EXISTENCE VALUES FOR GROUNDWATER PROTECTION

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Draft Final Report Prepared Under
Cooperative Agreement CR814041-01
Between the U.S. Environmental Protection Agency
and Resources for the Future

Project Officer:
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ABSTRACT

This study reports the findings of an investigation into the existence (nonuse) values people hold for groundwater resources and how these values can be measured for use in benefit/cost analysis. The study focused on a groundwater resource of drinkable quality that is located far from the participants' homes and is not now and is likely not in the future to be needed for human use (owing to the availability of substitutes) on the assumption that people's willingness to pay for protecting this type of resource from contamination will stem from existence values. Five focus groups were conducted in four cities -- Baltimore, Worcester, Princeton, and Hartford -- to explore in depth people's groundwater knowledge and concerns, and their protection preferences for this type of groundwater. In each group it was found that people's knowledge about groundwater is limited and that they mistakingly assume that contaminant plumes travel underground at very rapid rates. After steps were taken to correct this assumption, their preferences for preserving nonuse groundwater were explored. Many, but not all focus group participants placed substantial values on this type of resource. They are motivated by several types of existence values: (1) beliefs that the resource may be needed at some time in the relatively near or distant future (vicarious protection value and bequest value) and (2) a belief that preserving an unpolluted resource is a good think in itself (inherent value). Vicarious protection values are important because many participants are unwilling to believe that there is no likelihood of future use in the relatively near future, despite specific assurances to the contrary.

On the basis of this research a contingent valuation scenario was designed for use in in-person administration with the following features: (1) the scenario describes an aquifer that is isolated by natural geological features from other groundwater and is located 80 miles from the subjects' city, (2) it uses a referendum framework to ask subjects their willingness-to-pay to provide extra protection to prevent a new municipal waste dump from contaminating this aquifer, (3) diagrams and pictures are used to describe groundwater flow and the features of the aquifer.

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INTRODUCTION

In a review of agricultural contamination of groundwater, Lee and Nielsen declare that "a major research issues that must be addressed is the relationship between the social benefits and social costs of groundwater protection programs and policies" (1987:247). Assessing the benefits of protecting uncontaminated aquifers from contamination is not a simple matter, however. An important complication, and the subject of this report, is the magnitude of benefits that occur because people value particular groundwater bodies for reasons quite distinct from current human use or potential human use.

At present, not much is known about the presence or size of these nonuse or existence values (Raucher, 1986). Nevertheless, there is a consensus among resource economists that relying on benefits based solely on use values or benefits estimated by a damages-avoided approach alone is very likely to undervalue many environmental amenities (Randall and Stoll, 1983) including the value of protecting groundwater (Policy Planning & Evaluation, Inc., 1985; Raucher, 1986), and that this undervaluation may, in some cases, be very large. On the other hand an incorrect estimate of these nonuse or, as we will refer to them in this report, existence values, could result in a large overestimate of the benefits of preserving uncontaminated aquifers from contamination. This is possible because the only benefit measurement methodology capable of estimating existence values is

the contingent valuation (CV) method (McConnell, 1983; Fisher and Raucher, 1984) which uses survey research techniques to elicit people's willingness-to-pay (WTP) amounts (Mitchell and Carson, 1989). While accepted as a valid method for measuring economic benefits under some circumstances (Cummings, Brookshire, and Schulze,eds., 1986; Mitchell and Carson, 1989), this method is vulnerable to bias induced by incorrect or inappropriate survey design.

In this report we present the findings of research we conducted to explore the types of values people hold for underground aquifers and to determine if it would be feasible to use the CV method to measure groundwater existence values. In the course of the research Robert Mitchell conducted five focus groups in four different East Coast cities to probe people's knowledge, attitudes and concerns about groundwater protection and developed a design for a CV scenario that might measure groundwater existence values. Other components of Phase I research included a review of the literature on groundwater and drinking water perception and communication, a series of interviews with EPA officials, a review of EPA groundwater policy, and several seminar presentations to EPA personnel. The contacts with EPA personnel were directed at understanding EPA groundwater policy and soliciting reactions to possible types of scenarios so that the possible CV survey could address EPA's needs in a credible fashion without compromising the need to have a scenario that those participating in the CV experiments can understand and relate to in a meaningful way.

The overall conclusion of this preliminary research is that there are indeed existence values for groundwater, that they are likely to be significant in size, and that it is likely that some estimate of their magnitude can be achieved by the contingent valuation method. In this chapter we discuss the research objective and the nature of existence values and how they can be measured.

USE VALUES AND THE RATIONALE FOR NOT PROTECTING ALL GROUNDWATER RESOURCES

What values do people hold for protecting groundwater from contamination or, in economic terms, what utility do people receive from protecting the resources? One set of values involves the uses to which humans put groundwater. In addition to drinking water, groundwater is used in food processing, industrial processes, agricultural irrigation, livestock watering. Aquifers can be used to recharge streams, mine and process minerals and fuel oil, and receive waste (Magnuson, 1983). These uses are not all compatible with each other; waste receiving in particular can render groundwater undrinkable without treatment. From the perspective of citizens who do not live in rural areas (and many of those who do), the most salient use of groundwater is for drinking water and this use receives priority in groundwater planning.

This raises the central policy question addressed in the present study. Given the cost of protecting groundwater from contamination should we require <u>all</u> groundwater resources to receive such protection even when they are not needed for

drinking water? There are several considerations having to do with the nature of groundwater contamination and the availability of remedies which might argue against requiring all the nation's as-yet-uncontaminated groundwater resources be drinkable in quality.

First, contaminated groundwater spreads very slowly and therefore poses only a local threat. If the contaminant enters the ground from a surface source, it forms a vertical plume until it enters the saturated zone where it tends to be deflected by the groundwater in the direction of the hydraulic gradient (the prevailing flow of the groundwater). Contaminant plumes are rarely more than a few hundred feet in width and, in depth, they are seldom more than a few tens of feet deep (Lehr, 1984). The rate by which a plume travels is governed by the rate of groundwater flow which varies according to the geology of the site, contaminant characteristics (miscibility, density and solubility in water), and the degree to which there is substantial nearby pumping activity which affects the hydraulic gradient.

The slowest transport time is given in the Ground-water Protection Strategy report issued by the U.S. EPA in August 1984 which states that "Ground water is slow-moving, with velocities generally in the range of 5 to 50 feet per year" (USEPA, 1984:11). The number of years it would take to travel one mile at these rates is from 1056 years to 106 years. Another estimate was given by Dr. Jay Lehr, Executive Director of the National Water Well Association, (1984:396) in testimony before Congress

where he stated that groundwater moves on average 3 inches a day (see also Cherry, 1983:144) or 91 feet a year, but in sand on Long Island it can move a foot a day. At 3 inches a day it would take almost 58 years for a contaminant to travel one mile underground, but most contaminants travel more slowly than the groundwater itself. How much slower the contaminants travel is not well understood at present according to Lehr.

Sharefkin, Schechter, and Kneese describe the state of groundwater transport modeling of toxic chemicals in less sure terms (1984:1774) than Lehr and express the belief that it travels at a somewhat faster rate. According to them, "typical groundwater flow velocities are of the order of one foot per day" (1984:1774). That groundwater can actually travel this fast and contaminate water wells is confirmed by a case study of groundwater contamination described by Robert Raucher (1986) where the 58th Street landfill in Dade County Florida contaminated a municipal drinking water field 1.5 miles down gradient in approximately 30 years, a rate of 1.4 feet per day. Presumably the material through which the contamination was transported is similar to the sand described in Lehr's worst case.

The range of transport velocities offered by these authorities ranges one foot per day to five feet a year. Even at the fastest rate it would still take 14.5 years for contamination to travel one mile, a relatively slow travel time. In most locations velocities of 50 feet or less a year can be expected.

Thus groundwater moves slowly or extremely slowly; it seeps rather than flows.

