perforated pipes run over the bottom of the site, just above the liner, to collect the leachate in the same manner as drainage pipes are used to lower the water table in fields. In theory, these pipes carry off the leachate to a wastewater treatment plant, where the leachate is processed to remove the toxic chemicals.

One of the least-studied aspects of landfill design is how to make a leachate collection system that will work for many decades (much less many hundreds of years). The fact is, leachate collection systems can clog up in less than a decade and, when that happens, fluids begin to build up inside the landfill - a dangerous situation, as noted above.

Leachate collection systems fail in several known ways. First, they can clog up from silt or mud. Second, they can clog up because of the growth of micro-organisms in the pipes. Third, they can clog because of a chemical reactions leading to the precipitation of minerals in the pipes. Fourth, the pipes themselves can be weakened by chemical attack (acids, solvents, oxidizing agents, or corrosion) and may then be crushed by the tons of waste piled above them.

The first problem, silt, can sometimes be avoided, or at least reduced, by installing a "filter layer" above the leachate collection system. The filter layer may be made up of gravel or of a rug-like plastic material called "geotextile". Since the oldest leachate collection systems date from the early 1970's, there is very little available experience with the long-term performance of leachate collection systems. The hope is that a "filter layer" will solve the silt-clogging problem, but after many decades the entire filter layer itself may clog. Only time will tell.

The growth of micro-organisms seems to be an uncontrollable problem. The conditions for growth of slime forming micro-organisms are not well understood. Even if they were understood, we could not control chemical and physical conditions (temperature, pH, etc.) at the bottom of a landfill because of the thousands of tons of wastes heaped up in the landfill.

The problem of chemical precipitation also appears to be uncontrollable. The chemical conditions that lead to precipitation may be known, but again the conditions in the leachate collection system cannot be controlled because the system is not accessible once wastes have begun to be dumped into the landfill.

Finally, there is the straightforward problem of loading many tonnes of waste onto the leachate collection pipes. As more waste is piled into the site, the ground beneath the landfill settles to accommodate the stress. This can cause bending, splitting or complete fracture of

the pipes.

All these factors make 'modern', 'state of the art' landfills, very risky.

2.7 EC Waste and Groundwater Directives

These directives, now given force in the UK through Part II of the Environmental Protection Act 1990, require that all waste disposal operations are carried out in a manner which does not cause harm to the environment. The Directives makes it explicitly clear that the landfills should not directly release 'List 1' substances into the environment, and releases of 'List 2' substances must be minimised.

If you consult Waste Management Paper 26, it makes it very clear that domestic waste contains List 1 substances - research from companies such as Aspinwalls on the presence of 'List 1' and 'Red List' substances in leachate has found that concentrations can reach 100ugl^[6]. This also raises other problems - such as the fact that any discharges of leachate to surface waters or to sewers will need a consent from the Environment Agency.

If we then take this interpretation of the Directives, it has great implications for where landfills are actually sited. If we assume that, for sake of argument, all landfills leak, any landfill site that is located over any potable groundwater aquifer must be a breach of the waste and groundwater directives since, by leaking, they emit List 1/2 substances into the groundwater.

2.8 The NRA's Groundwater Policy.

There has been much criticism from the environment movement nationally that the NRA, having formulated their groundwater policy, have failed to implement it. It has been my experience that not only are the NRA unwilling to take an active part in planning applications and public inquiries into landfill proposals, but where contamination of groundwater has taken place they put little effort into investigation of the source, composition and extent of contamination.

Certain members of the NRA are pushing for better standards - Bob Harris of Severn Trent Region for instance. The following is an extract from his paper given to the Second Groundwater Pollution Conference in London^[7]

"Planning For New Landfill

"Consideration of groundwater vulnerability at the planning stage is well illustrated by the example of locating new landfill sites. Most landfills are currently sited in worked out mineral excavations since planning authorities, when granting permission for extraction, have invariably required quarries to be reinstated to agricultural land. The presence or absence of a hole in the ground still drives landfill site locations in many parts of the country. Because aquifers are often also good sources of mineral (e.g. Triassic sandstone for building sand, Carboniferous limestone for chemical industry, roadstone etc.) void space is continually being created below ground in the areas of highest risk to groundwater resources.

There are several reasons why such sites are not compatible with groundwater protection:

- a). The waste is deposited closer to the water table than if it was on the surface. Any protection that might be afforded by the unsaturated zone is therefore reduced or negated.*
- b). The waste and the engineering infrastructure to mitigate against leachate migration is largely inaccessible once in place. Engineering measures must therefore be highly efficient since there is no second chance to get it right.*
- c). The effective lining of steep sided quarry walls is difficult.*
- d). Leachate, and gas migration is possible both vertically and laterally and is difficult to detect.*
- e). Remedial measures are limited and costly.*

If it is accepted therefore that modern day waste disposal to land is better located in areas of least risk to water resources then the outcrop of non-aquifers is logically the best location."

We believe that the paper Bob Harris gave to the 2nd Groundwater Pollution Conference makes it quite clear that, just because there is a hole in the ground, it should not be filled with waste if doing so presents a risk of pollution to underlying aquifers.

A further and potentially more serious problem is that we are likely to become even more dependent upon groundwater to supply our needs. About 75% of groundwater currently abstracted is used for public supply and the groundwater in England and Wales makes up about 35% of the total public supply. The demand for water is increasing rapidly. Global warming could further worsen the problem, making rainfall more sporadic - less predictable. It is vitally important therefore that all potentially viable aquifers be preserved for use by future generations.

All in all, landfilling of mixed waste, and other wastes such as incinerator ash where the chemical constituents are highly leachable, presents great risks to the environment, as even the best designed liners systems are certain to fail, allowing pollutants to enter the environment.

The conclusion of this section must be that neither landfill nor incineration are acceptable methods for the disposal of the majority of the waste stream.

3. Aller Barton Landfill Proposal

3.1 Assessment of the application

i. Size

First and foremost I must note the small size of this site. Today, due in part to the requirement to include highly engineered leachate and landfill gas containment systems in landfill sites, the trend is for sites to get bigger. At 917,000m³, with a void space of 655,000m³, it is difficult to see how Devon Waste Management hope to develop this site as one of their key landfill assets in the coming years (all their other sites will close before this site is complete).

ii. Landfill liners

Within the application there seems to be a blind assumption that the lining of the site will prevent leakage of landfill gas or leachate, when the evidence from within the UK and the USA is that this is not the case.

It is not clear whether the underlying mudstones are of sufficient quality to provide an adequate barrier to the migration of leachate. This puts the emphasis on the integrity of the 'flexible membrane liner'. In terms of recent work on liners and their behaviour in landfill sites, the liner can almost certainly be guaranteed to leak. Not only is there a problem with regards welding the strips of liner material together to form an impermeable barrier many acres in size, but as is acknowledged in Appendix H of Waste Management Paper 26B, FMLs, even with the best 'construction quality assurance' (CQA), are expected to leak. Taking the figures in Appendix H, and the area of the site to be filled, it is possible that the FML, even with the best CQA and the best liner materials, could potentially leak many thousand gallons of leachate per year - even before the site has completed operation.

iii. EC Groundwater Directive

The potential for parts of the local geological formation to be used as a source of water, limited though that might be, makes it imperative that the site not leak. In terms of the Groundwater Directive, the 'direct' discharge of 'List 1' substances to groundwater is not permitted. As noted earlier, it is possible that levels of List 1 substances could reach 100µg/l.

If there is evidence that these strata have been used as a viable groundwater source, then the terms of the directive would need to be strictly applied. If it could not be shown that the site liner was completely impermeable to leachate, the development could not be permitted.

iv. Pollution

There is little information in the environmental statement on the scale or effects of polluting emissions from the site, both liquid and gaseous. Given that the site will leak toxic materials

into the local groundwater over the next tens or hundreds of years, and that either the landfill gas (LFG) flaring or energy generating systems will emit large quantities of airborne pollution, it would have been useful to have had some quantified assessment of the potential for pollution.

Taking recent research on the predictable leachate emanating from the 'average' landfill, it is possible to come up with an estimation of the type and magnitude of the pollutants which will be produced by the site. The model projecting emissions for this site is at the end of this section.

The results of this model, as compared to other sites, are not exceptionally large by virtue of its small size - but they are significant. For example...

- Over its lifetime the site could emit 6.4 tonnes of heavy metals to the leachate collection system, and perhaps another tonne to groundwater if the liner is ineffective.
- The burning of landfill gas in flare stacks or engines produces combustion pollutants such as nitrogen oxides - 71 tonnes, as well as other more toxic compounds, for example volatile organic compounds (VOCs) such as phenol or chlorinated hydrocarbons.
- The combustion of landfill gas containing chlorine, organic compounds, in the presence of catalysing agents such as copper, will cause the formation of dioxin. This model estimates 0.2 grams, which does not sound very much, but given the safe limit for dioxin - if there is such a thing - could be as low as 6 picograms (0.000000000006 grams) per kilo of body weight per day, if evenly distributed would equal 18,600 toxic doses.

Much of the pollution in the leachate will be purposefully pumped from the site in order to keep it dry. Therefore the point where this material emerges may be on site, or perhaps more likely off-site. The gaseous emissions should all occur on site.

Of concern to the local planning authority must be the proposals for leachate treatment and discharge. This is governed by other authorities, but the principle of how exactly it is proposed to dispose of leachate should be precisely determined as part of the planning permission since it will effect the extent of treatment works necessary to process the leachate.

There are four possible options for disposing of the leachate...

- Transport to a licensed facility for dealing with such material - unlikely in practice because of the cost;
- Disposal to a nearby foul sewer, if the local sewage works were capable of taking the additional load and chemical contamination, and subject to a 'trade waste' consent being granted under the Water Industry Act 1991 by the local sewerage undertaker;
- Transport to a nearby sewage works for discharge directly into the works - but this again would require a contract and consent from the sewage undertaker concerned;
- Following on-site treatment, treated effluent could be discharge to a nearby brook, or the canal, but this would require a consent under the Water Resources Act 1991.

If the material being discharged to sewer, or to a watercourse, contained 'prescribed substances' (such as mercury or cadmium) above the levels set in law, a further consent would also be needed from Her Majesty's Inspectorate of Pollution.

