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**USING CHOICE QUESTION FORMATS TO DETERMINE
COMPENSABLE VALUES: THE CASE OF A
LANDFILL-SITING PROCESS**

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ABSTRACT

Siting noxious facilities, such as community landfills, is a challenging problem for local planners, who recognize the importance of economic efficiency and equity, political acceptance, and meeting federal regulatory standards. Meeting these criteria requires technical and socio-economic analyses in conjunction with public input. Planners may also recognize that political acceptance requires compensation for the host community, either in the form of monetary or in-kind transfers. Following Breffle and Rowe (2002), we use a “resource-to-resource” paired-comparison survey method to estimate compensatory values associated with an in-county landfill for both the host and nonhost communities. Our results indicate that while a host-community household’s minimum willingness to accept payment for hosting a landfill may exceed a nonhost-community household’s maximum willingness to pay for a landfill, a large difference in population sizes between the two communities enables the landfill to pass a Kaldor compensation test, in terms of both monetary and substitute-resource equivalents.

JEL Classification: Q24, Q51, Q53

USING CHOICE QUESTION FORMATS TO DETERMINE COMPENSABLE VALUES: THE CASE OF A LANDFILL-SITING PROCESS¹

1. Introduction

In their 1992 paper on the siting of noxious facilities, Swallow, et al. propose a three-phased approach that integrates the technical, economic, and political dimensions relevant to the site-selection process. In the first phase, a “long list” of candidate sites meeting minimum technical standards is identified by a committee of technical experts and community leaders. In phase two, the committee narrows down the phase-one list to a “short list” of candidate sites based on social suitability criteria. In phase three, a mechanism reflective of the community’s preferences (e.g., an auction, referendum, or community survey) is used to identify the final site. According to Swallow, et al. (1992), this approach “integrates economists’ concern for efficiency and equity with a centralized process to include expert input . . . by outlining a method to incorporate, analytically and empirically, diverse public preferences . . .” (page 284). The approach is also clearly more pragmatic than the decentralized, market-like mechanisms previously proposed by Kunreuther, et al. (1987) and Mitchell and Carson (1986).

This paper concerns the third phase of Swallow, et al.’s (1992) approach, in particular the outcome of a community survey recently conducted in Cache County, Utah to provide local decision-makers with critical information about a landfill-siting process.² In March 2004, the

¹The authors wish to thank Issa Hamud, Director of Environmental Services, Logan, Utah for helping to provide the funding for the community survey that forms the basis of this study. We also thank Taunya Jones for her skillful and tireless research assistance, the 600 Cache County households that participated in the survey, and the countless local officials and citizens who have given their time and energy to the various committees charged with making what is ultimately a very difficult landfill siting decision. William Breffle was especially helpful in guiding our initial modeling efforts.

²Cache County is located in northern Utah. Approximately 100,000 people reside in the county, the majority (40%) in the city of Logan.

Cache County Council approved a resolution authorizing its garbage contractor, Logan City, to proceed with property acquisition for a proposed landfill located in the northern end of the valley (Wright, 2004). Unbeknownst to the members of the county council and the various citizens and technical committees that helped to inform the council's decision, the resolution culminated a process that closely mirrored the site-selection approach proposed by Swallow, et al. (1992).

The process began in earnest in 1999, when a committee of technical experts and local community leaders (later to be known as the Technical Committee) proposed a list of 11 possible in-county sites for a new landfill and two existing out-of-county landfill sites for shipping of the county's waste (Division of Environmental Services, 1999). Later in 2000, the Technical Committee (TC) and a newly formed Citizens Advisory Committee (CAC) jointly shortened the in-county list to three possible sites. Finally, a series of studies including visual, economic, and environmental analyses as well as an innovative community survey were conducted in order to help the TC, CAC, and county council identify the most preferable of the three in-county sites, which would then be compared with the most preferable of the two out-of-county sites. It was therefore as if the various stakeholders in this process had agreed at the outset to follow the Swallow, et al. (1992) approach in spirit, if not to the letter.

Following Breffle and Rowe (2002), we use an innovative paired-comparison survey method to estimate compensatory values associated with an in-county landfill for both the host and non-host communities.³ Our results indicate that while the typical host-community household's minimum willingness to accept payment (WTA) for hosting a landfill exceeds the typical non-host-community household's maximum willingness to pay (WTP) for an in-county

³See Adamowicz, et al. (1998) and Magat, et al. (1988) for earlier uses of paired-comparison question formats. For background on the various federal statutes and regulatory promulgations in support of this methodology see Jones and Pease (1997). For a cautionary assessment of the methodology see Flores and Thacher (2002).

landfill, a large difference in population sizes between the two communities enables the in-county site to pass a simple compensation test, in terms of both monetary and substitute-resource equivalents. Further, our results help quantify potential monthly fees that non-host-community households would willingly pay to help make the host community “whole”, i.e., no worse off with the landfill and compensation than without the landfill (and therefore no compensation).

The next section discusses our survey instrument, sampling procedure, and the demographic characteristics of the sample. The main focus of this section is a discussion of the “resource-to-resource” question format used to elicit the WTA and WTP estimates which are subsequently used to determine the community-level compensatory values. Section 3 provides two types of unconditional analyses that examine the reliability and validity of the respondents’ answers to the paired-comparison questions. The first type delineates *inter alia* the respondents’ level of awareness of the landfill issue, the degree of confidence in their responses to the paired-comparison questions, as well as their trust in the underlying decision-making process. The second type pertains to a validity test performed on the responses provided to the paired-comparison questions. Section 4 presents the household-level random-utility model underlying our econometric analysis, as well as the social criterion used to decide between selecting an in-versus out-of-county landfill site. Section 5 provides the corresponding empirical results. Section 6 demonstrates how the empirical results can be used to inform policy, and Section 7 concludes with a summary of our main findings.

2. The Community Survey

The overriding goal of the community survey was to gather information regarding the concerns, perceptions, and preferences of Cache County adults related to a variety of future landfill options. While economic efficiency was not their overriding goal, local planners were

concerned about making host community “whole”, recognizing that acceptance requires compensation either in the form of monetary or in-kind transfers. Using extensive input from county residents, local government officials, and other interested parties, a mail-survey instrument was developed in the fall of 2003. The instrument was first pre-tested with focus groups from both the host and non-host communities (henceforth “H” and “NH” communities, respectively) in order to identify questions that were difficult to understand or answer and to obtain feedback regarding question wording, survey format, and survey length. A revised version was next presented to the CAC and TC at public meetings for final review and approval. Following their approval, the instrument was sent to 960 randomly selected households that currently pay for waste disposal in the county.