A second factor is the availability of substitutes for some types of contaminated aquifers. In some parts of the eastern United States there is an abundance of groundwater, only some of which is presently used or will be needed for drinking water in the forseeable future. Thus if a portion of an aquifer that is needed for drinking water use becomes contaminated alternative sources are available in form of bottled water or the use of an uncontaminated portion of the same or other nearby aquifers or in the treatment of the contaminated water at the wellhead to remove the contaminants.

Finally, contamination is not necessarily an irreversible process as contaminated groundwater can be treated under certain circumstances (Lehr, 1984:399) with the promise of purifying the groundwater.

The United States Environmental Protection Agency (1984) has developed an approach to classifying groundwater which consists of three classes. Class I groundwaters are resources of unusually high value either because they are irreplaceable sources of drinking water for substantial populations or ecologically vital. Class II groundwaters are other aquifers that are currently used or potentially available for drinking water and Class III aquifers are those not considered potential sources of drinking water because they are saline or otherwise contaminated beyond reasonable use as drinking water.

From this perspective, our focus in this study is only with that portion of the Class II groundwaters that are not used for drinking water at the present time and will not be needed for use in the conceivable future. For convenience in what follows we will call this resource "groundwaters not needed for human use" or GNN for short. GNN in our conceptualization has two additional characteristics: (1) contamination of a GNN would not harm above ground ecosystems, a plausible assumption given the average time of residence for groundwater of about 200 years (Lehr, 1984:396), and (2) contamination of a GNN would not effect other potential uses such as industrial use owing to the availability of substitutes. In short, GNN is a pure type of groundwater resource that has no use value. To the extent that people give value for it, it has some kind of nonuse value for them.

In this study we consider the methodology of how the benefits of preserving GNN can be measured for use in benefit/cost analysis. Is, for example, the benefit of requiring a state-of-the-art liner and leachate pumping system for a municipal dump located over an aquifer that there is every reason to believe will not be needed for drinking water greater than the cost of a simpler, but presumably less effective barrier system? In order to address this question, it is necessary to determine whether there are existence values for preserving presently uncontaminated groundwater in addition to the use values associated with its use for drinking water purposes.

THE NATURE OF EXISTENCE VALUES

Existence values[1] occur when people obtain utility from an amenity for reasons other than their expected personal use. In the recent economics literature this type of utility is sometimes called by other names such as nonuse values or intrinsic values (Fisher and Raucher, 1984). Whatever the name, and we shall discuss nomenclature below, there is considerable interest shown in existence values by resource economists because if they are a legitimate source of value they may contribute sizably to the benefits of certain types of environmental amenities. For example, one examination of the existence values of surface water pollution control concludes that there is "substantial agreement that intrinsic (existence) benefits may account for a sizable portion of society's valuation of improved (surface) water quality" (Fisher and Raucher, 1984:37). A recent study of the public's willingness to pay for groundwater protection concluded about the bequest form of existence values that:

> ...this benefit category cannot be ignored when evaluating the efficiency of a groundwater management policy, including a decision whether to avert contamination or wait until contamination is realized. Economists' recent interest in explaining and ascertaining bequest value should be extended to groundwater issues soon (Edwards, 1988).

The problem that economists tend to have with existence values revolves around their belief that if people really did obtain utility from existence values, their behavior would

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[1] Portions of the following discussion, which was developed as part of our research on this project, appear in Mitchell and Carson (1989).

express those values. In fact, people do find ways to express existence values in the private marketplace. A good portion of the millions of dollars in fees and voluntary contributions paid by members of environmental groups and the willinginess of environmental activists to volunteer their time to lobby for such legislation as the Alaska Wilderness Bill, can be cited as evidence for the reality of existence values for wilderness amenities as not all these people have visited or have plans to visit Alaska. Referenda on environmental programs often receive very strong voter support for taxing themselves even among voters whose communities are unaffected by the improvements.[2]

Although behaviors such as these are indicative that existence values are real, complete markets where people can express their existence value with dollars are typically missing. The Sierra Club addresses its direct mail to less than one-tenth of American households, and it cannot guarantee the provision of any amount of a particular environmental amenity to those individuals it does real. Many types of public goods never reach the ballot. Even pressuring an individual congressman to vote to provide a particular goods requires knowledge of the legislative status of individual bills and their content that most concerned citizens lack.

In other fields of economics (labor economics, for example) the term "psychic income/cost" (Maddox, 1960; Thurow, 1978) is

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[2] One way to consider contingent valuation surveys is that they represent an efficient nonbinding referendum on a possible policy.

often used to describe a concept similar to existence value. It has been demonstrated that some people are willing to accept a lower wage (or other pecuniary benefits) in exchange for the satisfaction of status (job titles) or the satisfaction of doing something worthwhile (Lucas, 1977). It has also long been recognized that there are psychic costs to moving people out of farming (Maddox, 1960), and that many urban workers are willing to return to a rural setting for wages far lower than a cost-of-living differential would suggest (Deaton, Morgan, and Anschel, 1982). In the cases of both existence value and psychic income, people are influenced in part by preferences for attributes of situations or goods that are secondary to the attribute which is presumed to be the primary source of value, such as the salary paid to a worker or the use of an aquifer for drinking water. In neither instance do the benefits result from the process of consumption as it is usually described in economic models, where the commodities are exhausted or used up (Smith, 1986a).

Influential early discussions of existence benefits by resource economists were presented by Krutilla (1967) and Krutilla and Fisher (1975). As the CV method has gained acceptance and benefits estimates have appeared that reflect a significant existence component, a number of economists have sought to clarify further the nature of these benefits (e.g., Bishop, 1982; McConnell, 1983; Randall and Stoll, 1983; Smith, 1983; Fisher and Raucher, 1984); Freeman, 1984; Brookshire, Eubanks, and Sorg, 1986; Smith, 1986; and Hanemann, 1989), and others have attempted to use CV surveys to obtain separate

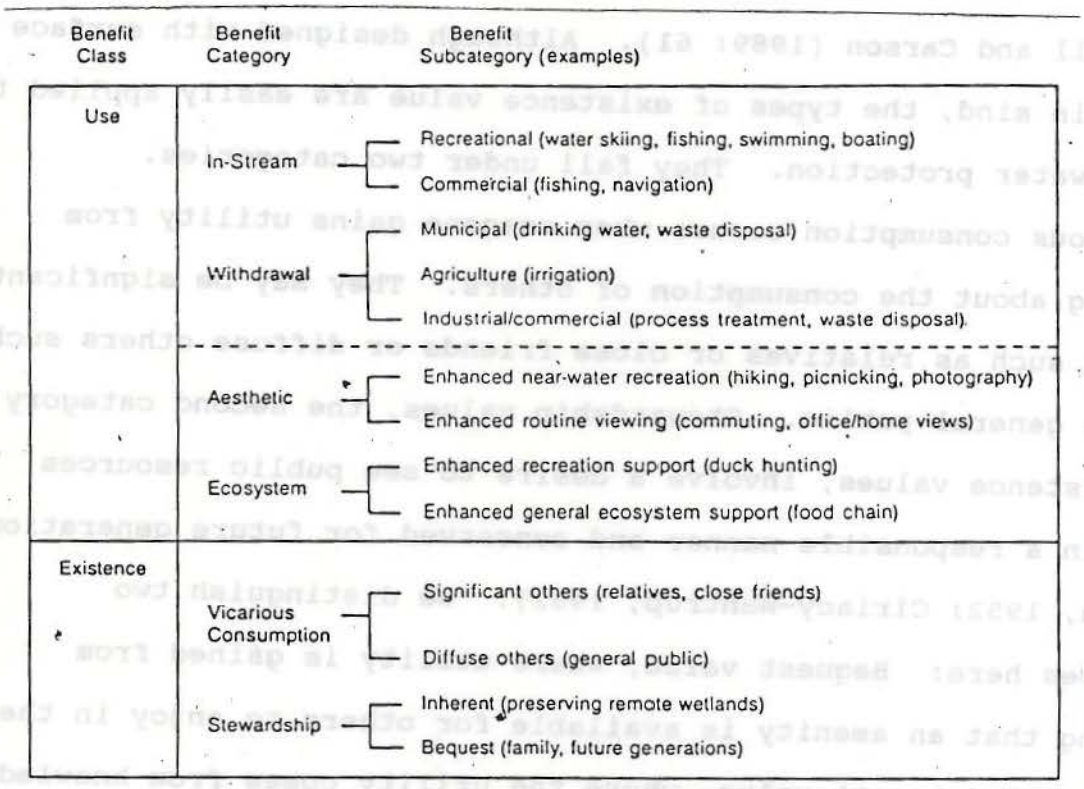
measurements of one or more of the various types of existence benefits.

