A Benefit-Cost Analysis of Recycling Programs for the Eugene Saint Vincent de Paul

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EXECUTIVE SUMMARY

This study aims to conduct a benefit-cost analysis of the recycling programs of the St. Vincent de Paul Organization. It begins by examining the costs of landfill use, including operating costs, external costs, and the issue of scarcity rent as it relates to landfills. The benefits created from the recycling activities of St. Vincent de Paul are also examined. These benefits arise from the sale of recycled and reconditioned materials, as well as from the job opportunities the recycling program creates. We attempt to quantify the benefits from the vocational service programs provided by St. Vincent de Paul. The conclusions of the study are several. We show that the external costs of having and using a landfill are higher than the tipping fee, which causes an inefficiently high amount of waste to be disposed at the landfill. We argue that the external costs of the landfill justify higher tipping fees (perhaps by imposing a tax on the landfill), a subsidy for alternative methods of waste disposal, or increased payments to SVDP for diverting waste from the landfill. We make suggestions about what additional data needs to be recorded in order to fully estimate the program's benefits, perhaps for the purpose of justifying additional diversion subsidies or for additional government support for Oregon Jobs Opportunities and Skills (JOBS) or TANF clients.

INTRODUCTION

The purpose of this project is to use benefit-cost analysis to accurately measure the net social benefits from landfill diversion. Specifically, we are examining the recycling programs, which divert reusable goods from the waste stream, of the Saint Vincent de Paul organization of Lane County, Oregon.

Benefit-cost analysis (BCA) is an important tool in decision-making. The idea is to evaluate all the benefits of a proposed policy or action, and then divide these benefits by the costs of the action, to determine the benefit-to-cost ratio. The net benefits can also be determined by subtracting the total costs from the total benefits. The basic goal of this process is to determine which decision maximizes the possible benefits of a policy or action. A benefit-cost analysis can be used for any decision, and is a very common technique. For an individual or single organization, it is relatively easy to determine the benefits and costs. When benefit-cost analysis is applied to public policy decisions, many complications arise, since there are multiple parties involved and the people who benefit from an action may not always be the same people who incur the costs of the action (Gramlich 4). Even when BCA does not produce a definitive answer, the exercise of accounting for private and social benefits can still be useful because it helps to demonstrate where the costs and benefits are coming from and who bears them.

For public policy decisions, the logical solution to the complications was first stated by Vilfredo Pareto. His rule simply states that a program improves the welfare of society if it makes at least one person better off without making anyone else worse off. In practice, this makes little sense because most policies cause someone to be worse off, which is why we use a benefit cost analysis to assess whether or not there is a net benefit to everyone. Instead of being a *truly* Pareto improvement, actions with a net benefit are considered a *potential* Pareto improvement

since, in theory, the benefits could be allocated so that no one is worse off while someone gains, showing that there are net gains (Gramlich 31).

As mentioned, this project attempts to conduct a benefit-cost analysis on the landfill diversion activities undertaken by the non-profit organization St. Vincent de Paul (SVDP) of Lane County, which primarily operates in Eugene, Oregon. SVDP helps the local homeless and at-risk population by providing social service programs, including emergency provisions (food, clothing, shelter, and basic needs), affordable housing, and vocational services. These programs are supported by the organization's waste diversion and recycling efforts. SVDP has created thrift stores which recycle clothes, books, and furniture – among many other items – and they also have a mattress factory, glass foundry, appliance shop, woodshop, and computer center, which all use recycled material to produce new and refurbished products. These different operations sell recycled and refurbished material to support the social services provided by St. Vincent de Paul, making the organization dependent on their diversion efforts in order to maintain and increase their operations. Our goal is to quantify the benefits and costs of these programs in order to help future policy decisions about landfill disposal and waste diversion.

Conducting a benefit-cost analysis of the St. Vincent de Paul recycling programs has elements that are very straightforward, such as calculating the operating costs of both options (landfill disposal or recycling), but also contains elements that are harder to quantify, such as the environmental effects of landfills. These effects, which are not directly imposed on the operators, are considered external factors. External factors (that is, externalities) can either be negative or positive, and they cause failures in the market system. A negative externality, for instance, can lead to too much of a good or service being used. In the case of landfill disposal, the external environmental costs are generally not included in the price of dumping waste, sending an

undervalued price signal to consumers, who in turn use more landfill space than is optimal. In the case of a positive externality, the external benefits to people are somehow not being included, causing *less* than the optimal amounts of use/consumption. When we attempt to conduct a benefit-cost analysis on the landfill diversion activities undertaken by St. Vincent de Paul of Lane County, we must include these externalities, since someone in the community does eventually bear the external costs and benefits from their activities.

The negative externalities associated with landfills include environmental effects and disamenities to the surrounding area. The environmental effects arise from the greenhouse gasses (such as methane) emitted from landfills when waste decomposes, the potential groundwater pollution through toxic seepage, and air pollution from the transportation of waste. The local disamenities include decreased property values in the areas surrounding landfills, increased traffic, and increased traffic accidents. It is important to note that although many landfills, including the Short Mountain Landfill in Lane County, have implemented methane recovery facilities which capture the methane gas emitted by decomposing waste and use it to create energy, these systems are not perfect and some gasses still escape into the environment. Likewise, landfills also now have protective linings which significantly decrease – but do not eliminate – the potential for pollution to groundwater from leachate seepage.