The survey design and mailing process followed the Dillman (1978) Tailored Design Methodology.⁴ The first mailing was sent with a cover letter and a prepaid business reply envelope to all 960 sampled households in January 2003, and a reminder postcard was sent one week later. To increase response rates, a second survey was mailed to non-respondents three weeks after the initial mailing, and again a reminder postcard was mailed one week later.

The sample was stratified to include equal numbers of households (320 each) in the following three groups: (1) residents of the host community, (2) residents of the city of Logan, Cache Valley’s largest city, and (3) residents in the remaining areas of Cache County (groups 2 and 3 together are henceforth referred to as the NH community).⁵ Usable responses were received from over 66% of the eligible respondents. The specific response rates by area were 67%, 69%, and 63% for groups 1, 2, and 3, respectively.

⁴A copy of the survey instrument is available from the authors upon request.

⁵Because the survey was designed to over-sample residents in the H community and in Logan city, numeric weights are assigned to each observation for the econometric analysis in order to correct for any over-sampling bias that may exist in the data. Details of this weighting process are provided in Jackson-Smith, et al. (2003).

Descriptive statistics of respondents in each of our three study areas, along with a weighted estimate of the characteristics of all adults in our combined sample, are presented in Table 1. Overall, the average respondent in our study is 42 years old, although respondents in the H community are notably older. Roughly a quarter of the respondents have lived in Cache County their entire lives, though this ranges from 20% of Logan residents to almost half of the H-community respondents. Most respondents have some post-high school education – almost 40% have completed a bachelors or graduate degree. Formal education levels are highest in the NH community. Over 70% of respondents are employed (most full time), 10% are retired, and just under 20 percent are “keeping house”, in school, or unemployed. Logan residents have lower levels of employment, reflecting the higher proportion of active students working on degrees at Utah State University.

We compared the summary statistics reported in Table 1 with published population characteristics from the 2000 U.S. Census. The results suggest that our samples from each of the three study areas generally have a gender balance and proportion of adults living in owner-occupied housing that is quite close to the census population. The exception reflects overrepresentation of males in the H community. Across all three study areas, there tended to be proportionately fewer young adults (age 18-39) and a larger number of older adults (age 60 and over) than is present in the population. There is also an overrepresentation of adults with bachelors and graduate degrees. The overall results of our study should therefore be interpreted with this sample bias in mind.

Generally speaking, results obtained from the survey were as expected. Most respondents are aware of the landfill debate. Protecting the environment and minimizing the costs of waste disposal are top priorities. Residents (particularly those located in the H

community) are most concerned about water quality, nuisances, and loss of habitat associated with an in-county landfill. Most adults residing in the NH community prefer an in-county option (due primarily to the ability to retain local control over future garbage pricing), while those residing in the H community prefer an out-of-county option. However, most residents in the NH community support mitigation of impacts and compensation for the H community should an in-county site ultimately be selected.

To investigate various compensation alternatives and to elicit quantitative estimates of the value of these alternatives, we developed a series of paired-comparison questions along the lines of Breffle and Rowe (2002). The basic design of the survey questions were four blocks of questions that present respondents with pairs of alternative scenarios for a future landfill, and ask them to state their preferences by choosing one of the two alternatives. Each alternative includes a proposed landfill location, an estimated additional monthly cost to a typical household, and various levels of additional compensation provided by residents of the NH community to residents in the H community.

Two types of compensation packages are considered – “local community payments” and “new public services”. Local community payments would be made to the H community’s local government, which could be used to mitigate unwanted impacts from the landfill, to reduce local property tax burdens, or for any other public purpose. New public services would involve the county paying for staff and equipment to provide new or improved public services in the H community. These services could include either (1) the county assuming responsibility for the maintenance and improvement of local roads (particularly during the winter months), (2) county provision of local fire and police protection services, or (3) both. Table 2 lists the specific values for these compensation packages as well the future landfill locations and the added monthly costs

to households of a new landfill.⁶ The compensation packages, levels of compensation, and monthly costs were based on input from county residents, local government officials, and other interested parties. Figure 1 presents a map of the locations of in-county sites 1, 2, and 3.

While each individual survey included four distinct pairs of questions (each with a specific compensation package), there were eight versions of the survey used in the H and NH communities. The use of multiple versions allows the estimation of WTP (or WTA) for various levels of public services and landfill site locations.⁷ The first three choice questions represented resource-to-resource tradeoffs, while the fourth question represented a simple referendum choice. Figure 2 provides an illustration of the resource-to-resource choice questions (described further below) presented to the respondents, while Figure 3 provides an illustration of a referendum choice question also presented to the respondents.⁸

In the pairwise question presented in Figure 2, respondents make a choice between a local community payment and whether or not to site an in-county landfill. This particular choice question is “simple” because the only differences between the alternatives pertains to Local Community Payments (which are zero in Alternative A and \$50,000 in Alternative B) and Future Landfill Location (which is out-of-county in Alternative A and in-county in Alternative B).⁹ Everything else between the alternatives (i.e., New Public Services and Added Cost to Household) is the same. Thus, in this particular question, the respondent is weighing the tradeoff

⁶The specific values in Table 2 resulted from consultations with technical experts and community leaders as well as the participants in our survey focus groups.

⁷The specific combinations of alternatives per choice pair and characteristics per alternative for each choice pair were selected with the help of the SAS Optex procedure. Given the number of characteristics and the levels they can take (see Table 2), there were 132 possible alternatives and therefore an extremely large number of possible choice pairs. The Optex procedure provides an orthogonal experimental design that helps to eliminate certain types of inappropriate pairs.

⁸The full set of choice questions used in the eight different versions of the survey is available from the authors upon request, and from Jackson-Smith et al. (2003).

⁹A “complex” choice question varies both local community payment levels and new public services along with landfill site across alternatives.

between (1) siting the landfill in the H community and compensating the H community with an endowment of \$50,000 per year, and (2) shipping the county's waste out-of-county and therefore not compensating the H community. The simple referendum depicted in Figure 3 compares an out-of-county site (with a higher monthly fee) and an in-county site (with no additional fee).