Types of Existence Values

In figure I-1, we reproduce the typology of possible benefits for an improvement in an amenity that appears in Mitchell and Carson (1989: 61). Although designed with surface water in mind, the types of existence value are easily applied to groundwater protection. They fall under two categories. Vicarious consumption occurs when someone gains utility from knowing about the consumption of others. They may be signficant others such as relatives or close friends or diffuse others such as the general public. Stewardship values, the second category of existence values, involve a desire to see public resources used in a responsible manner and conserved for future generations (Pigou, 1952; Ciriacy-Wantrup, 1952). We distinguish two subtypes here: Bequest value, where utility is gained from knowing that an amenity is available for others to enjoy in the future and inherent value, where the utility comes from knowledge that the resource is preserved regardless of whether anyone will ever use it.

Although nonuse benefit typologies frequently include option value among the benefit types, we exclude option values from this typology because we assume certainty -- that the respondent buys sure provision of the amenity -- as this is the assumption used in most CV studies. Even under conditions of uncertainty, recent work (e.g., Chavas, Bishop, and Segerson, 1986; Fisher and Hanemann, 1986) suggests that option values are more

Figure 1-1 A TYPOLOGY OF POSSIBLE BENEFITS FROM AN IMPROVEMENT IN FRESHWATER QUALITY



Source: Mitchell and Carson (1989).

appropriately viewed as correction factors to calculations of total benefits than as separate categories of benefits.[3]

The different types of existence benefits coexist with each other and with use values. For example, while stewardship values do not result from current human use, they may be stimulated by and occur simultaneously with use; someone's stewardship value for wilderness lakes is likely to be enhanced by the experience of fishing in them during wilderness hiking expeditions. Thus, while the several dimensions of existence value are analytically distinguishable, and all enter into a consumer's utility function, it is difficult for individuals meaningfully to disentangle the contribution that each of these motives makes to the valuing of a nonmarketed amenity in order to place a dollar value on it (Mitchell and Carson, 1985).

The validity of inherent values for benefit measurement recently was questioned by Brookshire, Eubanks, and Sorg (1986) who argued that this type of motivation is not consistent with the "efficiency ethic" they believe underlies benefit-cost analysis. They describe the efficiency ethic as a management ethic focused on human welfare. In their view, vicarious consumption and bequest values pass the efficiency-relevant test because these values involve efficient use of the resource in the interest of humans, but they do not believe this is true of

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[3] Once uncertainty is introduced, there is a switch from defining total benefits in terms of a Hicksian compensating or equivalence surplus to the analogous type of option price. We discuss this matter in detail elsewhere (Mitchell and Carson, 1989, pp. 60ff).

inherent values. They argue that even though a person may be willing to pay something "simply because he believes we ought to protect wetlands wildlife against human action which would threaten the existence of the wildlife," this is not an acceptable motivation for benefits because it does not contribute to human welfare (1986:1515). Actions based on ethical considerations, on a desire to do what is right, are "counterpreferences" since they do not increase utility.

There are a number of faulty assumptions in their analysis. First, it should not be assumed that there is no basis in welfare theory for restricting benefits to human use of an amenity. While it is true that economic theory rejects the notion that "trees have rights," the idea that that "trees have rights to the extent that humans are willing to pay for those rights" is fully consistent with economic theory. Second, it should not be assumed that ethical motivations are unique to inherent values. A "commitment to do what is right" underlies the vicarious and bequest values which Brookshire, Eubanks, and Sorg accept as legitimate. People gain utility form helping others without expectation of a material reward because they have learned to value this behavior. Third, and most important, it is erroneous to assume that making choices on the basis of ethical beliefs necessarily involves self-sacrifice; in fact, those who make choices of this kind obtain utility from satisfying internalized social norms (Bredemeier and Stephenson, 1962; Etzioni, 1968; Mueller, 1986). For some people such things as preserving wilderness for its own sake or living in a small town among

friends and relatives are amenities whose provision genuinely improves their personal welfare as they conceive it. Far from being "counterpreferential," in properly conducted CV studies choices based on these preferences are motivated by self-interested and egoistic considerations.

Existence Values and Groundwater Protection

What types of existence values might people have for the protection of GNN as defined earlier? Stewardship values immediately come to mind as it is plausible to imagine some people holding inherent values for a GNN out of a belief, fostered by environmentalism, that it is wrong to contaminate such a resource under any circumstances even when there is no possibility it will ever be used. It is even more plausible to imagine some people holding the belief that it should be preserved for future generations on the grounds that future generations should not be endangered (through inadvertent use of contaminated water for drinking water) or have their use of the resource hampered by actions taken by the present generation. According to a report prepared for the U.S. EPA,

> ...numerous cases have occurred where communities and public officials argue heatedly for total clean-up of contaminated aquifers which are not even presently being tapped, and thefore presumably provide no current value to the local population. In these cases, people either anticipate substantial potential future uses of the aquifer (option values) or they perceive a large, nonquantified benefit associated with its mere presence (bequest value) not considered by the policy analysts. (Policy Planning & Evaluation, Inc., 1985:A-29).

The other major category of existence values, vicarious values (including risk of harm from drinking contaminated groundwater),

would appear to be irrelevant for GNN since, by definition, this type of groundwater would not involve any human use. However, the research findings we present in chapter 2 reveals that "vicarious protection" -- a more appropriate way to refer to the vicarious consumption type of existence value in the case of this study -- cannot be ruled out because a significant number of people assume that every aquifer may be needed at some point in the future and it is very difficult to dissuade them from this view.

How strong is the demand for groundwater protection stemming from existence value likely to be? There are two lines of thought -- one economic and one cultural -- that would predict a weak demand. According to Randall and Stoll (1983: 268), "For resource amenities with many close substitutes, existence demand will be weak" and people will not pay much for marginal increases in their supply. Groundwater in many areas of the Eastern United States is relatively abundant. This, the presence of surface sources, and the availability of bottled water and home purification devices provides many close substitutes for consumers who are denied access to part of an aquifer for some reason. This line of argument would imply that demand for protection based on existence values should be low. However, elsewhere in the same paper Randall and Stoll suggest that marginality is relative and that people may place a high value on local amenities that may be in large supply from a regional perspective. This characteristic of groundwater should be kept in mind in evaluating our focus group findings.

The cultural argument holds that individualistic values play an important role in influencing people's perceptions and responses to groundwater contamination. Based on her anthropological research in communities experiencing groundwater contamination problems, Janet Fitchen argues that "individualism may be a force working against the protection of groundwater for the future" (Fitchen 1987: 2) because the American deemphasis on the collectivity encourages people to find private solutions such household use of bottled water rather than seek collective protection efforts through government action. Such an individualism, if it is a major determinant of public attitudes towards groundwater protection, would appear to be incompatible with the concern for others that would motivate people to hold vicarious protection and bequest values.

Measuring Existence Values

The concept of willingness-to-pay is regarded by resource economists as the correct measure of benefits. According to the principle of consumer sovereignty, if people are motivated by existence considerations to pay for protection, the amounts that result should be accepted as representing a legitimate expression of WTP and should be included in a benefit estimate. The only benefit measurement methodology capable of capturing the existence value portion of the values consumers hold for groundwater protection is the contingent valuation method. This methodology is based on direct reports from consumers about their willingness to pay in response to a hypothetical decision context

or scenario which poses the valuation question in a carefully defined context. The advantages of the CV method lies in its flexibility, its consistency with standard welfare economic theory (Freeman, 1979; Just, Hueth, and Schmitz, 1982), and its proven ability to obtain valid benefit measurements (Cummings, Brookshire, and Schulze, 1986; Mitchell and Carson, 1989).