A certain route for disposal should be identified now so that the implications in terms of the potential for pollution, and the need to construct additional facilities on site, can be considered with the planning application currently before the authority.

v. Alternatives

One of the suggested requirements of environmental statements is that alternatives to the proposal be identified. The attempt to justify this project within the environmental statement is woefully inadequate. The applicant's basic argument is that because waste is dumped in a landfill, we need more landfill. A similar analogy might be that the continued presence of elephants requires that we keep and maintain a supply of elephant guns - when in fact other options such as tranquilliser darts will work equally as well.

It is not merely a matter of identifying an alternative to landfilling waste:

- The environmental statement could specify alternative treatment processes for the waste prior to landfilling to make it more stable/less polluting in the site to prevent groundwater pollution, or to make it break down more quickly to prevent excessive gassing.
- The applicant could also have provided information on 'what if' the waste disposal requirements in the county changed, meaning that the waste types ceased to be mixed waste - for example the majority of waste may become incinerator ash and inert cover if the county went for mass-incineration of waste. This would have starkly different effects of the future of the site in terms of landfill gas production, and the toxicity of leachate from the site.

All in all, it is our considered view that this application is technically very weak, and relies heavily on the fact that the type of design chosen is 'current guidance' - little evidence is produced to demonstrate that the technology selected for this site is correct for the local situation.

3.2 Planning context

The site is not allocated in the development plan for waste disposal, and the absence of a Waste Local Plan for Devon makes determining this application all the more difficult. In terms of the structure plan (both adopted and draft versions) there is minimal guidance of waste *management* developments - Policy PRW 12 relates primarily to landfill, and so cannot be considered up-to-date in terms of other *material considerations* since the publication of the White Paper on Sustainable Waste Management. Within the relevant local plans, there is nothing which supports the development of a landfill on this site - but many policies which would urge refusal of this development given both its short and long-term effects on the natural environment and agriculture.

Given that a planning application must be decided primarily on '*material planning considerations*', it is curious that the application statement gives so little consideration to Town & Country Planning considerations. This, we believe, is a demonstration of the 'weak' position this application has in terms of conformity with the development plan.

The Town and Country Planning Act, 1990 (as amended by the Planning and Compensation Act 1991), states in section 54A that...

"Where making any determination under the planning Acts, regard is to be had to the development plan, the determination shall be made in accordance with the plan unless material considerations indicate otherwise".

Section 54A is further reinforced by section 70(2) of the 1990 Act...

"In dealing with such an application the authority shall have regard to the provisions of the development plan, so far as material to the application, and to any other material considerations".

On both these counts, the application must fail. This site is not allocated for any type of development within either the structure plan, or the local plan. Also, if the applicant relies on the content of structure plan policy PRW12 to justify approval of this application, issues such as the potential for off-site pollution, and the effects on the natural landscape and agriculture, could be considered as over-riding factors.

Planning Policy Guidance 23

The national guidance directly relevant to this matter is PPG23 on 'Planning and Pollution Control'. This outlines particular 'environmental' and 'pollution' matters that are relevant to determination of planning permissions. Taking the relevant quote from the PPG...

"3.1 Decisions on planning applications for developments which may give rise to pollution, like all planning decisions, must be made in accordance with the development plan, unless material considerations indicate otherwise. They must also be made in accordance with relevant EC Directives..."

3.2 Material considerations may include:

- the availability of land for potentially polluting development, taking into account its proximity to other development or land use, which may be affected;*
- the sensitivity of the area, in particular as reflected in landscape, agricultural land quality, nature conservation or archaeological designations, if evidence suggests that there is a risk of such features being affected by pollution;*
- the loss of amenity which the pollution would cause;*
- any particular environmental benefits, such as, the regeneration of derelict land, or transport improvements;*
- the design of the site and the visual impact of the development, including, for example, the transport mode and the impact on the road network and on the surrounding environment;*
- the condition of the site itself, where it is known to be or likely to be contaminated, and any potential remediation;*
- the proposed after use of the site, and feasibility of achieving restoration to the required standard where its intended use has limited duration;*
- the potential use of mineral workings sites for landfill;*
- the hours of operation required by the development where these may have an impact on neighbouring land use;*
- the possibility that nuisance might be caused, for example, by the release of smoke, fumes, gasses dust, steam, smell or noise, where not controlled under Part I of the EPA 1990, or, in the case of waste facilities by birds, vermin or overblown litter; and*
- transport requirements arising from the need to transport polluting substances or waste, including the scope for transport by rail or water.*

Material considerations also include the potential economic and social benefits of the development, such as the provision of a product or service, the generation of secondary trade

with local businesses, the recovery of energy from waste and the contribution to energy efficiency, and employment. Local authorities will need to make sure that proper weight is given to these factors in order to maintain an appropriate balance between economic and environmental considerations.

3.3 There may be other considerations to be taken into account to the extent that they have land-use implications. These are likely to be the responsibility, of the relevant pollution control authority who will be able to advise on the extent to which they are able to address these considerations through their own mechanisms. These include:-

- the possibility of land contamination arising from the proposed development, and protection and remediation measures as appropriate;*
- the impact of any discharge of effluent or leachates, which may pose a threat to current and future surface or underground water resources or to adjacent areas;*
- the risk of toxic releases, whether on site or on access roads; and*
- the waste generated by the development, including that arising from the preparation and construction phases, and proposed arrangements for storage, treatment and disposal. The weight attached to such considerations will be reduced to the extent that they are capable of being addressed by the pollution control authority in carrying out its statutory responsibilities.*

In terms of the above considerations, this development does not fare well. This is mainly due to the lack of information. More importantly there are many claims made within the application statement, not supported by empirical data or references, which upon investigation can be shown to be incomplete or not fully accurate to the situation on the ground.

If we go further into PPG23, other considerations are also mentioned...

"3.15 Applicants do not normally have to prove the need for their proposed development, or discuss the merits of alternative sites. However, a number of judicial decisions have established certain categories of development where a duty to consider the existence of alternative sites may arise (Greater London Council v SOSE and LDDC. (1985) 52 P&CR 158; [1986] JPL 193. Trusthouse Forte Hotels v SOSE (1986) 53 P&CR 293; [1986] JPL 834; [1986] 2 EGLR 185). The nature of such developments and national or regional need may make the availability, or lack of availability, of suitable alternative sites material to the planning decision. In the case of an application for a waste facility, special statutory duties apply (set out in the Waste Management Licensing Regulations 1994, see paragraphs 5 . 3 - 5 . 8) .

3.16 Environmental statements, which must accompany particular applications (see Annex 9), can identify matters that will be relevant to the determination of the application. They may - and as a matter of practice normally should - include an outline discussion of the main alternatives studied by the developer and an indication of the reasons for choosing the development proposed, taking account of environmental effects.

3.17 In setting standards for a particular process, pollution control authorities operate under requirements that they should have regard to the particular local environmental circumstances. Standards must be set with the aim of ensuring that there is no danger to human health, harm to the environment or unacceptable statutory nuisance. Higher standards of environmental protection should be set if the local environment is more sensitive, for example, if the releases would affect a designated area or if storage of chemicals would present risks to an aquifer. Provisions exist under pollution control legislation to require account to be taken of improved technology and knowledge about the effects of pollution.

3.18 However, there may be circumstances where a development that is likely to satisfy pollution control requirements may still be considered by the planning authority to present an unacceptable risk in planning terms, because of social, economic or environmental factors incorporated in that risk. In considering the weight to attach to the risk of a pollution incident, the planning authorities should rely on the advice of the pollution control authorities. The perception of risk should not be material to the consideration of the planning application unless the land-use consequences of such perceptions can be clearly demonstrated. Where such consequences are considered unacceptable and cannot be overcome by appropriate planning conditions, permission may have to be refused. In these circumstances, the planning authority will need to demonstrate the land use planning reasons (not subject to pollution control) which have led them to conclude that the development is unacceptable.

3.19 It is not the role of the planning authority to undertake detailed risk assessment of releases into the environment. In any assessment of a particular risk, full regard should be given to the responsibility of the relevant pollution control authority or the Health and Safety Executive in respect of assessing that risk; planning authorities should not seek to substitute their interpretation of such risk assessment for that of the relevant authority."

On the basis of these criteria, the application does not fare well either. In terms of nuisance effects, no empirical data has been presented to demonstrate that odour and noise nuisance can be controlled so as not to cause offence to landholders. Likewise, in terms of the 'risk' of 'potential pollution', no data has been produced to substantiate the claims that the 'containment' landfill design will achieve the aim of isolating the wastes from the environment.

In terms of this policy guidance, none of the criteria for the adjudication of planning applications can be satisfactorily met - in terms of the exclusion of reasonable doubts. We therefore find it difficult to see how the County Planning Authority could recommend approval for this development.

4. Uffculme Landfill Proposal

4.1 Assessment of the application

Much the criticism of the 'lined' site approach taken with the Aller Barton proposal is equally applicable. However, in the case of Uffculme, the geological conditions are even more unsuitable for landfilling waste.

i. Liner system

The information supplied with the application is much more detailed - and technically competent - than that supplied by Devon Waste Management for their application. However, this additional level of detail leads us to have greater concern about this site. There are three issues:

Firstly, the extent and form of the aquifer in the area to be developed as a landfill. As noted previously, the restrictions imposed by the Groundwater Directive prohibit the direct discharge of 'List 1' substances to groundwater. As with the Aller Barton site, although this liner is in part more substantial, it is still as inevitable that leachate will issue from the liner at some point and enter the groundwater. The geological/hydrogeological data produced for Haul Waste adds to the uncertainty about the exact sequence of strata around the site. The presence of faults also gives rise to the possibility of differential settlement/earth movements, and consequentially the build up of shear stress across the liner which could lead to catastrophic failure.

Secondly, exactly how stable the 'Christmas tree' liner will be on this site is not absolutely certain. Although the reports mention Biffa's Trecatti site in South Wales, that site itself has not had a successful history. Of particular concern is the build up of water behind the liner which might lead to pressures being applied to the sides/base of the site - which again might lead to failure of the liner.

Finally, as with the Aller Barton site, there has been little attempt to characterise and assessment the possible scale of any leakage from the site, and what effect it may have on the groundwater. As with the Aller Barton site, I have included a model at the end of this section which lists the expected pollution outputs from this site. They are of course larger than those for Aller Barton given this site's much larger void space.

ii. Risk assessment

The environmental statement does include a risk assessment, but this primarily considers the likelihood of contamination causing problems at some distance from the site. Also, the concentration in terms of water resources is on the presence of water abstractions at some distance - and not the viability of the groundwater in that area as a water resource.

Also, at no point are the restrictions imposed by the Groundwater Directive adequately considered.