By varying the compensation package mixes and levels across questions and examining the choices made, mathematical methods (described in Section 4 below) are used to determine how much of one kind of restoration has equivalent value to different amounts of another compensation package. The alternatives, and the choice between alternatives, are designed to reflect realistic and meaningful compensation alternatives. To present realistic choices, each of the alternatives includes a dollar cost to the household associated with the alternative. The dollar values presented differ across choice pair, and across survey versions, which allows for calculation of the public's WTP and WTA for compensatory values.

3. Reliability and Validity of the Survey Responses

As Breffle and Rowe (2002) point out, higher awareness of the issue at hand can be expected to enhance the reliability of responses and to reduce the burden of communication in survey design. To examine the degree of awareness in the sample, respondents were asked, "How familiar are you with [the] issues [surrounding the future in-county landfill options]?" Overall, 45% of the respondents felt they were somewhat to very familiar with the issues at the time of the survey. However, this overall percent is based on a large divergence between H and NH community respondents (89% and 43%, respectively).¹⁰

Despite this divergence in awareness levels across the two communities, approximately 70% of the respondents felt confident about their responses to the choice questions. Similarly, a

¹⁰For further information about the results for this and the following awareness and confidence questions, see Jackson-Smith, et al. (2003).

large majority of NH respondents (73%) are confident that a new in-county landfill would meet federal regulatory standards and that the standards are adequate, although H-community households in particular do not share this level of confidence (only 44%). Finally, most respondents feel powerless (84%); that is, they feel that their opinions will not influence the landfill decision.

Taken together, these results indicate that while the overall majority of the survey's respondents feel they are not well-informed of the issues surrounding the future in-county landfill options and that their opinions are unlikely to influence the decision anyway, the majority does feel confident of their responses to the choice questions and that an in-county landfill, if sited, would meet adequate federal regulatory standards. Thus, the perceived lack of awareness among our survey respondents may be offset at least somewhat by their relatively high levels of confidence, indicating that the reliability of their responses is not necessarily compromised by a lack of awareness.

With respect to the validity of the respondents' answers to the paired-comparison questions, a test was conducted by comparing responses to similar pairwise questions from different survey versions. One would expect that a program offering greater provisions (as compensation) or a lower monthly cost, *ceteris paribus*, would be selected by a larger percentage of respondents. In this study, it is difficult to assess whether the provision of road maintenance is a better level of public services than the provision of police and fire services. Therefore, the survey design limits the ability to conduct a simple scope test.¹¹

¹¹As a result of the SAS Optex procedure to ensure an orthogonal survey design, not one feasible comparison could be made between two surveys that holds all levels of alternatives constant while allowing the annual community payment and landfill site to vary. Ideally, this type of variability would have allowed for a scope test.

Nevertheless, a single scope test was conducted by comparing a similar referendum question from two survey versions. As expected, the results show that a larger percentage of respondents in one survey (51%) selected the out-of-county option (site 5) with a lower monthly household cost of \$5 than did respondents in the other survey (41%) at a monthly household cost of \$15. Overall, a majority of H community respondents consistently chose an out-of-county option, while a majority of NH community respondents consistently chose an in-county option. This result is consistent with responses elicited from H and NH households to questions provided earlier in the survey questionnaire concerning their general attitudes toward the in- and out-of-county options.

4. The Economic Model and Social Criterion

In this section, we present the model used to estimate preferences for compensating the H community. The model can be used to examine how individuals trade-off different levels of the two compensation packages, and how they value changes in package levels in monetary terms (i.e., traditional WTA and WTP measures). The choice-question model seeks to explain statistically each respondent's four choices from the choice pairs as a function of a number of compensation-package and individual characteristics. The model parameters therefore represent a quantitative measure of the relative importance of the program characteristics in determining benefits individuals receive from their availability (Breffle and Rowe, 2002). For example, the parameter value on the variable for level of local community payment indicates the increase (or decrease) in the individual's utility if the payment to the H community is made at that level.

In making their choices, we assume that survey respondents chose the alternative (A or B) in each pair that provides the largest net benefit. Following Breffle and Rowe (2002), let individual i 's utility, $i = 1, \dots, I$, for the compensation packages be given by:

$$U_{ij}^{k_{ij}} = \beta x_{ij}^{k_{ij}} + \varepsilon_{ij}^{k_{ij}}, \quad j = 1, \dots, J \text{ and } k_{ij} \in [1, 2], \quad (1)$$

where $U_{ij}^{k_{ij}}$ is the utility of the k^{th} alternative of choice pair j to individual i . In our case, $J = 4$, since each respondent received a total of four choice questions in the survey, and k_{ij} indicates which of the two alternatives within each choice pair is ultimately chosen by the respondent. The vector $x_{ij}^{k_{ij}}$ contains the characteristics of the k_{ij}^{th} alternative. Thus, the corresponding vector of unknown elements β (which we statistically estimate) can be interpreted as the respective marginal utilities. Preference heterogeneity can be modeled by interacting the vector $x_{ij}^{k_{ij}}$ with a host of demographic, attitudinal, and knowledge-level characteristics that vary among individuals. By doing this, the marginal utilities are allowed to vary by individual characteristics.

While $\beta x_{ij}^{k_{ij}}$ represents the non-stochastic part of utility, the term $\varepsilon_{ij}^{k_{ij}}$ represents its stochastic element. This stochastic element accounts for the fact that the respondent's preferences can vary randomly over time and that the researcher likewise has imperfect information about what the respondent's preferences really are. In other words, neither the respondent nor the researcher knows the respondent's preferences with certainty. For estimation purposes, we assume that $\varepsilon_{ij}^{k_{ij}}$ is independently and identically distributed across both i and j , is uncorrelated with $x_{ij}^{k_{ij}}$, is mean-zero type 1 extreme value, and has constant unknown variance σ_ε^2 .