The major difficulty with the contingent valuation method is that it places great demands on the respondents who are asked to respond to a hypothetical situation and place a dollar value on an amenity that they have never before directly valued. Specifically, the designer must design an instrument which presents the respondent with the contingencies and information that economists believe should be presented and yet will be understandable and plausible to respondents of all educational levels. The instrument must also ensure that the possible biases introduced by the use of a hypothetical decision context are prevented or, if this is not possible, sufficiently understood so that they can be taken into account in the analysis. This requires an understanding of the knowledge, beliefs, and attitudes potential respondents have about the amenity (GNN) and the experience of being asked to value it, an understanding that requires preliminary research of the kind we describe in the next chapter.

Chapter 2

PUBLIC PERCEPTION OF GROUNDWATER AND GROUNDWATER PROTECTION

In order to understand and develop ways to avoid the potential biases that might distort the existence value benefit estimates for groundwater protection in a possible CV study, we conducted preliminary, in-depth focus group research, to determine how best to frame the market described in the scenario and communicate it to the respondents. After a brief overview of the available public opinion data on groundwater, this chapter presents the results of our research which, given the paucity of empiricial research on nonuse values in general and on the public perception of groundwater in particular, is a significant first step towards understanding the factors that influence the public's demand for aquifer protection in general and the degree to which existence values motivate this demand.

PUBLIC OPINION SURVEYS

One source of information about how the public perceives groundwater are public opinion surveys. Although there are many surveys that touch on some aspect of drinking water, surveys about groundwater are far fewer in number and thus far have failed to assess the public's knowledge about aquifers, the reasons why they may or may not be concerned about groundwater contamination, nor their policy preferences about groundwater protection, all topics of interest to the present study. The

major source of public opinion about groundwater is the series of annual surveys conducted by Cambridge Reports for the Trends & Forecasts series of publications it sells to its clients.

Cambridge Reports

Beginning in the 1980s, Cambridge Reports has regularly included a few questions about groundwater in its March Cambridge Reports survey.[1] (Over this same period of time, it might be mentioned, public concern about environmental problems was as high or higher than it had been during much of the 1970s (Dunlap, 1986).) We draw the following conclusions from the Cambridge Reports data available to me for the period 1982-1985:

* Awareness. As of 1985[2], only a minority of the public had heard about groundwater contamination problems. One third of the national sample of 1810 people said they had heard or read anything "recently" about the "pollution or contamination of underground water supplies" which were defined in the question as "the basic supply of fresh water in underground geologic formations".

* Concern. As shown in table 2-1, less than 10 percent of the public identified "contamination of underground water supplies" as the "single most important environmental problem in the country today." However another 21 percent said the same thing about "disposal of hazardous waste materials" whose negative effect would presumably be aquifer contamination. There is no statistically significant increase in the identification of groundwater or hazardous waste as most-important-problems from 1981-85.

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[1] The most recent compilation available to me is contained in their 1986 report, Emerging Environmental Concerns and Controversies (Cambridge Reports, 1986).

[2] The latest year for which data were available.

Table 2-1 SINGLE MOST IMPORTANT ENVIRONMENTAL PROBLEM, 1983 - 1985.

	3/85	3/84	3/83
Disposal of hazardous waste materials	21%	21	22
Air pollution by business and industry	18	20	22
Disposal of radioactive waste materials	16	12	16
Water pollution by business and industry	10	11	10
Water pollution by cities and towns that are not handling their sewage properly	8	9	9
Contamination of underground water supplies	7	6	4
Air pollution caused by cars and trucks	5	6	5
Acid rain	5	5	4
Other	8	7	5
Don't know	3	3	2

"Here is a list of some of the environmental problems facing the country today. Which one of the problems listed do you think is the single most important environmental problem in the country today?

Source: Cambridge Reports (1986: 5).

Table 2-2 BELIEF ABOUT EXTENT OF GROUNDWATER CONTAMINATION, 1981-1985

Number of sources of underground water contaminated...	3/81	3/83	3/84	3/85
Most	11%	9	7	7
As many as are not	29	28	22	21
Not very many	36	32	39	44
None	2	1	3	3
Don't know	21	29	29	25

"There are a lot of sources of underground water in the United States. Some people say many of these sources are contaminated with chemicals or other pollutants. Do you think most underground sources of water are contaminated, as many underground sources are contaminated as are uncontaminated, not very many are contaminated, or none are contaminated?

Source: Cambridge Reports (1986:35).

* Belief about the extent of aquifer contamination. A large and slowly increasing number of Americans appear to accept the idea that many aquifers are contaminated. The wording of this question, which is shown in table 2-2, was somewhat loaded in the direction of encouraging people to believe contamination is widespread. Choosing from options ranging from most to none with "as many as are not" and "not very many" as the middle categories, 11 percent said most and 29 percent said as many as are not. This total of 40 percent is an increase of 12 percent from when the same question was asked in 1981.

* There is an increase in concern about drinking water and people associate drinking water quality with groundwater quality. People report that they are more concerned about drinking water than they used to be. In 1985 41 percent said they are paying more attention to the "quality and safety of their drinking water" than they did a few years ago. Just 4 percent said they were paying less attention. In another question, 31 percent said the quality and safety of their drinking water is worse than it was five years ago (25 percent said it was better). In the Cambridge survey data, those who said the quality of their drinking water had grown worse over the past five years were more than twice as likely as the other respondents to say that they believed "most" of the underground water sources are contaminated.

Other Survey Findings

Two other survey findings bear mention here. The first is from a question commissioned in a national omnibus survey by the National Well Water Association (Market Facts, 1986) which provides a glimpse of people's perception of the quality of well water vs. water from other sources such as a water utility or a reservoir. The 1000 respondents in the 1986 telephone survey were basically split over whether they preferred well water with 43 percent regarding it as "safer to drink", 66 percent as "less expensive" and 47 percent as "overall a better source of drinking water." Younger and less educated respondents were more likely

than other types of respondents to prefer well water as a safer alternative.

Another set of survey findings are from a survey conducted by Charlton Research for the Santa Clara Valley Water District on public attitudes and opinions of water quality (Charlton Research, 1988). In most of the valley, groundwater is used to supply at least a portion of user needs. Because the area served by this water district includes Silicon Valley which has experienced well publicized aquifer contamination by chemicals from local computer manufacturers, the survey offers a glimpse of how such an experience affects people's views about drinking water. One reaction is to use substitutes, such as bottled water which 39 percent of the 1000 respondents interviewed by telephone said they used. Another is that 63 percent said they would be "willing to pay something extra" to improve the quality of their tap water rather than "pay nothing for (the) program." The questionnaire did not probe how much extra they would be willing to pay. Unfortunately the survey is typical of drinking water polls in that it did not consider the issues of aquifer protection per se and of course it did not explore nonuse values.

FOCUS GROUP FINDINGS

The major component of the present research effort was a series of five focus groups that Mitchell personally conducted in four eastern seaboard cities. Focus groups are group discussions in which a trained leader probes the participants' knowledge and

attitudes about a predesignated set of topics. Traditionally, they have been used in marketing research as a tool for understanding consumer preferences. More recently survey researchers have used focus groups during the instrument development phase of a project to learn how best to word and present the topics to be covered in the survey. They play an especially important role if the survey topic is one for which there are few prior surveys and where the topic involves complex ideas that may be very difficult to convey in survey questions, characteristics common to many CV studies including this one. In addition, they are well suited to helping the researcher understand how to frame a hypothetical market so that the potential sources of bias can be minimized. One group of researchers (Smith, Desvousges, and Freeman, 1985) used the method to develop a major survey about risk avoidance preferences from hazardous waste and found that the focus group sessions yielded substantial information that "was invaluable in the questionnaire development process" (1985: 8-2).