4.2 Planning context

Unlike the Aller Barton application, consideration is given to 'relevant' planning policy issues in relation to the application. However, these primarily rely on Policy PRW12 of the structure plan.

In terms of the position of the application as a whole, there is a noticeable lack of consideration of national policy guidance, and in particular PPG23 on planning and pollution control. The applicant has quite simply put forward those parts of policy guidance which support their application, and have not spent any effort rebutting those arguments which might be applied as 'material planning considerations' that would advise refusal.

As with the Aller Barton site, we do not believe that there are sufficient arguments and evidence to grant this permission with certainty, and so the precautionary principle should be applied and the application refused.

5. Waste Policy in Devon

5.1 The Current Situation

In the past Devon has claimed to be one of the most foremost 'recycling' counties. While schemes have been developed to improve waste reclamation and reuse, and there have been moves to encourage waste minimisation, this appears to have had very little effect on the underlying philosophy of waste disposal as a whole. It is further confounded by the lack of an up to date Waste Disposal Plan (since April 1st, a matter no longer in the control of Devon County Council), a Waste Local Plan, or a detailed set of waste policies in the adopted Devon Structure Plan.

On top of this, the setting up of the Local Authority Waste Disposal Company (the LAWDC), required by law under the Environmental Protection Act 1990, has still not taken place some three years after the process should have been completed. This puts the County in rather difficult position with respect to the Aller Barton application since it has a financial interest in approving the proposal.

These factors taken together make the management of waste in Devon somewhat chaotic - in terms of the public's position there is no certainty; and in terms of the waste industry one must question whether it is possible to commit capital to fund waste reclamation/disposal projects given this uncertainty. We find it difficult to see how the County can realistically address the problems of waste in the future given the current situation, especially with regard the development of long term, sustainable and viable waste disposal options.

The Government's recent White Paper on 'sustainable waste management', "Making Waste Work"^[8] holds particular challenges to the County if it wishes to continue its 'green' image on waste. Reducing waste going to landfill by 40%, encouraging waste minimisation and improving local recycling facilities are all very difficult when there is no strategic view within the statutory planning systems.

As part of the decision on the two landfill applications, the County Council must consider what the future of waste disposal in the County is to be, and on this basis judge whether these facilities should be approved.

5.2 Waste Regulation in Devon

On October 5th/6th 1995 I visited Devon Waste Regulation Authority (WRA) - which has since been absorbed into the new Environment Agency - to survey the records and produce a view on the status of waste regulation in the County.

During 1994 the new Waste Management Licensing Regulations were introduced into law. This has meant that changes have had to be made to the licenses for most waste sites. During 1995 Devon WRA were well underway with the work of reviewing all existing waste licenses. Those for putrescible waste have already been reviewed and issued. The review of inert waste sites and waste transfer stations were just being completed.

Devon WRA, unlike others, has been progressive - for example specifying a level for what

constitutes 'pollution of groundwater' (a level of pollution 2 standard deviations above background levels). Another example of good practice is the regular photographs taken of sites, which are then kept as visual records of how the sites are managed. But while compared to other WRAs the site files were well organised, and easy to access, a number of problems did exist:

- I was informed, "that no data on sites prior to December 1992 is available because of the restrictions in the Access to information Regulations". When I asked Dr. Ian White to confirm this he stated this was not correct. What the staff actually meant was that the files before December 1992 had not been cleared of commercially confidential information, and so were not openly available. However, if someone requires something specific they can ask and that data for the site will be extracted from the file. Site reports, applications, and monitoring data are still available for sites prior to December 1992.
- Having gone through a number of licenses, it appears that there is no regular/detailed sampling for pesticides, complex organics, volatile organic compounds, etc. - only the standard set of landfill leachate parameters (organic breakdown products and heavy metals).
- The WRA receives copies of all information relating to radioactive waste from HMIP - mainly the Navy dockyards at Plymouth - but did not receive copies of HMIP data on the Exeter incinerator. Curious since radioactive waste is not their responsibility, but the incinerator was.
- Detailed data on available void space in different parts of Devon is 'commercially confidential' - thus not available. This makes independent analysis on the waste management industry in Devon very difficult.
- All site operators, as part of the relicensing of sites because of the new Waste Management Licensing Regulations, have been informed that they may be required to monitor for 'List 1 and List 2 substances'. As yet, none of the sites granted an up-to-date license appears to have submitted any such data.

How regulation of the waste sites in the area progresses in future under the guidance of the Environment Agency will be interesting. The potential conflict of interests between the waste regulator and Devon Waste Management (the County's waste disposal company) having been removed, Devon Waste Management might begin to experience tougher operational controls, and potentially enforcement action, which before may have been curtailed by the 'internal' politics that sometimes dominate the relations between the different departments of some local authorities.

5.3 The state of Devon's waste sites

In my search through Devon WRAs licenses I selected from the 240 or so waste licenses those for the landfilling/incineration of putrescible waste, and any other site/transfer station licenses which had any prominent histories. Unfortunately time did not permit the checking of the 800 or so waste licensing exemptions.

This search produced information on a number of sites...

- **Northam Barrows CA:** Primarily a civic amenity (CA) site. There were a number of problems with tidiness, fences and security. The only monitoring data is an analysis of surface water (10/3/95) showing elevated levels of organic pollution.
- **Anvil Corner landfill:** Internal memo of 9/1/94 notes the contravention of license

conditions. There was water standing in the site, and problems with the temporary covering of tipped waste.

- **Lyn Down CA:** Primarily a CA site. There were a number of problems with upkeep of the site - e.g. two leaking diesel tanks found on the site (deposited by local farmer) still containing and actively leaking diesel (details in a letter from Colin Plummer, DCC WRA, 19/7/95).

- **Little Silver Quarry landfill:** Operated by a small company, sorting and depositing waste on site. Almost all of the site report for 1995 had a large number of the 'unacceptable' or 'not acceptable' boxes ticked. There is no apparent move to improve the standards on site, except for a letter informing them about the 'higher standards' required under the new waste licensing regime.

- **Knowle Hill Plantation CA:** Some concern in January 1995 about the running of the site. Problems with used battery storage, broken glass, and the potential for wind blown waste to create a statutory nuisance. On the whole most of the 1995 reports were ticked 'acceptable'.

- **Sutton Quarries landfill:** Letter in monitoring file from Dr. Ian White, 22/7/93, requesting monitoring data for site. Attached tables noted requirements for monitoring of site (e.g., surface water every month). However, there is no data on the monitoring file.

The site file has a number of criticisms in inspection reports - problems with daily cover and storage of waste before disposal. Letter from 18/5/95 from Devon Waste Management (DWM) note that monitoring boreholes were about to be drilled (although these were requested in the letter of 22/7/93).

Problems with agricultural building being constructed 10 metres from site boundary. Problems also with leachate control. General site operation problems noted during late 1994.

- **Exeter Incinerator:** No monitoring on data file - on further query Dr. Ian White (head of waste regulation in Devon) stated that HMIP do not copy information on emissions to air/water to them.

Inspection reports regularly state that recycling facilities are in an unacceptable condition. Complaints about tipping of waste around site boundary. Also problems with waste build-up and overflow in the pit during routine maintenance periods, and slowdown in feed of waste. Capacity problems noted at incinerator throughout 1995.

- **Hacche Lane landfill:** Many problems noted. Enforcement notices dated 29/9/95 specifies 12 conditions being breached. Most of 'unsatisfactory' boxes ticked during most of the 1995 site visits. Monitoring file empty.

- **Deep Moor landfill:** Main site being restored, extension being filled. Problems noted in late 1994 on site reports - fencing, pest control, surface water control and condition of CA site.

There are records of private water supplies on file as part of a consultants' search. They are in the settlements of (number of dwellings given)...

	St. Giles	Torrington
Confirmed operation	11	1
Unconfirmed operation	2	2

On 19/7/94 there was a letter from the WRA requesting data on the leakage of "11,000 gallons" of leachate into a local stream. DWM response (3/8/94) stated that they needed time to consider the WRA's letter. Later DWM response noted that the cause of the problem had been high rainfall. An excess of leachate had been stored in the lagoons. Subsequent sunny weather made the clay liner in the lagoons crack and 50 cubic metres (roughly equivalent to 11,000 gallons) of leachate escaped. Action had been taken to prevent leakage into watercourse - NRA were informed, and pumps were used to divert the flow of the stream back into leachate lagoons. According to DWM, "minimal" damage to the aquatic environment was caused. In October 1994 there were memos/letters relating to leachate seeping into North Stream. Letters from DWM in October state that this had been stopped.

- **Punchbowl CA/landfill:** Letter from WRA 23/3/95 notes (again) that 'sewage fungus' (an algal bloom caused in rivers and streams by organic pollution) is appearing in Hollacombe Brook - operator requested to deal with pollution in stream. Letter 14/2/95 notes that source of pollution is the contamination of surface water by leachate, entering site drains. Apart from the above there are few problems noted on site inspections.
- **Molescombe landfill:** Site closed. Memo on 23/4/94 notes that there is a possible underground fire on the site. Also a problem with leachate escaping from the site, possibly due to ground saturation. Further notes on file of hot gases coming off north end of site in June 1994. Last site report on file, 20/11/94, noted that the ground was still very hot, although it was a cold Autumn day (methane 13% on spike test). Little in monitoring file - mainly gas data.
- **Crowndale:** Landfill complete, CA still operational. Internal memo, 18/1/95, notes that inspector had seen leachate running off site roads into stream. Leachate was traced back to a bank at the edge of the landfill. Letter from NRA (28/6/95) notes the discharges of leachate into the River Tavey, and in their opinion they are illegal. NRA request information from WRA on what will be done to solve the problem. WRA response did not consider leaks a problem - they suspect that a mine leat/adit has collapsed below the site and that the mine discharge is flushing out the leachate.
- **Chelson Meadow landfill:** Problems with waste oil from the CA site leaking into leachate lagoon (letter from WRA to DWM, 22/4/94). Complaint on file from early 1994 about pollution of the tidal River Plym. Letter of 18/3/94 noted that they had taken 'statutory samples' for analysis. WRA memo/report of 6/5/94 noted large number of asbestos bags, some of which (in the photographs) had split, had been found on site not covered over. Reports note regular problems with temporary/daily cover. Other reports generally OK.
- **Heathfield landfill:** Letter from WRA 13/1/95 - proposes new liner construction method using composite construction. Perceived problem of instability within existing liner which uses 2m layer of clay, and problems of getting 120,000 cubic metres of clay in place. Site reports generally OK. Asbestos and pharmaceutical containers were not being immediately covered - some drugs found scattered around the site. Letter from WRA of 7/3/95 notes problems with wind blown waste and sharp objects such as pallets and metal fence spikes being found on top of the plastic landfill - this is very serious since it could provide a large pathway for leachate to leak from the site. The possibility of puncture of the liner was raised with Haul Waste. In response, Haul Waste state that

they have tightened procedures. Pictures of the material on the liner on file.