Since St. Vincent de Paul uses waste diversion as a way to fund their social programs, we must also include the external benefits from their activities in this analysis. Most of this benefit arises from SVDP's vocational service programs, which help at-risk individuals receive the experience and training necessary to hold steady jobs. The benefits, which are both private and public (that is, external), include increased wages and decreased social spending for program participants.

Another goal of this paper is to examine whether or not tipping fees (fees paid to dispose of waste in a landfill) are below the optimal price. If the external costs previously discussed are not considered in the tipping fee, then this would be true, causing too much waste to be disposed of in landfills. This would then have to be corrected by either a tax on waste disposal to discourage waste disposal or a subsidy on recycling activities to attract waste away from the landfill. An important issue associated with tipping fee pricing is scarcity. When we deal with exhaustible resources such as landfill space, we must account for the future value of the space as we use it in the present. This value, when taken into consideration, causes it to be beneficial to conserve the resource by increasing prices now. In this paper we will examine the cost of this scarcity rent for the local landfill.

Past studies have calculated various values for the external costs of landfills, and have looked at the benefits from vocational service programs similar to those of St. Vincent de Paul. For this project, we will calculate the private benefits and costs of the landfill diversion activities undertaken by St. Vincent de Paul by using numbers from landfill operations and St. Vincent de Paul. We will then attempt to calculate the external costs by using the most prevalent studies on landfills and vocational service programs.

LITERATURE REVIEW

The following section details various articles and documents of significance to this benefit-cost analysis. The first group of literature reviewed considers the topic of landfills and waste management. Information on Lane County's landfill and the external costs of landfills is gathered. The second group of literature discusses the effectiveness of government vocational service programs, quantified by the changes in individual income and social services spending.

In August of 2002, the Waste Management Division of Lane County published the "Lane County Solid Waste Management Plan" (SWMP). The purpose of the plan was "to provide a guide for the development and operation of an effective solid waste management system" and to serve as "a road map for making decisions to enhance and improve the quality of services currently being provided" in Lane County (Ferguson 1). The document does this by listing and detailing the various methods of waste management in Lane County (solid waste disposal, recycling, and so forth), then suggesting changes and expansions to improve waste management.

Solid waste in Lane County is dumped in the Short Mountain Landfill, located south of Eugene near Goshen. The SWMP document discusses the general use, operations, and future of the landfill, all of which is very important to this analysis. One such important detail is the disposal fee charged by the landfill for dumping waste. The total fee is $45 per ton for loose waste and $46 per ton for compacted waste, which breaks down in to two parts: a *tipping fee* "used solely to fund landfill operations, such as capital improvements, leachate treatment, landfill development, closure and post-closure set-asides" which accounts for $27.40 of the total disposal fee, and a *systems benefit fee* of $17.60 per ton "that covers programs and services of community benefit that are available to all Lane County residents" (Ferguson 81). Since some of the tipping fee is allocated to landfill development and closure, there is some accounting for the issue of scarcity rent.

Other important details from the SWMP document include the amount of waste received annually by the landfill – approximately 230,030 tons – and plans for the future expansion of the landfill, which began in 2002 and will occur in "a series of 10 lateral expansions to the existing landfill" (Ferguson 62-63). The original estimate indicated that the expansions would provide

Lane County with 40 more years of landfill use, but revised estimates allow for up to 80 years of use (Hansen).

Another important document is the policy brief "Getting Waste Management Prices Right", by the Resource Recovery and Recycling Authority of Southwest Oakland County. This paper discusses both landfills and recycling. The salient information from this paper for this analysis is the summary it provides of estimates for various external costs associated with landfill operations.

Some of the most widely recognized and largest external costs associated with landfills are air and groundwater pollution, transportation of waste, local property devaluation, and other local disamenities. The policy brief details and prices these external costs as follows: The marginal cost of greenhouse gas pollution is "$3.27 per ton for landfills without energy recovery and $2.22 per ton for landfills with energy recovery"; "local disamenity cost (odor, visibility, and general disamenities)…[is] between $3.05 and $4.39 per ton"; "the costs of waste transportation to landfills (congestion, air pollution, and the increased probability of road accidents…[is] $0.51 per ton for urban landfills and $1.69 per ton for rural landfills" (PB 3).

Another group of landfill externalities, which the policy brief does not provide information on, is the potential *health risks* from landfill pollution. It is possible that the cost given for greenhouse gas emissions includes the costs of health problems, but it seems far more likely (as it is common practice) that this cost captures damage to nature and the environment, and not the cost of health problems. A 2004 study for the United Kingdom's Department for Environmental, Food, and Rural Affairs (Defra) seeks to monetarily value "the external costs and benefits to health…of waste management options" (Defra 1). Several times the study mentions that some of the data is uncertain and/or unreliable. It also points out that the exact data

is based on the system of waste management in the United Kingdom, and therefore not applicable to other processes (Defra 4). The study nevertheless provides a detailed list of the possible health risks due to landfill pollution, some of which may still occur in the United States, although in levels differing from the UK and thus with different costs. The list of health effects includes acute mortality, respiratory and cardiovascular illness, cancers, and several possible birth defects (Defra 22). Some information on these issues in the United States is available, and will be discussed later in this analysis.