Letting $K_{ij} \in [1, 2]$ be a random variable that is the choice for individual i when confronted with choice pair j , the individual is assumed to choose the k_{ij}^{th} alternative with probability¹²

$$P(K_{ij} = k_{ij}) = P_{ij}^{k_{ij}} = P(U_{ij}^{k_{ij}} > U_{ij}^{3-k_{ij}}), \quad (2)$$

where k_{ij} is the observed value of K_{ij} resulting from the survey response. From equations (1) and (2) and the assumptions on $\varepsilon_{ij}^{k_{ij}}$, the probability of choosing alternative k_{ij} may be rewritten as

$$P_{ij}^{k_{ij}} = P(\beta x_{ij}^{k_{ij}} + \varepsilon_{ij}^{k_{ij}} > \beta x_{ij}^{3-k_{ij}} + \varepsilon_{ij}^{3-k_{ij}}) = \Psi(-\beta(x_{ij}^{k_{ij}} - x_{ij}^{3-k_{ij}})), \quad (3)$$

where $\Psi(\cdot)$ is the univariate logistic distribution function. This probability enters into the following likelihood function L ,

$$L(k_{ij}, i = 1, \dots, I; j = 1, \dots, J | x_{ij}^1, x_{ij}^2; \beta, \sigma_\varepsilon^2) = \prod_{i=1}^I \prod_{j=1}^J P_{ij}^{k_{ij}}, \quad (4)$$

where the 1 and 2 superscripts on x_{ij} denote alternative 1 and 2, respectively, and the Π operators indicate that the J observations for each respondent are “stacked” to produce a dataset with JI observations.

Two model specifications are used in this study: a restricted model and a full model.

The following empirical specification of $U_{ij}^{k_{ij}}$ represents the restricted model,

$$U_i = \beta_Y(Y_i - C_i) + \beta_A D_A + \sum_{r=1}^3 \beta_r^{\text{loc}} (D_{\text{loc}} \bullet \text{roads}_r) + \beta_p^{\text{loc}} (D_{\text{loc}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{loc}} (D_{\text{loc}} \bullet \text{landfill}_w) + \varepsilon_i, \quad (5a)$$

while the full model is,

¹²In this notation, if the individual chooses alternative $k_{ij} = 1$ (or 2), then the alternative that is not chosen is $3 - k_{ij} = 2$ (or 1).

$$\begin{aligned}
U_i = & \beta_Y (Y_i - C_i) + \beta_A D_A \\
& + \sum_{r=1}^3 \beta_r^{\text{loc}} (D_{\text{loc}} \bullet \text{roads}_r) + \beta_p^{\text{loc}} (D_{\text{loc}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{loc}} (D_{\text{loc}} \bullet \text{landfill}_w) \\
& + \sum_{r=1}^3 \beta_r^{\text{know}} (D_{\text{know}} \bullet \text{roads}_r) + \beta_p^{\text{know}} (D_{\text{know}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{know}} (D_{\text{know}} \bullet \text{landfill}_w) \\
& + \sum_{r=1}^3 \beta_r^{\text{sconf}} (D_{\text{sconf}} \bullet \text{roads}_r) + \beta_p^{\text{sconf}} (D_{\text{sconf}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{sconf}} (D_{\text{sconf}} \bullet \text{landfill}_w) \\
& + \sum_{r=1}^3 \beta_r^{\text{vconf}} (D_{\text{vconf}} \bullet \text{roads}_r) + \beta_p^{\text{vconf}} (D_{\text{vconf}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{vconf}} (D_{\text{vconf}} \bullet \text{landfill}_w) \\
& + \sum_{r=1}^3 \beta_r^{\text{comp}} (D_{\text{comp}} \bullet \text{roads}_r) + \beta_p^{\text{comp}} (D_{\text{comp}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{comp}} (D_{\text{comp}} \bullet \text{landfill}_w) \\
& + \sum_{r=1}^3 \beta_r^{\text{minc}} (D_{\text{minc}} \bullet \text{roads}_r) + \beta_p^{\text{minc}} (D_{\text{minc}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{minc}} (D_{\text{minc}} \bullet \text{landfill}_w) \\
& + \sum_{r=1}^3 \beta_r^{\text{hinc}} (D_{\text{know}} \bullet \text{roads}_r) + \beta_p^{\text{hinc}} (D_{\text{know}} \bullet \text{payment}) + \sum_{w=1}^4 \beta_w^{\text{hinc}} (D_{\text{know}} \bullet \text{landfill}_w) + \varepsilon_i,
\end{aligned} \tag{5b}$$

where $U_{ij}^{k_{ij}}$ is replaced by U_i to simplify notation. Each of the variables included in (5a) and (5b) are defined in Table 3.

With the exception of β_A , the various β parameters in (5b) measure the marginal utilities associated with one unit changes in the corresponding variables.¹³ For example, β_Y indicates the increase in utility if the cost of the compensation package decreases by \$1, and thus may be interpreted as the (constant) marginal utility of money. It is expected to have a positive sign, implying that the individual prefers to pay a lower cost. The remaining individual-characteristic parameters— β^{loc} , β^{know} , β^{sconf} , β^{vconf} , β^{comp} , β^{minc} , and β^{hinc} —represent the change in utility associated with a unit change in each of the respective individual characteristics (relative to their respective base categories), all else equal.

¹³ β_A controls for the fact that the typical respondent is more likely to choose alternative A.

Referring to (5b), when $\text{loc} = H$ and $r = 1$, $\beta_r^{\text{loc}} = \beta_{r=1}^H$ indicates the change in an H-community household's utility associated with the county providing road service to the H community. Similarly, when an individual perceives herself as being somewhat to very informed about the landfill issue and $r = 1$, $\beta_{r=1}^{\text{know}}$ indicates the change in this individual's utility associated with the county providing road service to the host community.

The linearity of the empirical model specified in (5a) and (5b) allows for straightforward compensating-surplus (CS) computations of WTA and WTP. CS is computed as the change in utility between the "new" and "reference" situations (e.g. between $r=1$ and $r=0$; $w=1$ and $w=0$; etc.) divided by the marginal utility of money (i.e. β_Y),

$$CS_i = \frac{\beta^s}{\beta_Y}, s \in [\text{set of individual characteristics}] \quad (6)$$

where β^s represents the β parameter associated with the given individual characteristic. For example, if $\text{loc} = NH$ and $r = 1$, then $\beta^s = \beta_{r=1}^{NH}$ and CS_i equals the typical NH household's estimated WTP for county provision of roads in the H community. Similarly, if $\text{loc} = H$ and $w=1$, then $\beta^s = \beta_{w=1}^H$ and CS_i equals the typical H household's estimated WTA payment for selecting landfill site 1 in the H community. To the contrary, if $\text{loc} = NH$, then CS_i equals the typical NH household's estimated WTP for selecting landfill site 1 in the H community.