Although to many people the catalogue of incidents and problems listed above may be shocking, it must be put into balance by noting that many similar incidents happen across the country. However, this is not to say that any of the problems noted at the sites are acceptable.

Also, in terms of the two applications before the authority it is interesting to note the past history of the site operators on other sites in the County. For example Haul Waste's problems with sharp objects on the liner at Heathfield - a potential major cause of failure for the site containment if any objects did puncture the liner and go unnoticed. Likewise Devon Waste Management's problems at Sutton Barton, Deep Moor and Chelson Meadow.

5.4 Devon Waste Management and restoration/aftercare liabilities

Of particular concern to us at the moment is the continuing problem with the vesting of Devon Waste Management. In the reports to the County Council the failure to vest has been presented as a 'bonus' since waste disposal has been charged at cost and not at commercial rates.

However, the failure to set up Devon Waste Management properly as an independent waste company calls into question the whole basis of the relationship between Devon County Council and Devon Waste Management in relation to the Aller Barton Landfill application. The whole purpose of separating local authority waste disposal functions and waste disposal assets is to reduce the conflict between those developing waste facilities (the waste industry), and those needing to engage waste disposal contractors (the local authorities). This division is non-existent in this case.

Across the country, in response to the legal requirement under the Environmental Protection Act 1990 to remove waste disposal facilities from local authority control, most local authorities did one of two things:

- They set up a Local Authority Waste Disposal Company (LAWDC) which operated the sites as a private company, independent of the local authority, and in competition with other waste disposal companies;
- They simply sold their waste disposal assets to existing waste companies.

In the case of Devon County Council, although the LAWDC has been set up as a waste disposal company, it has no assets - they still belong to the County Council. Until the County 'vest' Devon Waste Management with the assets, it is not an independent entity.

Until now some people have speculated that the failure to vest the company has been because of problems within the County Council. Evidence we have obtained would suggest the contrary.

While searching through the Waste Regulation Authority's records last October I came across a report detailing Devon Waste Management's outstanding liabilities. Such a document is commercially confidential and should not have been on the files. According to this report DWMs outstanding liabilities are in the region of £18,334,000.

Table 1: Devon Waste Management's Liabilities

Devon Waste Management site:	Outstanding liability	void, m³	Remaining @£4.50/m³	Shortfall
Deep Moor	£4,866,840	1,076,000	-£24,840	
Bickley Ball	£2,124,502	130,000		-£1,539,502
Combebow	£1,463,151	173,000		-£684,651
Sutton Barton	£1,545,248	148,000		-£879,248
Chelson Meadow	£8,335,592	1,988,000	-£656,408	
Total	£18,334,333		3,525,000	£2,471,833

The report listed Devon Waste Management's landfill sites, and the outstanding liability at each site (figures detailed on the following page). In the report it was not made clear as to whether the financial liability was the present value, or that which would still be required upon completion of filling each site. However, if we assume that it is the current liability, then by getting an estimate of the remaining void space we can project what the outstanding liability might be when each site is completed. Conveniently, as the Waste Regulation Authority would not divulge the information, the remaining void space at each site is listed in Appendix 9a of the environmental statement for the Aller Barton applications to the company.

If we assume that Devon Waste Management were able to make £4.50 profit on each tonne of waste disposed of, it is possible to calculate the income still to come in from each site. By subtracting the liability for each site from this figure we arrive at a figure representing the final profit or liability from each site. At £4.50 per tonne profit Devon Waste Management's liability is still nearly £2.5 million. In fact, to erase the liabilities, the company must make just over £5.20 clear profit after operating costs in order to cover the liabilities.

This we believe demonstrates the main reason that Devon Waste Management has not been vested. The outstanding liabilities, particularly for the Bickley Ball site, are just too great to make the company a viable business.

This has an interesting effect on the determination by the County Council of the Aller Barton landfill application. Given that Devon Waste Management's existing liabilities are in effect the liabilities amassed by the County Council because they made insufficient financial provision and kept waste disposal prices low, it may ultimately have to be the County Council who come up with the funds to cover the liabilities before Devon Waste Management is vested - in terms of recent Government privatisations what has been popularly called a 'sweetener'. The other option would be for the County Council to vest Devon Waste Management with sufficient new assets to cover the liability - for example planning permission for a new landfill site.

This generates an obvious conflict of interest between the County Council as ultimate owner of Devon Waste Management's assets, and the role of the County Council was waste planning authority. A conflict, it must be noted, which would not exist if the County Council had disposed of their waste disposal assets at the appropriate time.

A further complication could arise with the licensing of the site once planning permission has been granted. Waste Management Paper no.4^[9] - "Licensing of Waste Management Facilities", sets out specific provisions with regard to the financial stability of disposal

companies. Particularly in paragraph 3.70 it notes that the company's, "*financial provision should depend upon the site's capabilities for pollution and harm*". As noted by the survey of the WRA's files, some of Devon Waste Management's sites are already causing pollution. The level of their outstanding liabilities, and the potential for pollution, must therefore call into question the ability of the Environment Agency to continue to allow their operation should they be vested with only their current assets.

6. Developing sustainable waste management policies

6.1 Introduction

As noted at the beginning of this report, we are faced with a situation in Devon where there is no clear and up-to-date guidance on how waste will be managed in the future, plus two applications for landfill sites which pose potential risks to the environment and local communities, and on top of all this a LAWDC which is not vested, and a number of County Council owned landfill sites whose liabilities may exceed their residual value. It is one thing to come out in opposition to the landfill proposals, but what is the alternative?

The purpose of this section is to consider how issues of sustainable development affect and interact with the development and management of waste collection and recovery systems in the County.

In spirit at least, Government policy now requires the 'sustainability' implications of actions taken by local authorities be considered. This applies in particular in local land use planning. Broad definitions of the terms/philosophy of sustainable development, and outlines of the requirements for implementing it, arise in a number of reports and international agreements...

- The White Paper on the Environment, "*This Common Inheritance*"^[10], sets out the government's policy on environmental protection and enhancement. It was produced in 1990, well before the Rio 'Earth Summit', but the policies it puts forward fit very well with the model of sustainability agreed at the Rio Summit because they are made from a parallel philosophy - that of 'stewardship'. This policy of stewardship is outlined at the beginning of the White Paper:

'The starting point for this government is the ethical imperative of stewardship which must underlie all environmental policies. We have a moral duty to look after our planet and hand it on in good order to future generations. That is what experts mean when they talk of "sustainable development": not sacrificing tomorrow's prospects for a largely illusory gain today.'

- At the United Nations Conference on Environment and Development in Rio de Janeiro (the "*Earth Summit*") in June 1992, the UK signed the final conference report - a convention on sustainable development normally entitled 'Agenda 21' (the Agenda for the 21st Century)^[11]. In doing so, the UK has committed itself to achieving a wide range of environmental objectives and targets;

- Both in terms of stewardship, and sustainable development, the general definition of sustainability is that originated in the 1987 World Commission on Environment and Development Report (usually called the 'Brundtland Report')...

'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains two key concepts:

- *the concept of needs, in particular the essential needs of the world's poor, to which over-riding priority should be given;*
- *the idea of limitations imposed by the state of technology and social organisations on the environment's ability to meet present and future needs.'*

Many see 'sustainability' as representing very much a 'business as usual' approach; the use of the words 'sustainable development' meaning little more than a commitment to 'managing' existing practices in an 'environmentally friendlier' manner. With such an attitude, businesses

and local authorities do not properly consider the issues of sustainable development. Taking a 'sustainable' view incorporates three practical ideas:

- Environmental appraisal: Before any serious consideration can be given to other issues of 'sustainability', we need to know where we stand now, and what the effects of current proposals are in the longer term;
- Sustainability: This does not mean making things 'environmentally friendlier'. At its heart is a commitment to abandoning those practices which can be shown to damage the environment in the long term, and adopting procedures in their place which can be carried out, for generations to come, with little or no effect on the wider environment. Of course, this does entail the cleaning up of existing 'damaging' practices, but the implications are much wider. The base of any 'sustainable' plan must consider resource use, and how the use of these resources affects the wider environment and future generations of 'life' (the term 'life' must be used since consideration of future generations cannot be limited to merely human life). Only by tackling these fundamental issues will we be able to make our society more sustainable;
- The precautionary approach: This urges that action should be taken, '*where there are good grounds for judging either that action taken promptly at comparatively low cost may avoid more costly damage later, or that irreversible effects may follow if action is delayed*' (definition from *This Common Inheritance*). This approach would also, from a policy point of view, advocate the adoption of policies and strategies at the earliest possible stage, rather than waiting to find 100% confirmation that the problem or situation actually exists.

6.2 Agenda 21

The industrial world recently signed up to a programme of radical change in the way global resources are managed and used, through the UN Conference on Environment and Development, and the final conference document, Agenda 21 (the Agenda for the 21st Century). This requires signatory states to move towards 'sustainable' economic and social systems during the first part of the next century. Given this requirement - and the ever present prospect of increasingly scarce natural resources, can current practices - and assumptions - about waste management and recycling be carried forward into the next century without serious challenge?

The problem with 'sustainability' is that there is not one concrete definition of the term. One of the best analyses of sustainability issues and the development planning system has been produced by the Town and Country Planning Association^[12]:

"Sustainable development is a vague concept that, at once, offers a comprehensive, consensual and conservative approach able to weld together quite disparate and conflicting interests in environment and development. But, because it is vague and its implications poorly understood, in practice it offers few clear solutions. Anyone can sign up for sustainable development so long as it requires no specific commitment to do anything that will threaten their material interests."

The meaning of sustainable development is normally explained by the oft-quoted definition in the Brundtland Report^[13]:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

In terms of waste management, what the industry deals with is the 'sterilisation' of resources, by burying them, burning them, or dumping them at sea, preventing their use by future generations. Although these resources can be remade, this requires large amounts of energy, and the consumption of more resources. What the waste management industry must achieve, in association with society and industry at large, is the closing of the 'loop' - turning the currently linear use of resources into a cyclical one. This could be achieved through:

- The minimisation of the amounts of waste/resources being lost to landfill, incineration or other forms of dumping.
- The highest levels of recycling, where it can be shown on a life cycle analysis that this saves resources and energy.
- Where wastes cannot be recycled or reused, urge substitution for materials which can.