Richard Porter's book "The Economics of Waste" discusses three major topics with regards to waste: Solid waste, recycling, and special waste (such as hazardous chemicals). The first two topics are relevant to this analysis. Porter discusses the two bodies of common (non-special) waste, which are business and household waste (Porter 23-53). He then reviews the various ways in which these wastes can be disposed of, including landfills and incineration. There is surprisingly limited data in the text about the various external costs associated with the existence and operation of landfills. Porter does include EPA data on the potential cancer risk from landfill-polluted groundwater (Porter 63). It is mathematically shown in the following sections that the annual cost of this risk per ton of landfill waste is, perhaps surprisingly, so small that it can be considered zero.

Another relevant issue Porter discusses is scarcity rent, which is very important to this study. He briefly outlines one way to measure the value of scarcity rent, arguing that the marginal private cost should be a function of the variable costs of operating plus a component of the cost of opening a current landfill and closing the previous one, with this second part (the costs of opening and closing a landfill) rising at the interest rate (Porter 56). In this way, the price of landfill disposal increases as the resource becomes increasingly scarce.

Another method of calculating scarcity rent comes from the article "Optimal Pricing of Depletable, Replaceable Resources: The Case of Landfill Tipping Fees" by economists Mark J. Ready and Richard C. Ready. In their paper, Ready and Ready present a model for determining the optimal pricing policy for resources such as landfills. Their model is similar to a model presented by Hotelling, except that landfills can be replaced after the space is exhausted. By using a Hamiltonian (a complicated mathematical model whose details are beyond the scope of this paper) to determine the present value of future space, Ready and Ready calculate that the marginal private cost of landfills should be equal to the variable costs of operating the landfill plus a component that rises at the real rate of interest, where the component that rises at the real rate of interest is determined by the value of space to consumers.

In both Porter's and the Readys' (very similar) models, the amount of scarcity rent added to the variable cost of operating the landfill will be very low when the resource – that is, the landfill – is plentiful, but increasingly becomes a factor as the resource is reaches exhaustion.

As mentioned, Porter devotes a portion of his text to recycling, which is very interesting with some relevant information. Porter details the logistics of, policies for, and arguments surrounding recycling. He also argues that job creation is not a legitimate benefit of recycling programs, citing possible errors in such an argument. One of these errors is that recycling is expensive, requiring labor and capital that could "be used to fulfill other goals of public policy", and the jobs created by recycling programs only take away from jobs in other industries (Porter 130). He also argues that even if the programs do to create new jobs, "we would still have to be sure that recycling was the best way to achieve this outcome" (Porter 130). While Porter's argument is very likely valid for some recycling programs, the recycling programs of SVDP utilize their labor *at least as* effectively (if not *more so*) than elsewhere, and the programs

successfully create *new* jobs. The specifics of why and how Porter's arguments do not hold for SVDP's program will be detailed in a later section.

Along these lines, there is an important body of literature on the effects of vocational services. The first study worth mentioning is "A Meta-Analysis of Government Sponsored Training Programs" from 2001. The meta-analysis aimed to combine information on the effects of various sizes and types of government-sponsored job training programs in the United States, with the goals of determining "which training types are most effective, the sorts of people for whom they are most effective, and the circumstances under which they are most effective" (Greenberg ES-1).

While most of the specific data and details of the meta-analysis were not relevant to this study, there were nevertheless some very important general conclusions about the effects of government job training programs. Unfortunately, the various government-sponsored and/or subsidized training programs do not appear to have improved over time in regards to increasing the income of program participants (Greenberg 33). That is, the effects of the programs appear to be about the same now as when the programs began. This is especially unfortunate, since "the effects [on income] are rarely found to be large" which leads the authors to conclude that "a more expensive training program is not necessarily a superior one, in terms of increasing earnings" (Greenberg 33). A positive result of the meta-analysis is that it "found no evidence that the effects of training on the earnings of adults diminish over time once participants leave a program. Indeed, there is some indication that earnings effects may even increase somewhat" (Greenberg 33). So although the effect of a program on income is small, the effect does persist.

Data more relevant to the purposes of this research can be found in Gayle Hamilton's 2002 paper "Moving People from Welfare to Work". This paper details the results of a national

study on the government's welfare-to-work programs, the "National Evaluation of Welfare-to-Work Strategies", which looked at the effects of the programs on welfare recipients, and "addressed important policy questions".

Chapter four of the paper details the two general types of programs: those that encourage education and those that encourage employment. In both of these contexts, there were two sub-groups: Those for whom the goal (employment or education) was strictly monitored and highly encouraged, and those for whom there was less monitoring. There was also a control group for each of these four general types of programs. For all groups, data was collected on annual income and the sum of welfare payments received. In general across all groups, the study found that participants in the programs had higher earnings and lower welfare payments than the participants in the control groups. Annual income increased from $788 to $2,187, and total annual welfare payments decreased from $561 to $2,048 (depending on the type of program). The study also found that "employment-focused programs generally had larger effects on employment and earnings than did education-focused programs". As is consistent with the meta-analysis, this study found that although the programs increased the earnings of program participants, the impacts were not very large (and thus the participants still had fairly low income).