Turning now to the social criterion for determining whether an in-county site should be chosen over an out-of-county site, let (1) C_{IC} and C_{OC} represent the costs of constructing and operating a new in-county landfill and shipping waste out-of-county, respectively, (2) n_H and n_{NH} be the number of households in the host and non-host communities, respectively, and (3) $\overline{WTP}$ and $\overline{WTA}$ represent mean WTP and mean WTA, respectively, for a given community and

landfill location. For a given in-county landfill site to be selected over a given out-of-county site the following condition must therefore hold,

$$C_{IC} + \left(n_H \times \overline{WTA}_H^{IC} - n_{NH} \times \overline{WTP}_{NH}^{IC} \right) \leq C_{OC} + \left(n_{NH} \times \overline{WTA}_{NH}^{OC} - n_H \times \overline{WTP}_H^{OC} \right), \quad (7)$$

where the terms in parentheses represent respective welfare changes, defined as the welfare cost of a site location to one community (e.g., $n \times \overline{WTA}$) less the corresponding welfare benefit to the other community (e.g., $n \times \overline{WTP}$). A given in-county site is selected when its total cost (the sum of construction and operating costs plus the associated welfare change) is not more than the total cost associated with shipping the county's waste to a given out-of-county landfill.¹⁴ Note that in the case of multiple in- and out-of-county sites, the social criterion requires that the respective in- and out-of-county sites first be rank-ordered according to (7). Then, the lowest-cost in-county site is compared with the lowest-cost out-of-county site.

If (7) holds and the net welfare change satisfies a Kaldor Potential Compensation Test (Freeman, 1993), i.e., $n_H \times \overline{WTA}_H^{IC} \leq n_{NH} \times \overline{WTP}_{NH}^{IC}$, then the level of compensation (COMP) provided (per household) from the non-host community (in monetary-equivalent terms) should satisfy¹⁵

$$\frac{(n_H \times \overline{WTA})}{n_{NH}} \leq \text{COMP} \leq \overline{WTP}. \quad (8)$$

¹⁴Because the benefits and costs are incurred over some given time horizon, equation (7) refers to the present value of the stream of benefits and costs that will accrue over that horizon.

¹⁵Note that in the case where (7) holds but the Kaldor Potential Compensation Test does not, compensation may still be possible. In this instance, it must be the case that $C_{IC} < C_{OC}$ and the associated cost difference potentially could be passed through in monthly savings to households. Thus (8) becomes,

$$\frac{(C_{IC} - C_{OC}) + (n_H \times \overline{WTA})}{n_{NH}} \leq \text{COMP} \leq \overline{WTP}.$$

Condition (8) ensures that the aggregate level of compensation provided to the host community is somewhere between the host community's aggregate WTA and the non-host community's aggregate WTP for the in-county site.

5. Empirical Results

We turn now to the results associated with the estimation of equations (5a) and (5b). To begin, we estimate (5a) in order to focus on the most important determinants of our CS measures. To this end, the set of individual-characteristic parameters, excluding β^{loc} , are assumed equal to zero (i.e. $\beta^{\text{know}} = \beta^{\text{sconf}} = \beta^{\text{vconf}} = \beta^{\text{comp}} = \beta^{\text{minc}} = \beta^{\text{hinc}} = 0$).

Referring to Table 4, several of the β coefficients in (5a) are statistically significant. For example, locating an in-county landfill at sites 1, 2, and 3, respectively, relative to the "left-out" out-of-county site 5, increases the typical NH household's utility by 0.875, 0.516, and 0.721 utils, implying that of the three possible in-county landfill sites, the typical NH household most prefers site 1. However, choosing out-of-county site 4 over site 5 has no statistical effect on the household's utility level. Converting these marginal utility estimates to their corresponding CS values via (6) results in monthly household WTP values of \$14.14, \$8.33, and \$11.65 for in-county sites 1, 2, and 3, respectively. These dollar amounts reflect the value NH households receive from retaining local control over the county's waste disposal system, and, presumably, from compensating the H community *other than* through a community endowment fund or provision of new public services. Given the statistical results for the community endowment fund (i.e. the payments variable) and new public services (i.e. roads, police and fire protection), NH households apparently are unwilling to fund these compensation packages through contributions to an H-community endowment fund.

Not surprisingly, H households would need to be compensated to willingly accept the siting of a landfill in their community. The typical H household's utility decreases by 2.217, 2.566, and 1.264 utils, respectively, as in-county sites 1, 2, and 3 are chosen, implying that the typical H household prefers site 2 the least.¹⁶ Converting these marginal utility estimates to their corresponding CS values via (6) results in monthly household WTA values of \$35.81, \$41.45, and \$20.42 for in-county sites 1, 2, and 3, respectively. These dollar amounts reflect the perceived social costs that these households will suffer as a result of the siting of a landfill in their community. Also as expected, the typical H household has no preference for out-of-county site 4 over site 5.

While H households would gain utility from the county provision of roads and fire/police protection services, the combination of roads and fire/police protection has no statistical effect on utility. On the surface, this is a curious result. One would think that the more public goods provided, the larger would be the increase in the household's utility level. However, in this case, adding fire and police protection to the provision of roads completely eliminates the utility gain of 0.806 utils that the household obtained solely from the provision of roads. One explanation for this result is that while the H community may be comfortable with the county assuming responsibility for providing roads services, they are uncomfortable with the county being in a de facto monopoly position of supplying public goods to the community (which may, perhaps, pose a threat to community job security). Another explanation may simply be that while H households may trust the county to adequately provide roads alone, if the county is also responsible for police and fire protection it may not have the resources to adequately ensure quality road provision in the future.

¹⁶The aversion of H-households to site 2 likely reflects its proximity to the towns of Clarkston and Newton in Figure 1. Similarly, the aversion of H households to site 1 likely reflects the fact that all of the H-community towns are en route to this site.

Finally for the restricted model, Table 5 presents the 95% confidence bounds on the WTP and WTA estimates for the in-county landfill sites. For the H community, the WTA intervals for sites 1 and 2 overlap to a fairly large extent, indicating that the H community's preferences for these two sites are roughly equal. To the contrary, the NH community's WTP intervals for all three in-county sites overlap to a great extent, reflecting the fact that households in the NH community do not likely have strict preferences for any one site over another.