Methodology

The groups conducted for this study took place in Baltimore, Worcester MA (two separate groups, I and II), Hartford, and Princeton NJ. These communities were selected to provide a range of East Coast locations to ensure that the focus group findings were not narrowly community-specific. Table 2-3 provides a brief summary of each group's characteristics. The Princeton group was more knowledgeable about groundwater than the other groups as

Table 2-3 CHARACTERISTICS OF THE FOCUS GROUPS CONDUCTED FOR THIS STUDY

1. BALTIMORE August 28, 1987 (B)

Consumer Pulse of Baltimore was responsible for recruiting the group and providing the meeting room which was located in a large Mall north of the city. Nine participants from Baltimore and nearby northern suburban communities took part. This group was intended to be exploratory.

2. WORCESTER I, January 21, 1989 (W1)

The group was recruited by Mitchell's graduate assistant and the session was held in a university seminar room. Twelve people chosen randomly from Worcester and surrounding communities took part. None were associated with Clark or any other Worcester university. Several preliminary aquifer cleanup scenarios were explored.

3. HARTFORD, May 17, 1988 (H)

The Hartford Research Center recruited the group which took place in their facility six minutes from Hartford in Wethersford, Conn. The ten participants were from Hartford and its southern suburbs. In this and the Princeton group, three community dump aquifer protection scenarios were tried out, the most protective of which featured plastic liners and pumping and treatment of any leachate that penetrated the liner.

4. PRINCETON, May 18, 1988 (P)

The contractor for this group was the Opinion Research Corporation who recruited 8 participants from the areas near Princeton, N.J. and Trenton. None were associated with the university. The session was held in ORC's facility in Princeton. The format of the group was similar to the Hartford group.

5. WORCESTER II, August 17, 1988 (W2)

The arrangements for the second Worcester group were the same as those for the first Worcester group. Ten people participated in this group which focused almost entirely on a version of the present draft instrument. The most protective scenario in this case involved a concrete containment structure under a community dump.

about half of the participants used or had used their own wells for their drinking water.

Participants, who ranged from 8 -12 in number, were recruited randomly by sampling from telephone books from a 20 mile area around the location of the facility where the focus group was held. Efforts were made to recruit equal numbers of men and women and to have a spread of ages in every group. In order to avoid any selection bias in favor of those with a particular interest in or knowledge of groundwater, prospective participants were only told that they would take part in a two hour discussion group on "local community problems." In every case, participants were offered a $30 incentive payment for taking part in the two hour session which was recorded and transcribed for further analysis.

My experience in recruiting the Worcester groups is that it takes approximately 10 calls to randomly chosen people to recruit one participant. People refuse for a variety of reasons ranging from an unwillingness to pay attention to any unknown caller to prior plans for the evening in question. Compared with the general population in the recruitment area, those who attended the focus groups are somewhat higher in average educational[3] and

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[3] One third of the 30 participants in the Worcester I, Hartford and Princeton groups were high school graduate, 6 had some college, 6 were college graduates and 8 had some graduate training.

income[4] than the average American and it is very likely that they are more civic minded. While it is obviously not possible to generalize from the types of participants that were recruited for these groups to the general public, nor did we intend to make such a generalization, we can safely assume that if people like these had problems understanding an aspect of a scenario many other, less educated or interested people would also experience this problem.

The focus group discussions were designed to elicit information about the following: (1) people's knowledge of aquifers and groundwater, (2) people's knowledge of how contamination occurs and how it can be prevented or treated, (3) people's concerns about groundwater contamination, (4) the types of values (use, existence) they hold for groundwater protection, (5) their reactions to various elements, including art work, that might be used in a CV scenario to measure the existence values people hold for groundwater. The goal was to find a scenario in response to which people would express a WTP amount for protecting an aquifer only if they genuinely held existence values for the amenity. In order to accomplish this goal it was necessary to learn how to convey the concept of GNN -- groundwater not needed for human use, how to pollute the GNN in such a way that participants would feel a responsibility for

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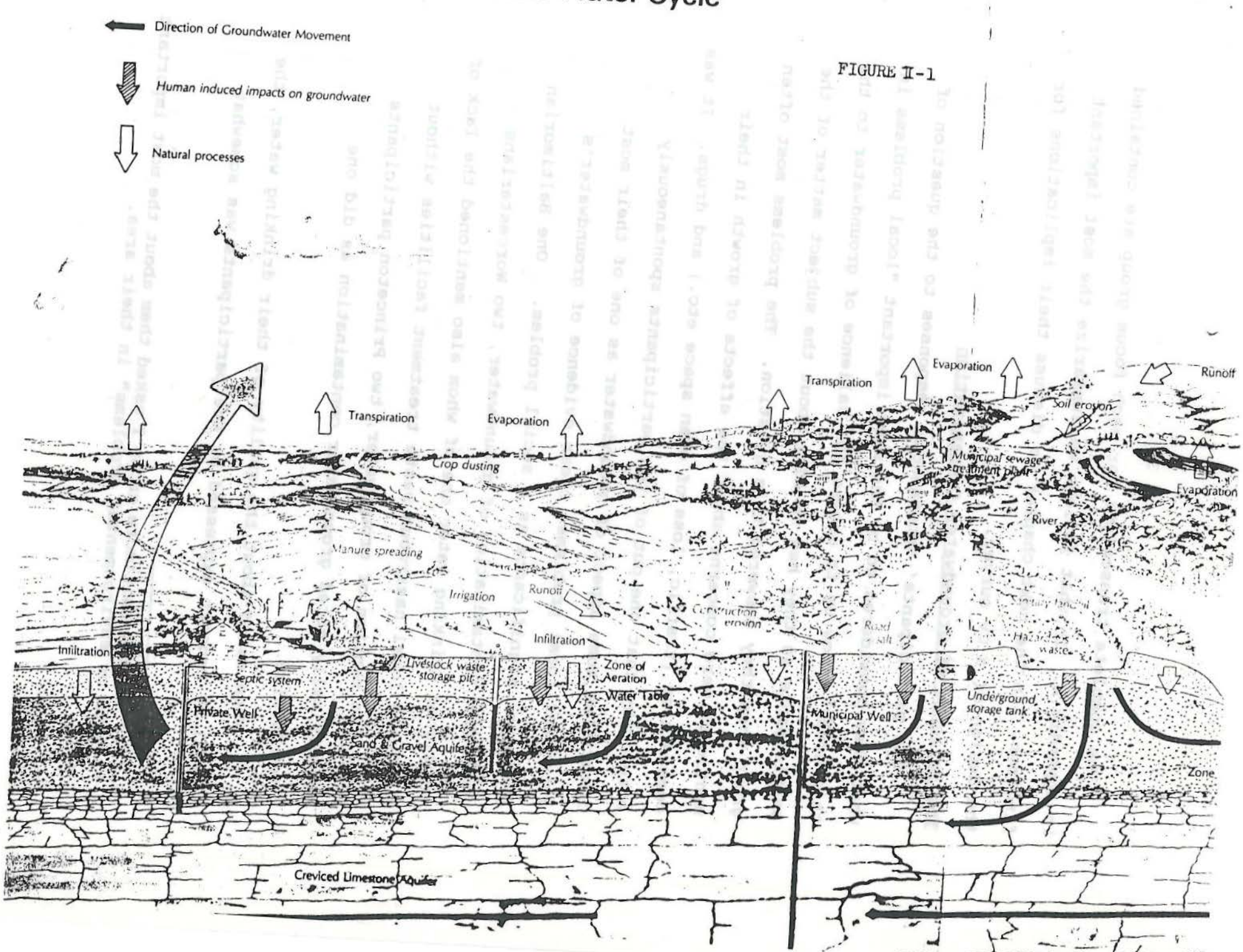
[4] In the two groups (Hartford and Princeton) for which income information is available, no participant's household income was lower than $21,000 and 4 of 14 participants had incomes in excess of $50,000.

making a decision about whether this should happen or not, and how to convince the participants that the pollution would not spread beyond the confines of the GNN.