The other interesting section of the study is in chapter seven, where it details the costs of the programs and evaluates the costs relative to the benefits. The general conclusion is that the financial benefits of the programs (to the program participants) are sometimes but not always greater than the government's costs for the programs. Also, as is consistent with the meta-analysis, the study found that higher-cost programs do not always result in "larger earnings and welfare impacts than do lower-cost programs".

It is important to note at this point that there are distributional issues to consider. The government programs are paid for by tax revenue, the majority of which tends to come from wealthier members of society. It is then spent on the poorer members of society, who are generally able to increase their income thereafter. There is thus a rich-to-poor redistribution which occurs. The especially significant point to consider is that poorer people tend to have higher utility from increases in their wealth than do wealthier people. In other words, if both a poor person and a wealthy person were given one dollar, the poor person would *value* that dollar more and derive greater benefit from it than the wealthy person would. Likewise, if one dollar were taken from a wealthy person and one dollar were given to a poor person, the poor person would value the dollar gained *more* than the wealthy person values the dollar lost. Thus the rich-to-poor redistribution creates value in the form of net utility increases, which are difficult to capture in a monetary sense but are nonetheless important to consider.

Additional useful data comes from the article "The Value of Vocational Rehabilitation in Substance User Treatment", which is from a larger volume of work titled "Substance Use & Misuse". As the title indicates, the article examines whether providing vocational rehabilitation (VR) as a part of substance abuse treatment is cost effective. It uses "data from the Alcohol and Drug Services Study", which was conducted in three phases during the late 1990s (Shepard 2594). Although there are numerous potential benefits from providing vocational rehabilitation to substance abusers, the article's main concern was the effect on treatment costs. The analysis determined that although it is more expensive, on average, to provide VR as a part of treatment, the individuals who receive it have a higher probability of drug abstinence and are abstinent for longer periods of time (Shepard 2603). The "estimated cost-effectiveness of VR in promoting abstinence is $35,000 per additional abstinent client" (Shepard 2604). Thus the authors conclude

that even though VR is more expensive, it is a worthwhile investment because of its additional benefit (Shepard 2603).

A final pertinent issue is the effect of vocational services on crime rates and recidivism. Some of the people employed by SVDP are ex-offenders, who tend to have higher crime rates (relative to non-offenders) and are thus more costly to society (as they burden the justice system). Literature and theory suggest that, among the previously incarcerated, "having a legitimate job lessens the chances of re-offending following release from prison and that recidivism is less likely among those with higher wages and higher quality jobs" (Visher 295). Thus the vocational services and employment opportunities provided by SVDP might decrease the social costs of such people.

In a meta-analysis by Visher, Winterfield, and Coggeshall, the authors sought to compile and examine the available literature on "ex-offender employment programs and recidivism" (Visher 295). After reviewing eight studies on the topic, the authors came to the conclusion that "on average, the employment interventions examined did not reduce arrest among the treatment group subjects by more than the amount expected by chance (Visher 307). In other words, none of the studies showed a "significant effect on the likelihood that participants would be arrested" (Visher 310). In the face of common theory and logic, this result is very surprising. Indeed, the authors indicate in their final conclusions that they do not trust what the data seems to indicate, citing a number of reasons for the "no effect" outcome, such as: insufficient modern research; "lack of federal funding for ex-offender employment programs in the 1980s", which had negative effects on the programs during subsequent years; new types of programs introduced in the 1990s which have yet to be fully analyzed; and a need to provide diverse, specific services and link them to the different needs of ex-offenders (Visher 311). It can thus be argued that

although the literature indicates that vocational training has no effect on recidivism, it is uncertain whether this is actually the case, as the programs may, in fact, have an effect. More research is needed to evaluate this issue.

In all, the literature provides a large amount of important information for use in this analysis. This information includes details on landfills and waste management, such as listing and quantifying the private and social costs of waste, and explaining the process of accounting for scarcity rent. The literature also has details on the value of vocational service programs like those of St. Vincent de Paul. These details include the effects on income and social services spending for individuals who successfully complete the program, although further research is needed to quantify all of these benefits.

DATA

The data for this study comes from a variety of sources. As mentioned, the values for the benefits and costs of landfills come from the literature on the subject – that is, the SWMP document and the Policy Brief. Additional data is needed directly from St. Vincent de Paul in order to estimate the costs and benefits of the recycling programs and the vocational services. The exact data needed is detailed in appendices C and E.

For the purpose of this study, we chose to evaluate only the major products which SVDP recycles. These products are: mattresses, appliances (stoves, refrigerators, and washers/dryers), clothing, and books. All of these materials are recycled in one of two ways: they are either reconditioned for resale or scrapped for their materials (which are then separately resold). The benefit of each of these activities is the net profit from reselling the product or materials, which can be derived from the individual costs and benefits of the activities. To determine the cost of

reconditioning, for instance, we need to know the labor costs and the cost of new materials (where applicable). The cost of *recycling* (that is, scrapping for parts) comes from the labor costs and labor productivity. The spreadsheet for this project is designed to calculate these figures, which are the major costs and benefits of the operations. It is very important to note that there are other many other minor costs incurred by the operations, such as the cost of equipment and overhead costs.