Table 6 presents results for the unrestricted model (5b). To save space, only the statistically significant individual-specific variables are included in Table 6 along with the community- and alternative-specific variables. To begin, note that with the individual-specific variables included in the model, the WTP values for the typical NH household for in-county sites 1, 2, and 3 are no longer statistically different from zero. In other words, when accounting for more heterogeneity among our respondents than simply location of the household, the previous finding for the restricted model that NH households are willing to pay a premium for the siting of an in-county landfill no longer appears to hold. In other words, WTP is a function of household characteristics (e.g., confidence) more so than where the household resides.

The WTA results for H households have also changed relative to the restricted model. WTA is now highest for site 1 (approximately \$54 per month) rather than site 2 (approximately \$46 per month). Note that the typical H household's WTA estimates are significant for each in-county site. However, the WTP estimates for county provision of roads and for police and fire protection are no longer positive, indicating that welfare losses incurred by H households cannot be partially offset by these new public services.

However, with respect to the individual-specific variables that explain a typical household's WTA/WTP, we find that households that are either somewhat or very confident that

an in-county landfill will meet federal regulatory standards are willing to pay a positive monthly amount to avoid having to ship the county's waste out-of-county. For example, respondents who identify themselves as "somewhat confident" are willing to pay approximately \$12 per month, all else equal, to ensure that in-county site 1 is chosen rather than out-of-county site 5, while those who are "very" confident are willing to pay approximately \$21 per month. Recalling the results presented in Table 5, where approximately 80% of NH households reported being somewhat to very confident that an in-county landfill would meet federal regulatory standards, this suggests that the typical NH household may indeed be willing to pay some positive amount of compensation to the H community for incurring losses associated with the siting of an in-county landfill. We therefore conclude that, similar to the results from the restricted model, results from the fully specified model suggest that at least monetary compensation possibilities exist.

Finally, the information provided in Table 7 regarding the total costs of the in- and out-of-county landfill sites suggests that the latter sites represent more expensive options than the former.¹⁷ Using this information along with our empirical estimates of WTP and WTA from Tables 4 or 6 enables a straightforward application of conditions (7) - (9). Examples of this application exercise are provided in Section 6.

6. Using the Empirical Results to Inform Policy

To show how this information on WTP and WTA can be used to answer the overriding question, "At what level would NH residents have to compensate H residents such that they are made whole in the event that a landfill is sited in their community?," we provide two examples. The first example explores (a) whether the willingness of NH households to compensate H households in aggregate is larger or smaller than the H households' willingness to accept

¹⁷For a more detailed discussion of how the various costs in Table 7 were determined, see HDR Engineering (2003).

compensation, and (b) at what level the typical NH household would have to compensate the H community in order for the typical H household to be made whole. The second example looks at whether a combination of compensation packages might be feasible – and at what cost to NH households – in order for the typical H household to be made whole. In both examples, we use the information generated by the restricted empirical model in Table 4.

Example 1

According to the U.S. Census 2000, there are 439 and 27,104 households located in the H and NH communities, respectively.¹⁸ Thus, assuming site 1 is chosen as the preferred in-county landfill site, our empirical results indicate that NH households in aggregate would be willing to pay approximately \$383,250 per month (\$14.14 per household per month x 27,104 households) for locating a landfill at that site rather than shipping the county's waste to out-of-county site 5. However, the H community would need compensation of approximately \$15,720 per month (\$35.81 per household per month x 439 households). Thus, applying condition (8) to this result indicates that site 1 passes a simple compensation test, i.e., that the WTP of the NH community is sufficient to fully compensate H households for any losses associated with siting a landfill at site 1.¹⁹ This test is “simple” because it only measures the ability of the NH community to compensate the H community in aggregate. It does not ensure that the distribution of this compensation will be sufficient to make every household in the H community at least as well off as before the siting of a landfill at site 1.

An alternative way of using this information is to consider the minimum monthly cost to the typical NH household that would be necessary to make the H community whole. To do this,

¹⁸These numbers equal the average number of households by municipality and zip code area.

¹⁹Note that in-country sites 2 and 3 also pass this simple type of compensation test. These outcomes are driven by the fact that the number of NH households greatly outweighs that number of H households.

simply divide the aggregate WTA of H households (\$15,720 per month) by the total number of NH households (27,104) for a monthly cost of approximately \$0.60 per NH household. In other words, charging each NH household approximately \$0.60 per month would raise enough money to fully compensate the H community.

Example 2

An alternative to strict monetary compensation might be some combination of local community payments, new public services, and monetary compensation. Again, suppose in-county site 1 is selected. According to our empirical results, if the NH community provides road service for the H community, the typical H household will obtain the equivalent of \$15.21 in value per month, for an aggregate community value of approximately \$6,677 per month. Thus, if roads are provided, then only $\$15,720 - \$6,677 = \$9,043$ per month would need to be provided to the H community in monthly monetary compensation, or \$0.33 ($\$9,043/27,104$) per NH household. In other words, if the NH community provides road service and a monthly payment equal to \$0.33 per NH household, the H community would be made whole. Note that the only possible resource combinations include new public services with monetary compensation, as the WTA local community payments is statistically equal to \$0.00 per H household.

7. Conclusions

By having followed the three-stage approach advocated by Swallow, et al. (1992), Cache County decision-makers were able to integrate economists' concern for efficiency and equity with a centralized process that incorporated both expert input and diverse public preferences. In the end, the decision makers decided to proceed with property acquisition for in-county site 1. A cornerstone of this process was the conducting of a community survey that elicited compensating

surplus measures from both host- and non-host-community households using an innovative “resource-to-resource” question format recently pioneered by Breffle and Rowe (2002).

Our empirical results suggest that there appears to be room for the non-host community to fully compensate the host community for any negative effects – actual or perceived – that might eventually occur due to the new landfill. This finding has two implications. First, by virtue of passing a simple compensation test, the siting of an in-county landfill results in positive net benefits for Cache County residents in the aggregate relative to the selection of either of two possible out-of-county sites. Second, we find evidence that non-host-community households are indeed willing to compensate the host community at a level that would make the typical host-community household whole. This compensation could take the form of strictly a monetary payment, or a combination of monetary payment and the provision of new public services. Due to the large difference in number of households across the two communities, the cost of compensation to the typical non-host-community household would likely equal something less than \$1.00 per month.

Even without having conducted the community survey, Cache County may have decided to proceed with property acquisition for in-county site 1. However, as a result of having conducted the survey, local decision makers are now informed as to possible compensation packages that can potentially make the host community whole. From a methodological standpoint, we therefore conclude that the application of the resource-to-resource format to a landfill-siting decision is particularly appealing. The format not only enables a convenient and straightforward way of obtaining traditional monetary compensating-surplus measures, but also resource-based measures that allow the non-host community to examine a wide variety of resource trade-offs as possible forms of compensation for the host community.