Preventing waste amounts to the conservation of resources. It involves changes in production and design, with greater emphasis placed on quality, durability and utility. There must be a shift from a linear to a circular production process, instead of a succession of stages of production, each producing wastes that have to be managed in some way. This can be achieved at each stage by a combination of re-use, alternative use or recycling of materials otherwise unused during production and, wherever possible, by the use of waste products for some other useful purpose.

The consumption end of the cycle is the most important, and in practice, the hardest link to close. Products must be either returned and reused, put to secondary use, or recycled back to raw materials. This entails some sort of collection and return system, such as that now operated in Germany for some types of waste.

6.3 What is a sustainable strategy?

In practical terms the problem with 'sustainability' is that there is not one concrete definition of the term which can suit all situations. From the definition originated in the Brundtland Report, 'sustainable development' is phrased in a wider social, political and economic arena. These are three concepts which require precise definition...

- The first is development; which is not the same as growth, although the two are often used synonymously. Growth involves the physical expansion of the economic system. Sustainable growth is ultimately contradictory since there are physical limits imposed by the earth and its natural resources. Development, by contrast, implies improvement and progress and includes social and cultural as well as material dimensions. Sustainable development emphasises conservation and the recognition that natural resources are not simply free goods to be pillaged and pilfered at will.

- The second concept is needs; defined in the Brundtland Report as 'meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life'. The environment simply cannot cope with meeting the material standards enjoyed by the rich while, at the same time, supplying basic necessities to the burgeoning populations of the developing world.

- Thirdly, there is the concept of future generations; this involves the notion of stewardship. We have a moral duty to look after our planet and to hand it on in good order to future generations; this means improving already degraded areas and avoiding irreversible

damage (such as the destruction of species) or imposing risks on the future (from toxic or radioactive wastes, for example).

Looked at in this way the criteria for sustainable development are very tough indeed. Firstly, it will require a review of political and social systems - not just economic ones. Second, it implies a wholesale shift from exploitation to conservation through the accurate costing of resources which are currently considered free (the air, for example, used and polluted by power stations). Third, the actual needs of the populations of the 'developed' world need to be assessed, so as to plan a redistribution of resources from rich to poor. Finally, there has to be a withdrawal now from those activities whose effects transcend generations, and which rob or endanger future generations - the generation of radioactive waste for example.

Putting these principles into practice there are five primary goals which need to be implemented in order to achieve true sustainability. These are...

- **Conservation:** Sustainable development means the efficient use of non-renewable energy and mineral resources through higher productivity, recycling, development of alternative technology and substitution wherever these are possible and not environmentally harmful. It also means maintenance of biological diversity and potential. It will also require the economic valuation of natural capital assets regarded as free. The conservation goal can be said to ensure the environmentally efficient use of land and other resources.
- **Balanced development:** This goal is concerned with the use of physical resources and their impact on the built environment. Resource conservation requires patterns of development that minimise energy consumption, promote the re-use of buildings and prevent the waste of valuable natural resources. The goal here is to achieve an appropriate balance between the built and natural environment.
- **Environmental quality:** At the very least environmental quality means that processes must be avoided which degrade or pollute the environment. But it must also be an aim to improve and enhance environmental quality in those areas already degraded or grossly polluted. This goal is therefore to prevent or reduce processes that are harmful to the environment and human health.
- **Social equality:** A pattern of inequality has developed that intensifies the pressure on the environment from the high per capita demands of the rich and the struggle for survival of the poor. The conflicts that arise are a major obstacle to co-operation. Greater equality will not, in itself achieve sustainability since, under present economic systems, both wealth and poverty degrade the environment. But greater equality will remove the sources of conflict and is a precondition for political co-operation and commitment. The scale of inequality was first assessed in the Brundtland Report, and was further considered at United Nations Conference on Environment and Development (UNCED) through the proposals drawn up in Agenda 21.
- **Political participation:** Commitment will only be achieved through participation. This goal is to change values and attitudes by encouraging the increase of participation in political decision-making at all levels. Change cannot simply be ordained from above - it must also be stimulated from below. Within democratic systems of government, non-governmental organisations (NGOs) are able to promote ideas and mobilise support for them. Dispersal of power from the central state to the local level will encourage innovation, responsibility and support for policies of sustainable development. In this respect, the local planning system fails since it is strictly regulated by 'guidances' defined at the national level.

What we must consider here then, in terms of the 'sustainable future' for waste in Devon, is:

- What issues must be covered in any consideration of sustainable development locally;
- Given these issues, in terms of the sustainable management of resources what are the

important factors relating to waste, recycling and waste disposal;

- With these issues and broad topics defined, identify what are the key local factors which should be properly investigated, and action taken to encourage change in the community.

Then, having come to solutions to the tasks on this list, produce a strategy which meets these requirements.

6.4 Waste Management Options

Currently, waste materials have one of four fates:

- 'In house' recycling as part of a production process;
- Recycling of waste products after their useful life has finished as part of waste collection systems;
- Disposal to landfill;
- Disposal to incineration (with possible energy recovery).

All these routes have their benefits and disadvantages which need to be taken into account when considering the advisability of which route should be selected for which type of waste. The merits of these various options are outlined by the DoE in Waste Management Paper No. 1^[14]

Nationally, estimated annual waste arisings are roughly 400 million tonnes^[15]. Of this 400 million tonnes:

- A large proportion of 'waste' arisings are not controlled under any environmental legislation - primarily mine, quarry and agricultural wastes, which in total make up 41% of total waste arisings.
- At the present, only 8-10% of all waste material is reclaimed. It could be argued that agricultural wastes, consisting mainly of slurry, are reclaimed by spreading on the land. However, we do not consider this to be an accurate assessment of fact, since spreading is primarily a disposal option, and does not take account of the wastes potential as an energy resource.
- Although great effort is being directed by local authorities into meeting the Governments 25% domestic waste recycling target, even when all authorities achieve this target, the total reclaimed will only be 1.3% of all waste arisings.
- Although waste such as dredgings and some sludges are disposed of in the sea, most materials are disposed of on land - at least 330 million tonnes annually.

How this waste is disposed of is also important. The major route for waste disposal in the UK is landfill - 85% of controlled wastes are sent to landfill. Currently the UK co-disposes of many different types of waste in landfill, but this may soon change if proposed new European directives are brought into being.

At the same time as having potential changes to the types of waste disposed of, new guidance from the Department of the Environment^[2] requires that landfill sites be constructed as 'total containment' vessels, similar to the American 'dry-tomb' designs. Until recently landfills were operated on the 'dilute and disperse' principle, where pollutants were allowed to leach into the environment in the hope that dilution or natural degradation would prevent any widespread environmental damage. When all these changes to the landfilling of wastes have taken place,

it is likely that the costs of landfill could increase significantly.

On the last set of DoE data, around 4% of controlled waste was incinerated. But most incineration was carried out in old plants primarily designed to achieve mass reduction - such as Devon Waste Management's site in Exeter. The plants 'pay' for themselves through savings in the total cost of landfilling waste, and some also generate electricity or process heat for industrial/domestic use. Many of these plants have now closed due to European directives on the operation of waste incineration plant because modification or retrofitting of pollution control equipment was too expensive.

Recycling is seen as a 'sustainable' alternative to landfilling waste, but the problem with recycling in the UK is that all the emphasis to date has been on domestic and commercial wastes, these being the most visible to the public at large. Other wastes which could be put to good use - colliery and quarry waste for example - have suffered as a result.

Recycling domestic waste has been promoted as the way forward to solving our waste and resources problems in the future. However, as highlighted earlier, even with 25% of all domestic waste being recycled, only 1.3% of all waste arisings will be reclaimed. Also, because the primary responsibility for waste recycling is being put on local authorities (the domestic waste collectors) rather than the waste producers, recycling is a very expensive option, especially in rural areas.

The other disposal option is sea disposal - this is mainly for harbour dredgings and sewage sludge. New European agreements will stop the dumping of sewage sludge at sea from 1998, so meaning that new disposal routes will have to be found. In Devon this will mean that space will have to be found for 100,000 tonnes of sewage sludge which is currently dumped at sea.

6.5 Developing a sustainable waste management strategy

Agenda 21, chapter 21, sets out a programme of measures to implement more sustainable waste management systems. Reading through the targets in the document, if all these measures were implemented in the required timescale, the next four or five years will see a fundamental shift of emphasis in the waste management industry from a primary objective of waste disposal to one of reuse and recycling.

Thus far, the main thrust of national campaigns to solve the problem of waste has been towards the packaging of domestic goods. We consider this to be of little benefit in the sensible management of resources because at most, it represents less than 1% of the whole UK waste stream. Even with the latest recycling targets for industry declared by the Department of the Environment, the actual level of recycling may never exceed 5% to 10% of national waste arisings, because these targets are aimed at the packaging industry, rather than other areas such as sludge producers, or industrial waste producers.

Criticism of recycling has come from the House of Lords Committee on the European Communities. Their report^[16] notes that the belief that recycling is 'morally right' is simplistic and unsound, and the "*political drive to recycle anything and everything has become a matter of dogma unsupported by rational economic or environmental thinking*".

One of the fundamental flaws with recycling is that it does not encourage minimisation of

wastage. More efficient use of materials will be encouraged during manufacturing processes due to economic mechanisms, but the 'back end' of the system - the disposal of waste materials by society at large - is not encouraged.

If we take the conclusions of the Royal Commission on Environmental Pollution, made in their Eleventh Report^[17] and restated in their Seventeenth Report^[18]:

"The Commission's general approach to waste management can be presented as a four-stage decision procedure:

1st. wherever possible avoid creating wastes.

2nd. where wastes are unavoidable recycle them if possible.

3rd. where wastes cannot be recycled in the form of materials, recover energy from them.

4th. when the foregoing options have been exhausted, utilise the best practicable environmental option to dispose of wastes."