The monetary benefits of St. Vincent de Paul's programs are not the only benefits. As mentioned, there are also benefits from the jobs the program creates. To accurately determine the total job creation benefits from the recycling activities, there are many areas of their operations from which we need data. If this data is recorded, it would then be possible to determine the net social benefits from these vocational service activities, which is relevant to both future policy considerations by the organization and for receiving state grants. As mentioned, the exact details of the data needed to calculate the vocational service program benefits are listed in appendix E.

SVDP uses their recycling programs to support and place at-risk people into jobs. SVDP has contracts with the state of Oregon in the JOBS program, which helps individuals gain the skills they need for long term employment. Their recycling programs allow SVDP to create jobs for people in Lane County. Past studies have determined the economic benefits from vocational services such as these, but to accurately determine the benefit one would need the success rates of individuals in the St. Vincent de Paul programs. We suggest that by keeping slightly more detailed data on the individuals in their programs, SVDP would be able to quantify the benefits from the programs. As mentioned, two of the main benefits from these vocational services are the increase in income to the individuals and the decrease in social service spending by the state.

The people in St. Vincent de Paul's vocational service programs fall into at least one of four major categories. They are either disabled, have a history of drug abuse, are ex-convicts, or have life skills problems. Each of these categories has different costs and benefits to the system, which must be included in to understand the net benefits of employing these individuals. In order to estimate the net benefits from SVDP's program, more detailed information is needed about the individuals entering the system and what happens to them after completing the program.

If all of the aforementioned data was available, our model would be able to show the benefits from St. Vincent de Paul's recycling programs, where the monetary benefits of the recycling programs can be estimated on a marginal basis (that is, per ton) and the benefits of the vocational services can be estimated on a per-person basis. Although it is a useful figure, the nature of SVDP's organization makes it somewhat beyond the scope of this study to estimate the vocational service program's benefits per ton.

METHODOLOGY

As mentioned, we have designed a spreadsheet to calculate the net benefits of SVDP's recycling program and vocational services. The spreadsheet organizes the efforts of SVDP into three parts: The external costs of landfills, the costs and benefits of the major products SVDP recycles, and the vocational service benefits. The design of the spreadsheet for each of these areas is explained in the following sections.

External Costs, Landfills *(Appendix A)*

To estimate the external costs of landfills, information is primarily pulled from the SWMP document and the Policy Brief, with some information from Porter's book "The Economics of Waste".

The SWMP document provides an estimate of the direct costs per ton of waste via the tipping fee. As mentioned, this fee accounts for the operating costs of a landfill – including site maintenance and pollution reduction – and it accounts for programs associated with the landfill and waste, such as the transfer station and recycling programs. As noted, these direct costs amount to $45 per ton. These costs are paid for when individuals and waste management companies pay the Short Mountain Landfill to dump waste.

The Policy Brief outlines most of the significant external costs associated with the landfill. Since the Short Mountain Landfill practices energy recovery, the external cost of air pollution (that is, greenhouse gas emissions) by the landfill is approximately $2.22 per ton. The range of cost estimates for landfill disamenities is $3.05 to $4.39 per ton, the average of which ($3.72) is used for this research. The final estimate from the Policy Brief is for the traffic impact of waste transportation. Since the Short Mountain landfill is in a rural area, the appropriate estimate for the traffic impact is $1.69 per ton. In all, these estimates from the Policy Brief for the external costs of landfills sum to $7.63 per ton.

Another important cost to consider is social cost of health risks caused by air and water pollution from landfills. As mentioned, there are a number of such health risks, including birth defects and cancers. Not all of these risks, however, are relevant to this study. The United States has very strong measures in place to reduce landfill pollution, which severely decreases the possible health risks. There is also very little data available for the United States on the emission levels of landfills or the cost of health risks. It is thus very difficult to estimate such costs.

Given that cancer is a major health risk, however, some data is available to estimate the social costs of cancer risk. As mentioned, Richard Porter's text includes EPA data on the estimates of cancer from landfill-polluted groundwater. For "the average U.S. landfill…[the]

probability of causing a cancer death each year" is 0.00000007 (Porter 63), which seems surprising low. The low risk figure is due in part to the high safety standards imposed on landfills (such as requiring them to place layers of protective lining specifically designed to prevent leachate seepage in the landfill). The other reason for the low risk is that "54% of the MSW landfills in the United States have no wells within one mile" (Porter 62). Thus roughly half of all landfills are not located near enough to a source of drinking water to pose a threat to it.

In order to calculate the cost of the potential cancer risk, the probability of cancer (0.00000007) is multiplied by the high-end estimate of the value of a life ($5 million), as given in the text. The average cost of cancer per landfill per year is thus $0.35 (0.00000007*$5,000,000). For the Short Mountain landfill, the marginal cost of cancer from groundwater pollution is then $0.00000015 per ton ($0.35 per year divided by 230,030 tons per year). This figure is essentially zero, and is thus entered into the calculations as such.

As mentioned previously, given that landfills are an exhaustible resource, there is a "scarcity rent" cost to consider. Short Mountain Landfill, however, has an estimated future operating life of 80 years (Hansen). Thus when the scarcity rent cost per ton is calculated and discounted to its present value (accounting for the time value of money), the scarcity rent value is very small. Thus, at the present time, it does not affect the marginal cost of landfills. It is, however, very important to note that this will not always be the case. As the Short Mountain landfill comes increasingly closer to reaching capacity, the cost of scarcity rent becomes increasingly significant and large relevant to the marginal cost of operating the landfill.