Mitchell served as the leader for each focus group which usually began with each participant giving their name and describing where they live. In all but the second Worcester group, he began the session by having the participants write down what they regarded to be the most important local problem which they then described to the group. He next probed to get their views about their household drinking water and to learn whether they knew where it comes from. The next topic of conversation was groundwater. He usually asked whether they were familiar with the terms "groundwater" and "aquifer" and then described groundwater using a color illustration from the U.S. EPA brochure, "Protecting our Ground Water " (September 1985) part of which is shown in Figure 2-1. In most groups he then asked the participants guess how long it would take a contaminant to travel 1, 5, or 10 miles underground. The subsequent discussion topics varied by group but usually involved having the participants discuss their reactions to various types of aquifer protection/contamination situations. In the later groups these scenarios evolved closer and closer to the final draft scenario contained in his report. Overall, the focus group participants were articulate and their comments were extremely useful in identifying the problems and possibilities of using the CV method for measuring groundwater existence values.

Ground Water and Land Use in the Water Cycle

FIGURE II-1



The complete transcripts for each focus group are contained in Appendix A. In what follows we summarize the most important findings. In the next chapter we discuss their implications for the design of a CV survey.

The Salience of Groundwater Contamination

The participants' spontaneous responses to the question of what they considered to be the most important "local problems in this area"[5] allow us to assess the salience of groundwater to the participants as they had no idea about the subject matter of the group when they answered this question. The problems most often mentioned were concerns about the effects of growth in their communities (traffic, loss of open space etc.) and drugs. It was noteworthy that one out of ten participants spontaneously identified some aspect of groundwater as one of their most important local problems, clear evidence of groundwater's potential significance as a social problem. One Baltimorian mentioned contamination of groundwater, two Worcesterians mentioned drinking water one of whom also mentioned the lack of licensed local hazardous waste treatment facilities without specific mention of groundwater, two Princeton participants specifically noted groundwater contamination as did one Hartfordian.

When asked about the quality of their drinking water, the level of concern expressed by the participants was somewhat

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[5] In the Baltimore group I asked them about the most important "health or environmental problems" in their area.

higher than that shown in the public opinion surveys. As shown in table 2-4, the Worcester area participants were the most dissatisfied with their drinking water, reflecting the supply problems the city has experienced because of its antiquated infrastructure and the fact that the water is not treated and is therefore subject to concerns about contamination in its surface water sources. Overall, a small number of participants mentioned that they used bottled water. Hardly anyone spontaneously mentioned groundwater contamination as a source of drinking water contamination.

Table 2-4 SATISFACTION WITH DRINKING WATER PURITY BY FOCUS GROUP

	(N)	Extremely	Very	Somewhat	Not Very Much	Not At All
Worcester	(13)			15%	54	31
Hartford	(9)	22	57	22		
Princeton	(7)			71	14	14

"In general, how satisfied are you with the following aspects of the drinking water you get out of the tap? ... Its purity (the degree to which it is free from health risks)."

Knowledge of Groundwater and Groundwater Contamination

An important finding is the meager knowledge about groundwater held by most of the participants and the misconception they hold about how fast contamination spreads in groundwater. This included a lack of familiarity with terms. When asked if they had ever heard of "aquifers," only 9 out of 38 participants in the first four groups said they had. Seventy six

percent said they hadn't or weren't sure about this. What is more, of the nine who said they had heard of aquifers, only five or 13 percent of this group reported that they had previously understood its meaning. As shown in Table 2-5, self-professed knowledge about the term "groundwater" was higher with approximately three out of four participants in the three groups who were asked about this term saying they had heard about it. However, ten percent of these people confessed that they had not understood its meaning. The groundwater related concept which best evoked recognition was "well water" and "springs."

Table 2-5 SELF REPORTED KNOWLEDGE OF "AQUIFER" AND "GROUNDWATER" BY FOCUS GROUP

	--- Aquifer -----			-- Groundwater --			
	Yes	No	Not Sure	Yes	No	Not Sure	(N)
Baltimore		100%		---- N. A.-----			(9)
Worcester I	46	54		100			(13)
Hartford		90	10	60	20	20	(10)
Princeton	43	43	14	57	43		(7)

"Before tonight's group, had you ever heard the word "aquifer" before?...Had you heard the word "groundwater" before tonight?"

The most striking knowledge finding concerns the public's assumptions about groundwater transport. The speed by which groundwater contamination can spread is a fundamental piece of knowledge for anyone who has to make a decision about groundwater protection. The greater the presumed speed, the more threatening the contamination as it will be thought to threaten water

supplies over a large area. Every one of the focus group participants vastly overestimated the speed by which contamination would spread underground despite the fact that they were not asked about this until after visual aids had been used to describe groundwater and groundwater contamination to them.

Mitchell first posed this question in the Baltimore group where he asked for their best guess about how long it would take a contaminant to travel one mile underground once it got into the groundwater (B: 13)[6]. In order to prevent each person's guess from being contaminated by the views of the other people in the group he asked them to write their estimate down before having them say it out loud. According to estimates by experts and the U.S. EPA, the speed of contamination transport (see Chapter 1) ranges from 5 feet per year to one foot per day depending on the aquifer's soil and hydraulic conditions. The estimates made by the Baltimore participants, were much faster, ranging from a few hours for the contamination to spread a mile to four months for the same one mile journey. These estimates give an average rate of 1320 feet per day, a rate 1300 times faster than the fastest EPA suggested speed. In 20 days, according to the Baltimoreans, a well five miles from the site of a spill would be in danger of becoming contaminated.

In order to determine whether the Baltimoreans ignorance about this issue was an artifact Mitchell repeated a similar

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[6] The transcript of each focus group is in Appendix A. Page numbers will be referred to by the code letter for the group and the page of the transcript.

question in the next three groups with the results shown in Table 2.6.[7] Instead of one mile, he asked these groups to estimate the transport time to spots five or ten miles away from the spill. The guesses made by the Hartford and Worcester groups were similar to the Baltimore group in that on average they imagined the contamination spreading very rapidly, taking 8 or 10 days to go a mile. The Princeton group's estimates were much slower than the other groups. Their greater knowledge about groundwater transport may be due to the circumstances that groundwater contamination is somewhat more of a local issue there than elsewhere and a number of the Princetonians had personal experience with well water. Whereas the Worcester group thought that it would take 10 days on average for the contamination to travel one mile, the Princeton group's average estimate was about 230 days.

It is notable that in comparison with the actual likely travel time even the Princeton group vastly overestimated the speed by which contaminant plumes spread. Table 2.6 provides comparative data for four of the previously mentioned expert estimates. The last column provides the easiest way to compare the various estimates and shows that while the Princeton estimates for five miles are 3.2 years, the fastest expert estimate is 72 years and the fastest EPA estimate given in the

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[7] The data in table 2.6 are calculated using conservative assumptions. If someone said less than a year, for example, this was counted as 350 days, a "few days" were counted as four days etc.

TABLE 2.6 PERCEIVED TRAVEL TIME FOR CONTAMINANT TO TRAVEL IN AQUIFER

Focus Group/ Distance	(N)	Range in Days per Mile	Ave. Days Per Mile	Ave. Feet Per Day	Time to Travel 5 Miles
Baltimore					
One Mile	9	.7 to 120	4	1320	20 days
Hartford					
Ten Miles	10	.01 to 73	8	660	40 days
Worcester					
Ten Miles	12	.07 to 35	10	528	50 days
Princeton					
Five Miles	8	.1 to 730	224	22	3.1 yrs
Ten Miles	8	.3 to 730	226	24	3.2 yrs
COMPARISONS		One foot per day	5,280	1.0	72 yrs
		91 feet a year	21,178	0.3	290 yrs
		50 feet a year	38,544	0.2	528 yrs
		5 feet a year	385,440	0.1	5280 yrs

Source: Ratings by focus group members.

Ground Water Protection Strategy document (EPA, 1984) (50 feet a year) is 528 years!