In their Seventeenth Report they go on to state:

*"In terms of the four-stage decision procedure described at the beginning of this report, **the first priority in waste management must always be to avoid creating wastes wherever possible. The view was expressed to us that waste minimisation if pursued with sufficient determination, might remove the necessity for incinerating any wastes, other than the most intractable clinical wastes. The reduction of waste arisings was discussed by the Commission in its Eleventh Report, which noted that avoiding waste can bring increased commercial benefit by altering a process, by changing from one process to another which might cost less in itself, or by decreasing disposal costs by generating less waste.**" [my emphasis]*

It must be made clear at this point then that in no way can the Royal Commissions report on Incineration be seen as a whole hearted endorsement of the technology - as noted above, the correct strategy could eliminate the need to use incineration at all. This position was recently reinforced by a press release^[19] putting the Commission's support for incineration in perspective with the need to first ensure the development of waste minimisation and sound integrated waste management systems.

6.6 Incineration vs. other waste management options

Government policy has been to look upon the burning of waste with energy recovery as 'renewable'. However, there is a growing body of evidence that waste incineration is not only a more expensive option, but when considering its wider effects it is more environmentally damaging than, for example, waste recycling.

From a purely chemical point of view incineration does not recycle materials - it degrades them. It takes materials which have an energy value and releases this energy through combustion. Once released, these materials cannot be recreated without a much greater input of energy than that recovered from them. The term 'energy recovery' must therefore be looked upon as being completely misleading.

Often, waste incineration is called 'waste to energy'. This implies that waste incineration is an effective means of generating electricity - it is not. If we compare incineration to other forms of power generation, gas turbines cost around £1,500 per kilowatt of capacity. Waste

incinerators, even with the subsidy of the Non-Fossil-Fuel-Obligation cost in excess of £2,500 to £3,000 per kilowatt of installed capacity^[20].

Also, if we take a traditional fossil fuel such as coal, it contains more energy per unit volume than waste. Available evidence on the relationship between coal and waste derived fuel burning demonstrate the absurdity of municipal solid waste (MSW) as an energy source. If we take an absolute calorific value, then coal - calorific value 30 giga-joules per tonne (GJ te^{-1}) - has around three times the energy content of MSW - calorific value 8-12 GJ te^{-1} . Thus you have to burn three time more waste for the same energy release. However, taking the *energy* value of waste (that is, the energy taken to make the materials in the first place) as between 40 and 120 GJ te^{-1} , by not recycling material, you expend four to ten times more energy in the long-term.

What we have to ask is what is the primary purpose of an incinerator - to generate power or to dispose of waste?:

- If it is to produce power, there are other generation options with lesser environmental impacts, and an equal or smaller capital cost - e.g., wind, micro-hydro and wave/tidal devices;
- If it is to dispose of waste there are other options with lesser environmental impacts - e.g., anaerobic digestion, source separation of recyclable materials, or better still waste avoidance/minimisation;
- Another way to look at the issue - £50,000,000 (the cost of an average incinerator) would buy around 10,000,000 low energy bulbs, and would save 2.16 billion kilo-Watt hours of electricity - over twice the energy production of an average incinerator over 15 years. This of course does not include the cost to local authorities of feeding the incinerator with rubbish.

6.7 Recycling vs. incineration

Incinerators are expensive plants - even small plants burning around 100,000 tonnes per year cost upwards of £40,000,000. The designed lifetime of the average plant is between fifteen and twenty years, and over this time it must be fed with a mixture of combustible materials as homogenous as possible, with a calorific value of between 8 and 12 GJ te^{-1} .

This leads to some practical problems. Firstly, the incinerator operator will want a contract with the organisation supplying the fuel for the duration of the plant's life. In practical terms this means that a local authority will have to sign a fifteen or twenty year contract to supply the plant with waste. There will also be conditions in the contract relating to the calorific value of the waste supplied, which will mean restrictions on the types of waste which can be supplied.

The fact that the calorific value must be maintained leads to a conflict between materials recycling and incineration. The materials in the domestic waste stream with the highest calorific value are plastic (30 GJ te^{-1}), textiles (15 GJ te^{-1}) and paper (12 GJ te^{-1}). These must be balanced by amounts of putrescible and non-combustible matter in order to balance out the calorific value to between 8 and 12 GJ te^{-1} - values outside of these limits cause problems with the operation of the incinerator plant. This means that the adoption of an incineration policy automatically precludes any large scale materials recycling schemes over the lifetime of the incinerator contract.

Another problem with the recycling side of things is that all materials have two economic values - one based on their value as recycled material, and one according to their potential to burn and produce electricity. From this perspective the burn value of glass and metal is negative - because they do not burn, and actually remove energy from the system as they heat up. Plastics and paper on the other hand have a great burn value. Balancing this, metal, glass, paper and plastics have a reclaim value.

To ensure the maximum operating profit, the balance between recycle vs. burn has to be operated very strictly. The major factors are...

- The value of the recycled product.
- The cost to sort/process the material.
- The value of generated electricity.
- The efficiency of generation.
- The operating/capital cost of the plant.

The greater the value of the electricity and the less the value of the recycled product, the greater the incentive to burn, or if the material has a negative value as fuel, the greater the incentive to send the material directly to landfill. Only where the value of the recycled material is great, and the material has a low or negative value as fuel, will the emphasis be on recycling (for example, glass, aluminium and steel).

Any subsidy distorts a market - that is the purpose of subsidy. The subsidy paid to 'renewable' energy from incinerators can also, like many other subsidies, be abused. Many incinerators generate power, a certain proportion of which is used to run the plant itself. Where power is sold to the national grid, and Non-Fossil Fuel Obligation (NFFO) contracts are in operation, it is possible for operators to sell all their output to the national grid, which pays the subsidy, and then buy back their own power at commercial rates - thus pocketing the difference.

In practice, if the plant is to make a return on the large capital cost of the incinerator, the plant will have to burn most or all of the paper, card and plastics - leaving only metals and glass as viable recycling options. Putrescibles/wood have value if composted, but the need to make a return on the large capital cost would mean that, even though compost has a small calorific value, it would be more worthwhile to burn these materials for the energy they contain.

6.8 Incinerator/landfill contracts

The greatest problem with incinerators, and how incinerators affect other waste management options, is the contract the operator will require the local authority to sign. Contracts last a long period - fifteen to twenty years. Over this period the authority will have to supply specified quantities of waste, with a specific composition. This means that at certain times of the year waste will still have to be sent directly to landfill - either because there is too much, or because it is the wrong composition (too much garden waste for example).

Landfill contracts with local authorities, although they may be for a shorter period, will normally also have some form of 'minimum tonnage' clause. This again could lead to problems if a local authority aggressively pursues waste minimisation and recycling since this could have a significant impact on the quantities of waste being disposed from the municipal waste stream. In practical terms it is more of a problem for local authorities rather than large companies - local authorities are subsidised to recycle through the payment of recycling

credits, but as these credits only cover domestic waste commercial/industrial waste producers have less incentive to reclaim material.

Perhaps the greatest problem with long contracts will be cost escalations. For incinerators, over twenty years, it is highly likely that emission standards or operating procedures will be tightened by regulatory authorities - the current round of incinerator closures is a good example of this. Likewise with landfills, the new waste licensing regime, and the new requirement for sites to be lined, significantly pushes up costs. It is normal practice within waste contracts that any upgrading costs, and any subsequent increased running costs, will be passed on to the customer through higher gate prices. This means that what might be an attractive financial option for the authority in the first year of the contract could become, in subsequent years, a financial millstone.

6.9 Incinerator ash disposal

It has been stated in the local press that the solution to having the two proposed landfill sites will be to have incinerators instead. This is incorrect. Incinerators produce around a 60-80% volume reduction in the waste stream - but you still need somewhere to put the 20-40% of the waste. This may mean that landfill sites last longer because volumes are smaller, but the additional toxicity of incinerator ash - particularly fly ash - mean that higher levels of engineering are needed in the site, and in practice this can only be feasibly achieved by making the site larger to achieve savings due to economies of scale. In practice then having incinerators does not remove the need for landfill, and it can mean that what landfills there are will be larger, and could potentially have much more toxic material leaching out of them over time.

Incinerator ash comes in different forms:

- Ash from the grate (bottom ash) consists of non-combustible metals and ceramics which 'drop' straight through the system. In some places this material is reused, following separation of the metals, as an aggregate. But in general, contamination problems may prevent reuse;
- Boiler ash is fly ash that is cleaned from within the system. It contains varying concentrations of heavy metals, dioxins, and similar products of incomplete combustion (PICs). This material would normally be landfilled, and depending upon its toxicity may be classed as 'special waste' - requiring special handling and disposal to an appropriately licensed site;
- Baghouse ash is a mixture of fly ash and the pollution control reagents - normally lime and activated carbon - used in the pollution control system. This is classed as special waste primarily because of the presence of the lime, but the concentration of contaminants cleaned from the flue gas will also make the ash particularly hazardous to health. Another issue is that the higher the emission standard achieved in the incinerator, the more toxic the fly ash must become.

The amount of ash produced by the incinerator will vary - below is a simple mass balance for a 100,000 tonne per year incinerator (all figures are in tonnes).

If the incinerator plant cannot get rid of its ash - it cannot operate. It is a fact that the rush for incineration is due in part to the shortage of landfill, and this of course spells problems for ash disposal. Only certain sites can accept incinerator ash, partly because of the problems involved in handling it, but also because of the extra design/engineering features which are required for the landfilling of special waste. This makes special waste space a premium commodity.

Currently one large incinerator - SELCHP in Lewisham, London - is having problems finding space for its ash. This is before any of the proposed larger incinerators planned for the south-east has even been built. At the end of 1994, according to a source within a Waste Regulation Authority, SELCHP were phoning around the country looking for special waste void space for their ash. Currently, ash is going to a site at Bishops Cleeve near Cheltenham - a road journey of 115 miles.

With any large incinerator, there is a significant quantity of ash to be disposed of. If waste void space is in short supply, this will not only be expensive, but may involve significant transport costs too. How will any new incinerators proposed for Devon dispose of their ash? Given that incinerators are proposed/have been consented in Kent, London, Surrey, and Dorset, there could soon be an incinerator ash 'crisis' in southern England.

6.10 Is sustainable waste management possible?

Rather than 1960s 'big' solution thinking, we need to think in alternative ways. The problem is that we have waste, and we have to do something with it. The best solution would be to stop making it. If making it is unavoidable, then in some way it should be directly reused, or its component materials recycled. No processes should be used which degrade the materials so that they are useless (e.g., incineration), or sterilise and contaminate them with other materials and toxic substances (e.g., landfill).

The move towards sustainably managing the waste generated in Devon involves five definite steps...

- Considering waste arisings as a whole - not just domestic waste;
- Concentrating on levels of per capita waste production;
- Improving levels of reuse and recycling;
- Processing the remainder of the waste stream by the 'best practicable environmental option';
- Minimising, and where possible eliminating, the amount of material going to landfill or incineration.