Recycling Programs *(Appendix B)*

SDVP recycles a wide range of products. For this analysis, we focused on the largest components of their recycling program: mattresses, appliances (stoves, refrigerators, washers

and dryers), books, and clothing. As mentioned, SVDP either prepares these products for sale in their thrift stores, or else scraps them and resells the components. Thus the spreadsheet on the recycling program is able to estimate the costs and benefits of both the reconditioning and scrapping portions of the business. It is important to note that since data was not available from SVDP, the numbers used the spreadsheet are only meant to serve as placeholders which show how the calculations work, and are not accurate approximations.

It is very easy to calculate the net benefit of reconditioned products if the average profit margin per unit is known. The average profit margin is simply multiplied by the number of units per ton to yield the net benefit per ton. If the average profit margin is not known, it can be derived from the costs and benefits of reconditioning the product. Some products (mattresses and appliances) require new materials to prepare them for sale in the stores. This materials cost can be estimated per product and then multiplied by the number of products in a ton to yield the reconditioning cost per ton. The other relevant cost in reconditioning products (which is relevant for all products) is the labor cost per ton, for which we need an estimate of how many tons of a product are reconditioned per day by an employee and the daily wage of employees (which equals the hourly wage times the average shift length). Dividing the daily wages by the daily productivity (in tons) yields the per-ton labor cost. Combining this with the materials cost – where applicable – gives the total cost per ton to recondition. The net benefit or cost of reconditioning is then the approximate revenue per ton of product less the cost to recondition. It is important to note that this figure does not account for the initial cost of transporting the products to SVDP. This cost will be accounted for and explained shortly.

The costs and benefits of scrapping products are also straightforward. The labor cost is calculated the same way as before: The daily labor cost per employee is divided by the daily

productivity (in tons) to get the cost per ton of scrapped materials. The benefits of scrapping the product are the resale values of the various individual materials. The revenue per material per product is multiplied by the number of product units per ton to get the revenue per ton of each material. The revenue per material per ton of product is then summed to yield the total benefit. To clarify, consider the example of polyurethane foam from mattresses: If the foam in one mattress resells for $2 and there are 50 mattresses in one ton, the revenue from polyurethane foam per ton of mattresses is $100 ($2*50). Adding this to the per ton revenue for steel, wood, and so forth (the materials from a scrapped mattress) yields the total revenue per ton of mattresses scrapped. Thus the net cost or benefit of scrapping is the revenue from the resold materials less the labor cost to scrap the product. The portion of the spreadsheet which calculates the net benefit of scrapping mattresses looks like:

Scrapping**		
Revenue from materials resold	Per mattress	Per ton
Steel	3	128
Wood	2	100
Cotton	1	50
Polyurethane Foam	2	100
Total revenue from scrapped mattresses =		**$377.50**
Labor costs		
Mattresses stripped daily (per indiv.)	100.00	2
Employee wages (hourly/daily)	$ 8.00	$64
Labor costs for scrapped mattresses =		**$32**
Net benefit:		**$345.50**

(Again note that these figures are only meant to serve as placeholders and are not accurate.)

It is important to note at this point that mattresses are somewhat different from the other recycled products. While the other products are *either* reconditioned *or* scrapped, mattress are *both scrapped and reconditioned*. For all mattresses, 85% of the springs (steel) are recycled, and

100% of the other materials are recycled. The remaining 15% of mattress springs are reconditioned to make new mattresses. This distinction from other products is especially relevant when calculating the per-ton total costs and benefits, as will be explained.

Another relevant issue for all recycled products is the cost of transporting the goods to SVDP. When the goods are dropped off at a SVDP location, there is no cost to the organization to transport the goods. When SVDP transports the goods (from a transfer station or landfill, for instance), the organization incurs a cost. Since this cost is the same for both the products which are reconditioned and the products which are scrapped, it is only necessary to include this in the marginal totals; it does not need to be divided between the two outcomes. Moreover, since this cost only occurs for the portion of the products which SVDP must transport, the actual per ton cost is the average cost per ton to transport multiplied by the average percent of products the company must transport. (For instance with mattresses: If the average cost to transport is $25 per ton and SVDP must transport 80% of all the mattresses it recycles, the actual relevant cost is $25*0.8 or $20 per ton.)

For some materials, SVDP receives a tipping fee from both individuals who drop-off products and the landfills from which products are removed. This is definitely the case for mattresses, and possibly the case for other products. A space was thus included in the spreadsheet for all products to account for this. In the case of mattresses, SVDP receives a different fee from landfills and individual drop-offs. To determine the total tipping fee revenue to the organization, each per-product fee is multiplied by the number of products in a ton. Each figure is then multiplied by the percent of products received in the respective manner, and the two figures are added together. Again to clarify with an illustration (using mattresses): If SVDP receives $5 per mattress from individuals who drop them off and there are 50 mattresses in one

ton, the revenue per ton of mattresses dropped off is $250 = $5*50. If 20% of all mattresses come from individuals who drop them off, the relevant per ton revenue is $50 ($250*20%). This would then be added to the relevant per ton revenue from mattresses SVDP receives from landfills to generate the total tipping fee revenue per ton.