Since it is unlikely that people with less education and experience than those who are willing to attend focus groups would give different answers, these findings lead me to conclude that the average citizen's "default assumption" (the assumption made on the basis of everyday knowledge) about the rate by which groundwater contamination spreads is seriously at odds with scientific evidence and that a groundwater contingent valuation instrument will have to overcome this misconception or its valuations run the risk of being distorted.

This misconception has important consequences for how people evaluate public policies and their effects. As an example, consider the responses given by the Baltimore participants at the end of the focus group to the question of whether they prefer federal or state regulation of groundwater protection (B, 35ff). The Baltimoreans unanimously preferred federal protection. Why? Although other reasons were also mentioned, the major underlying reason appeared to be the threat they felt from out-of-state contamination, especially from Pennsylvania. As one woman put it:

> And you can't have Maryland saying, well we're going to do this and Pennsylvania has said, well we're not going to do it, you don't make any headway. Their water is coming down. (B, 36)

This also shows the persistence of this default assumption since it occurred even after it had been pointed out to them that

contamination spreads underground much more slowly than they had assumed.

In order to explore the thinking behind the fast-transport assumption Mitchell probed in several of the groups to try to learn more about the image of groundwater they held in their minds. Specifically, he wanted to see if they thought of aquifers as underground rivers or lakes whose flow would be analogous to that of an aboveground river or lake. While it did appear that the Baltimore participants had something like this in mind and that they thought of the below ground threat from Pennsylvania in a way similar to their concern about Pennslyvania's contribution to the contamination of the Chesapeake Bay, efforts to check whether people in the other cities' groups shared this assumption were inconclusive. For example, despite the fact that they believed groundwater to travel rapidly, the Hartford participants claimed they imagined groundwater as more of a slow stream, a trickle, or a dribble than as a river or a lake (H, 10).

Evidence for the Presence of Existence Values

An hour or more of the discussion in each focus group consisted of getting the participants' views about whether and why they placed a value on groundwater located far from their homes and which was described as not needed for human use (GNN). These discussions showed that the notion of polluting aquifers is something most participants feel the government has a strong obligation to prevent. More than half of the participants

appeared to hold strong existence values for groundwater and were willing to tax themselves to protect a GNN aquifer from being contaminated on these grounds. Their willingness to pay is motivated by several types of existence values, especially vicarious protection and bequest values, and to a lesser extent by inherent values.

Given the normative character of groundwater protection, we must ask whether these findings are based on genuine expressions of preferences or are they the result of participants saying what they think Mitchell (or the other participants) wanted to hear? Mitchell, of course, took care not to reveal his own preferences nor the sponsor of the study (until the end of the focus group) and he made every effort to probe the participants' statements to make sure they were not based on a misunderstanding or were not genuinely held. One piece of evidence that these expressions of existence values are not exaggerations caused by a group effect or a desire to meet the leader's expectations was the willingness of some focus group participants to say that they would not pay money to preserve GNN type aquifers. Another is the fact that most (but not all) who did express existence value views continued to do so after he probed their views.

The Worcester I transcript provides an example of this type of probing. Towards the end of that focus group Mitchell initiated a discussion about the value of a cleanup of a hypothetical, already contaminated, aquifer by pumping the water up to treat it as compared with an alternative plan to construct

barriers to limit the spread of the contaminant and monitoring with well measurements. Because most people in the group tended to support the cleanup, he kept introducing additional considerations such as the site's remoteness, the availability of other water sources, and the cost of protecting it to see which if any might lead them to change their mind. This effort made little inroad on their views about preserving it until finally, one man complained in an exasperated tone of voice:

> You know, Robert, I am getting the opinion that you keep trying to refine your example or your situation to finally get a few of us to say, "Yeah, okay, put a barrier up. Don't clean the water..." You keep refining and say, "Hey, you can still use it for drinking water if you filter." Why don't you just say, "Hey, they can pollute the water, but you can still drink it..." (W1, 26-7)

It is noteworthy that the word "pollute" had not been used in describing the scenario; this word, which carries strongly negative connotations, clearly is part of the participants' vocabulary for discussing groundwater protection.

The probing made it possible to ascertain the depth of the participants concerns and whether they are aware of the tradeoffs involved in protecting groundwater. The following discussion occurred just after the quote given above:

> R.M. Of course, you're quite right. I am pushing you because I want to understand how much protection you want and why you want it.
>
> Male: It might not even be a question of protection as far as your own moral makeup. I don't think we should destroy something and then leave it there forever. Really we should return it back to its natural state if we can. Hey now there's a big price to pay and I am a taxpayer, so there's a lot of give and take. But I work for a company that does produce some hazardous material and we make sure that we use certified companies to take care of it and we pay that

price. It's in our overhead rate and it's passed on to the consumer. We play the ballgame right. I see this problem as really just being we've only discovered the tip of the iceberg and we have to get real tough now and in my opinion the way to get tough is to say we have to clean that water.

R.M. But your position is one of giving a warning to people; that is making companies pay. That's important because it will help to make sure that they do it right. Is that correct?

Male: No, it goes further than that. I think we should return the water to its correct state.

R.M. And not because we need to use it.

Male: Maybe not us personally in this generation, no. (WI: 23)

The following example from the Hartford group illustrates the robustness of existence values for those who hold them. Towards the end of the session he asked people to write down how much they would be willing to pay for extra protection so a GNN aquifer would not be contaminated by a town dump. After they wrote their amounts down, Mitchell had them read the amount to the group and probed to see why they were willing to pay something. Not unexpectedly in such a setting, the probing revealed that in a few cases people who had stated amounts were in fact unsure that the amenity had real value for them. This happened in the case of a woman named Betty, where it turned out that the small amount she said at first said she was willing to pay was only given because she felt a vague obligation to give something, not because she really thought the resource was worth protecting. Just after she said admitted that protecting the resource was "not that important" (H:22) to her, Mitchell then turned to Les who was raising his hand and seemed to hold another

point of view and said "Okay, but for Les..."

> Male: It is important, yes. Yes, it is important, but for a different reason. Her reason [for not valuing the amenity] may be very valid. I just feel very strong about the whole situation. We've ignored it and I think something has to be done, and I am not being an idealist ...
>
> R.M.: And so even protecting this little bit of ground water --
>
> Male: Sure. It may not even be near me. Maybe 10 - 15 miles away.
>
> R.M.: Even though nobody would use it for drinking water.
>
> Male: It's still important enough [to save].

Types of Existence Values held by Group Members

Stewardship values were frequently cited by the participants. In every group there were spontaneous mentions of the importance of preserving GNN aquifers for future generations (B: 22; WI: 11, 23, 27, 32, 34; P: 18, 28; H: 16, 19, 23; WII: 10, 15, 17). The following examples were all made in reference to groundwater of this type:

> Baltimore Group Female: I worry a lot about the world that we are leaving to our children. Not always through intent, but through ignorance, things have been done. We didn't know until fairly recently that asbestos is dangerous and now we know and it's very expensive to clean up. Is it not conceivable and possible that we are unaware of some potential dangers in the future and does it not behoove us then to take all the precautions that we can to leave the cleanest, safest possible world for the next generation? It's expensive. I know it. But I think we have to do that. (B:22)

*****

> Baltimore Female: I just don't think we should [contaminate a GNN aquifer] -- well, any kind of pollution if we can possibly prevent it.

Baltimore Female: Whether we think we are going to use it or not. If we can possibly prevent it, we should not allow it. (B:23-24)

*****

Worcester II Female: In some ways I agree with Greg. If you're thinking about your kids and your kid's kids, and what they're going to be drinking when they're older, if this is a way to protect the future for them, I mean I don't want to pay $2000.00 more a year in taxes, but I'd be willing to pay more in taxes than somebody putting sewers in the street like some of the cities, some places are doing. Me, I don't see that it is a great benefit where they live with what they've had for a long time, but something like this, you're talking about future generations that may benefit by it.