- **Considering waste arisings as a whole - not just domestic waste**

In order to have a properly sustainable waste management system it is necessary to deal with the waste stream in its entirety. This also allows some beneficial connections to be made - the anaerobic digestion of sewage sludge and the putrescible fraction of household waste for example.

There also needs to be better information on how waste is produced across the County. It is necessary to hold data on every area - and possibly every collection vehicle route, so the areas which fall below average can have resources targeted to

improve their performance. Only by collating and acting upon such information can waste minimisation, avoidance and recycling measures be effectively targeted. Currently there is no detailed data available on waste arisings in Devon.

- **Concentrating on levels of per capita waste production**

It is a fact that if you want to reduce waste then you must affect the amount of waste that is produced by each person, rather than trying to encourage more recycling. Encouraging recycling is capital intensive as it requires more bottle banks, materials recovery facilities (MRFs), etc. By going for reductions in waste production across all sectors (industry, commerce and domestic premises) we actually free up already overloaded systems, and generate capital savings through not having to increase overall processing capacity.

The European Commission has set a target of reducing per capita waste production to 300 kg/person/year by the end of the decade. Some areas of the country have very high levels of waste production - Berkshire is in excess of 600kg/person/year. Devon is fortunate that it has a moderately low level - just under 450kg/person/year.

Reducing this by one third to the European target will have a proportionate effect on municipal waste arisings - but the effect on controlled waste in general (all waste except mineral and agricultural) in Devon will be much smaller - around one seventh. This illustrates why it is as important to concentrate on industrial/commercial wastes as well as on domestic waste.

Finally, the key to pursuing waste minimisation is making the waste producer - be it the public or business - pay for the cost of their waste disposal in proportion to the volume/mass of waste they produce.

In parts of Germany now the dust carts are fitted with weighing equipment linked to a data-logger. As each wheely-bin is picked up the computer automatically logs the weight. At the end of the month/quarter, the premises receives a bill based on the total quantity of waste disposed of.

Such a system could prove useful in encouraging greater responsibility for waste production amongst the homes and businesses of Devon.

- **Improving levels of reuse and recycling**

As noted above, while minimisation is the main goal, recycling and reuse of materials is important in terms of resource conservation, and reducing the need to send materials for final disposal.

As noted above, only modest recycling facilities need to be built. If waste minimisation is pursued adequately then the shrinkage in the volume of the waste stream will enable the same facility to handle greater proportions of the total waste stream, as that stream gets smaller.

Some key targets set in the new sustainable waste White Paper are:

- to recover 40 percent of municipal waste by 2005;
- 40 percent of domestic properties with a garden to carry out home composting by the year 2000; and
- to have easily accessible recycling facilities for 80 percent of households by the year 2000.

These targets would need to be incorporated into future waste strategy documents when they are reviewed.

In addition, greater effort is needed to encourage all sectors of society to recycle waste materials - where possible with separation at source to reduce contamination and processing costs. Equal emphasis should be paid to businesses and industry, as

well ask the domestic sector. The problem for local authorities is that recycling credits are paid only on recycled domestic waste. However, where businesses are concerned, the recovery of waste, and often the consequential move to more up-to-date production methods, often saves much more money than the whole scheme costs when the initial funding is spread over two or three years. For this reason local authorities may be able to 'hire' their waste expertise to local businesses. Finally, it is essential that the Authority take a strong role, preferably in allegiance with other local authorities, to lobby the Government for changes in law to make the whole system of recycling and waste minimisation simpler, and where necessary to obtain new powers and funding to tackle problems along the way - perhaps to take on local fly-tippers who may not wish to pay the higher gate prices at disposal sites, brought about in part by higher environmental standards and the landfill tax. Local authorities also have an important role lobbying business and industrial interest groups. The reason all waste cannot be recycled is that there are still parts of the waste stream which, because of design or materials selection, are not recyclable.

- **Processing the remainder of the waste stream by the 'best practicable environmental option'**

The waste that remains, and which is non-recyclable, need to be processed in order to render it environmentally benign before disposal.

Incineration does not produce an environmentally benign residue by virtue of the fact that it contains a wide range of organic and inorganic chemical compounds of varying toxicity. Even with clinical wastes, recent developments demonstrate that incineration is not needed to render waste benign - autoclaving, microwave thermal treatment and chemical oxidation work equally as well, with less environmental impact.

Landfill, even where the latest lined designs are used, also offer no guarantee that leachate from the materials deposited will not reach the environment - even over quite short timescales.

With each type of waste, such as tyres, electrical equipment, white goods, etc., the most appropriate option for their disposal should be selected. This should, where possible, focus on 'mono-disposal' of the wastes rather than the current practice of 'codisposal'.

- **Minimising, and where possible eliminating, the amount of material going to landfill or incineration**

As part of any truly sustainable strategy, the end point of the whole exercise must be to move to a point where no waste is generated at all - all materials are recovered in some way. This is of course perhaps a few decades away, but we must acknowledge that the responsible stewardship of resources, and the protection of the environment, require that we stop producing waste.

Part of the strategy should be a commitment to manage waste without the use of incineration - on the basis of current waste processing expertise it is not necessary, even for toxic chemical wastes. Such a policy acknowledges the views of the Royal Commission on Environmental Pollution's report on Incineration where they state that if sufficient attention is given to waste minimisation, incineration of waste will be unnecessary.

At the same time, every effort should be made to restrict the amount of landfill void present. This will be necessary in order to keep final disposal costs high. We see one

of the historic problems in Devon being the cheap and easy access to landfill.

At the moment the key problem we see is that waste policy is being driven on a 'desperation' cycle - rather than a planned ahead policy basis - and which is steered by considering applications for needed disposal capacity as it arises. This also enables Devon County Council to shift its responsibilities for 'responsibly' managing waste disposal to others (either the landfill or the incinerator operator) by being able to dispose of collected waste in bulk loads.

In terms of Planning Policy Guidance no.12^[21], and government guidance on policy appraisal^[22] and risk assessment^[23], Devon County Council should have produced some sort of reasoned argument to support their selection of waste management technologies as part of any strategy for managing Devon's waste. Unless some form of systematic environmental appraisal is carried out there is no guarantee that the approach taken is the best. Fundamentally, it is a matter of applying the precautionary principle. The problem is, we have no policy.

In terms of Friends of the Earth's objections to landfill, one of the key problems is the 'sterilisation' of resources in landfill sites. Also, in addition to the resources issue, there is a significant pollution problem relating to incinerators. We believe that it is possible to create a strategy that does not rely on either incineration or landfill - this is advanced in the following section.

In terms of incineration - which many people have called for as an alternative to the proposed landfill sites, this idea of having a strategic view of what you are trying to achieve is very important. Does a move towards incineration, a policy advocated by Devon Waste Management not so long ago, perform any better than other waste management options?

Much of this may appear outside the scope of local government - but Devon County Council has a key enabling role by making sure that the policy guidance/strategy documents for the County set the right framework for encouraging the responsible management of waste materials.

7. Options for future waste management systems

7.1 What are the options

The tables produced in sections 3/4 listing the possible pollution output from the two proposed landfills are based on data from a recent publication by Procter & Gamble on the lifecycle analysis of waste management^[24]. The main criticism we have of the approach of the study is its narrowness - it looks more at the detailed composition and treatment of waste rather than considering large waste streams in their entirety. Taking the data in this large manual further, and adapting the spreadsheet based models supplied with the volume, it is possible to re-engineer the models to consider waste at the regional level.

What follows are projections of what the current situation in Devon is, and what could be done. The models produce not only a rough costing for the options, but also guides to the energy and environmental impacts of each option.

The model itself has many parts, and takes many pages to reproduce. A copy of the 'validation model' for Devon is included in appendix 1. However, for each of the scenarios considered here the summary page is included.

The options open to the authority are those outlined at the end of the previous section...

- Considering waste arisings as a whole - not just domestic waste;
- Concentrating on levels of per capita waste production;
- Improving levels of reuse and recycling;
- Processing the remainder of the waste stream by the 'best practicable environmental option';
- Minimising, and where possible eliminating, the amount of material going to landfill or incineration.

This is not as simple a matter as it appears. For example one response to the need to recycle more would be to encourage people to use 'bring banks' to deposit their waste in. But one of the main reasons to promote recycling is not only to save resources, but minimise the use of energy and emission of pollution creating or recycling resources. Any energy savings from waste recycling can be quickly negated if people drive their cars, laden with only a few kilos of materials, to their local recycling bank.

The table at the top of the following page illustrates this. For each type of 'bring' material the energy saving (in mega-joules - MJ) is given. It is assumed that the material must be transported 200 miles by road to be reprocessed, and the energy implications of this are calculated in the 'material transport' box, and subtracted from the energy saving for each material.

The 'car transport' box then calculates the energy used driving a car per mile. The net energy saving is then divided by the car energy figure to produce the "critical distance" (the point where the energy used in car travel erases any energy saving from recycling) for transporting recyclable materials to the bring bank, given different loads.

While materials like aluminium are very energy intensive to produce and so have a long critical distances, others such as glass are not so energy intensive to produce, and driving them short distances quickly removed the energy benefit of recycling. For example taking only five kilos of glass in your car more than half a mile erases the energy saving from recycling.

The alternative to this is to have 'segregated collection' of recyclable materials from the home, along with the normal refuse collection. The energy impact of this is calculated in the 'segregated collection' box. The last material column's energy value represents an aggregate of net energy savings in proportion to their occurrence in domestic waste. It is assumed that the materials are therefore picked up in this same fraction, and energy used accordingly.

For this calculation it is necessary to estimate the average length of a segregated collection round. A length of 60 miles was chosen as this takes account of the different urban/rural distances involved, and the need to take the materials to a local waste transfer facility. Also, given that the lorry will be running stop-start rather than continuously, a higher fuel consumption is used. The collection mass is also less taking account of the fact that segregated collection vehicles hold less material.

On this analysis a segregated collection round uses 1,146MJ, as compared to the 108,000 MJ saved by reclaiming the material. In fact, segregated collection, on this analysis, uses 1% of the energy saved by recycling. If we were to take a target of having a recycling bank an average of 2.5 miles from each member of the local population, then the use of the 'saved' energy by car transport would be 6.7% if 25kg were carried, 11.1% if 15kg were carried, 16.7% if 10kg were carried, and 33.5% if 5kg were carried.