There may be additional costs relevant to the different products. A space is created in the spreadsheet to include these costs, which can be entered on a per-unit basis. The spreadsheet then produces a per-ton cost.

Thus for mattresses, the portion of the spreadsheet which accounts for the cost of transportation, tipping fees, and other costs looks like:

Other		
Mattresses from Landfills	Per Mattress	Per Ton
Tipping fee from landfill	$ 7.50	375
Average cost to transport		$25.00
Percent from landfills		82%
Individually Dropped-Off		
Tipping fee from individuals	$ 5.00	250
Percent from individuals		18%
Total		
Cost to transport		**$20.50**
Revenue from tipping fee		**$352.50**
Other costs		
Cost A	$ -	$ -
Cost B	$ -	$ -
Total Other Costs		**$ -**

(The spreadsheets for the other products are very similar to this.)

For all of the products, the various costs and benefits are added to yield the per ton total cost or benefit. Excluding mattresses, the totals are calculated as follows: The profit margin (per ton) of reconditioned products is multiplied by the percent of each ton of product which is reconditioned, and the net benefit (per ton) of scrapping is multiplied by the percent of each ton which is scrapped. To these the revenue from tipping fees is added, and then the transportation

and other costs are subtracted, finally yielding the per-ton total benefit from recycling for each product. *(Again, see appendix B.)*

The slight difference with mattresses is due to the fact that nearly all mattress materials are recycled. Since the net benefit of scrapping accounts for the fact that only 15% of springs are reconditioned, the total per ton benefit of scrapping is the relevant cost. Since only 15% of the springs are reconditioned, only 15% of the profit margin per reconditioned ton is relevant. Thus the total benefit per ton is calculated slightly differently for mattresses.

Job Creation *(Appendix D)*

The final important consideration is the value of the jobs SVDP's recycling program creates. As mentioned previously, there are some arguments against counting such jobs as a legitimate benefit. These arguments are reviewed and discussed as follows:

One argument is: the jobs created merely reduce the number of jobs in other industries. This is perhaps true for some of the jobs created by SVDP's recycling programs. Landfills and waste transportation companies, for instance, need to employ fewer people to handle local waste, given that some waste is handled by SVDP. For this activity, the total number of jobs is relatively the same with or without the program. Given the nature of their operations and the eventual clientele for the products, however, SVDP likely creates unique jobs through the other parts of its program. Take, for instance, the mattress recycling program. For the argument to hold that SVDP's program only takes away from other jobs in the industry, it must be the case that demand for SVDP's mattresses detracts from demand for new mattresses from other sources. SVDP's low-income clientele, however, do not usually face such a trade-off between an SVDP mattress and another new mattress – their trade-off is between purchasing a mattress from SVDP or else *not purchasing* a mattress. In this circumstance, SVDP actually generates demand for a

product which did not exist before. For the portion of clients who do face a choice between an SVDP mattress and a mattress from another source, there is no affect on aggregate demand and thus no effect on the total number of jobs. For the *majority* of SVDP's sales, however, the products generate new/increased demand that did not exist before and thus *new* jobs are created.

Another major argument against counting the jobs created as a legitimate benefit is that the labor might be more effectively utilized elsewhere. Along this line same, some argue that if the workers were not employed in the recycling program, they would be employed elsewhere, and thus their wages are not really a benefit (they would be paid approximately the same amount under either circumstance). These arguments are again not accurate to SVDP because of the nature of programs and the organization. Wherever possible, SVDP aims to employ disadvantaged people (that is, people with low education, disabilities, recovering drug addicts, and so forth), who have difficulty finding jobs and are unemployed before working for SVDP. Since these people were not previously employed and have difficulty finding employment, it is not accurate to say they are "taken away" from other jobs. Some of these people would eventually find work elsewhere, but not all of them. SVDP contributes additional employment opportunities for such people.

The type of vocational services provided by SVDP creates additional individual and social benefits over other programs and especially over people not participating in programs. These benefits include higher income to individuals; lower costs to society via decreased use of welfare and TANF; decreased crime (and recidivism) rates, which decreases costs to the justice system; and decreased substance abuse, which decreases the use of Medicaid and other medical social services.

As noted, literature is available which estimates some of these decreased costs. The article on welfare-to-work programs estimated the income increases and welfare payment reductions for various types of programs. Since SVDP's program focuses on employment and has high goal-enforcement, the individual annual income due to program participation and successful job placement, as approximated by the study, is about 12.4% higher than individuals not enrolled in such a program. The individuals also receive about 14.9% less in annual welfare payments (Hamilton). If we know the average annual income of individuals who successfully complete the program, we can then estimate how much of this income is due to program enrollment. The total income is divided by the amount one plus the expected increase in income (that is, 1.124) to obtain the expected income without program participation. The actual income is then subtracted from this figure, which yields the amount of income increase from successful program completion per person.

To calculate the average decrease in welfare payments, the average welfare payments before enrollment can be approximated using state or county data on average welfare payments (rather than requiring data from individuals in the program). This number is multiplied by the expected decrease (14.9%) to get the decrease per individual.