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Table 1. Household Demographic Characteristics

Characteristic	Host	Non-Host
Percentage of adults 18-39 years old		
Census 2000	45.7	61.4
Survey Sample	25.0	49.3
Percentage of adults 40-59 years old		
Census 2000	35.1	24.8
Survey Sample	43.3	28.8
Percentage of adults 60 and over		
Census 2000	19.2	13.8
Survey Sample	31.7	22.0
Percentage male		
Census 2000	51.0	48.5
Survey Sample	59.8	49.2
Percentage of adults (25 and over) with 4-year college degree or higher		
Census 2000	22.4	32.0
Survey Sample	26.2	44.8
Percentage that owns their own house		
Census 2000	89.6	64.8
Survey Sample	91.0	68.3
Percentage native to Cache County	47.1	24.0
Percentage employed full-time	46.9	41.2
Percentage "keeping house"	7.7	16.7
Age of respondent	52.9	43.2

Table 2. Summary of the Compensation Packages

**Compensation Package & Corresponding
Level of Compensation**

1. Local Community Payments (\$/year):
 - 5,000
 - 10,000
 - 50,000
 2. New Public Services:
 - County provides roads.
 - County provides police and fire protection.
 - County provides roads, police, and fire protection.
 3. Future Landfill Location:
 - In-County Site 1
 - In-County Site 2
 - In-County Site 3
 - Out-of-County Site 4
 - Out-of-County Site 5
 4. Added Costs to Household (\$/mo.):
 - 5
 - 10
 - 15
-

Table 3. Model Variables

Variable	Definition
<u>Compensation Variables</u>	
C_i	Monthly household cost (in dollars).
roads _r , $r \in [1,3]$	=1 if New Public Services are provided at level r =0 otherwise services: roads; police/fire protection; roads & police/fire protection
payment [*]	Level of annual payment to H community (in dollars) levels: 5,000; 10,000; 50,000
landfill _w , $w \in [1,4]$	Future landfill site. sites: in-county sites 1, 2, and 3; Out-of-County site 4; Out-of-County site 5 ^{**}
<u>Individual Characteristics</u>	
Y_i	Annual household income (in dollars)
D_{loc} , $loc \in [H, NH]$	=1 if household location is NH =0 otherwise
D_{know}	=1 if somewhat to very informed about landfill issue =0 otherwise
D_{sconf}	=1 if somewhat confident that in-county landfill will meet federal regulations =0 otherwise
D_{vconf}	=1 if very confident that in-county landfill will meet federal regulations =0 otherwise
D_{comp}	=1 if you believe communities located near landfills should be compensated =0 otherwise
D_{minc}	=1 if annual household income is \$35,000-\$49,999 =0 otherwise
D_{hinc}	=1 if annual household income is greater than \$50,000 =0 otherwise
<u>Alternative-Specific Variables</u>	
D_A	=1 if alternative is A =0 otherwise

*Treated as a continuous variable for estimation purposes.

**Out-of-County site 5 is the reference landfill site. For the roads and payment variables, the reference service and level are "none" and 0, respectively.

Table 4. Estimation Results for Restricted Empirical Model

Variable	β	Stderr $_{\beta}$	Marginal Utility	p-value	WTP/WTa (\$/mo./HH)*
<i>NH Community</i>					
payment	0.000	0.000	0.000	0.000	0.00
Out-of-County Site 4	-0.107	0.116	-0.107	0.356	---
In-County Site 1	0.875	0.122	0.875	0.000	14.14
In-County Site 2	0.516	0.132	0.516	0.000	8.33
In-County Site 3	0.721	0.111	0.721	0.000	11.65
roads	0.136	0.211	0.136	0.518	---
police/fire protection	-0.046	0.148	-0.046	0.755	---
roads & police/fire protection	0.092	0.150	0.092	0.540	---
<i>H Community</i>					
payment	0.000	0.000	0.000	0.000	0.00
Out-of-County Site 4	-0.041	0.176	-0.148	0.816	---
In-County Site 1	-3.093	0.216	-2.217	0.000	-35.81
In-County Site 2	-3.082	0.242	-2.566	0.000	-41.45
In-County Site 3	-1.986	0.179	-1.264	0.000	-20.42
roads	0.806	0.402	0.942	0.045	15.21
police/fire protection	0.481	0.263	0.435	0.068	7.02
roads & police/fire protection	0.349	0.250	0.441	0.162	---
<i>Alternative-Specific</i>					
Alternative A	0.111	0.066	---	0.093	---
Y - cost	0.062	0.006	0.062	0.000	---

n = 2265; LL ratio = -1258.1; LL ratio (rest.) = -1568.9; Chi-Square = 621.5; $\rho^{2**} = 0.20$; $\bar{\rho}^{2**} = 0.19$.

*WTP/WTa values are not provided for those cells demarked by "----" due to the statistical insignificance associated with the corresponding coefficient estimates.

**The goodness-of-fit measure ρ^2 is defined as $1 - L_u/L_R$, where L_u is the value of the log-likelihood function at its maximum and L_R is the log-likelihood function when all parameters are zero. $\bar{\rho}^2$ is defined as $1 - (L_u - K)/L_R$, where K is the number of parameter estimates (Ben-Akiva and Lerman, 1985).