It can be seen then that segregated collection of recyclable material is much more energy efficient than introducing large numbers of bring banks. (It should be noted that the effect of materials transport is included within the energy calculations of the waste model used later in this section).

Another issue is what do the different options cost? This of course depends upon the option chosen:

- Landfill, taking £15/tonne as the local rate plus £7 landfill tax costs £22/te.
- With incineration, there is no landfill tax, but the cost is generally higher because of the additional expense in running the plant - £35 may be the price for new plants.
- The costs of recycling vary depending upon the process, and the materials recycled. Whereas some may have a *negative* cost in that income is received from the sale of collected materials, and recycling credits also subsidise the costs, processes such as anaerobic digestion may cost £30/tonne. For this reason you could reasonably take a middle figure of £15-£20 per tonne.

Below the recycling banks table shown earlier a graph illustrates the effect of cost and selection of options. If we were to landfill 100% of the waste, it would cost 100% of the charge for landfill. Varying the proportions of landfill, incineration and reclamation changes

to overall price accordingly. By picking a level of landfilling, it is possible to find the overall price using this graph.

In the top (dark shaded) line, it is assumed that all waste not sent to landfill is incinerated. This shows that, because incineration costs more than landfill, as the proportion being landfilled falls, so the cost increases.

In the bottom (light shaded) line it is assumed that all waste not landfilled is reclaimed. As reclamation over the whole range of materials costs less (when adding landfill tax to landfill prices, and taking recycling credits off reclamation costs), disposal prices progressively get less.

It is also possible to mix options and produce cost estimates. In the middle (black) line it is assumed that 25% is reclaimed, then after that all waste not landfilled is recycled. In this instance the cost is lower than incinerating all waste.

These two analyses, on the energy implication and cost implications of waste options, illustrate the kind of arithmetic that the 'waste management strategy analysis model' conducts.

7.2 The current situation

Before the model can be practically used, it is necessary to construct a model representing the current situation as closely as possible. The summary sheet for this is shown on the following page (the full listing is given in appendix 1). Also, with all the models, the energy value of the resources 'lost' to landfill or incineration are included in the energy calculations.

The model basically reproduces the various systems currently used to manage waste in Devon - data was taken from various current Devon County Council waste publications^[25].

The main results from the model are as follows:

- Disposal to landfill: 1,972,354 te/yr
- Total reclamation/reuse: 6,685,184 (85,184 te without mineral waste)
- Pollution emissions: 83,180 tonnes
- Energy production: 1,129,434 GJ
- Energy use: 51,408,745 GJ
- Energy surplus/(deficit)(50,279,310) GJ
- Overall cost: £30,719,451

Note that the cost shown by the model is not just that to the local authority - it is the cost for waste disposal within the whole of Devon - public and private sector.

7.3 Scenario 1: 400,000 tonne incinerator

Given that it has already been proposed that incinerators should be built in Exeter and Plymouth, it seemed sensible to investigate this as a possible option, and what the effects would be. Today's viable incinerator has a capacity of 100,000-150,000 tonnes per year. Realistic proposals for new plants are likely to have a capacity around 200,000 tonnes a year to serve each area. In the model it is assumed that 300,000 tonnes of the waste will be 'municipal', and 100,000 tonnes will be commercial. The model also assumes that 25% of municipal waste is recycled.

Additionally in this model, landfill prices have been raised to £22/tonne, reflecting the price rise brought in by the landfill tax. The level of landfill gas utilisation has also been raised to 60%, representing the increasing use of landfill gas as a 'renewable' energy source.

Additionally, although it does not change the figures, it is assumed that the 98,000 tonnes of sewage sludge currently sea-dumped will be land spread.

The results of this model are:

- Disposal to landfill: 1,481,883 te/yr
- Total reclamation/reuse: 6,786,875 (185,184 te without mineral waste)
- Pollution emissions: 431,854 tonnes
- Energy production: 1,517,330 GJ
- Energy use: 49,656,874 GJ
- Energy surplus/(deficit)(48,139,544) GJ
- Overall cost: £48,067,440

7.4 Scenario 2: Medium recycling/minimisation

The next scenario considers the effects of 'medium' levels of waste minimisation and recycling - but the underlying fact is that landfill still represents the major disposal option.

In this option it is assumed that 40% of municipal waste, 15% of commercial/industrial waste and 10% of construction waste is reclaimed. On top of this municipal waste arisings are cut by 25%, and commercial/industrial by 10%. It should also be noted that the recycling is achieved by the segregated collection of waste rather than 'bring banks'.

100,000 tonnes of sewage sludge, along with the organic fraction of waste left over from waste sorting/reclamation. 50% of the digestate is then sold on as a compost material. Given the large scale of the digester operation, operating costs have been cut to £25/tonne.

The results of this model are:

- Disposal to landfill: 1,515,890 te/yr
- Total reclamation/reuse: 6,976,976 (376,976 te without mineral waste)

- Pollution emissions: 95,955 tonnes
- Energy production: 1,110,461 GJ
- Energy use: 39,254,752 GJ
- Energy surplus/(deficit)(38,114,291) GJ
- Overall cost: £37,854,250

7.5 Scenario 3: High recycling/minimisation

This model assumes the high (but according to studies achievable) levels of waste minimisation and recycling. Municipal waste arisings decrease by 33% (to reach the European Community per capita target) and that recycling reaches 50%, that commercial arisings drop by 25% and recycling rises to 50%, that industrial arisings fall by 20% and recycling rises to 25%, and that construction arisings fall by 10% and recycling/reuse rises to 33%.

The anaerobic digestion figures are as scenario 2.

The results of this model are:

- Disposal to landfill: 489,126 te/yr
- Total reclamation/reuse: 7,292,776 (892,776 te without mineral waste)
- Pollution emissions: 436,289 tonnes
- Energy production: 1,377,251 GJ
- Energy use: 23,822,524 GJ
- Energy surplus/(deficit)(22,445,273) GJ
- Overall cost: £31,061,490

7.6 Finding a strategy

It is crucial that, following the problems surrounding the determination of the two landfill applications currently before Devon County Council, steps are taken to update all statutory waste policy documents covering the County (the Waste Local Plan and the district Recycling Plans), and that the policy and practice of the County Council seeks to ensure that all future waste developments form part of a sustainable waste management programme.

	Valida- tion	Scen. 1	Scen. 2	Scen 3.
Cost, millions of pounds:	30.72	48.07	37.85	31.96
Landfill, million tonnes:	1.97	1.48	1.52	0.49
Waste reclaim, million te:	0.09	0.12	0.38	0.89
Pollution, million te:	0.08	0.43	0.10	0.47
Energy prod., million GJ:	1.13	1.52	1.11	1.38

From the results of the models - each one chosen as a particular example of a particular outcome of a strategy, it is possible to see the potential for implementing a programme to reduce the need for waste *disposal* in Devon. The table below brings together results from each strategy...

These figures demonstrate quite clearly that waste reclamation can be achieved without excessive cost. The current problem is that waste recycling addresses such a small part of the waste stream that it does not make any difference to the main costs in any waste disposal budget - the cost of landfill disposal. Until waste recycling and minimisation either prevent or remove 40-50% of waste arisings, they will not produce significant lowering of future landfill costs

Scenario 1 also shows the impact incineration has - not only in terms of cost but also in terms of polluting emissions. Although reclamation also produces pollution, what is important is the ratio between the reduction in the waste going to landfill, and the increase in polluting emissions - incineration produces a much greater impact for the amount of waste it 'reduces' going to landfill, and generates very little energy.

Until better data is available on waste arisings in the County, it is not possible to produce a completely detailed strategy for debate, but it is hoped that the results of these models show what could be achieved if the proper waste management systems were developed in the County.

It is clear from this analysis that incineration is not an option - but neither is the continuation of landfill. What must be developed over the next decade or so is a new waste management option within the County - waste minimisation and recycling. This is not just a matter of providing more recycling banks (for the reasons explained earlier), but instead seeking new collection and management systems which:

- Use economic instruments - very simply the cost of disposal - to make alternatives viable for both the public and for business. As well as seeking improvements to current systems, which will inevitably increase the cost of landfill, other options such as charging households for the waste they specifically produce should be considered;
- Waste reclamation on its own is not enough - measures must be taken to cause reductions in waste arisings. This again has an economic angle, but it is also a matter of improving local facilities - such as home or community composting, and provision for the storage of dry recyclables in new housing developments, through to the Council taking collective action with other local authorities to pressure the relevant central government bodies to take action on waste minimisation and the development of reusable packaging/repairable appliances;
- Work should begin as soon as possible seeking a development partner in the private sector to provide waste sorting/recovery facilities to handle segregated collection by the waste collection authorities. But the important thing is to encourage inward investment to the region by the companies who reprocess waste to produce new raw materials. This has the benefit of not only reducing the energy/pollution used to transport the waste, but it encourages sustainable jobs to meet employment needs in the area.

8. Conclusion

It is clear from the evaluation of the planning applications and associated data supplied for the Uffculme and Aller Barton landfill sites that neither of the developments should be permitted:

- In the case of the Aller Barton site, Devon Waste Managements assessment of the site, and of the potential for pollution, is woefully inadequate - comparing it with the application from Haul Waste quite effectively demonstrates this;
- The Uffculme application poses a threat to groundwater, and the possibility of utilising groundwater resources in this area at a future date;
- For both applications, there is no reasonable justification for allowing these sites in terms of the policies contained in national planning guidance, or the local development plan.

Devon County Council should refuse these applications and proceed to examine the alternatives to further landfill provision as soon as possible. This review should concentrate upon:

- Considering waste arisings as a whole - not just domestic waste;
- Concentrating on levels of per capita waste production;
- Improving levels of reuse and recycling;
- Processing the remainder of the waste stream by the 'best practicable environmental option';
- Minimising, and where possible eliminating, the amount of material going to landfill or incineration.

Also, the County Planning Authority should begin as soon as possible the public consultation process on the Waste Local Plan.

Finally, the problem regarding the vesting of Devon Waste Management, its liabilities, and the potential problems arising from DWM's possible inability to manage their sites for the necessary aftercare period should be speedily investigated and resolved. However, the County Council should not rush into granting planning permissions for Devon Waste Management solely on the basis of enabling them to become a viable company in order that the County Council can dispose of them.

Rather Devon Waste Management might provide the most convenient future private sector partner for the development of waste reclamation facilities in Devon - which by their nature have much less long-term liability than either landfill sites, and they do not have the great initial capital costs of landfills.

END

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