The effects on income and welfare are assumed to be approximately the same across all characteristics, so the amount of change per individual is then multiplied by the total number of people who successfully complete the program, yielding the total income and welfare effects of the program.

The calculations on the remaining figures are fairly straightforward. For each of the previously mentioned four characteristic, the per person benefits (in terms of decreased social spending) are listed and summed. This total per person benefit is then multiplied by the number

of people from the given characteristic who successfully find jobs, giving the characteristic-specific social benefit. It is important to note that a single individual may fall under more than one characteristic (for instance, they may be both an ex-convict and a recovering substance abuser). It is accurate to include the social effects of successful program completion for the single individual for all categories to which they apply.

The last part of the "Job Creation" spreadsheet (appendix D) adds the income, welfare, and social spending benefits together. The average cost of the program per successful person is multiplied by the number of successful people and then subtracted from the total benefits, finally yielding the net total benefit of vocational services for successful individuals.

N.B.: It is very important to note most of the figures used in the spreadsheet are not accurate or approximated; they only serve as placeholders to show how the spreadsheet makes its calculations. The accurate figures in the spreadsheet are: the number of people enrolled in the program, the number who successfully complete it, and the rates of change for income and welfare payments. As mentioned, data is needed on the individual characteristics of the program participants, including the success rates of the people with different characteristics. Also, more research is needed on the social benefits (decreased health care and justice system expenses) from successful vocational service programs.

It is also important to recall that the benefits of successfully employing a recovering substance abuser, as given from the VR study, are approximately $35,000. While this figure is somewhat interesting and informative, it is a *total* not an *annualized* figure, making it difficult to interpret in terms of this study.

CONCLUSIONS

Although lack of data has hampered our attempt at quantifying the full benefits and costs of St. Vincent de Paul's recycling programs, much can still be derived from this analysis. First, we have shown that the actual costs of dumping waste in landfills is higher than the tipping fee, which results in an inefficiently large amount of waste being disposed of in landfills. Using previous studies, we calculated the total cost per ton total of waste is $52.36, of which $7.63 are the external costs. The external costs are not included in the tipping fee, meaning that the wrong price signal is given to people disposing at the landfill – landfill users see the cost at $45 instead of the full $52.63. The accurate higher price would cause fewer tons of waste to be disposed of in the landfill. In many cases, the cost of recycling would be cheaper, leading to more recycling and less landfill dumping. There are two ways in which this external cost can be accounted for, which would create market efficiency. One way is to impose a tax on landfill disposal. This tax, equal to the external costs, would help internalize the externality so that users would then consider the full costs of landfill disposal instead of only the direct costs. Raising the price of landfill disposal would also cause users to consider alternative methods of disposal, such as recycling. Such positive alternative disposal methods would most likely increase, but so might the negative alternative, which is illegal dumping. It is both difficult and costly to regulate illegal dumping, reducing the probability that an individual would be being caught doing so. Thus illegal dumping appears like a viable substitute to some individuals as the price of legal disposal increases. In both cases (taxing landfill disposal or subsidizing recycling), the amount of waste diverted out of the landfill to recycling would be dependent on the landfill user's response to increases in prices – that is, the elasticity of demand for landfill disposal.

The second way to reduce the inefficiency caused by the external costs of landfill disposal is to subsidize alternative forms of disposal – such as recycling – which would decrease the costs of using the alternative forms of disposal. The subsidy could be given directly to those who partake in alternative methods recycling, such as landfills that divert material or private individuals who chose to drop off materials (like mattresses) at a recycling locations. In this instance, a subsidy would probably be more effective in reducing the landfill disposal since a tax would also increase illegal dumping.

The second conclusion from this study deals with the issue of scarcity rent. As mentioned, scarcity rent is determined by the present value of the future use of a scarce resource, and since landfill space is scarce, we must attempt to include it. In this study, we determined that the scarcity rent at Short Mountain Landfill in Lane County, Oregon is negligible at this time. This is because the landfill still has 80 years left of operation. This is not to say that scarcity rent is not an issue, but rather that it only becomes a factor as we near the end of a landfill's lifetime. It may be a factor in areas where landfills are closer to their end and there is a lack of space for new landfills.

The last part of this study dealt with the benefits created from the recycling activities of St. Vincent de Paul. Since there is a lack of substantial data on both the job creation and profit form recycling, we were not able to conduct a full benefit-cost analysis. If more data was kept on profits from recycling activities and the characteristics and success rates of individual entering St. Vincent de Paul's recycling programs, we would be able to accurately determine these benefits. The spreadsheet, while designed specifically for SVDP's operations, could also be extended and/or altered for other recycling activities by making minor adjustments to the types of activities. Determining the net benefits of the program has many implications for future

use. Not only would it give an accurate representation of the benefits of recycling, but information on job creation could be used in the process of gaining more government contracts and grants. Many non-profit organizations compete for these contracts from the state, and this analysis can give St. Vincent de Paul a competitive advantage, since it quantifies the benefits of their program.

This examination shows that there are many external benefits from the recycling programs of St. Vincent de Paul of Lane County. Although not all these benefits can be quantified at this time, we believe that the benefits from these recycling programs will be substantial when they are quantified.

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APPENDICES A – E

(See preadsheets)