**Table 5. 95% Confidence Intervals Around Estimated WTP and WTA
for Restricted Model**

SITE	WTA/WTP	Lower Bound	Upper Bound
H-Community WTA			
SITE 1	\$35.81	\$26.67	\$44.95
SITE 2	\$41.45	\$30.90	\$52.00
SITE 3	\$20.42	\$13.93	\$26.91
NH-Community WTP			
SITE 1	\$14.14	\$9.93	\$18.35
SITE 2	\$8.33	\$4.09	\$12.57
SITE 3	\$11.65	\$7.98	\$15.32

Table 6. Estimation Results for the Unrestricted Empirical Model

Variable	β	Stderr $_{\beta}$	Marginal Utility	p-value	WTP/WTa (\$/mo./HH)*
<i>NH Community</i>					
payment	0.000	0.000	0.000	0.028	0.00
Out-of-County Site 4	0.304	0.429	0.304	0.479	---
In-County Site 1	-0.134	0.515	-0.134	0.795	---
In-County Site 2	-0.357	0.532	-0.357	0.503	---
In-County Site 3	-0.257	0.390	-0.257	0.510	---
roads	0.745	0.892	0.745	0.404	---
police/fire protection	0.443	0.624	0.443	0.478	---
roads & police/fire protection	0.417	0.563	0.417	0.459	---
<i>H Community</i>					
payment	0.000	0.000	0.000	0.051	0.00
Out-of-County Site 4	-0.311	0.233	-0.007	0.183	---
In-County Site 1	-3.211	0.294	-3.345	0.000	-53.97
In-County Site 2	-2.480	0.313	-2.836	0.000	-45.76
In-County Site 3	-1.704	0.251	-1.961	0.000	-31.65
roads	0.636	0.545	1.381	0.243	---
police/fire protection	0.200	0.347	0.642	0.565	---
roads & police/fire protection	0.198	0.614	0.338	0.559	---
<i>Alternative-Specific</i>					
Alternative A	0.118	0.072	---	0.101	---
Y - cost	0.062	0.006	0.062	0.000	---
<i>Individual-Specific</i>					
D _{sconf=1} x landfill _{w=1}	0.875	0.463	0.741	0.059	11.95
D _{sconf=1} x landfill _{w=2}	0.965	0.481	0.608	0.045	9.81
D _{sconf=1} x landfill _{w=3}	0.616	0.335	0.359	0.066	5.79
D _{vconf=1} x landfill _{w=1}	1.419	0.477	1.284	0.003	20.72
D _{vconf=1} x landfill _{w=2}	1.640	0.497	1.283	0.001	20.70
D _{vconf=1} x landfill _{w=3}	1.275	0.358	1.018	0.000	16.42
D _{comp=1} x landfill _{w=2}	-0.605	0.242	-0.962	0.012	-15.53
D _{know=1} x landfill _{w=2}	-0.549	0.280	-0.906	0.050	-14.62
D _{know=1} x roads _{r=3}	0.585	0.311	1.002	0.060	16.16
D _{hinc=1} x landfill _{w=4}	0.421	0.245	0.725	0.086	11.70
D _{hinc=1} x roads _{r=3}	-0.877	0.367	-0.461	0.017	-7.43

n = 2008; LL ratio = -1072.1; LL ratio (rest.) = -1390.5; Chi-Square = 636.8; $\rho^{2**} = 0.23$; $\bar{\rho}^{2**} = 0.18$.

*WTP/WTa values are not provided for those cells demarked by "—" due to the statistical insignificance associated with the corresponding coefficient estimates.

** The goodness-of-fit measure ρ^2 is defined as $1 - L_u/L_R$, where L_u is the value of the log-likelihood function at its maximum and L_R is the log-likelihood function when all parameters are zero. $\bar{\rho}^2$ is defined as $1 - (L_u - K)/L_R$, where K is the number of parameter estimates (Ben-Akiva and Lerman, 1985).

Table 7. Estimated Costs of the Proposed In- and Out-of-County Landfill Sites**I. Annualized Cost Comparison (in million \$)**

<u>Site</u>	<u>Site Life</u> <u>(years)</u>	<u>Annualized</u> <u>Capital Costs</u>	<u>Initial Operating</u> <u>Costs</u>	<u>Total</u>
In-County 1	83	1.5	2.3	3.8
In-County 2	37	1.7	1.6	3.3
In-County 3	67	2.1	2.0	4.1
Out-of-County 4	83	0.5	3.5	4.0
Out-of-County 5	83	0.4	4.0	4.4

II. Net Present Value (NPV) Cost Comparison (in million \$)

<u>Site</u>	<u>Site Life</u> <u>(years)</u>	<u>Capital (NPV)</u>	<u>Operating (NPV)</u>	<u>Total NPV</u>
In-County 1	83	21.4	23.4	44.8
In-County 2	37	25.0	16.6	41.6
In-County 3	67	29.2	20.8	50.0
Out-of-County 4	83	8.1	42.9	51.0
Out-of-County 5	83	5.1	47.4	52.5

II. Cost-Per-Waste Tonnage Comparison (\$/ton)

<u>Site</u>	<u>Site Life</u> <u>(years)</u>	<u>Capital</u>	<u>Operating</u>	<u>Total</u>
In-County 1	83	10-13	15-18	44.8
In-County 2	37	15-19	12-15	41.6
In-County 3	67	16-20	14-17	50.0
Out-of-County 4	83	2.70-3.30	32-39	51.0
Out-of-County 5	83	2.10-2.60	36-44	52.5

Notes: In the Annualized Cost Comparison, capital costs (in 2003 dollars) are applied to the year in which they would be needed for improvements and inflated (at 2.8% per year) to the year in which they are realized. The costs are then discounted back to the base year (2003) using an interest rate of 6%. The capital costs for each alternative are then applied over the life of the alternative and summed. The NPV Cost Comparison similarly inflates capital costs to the year in which they would be applied. The NPV is determined by factoring an interest rate of 6% and is calculated by summing the present value of all capital costs in the time period selected. Costs per ton under the The Cost-Per-Waste Tonnage Comparison are calculated by summing the capital and operating costs over the life of a site and dividing the sum by the total waste processed. The total wastes processed (in million tons) for sites, 1-5 are estimated to be 22.5, 6.2, 15.7, 22.5, and 22.5, respectively.

Figure 1. Map of proposed in-county landfill sites.

Note: The map above shows the approximate locations of the current county landfill (in Logan) and three proposed Cache County sites that could be used for a future landfill. Actual boundaries of future landfills would be somewhat smaller (text taken directly from the survey).

	Alternative A	Alternative B
Local Community Payments	No Payments	\$50,000 per year
New Public Services	No New Services	No New Services
Future Landfill Location	Ship to Out-of-County Site 5	Use In-County Site 2
Added Cost to your Household	\$10 per month	\$10 per month
	☐	☐
	I prefer Alternative A	I prefer Alternative B

Figure 2. A simple resource-to-resource choice question.

	Alternative A	Alternative B
Local Community Payments	No Payments	No Payments
New Public Services	No New Services	No New Services
Future Landfill Location	Ship to Out-of-County Site 5	Use In-County Site 2
Added Cost to your Household	\$5 per month	\$0 per month
	☐	☐
	I prefer Alternative A	I prefer Alternative B

Figure 3. A simple referendum choice question.