RM: But even though it would all be contained in a limited area -

Female: I still think that it's a benefit for future generations, you're not going to contaminate the water. There's a way to help prevent that by putting the concrete barrier up, you're helping your kids, your kid's kids. Someday there may not be that much drinking water around. (WII:11-12)

*****

Hartford Male: ...Just as previous generations have ignored the problem that they did not consider to be a problem and today we are in a situation [needing to protect groundwater] where we have to face up to a situation where at any cost we have to do something to protect future generations from a problem that could be very serious. The water that we take for granted could very well disappear and I realize that this here will not affect the drinking water but the environment also is a factor. I can say 100 years from now, who cares, I am not going to be around. ... my children, but I think it's something we have to consider down the road. If we just keep ignoring these things as we know it life will be a ... (H:19).

*****

Hartford Female: Yes, it [protecting a GNN] is in the long run. I mean, not to me but to generations on down the road. It might not be my children. It might be, you know, somewhere along the line.

R.M.: Betty, you're nodding your head.

is effectively devoid of current use value owing to the availability of substitutes. Otherwise the scenario would elicit values containing some mixture of use and nonuse values and he would be unable to isolate the resource's existence value with any degree of certainty. Second, it is also vital that participants accept assurances that the contamination will be confined to a localized portion of an aquifer. If they do not accept this premise, they will value the prevention of widespread contamination of needed aquifers instead of a GNN aquifer. Third, the participants need to believe that the tradeoff they are being asked to make, money for aquifer protection, is plausible. If for some reason they reject this notion, they will be likely to either give protest zero in response to the WTP question or, if they give a positive amount, they will not be motivated to carefully search their preferences and the amount will not be carefully considered.

The difficulty described above in convincing participants that groundwater contamination spreads slowly rather than rapidly shows how difficult it can be to overcome prevailing assumptions which work against the participants' acceptance of an existence-value scenario for groundwater protection. For reasons to be described in more detail below, people tend to be skeptical about the types of assurances required by this type of scenario. It is possible to communicate these assurances, but even when they accept them, some people express an uneasiness which underscores their natural skepticism. This is certainly the attitude of a

person in the Hartford group who said he was not willing to pay anything for extra protection measures to prevent a town garbage dump from contaminating a GNN aquifer.

> Male: I said zero [dollars], based upon the information that you gave. You know, basically we are trusting the judgment of what you're saying that this is true and that's basically what you have to go on. You know, you're the ones doing the monitoring, you're the ones that set it up, you're the ones that say this, you give the data. What do you want to pay to say, well, I feel more safe now? And I say, if what you're saying is true I don't need to pay any extra money to feel safe. That's basically it. So I don't want to pay anything for it. (H:22)

Clearly this person does not hold an stewardship value for the GNN resource. Just as clearly, he is wary of accepting our description of the aquifer's parameters.

Skepticism that the aquifers will not be needed. Despite his assurances that groundwater is abundant and substitutes readily available, Mitchell found a fairly widespread belief among the focus group participants in groundwater scarcity, especially in the future. As noted earlier, the participants were very conscious of population growth in their areas and how previously open lands were now occupied by new housing developments. This experience, and a distrust of politicians, made it difficult to convince some participants that an aquifer described as a GNN wouldn't really be needed in the relatively near future and that protection delayed will just cost more in the future (WI:23). While these views often assumed a relatively short term time frame, the following examples, one each from the Baltimore and Hartford groups, shows how they shade into the kinds of concerns about future generations that characterize

> Female: Yeah, generations down the road. I feel pretty strongly about that. (H:23)

Inherent values -- where the resource is valued irrespective of whether it will ever be used -- appeared to be held by some respondents who spoke of the importance of taking actions that did not pollute the environment as a good thing in itself. Our impression is that the expressions of bequest value cited above also involve inherent values. A clear expression of inherent values came at the end of the Princeton group:

> Princeton Male: Well, what worries me a little bit, is this reference to certain aquifers being redundant. Is the next thing we're going to hear is that certain areas of fresh air are unnecessary, ... for them to pollute that?
>
> Female: You're right, absolutely right.
>
> Male: Of course, you know water is precious to life just as air is precious to life, how can you take the life support systems and say well this piece of it isn't all that important, it's like being a little bit pregnant. I don't, that's what I have trouble with. (P: 30)

Vicarious protection, the other major category of existence values, was also cited by some respondents who believed that in the relatively near future either the water would be needed for human use or that the contaminated groundwater might harm people despite the careful assurances Mitchell gave them to the contrary. In explaining why she would pay some money in higher annual taxes for the most stringent of three proposed protection schemes, a Princeton female said:

> Just because it would be protecting the environment [inherent value] and I, this was brought up before, that maybe five years or ten years or fifteen years down the road who knows what's going to be at this particular spot or what people are going to find out and I would think about the

> family that I would have, for my children or for their children. And, some are saying well, we have a big problem here now and I would think that the money I would put toward that would help to prevent a problem or diminish it in some way. (P: 28)

This type of value is a significant reason for some people's willingness to pay for GNN protection. In the next section the reasons for skepticism about future need and harm are discussed.

Skepticism about the GNN Concept

In the course of the focus groups we sought to develop a GNN scenario that the participants would consider plausible, a major prerequisite for a valid CV instrument. In the early groups, the discussion focused on whether an already contaminated GNN aquifer should be cleaned up even if the cost of doing so was high. This approach proved to raise problems from a CV perspective as the focus group participants questioned the plausibility of the scenario on the grounds that the polluter rather than citizens such as themselves should pay and that the efficacy of the cleanup technology was uncertain. Since these topics were not central to the research task, it did not seem prudent to add these complexities to the scenario. Mitchell next experimented with scenarios that posed different levels of protection to a GNN aquifer from contamination by a community waste dump whose waste excluded industrial wastes and found that the focus group participants accepted this as posing a plausible choice situation.

For this type of scenario to capture existence values it is necessary for the participants to believe first, that the aquifer

bequest values.

In the following discussion a "C" aquifer refers to a GNN aquifer and A and B aquifers lack GNN qualities.

R.M. Okay, but what if we said we really didn't think we needed that water in the future.

Baltimore Male: Ah, there's no guarantee. You can't guarantee that. ... who's to say C isn't going to go to A as the environment grows. I heard a comment the other day that the newspaper industry is in jeopardy. There's not enough trees. That's why they are re-cycling paper.

R.M. So the threat of a shortage of water seems very real and the notion of C being really never going to be used seems incredible really.

Male: To people in this area that's true.

Male: I personally wouldn't want to bet on it.

Male: ... give up that piece of insurance.

Female: You may not think you're going to develop a place, like Los Alamos and places like that. That was out in the middle of the desert and then they put a big plant out there. You know, no one ever thought that desert would be used for anything, so we never know. Water is always in short supply.

R.M. So it would be worth higher taxes and higher prices to you to protect a C aquifer.

Male: ... think about Linda and her point. You're talking generations down the road. We're paying for what our kids are going to have.

R.M. Okay, ...

Female: Our population is increasing and where it may not be used now, in five generations it probably will be. (B:26)

*****

Hartford Female: [Question directed to R.M.] How do you know we won't need it. I mean we won't need it, or other people won't need it?

Male: It is going to be used some day.

Female: The world is only so big and it's just getting trashed ... (H:24)

This reluctance to believe that an aquifer would not be needed appeared in all the groups and was only partially amenable to persuasion. People are able to cite instances such as Los Alamos, and now Valdez, where the unexpected occurred and they have the example of rapid growth in their communities as a reminder of the relentless demand human communities have for local resources. Augmenting this concern is the view, expressed by several individuals, that paying money now to prevent pollution is likely to save a much higher expense in the future if an urgent demand for the now unneeded resource materializes. These concerns, which are not related to any identifiable current use may be viewed as representing vicarious protection or bequest values depending on the time scale. We conclude that while it is important to try to convince people that the aquifer will not be used, as this simulates the arguments that would be made by public bodies if a referendum on this issue were ever to come to a vote, CV researchers should assume that some people -- perhaps many -- will discount these assertions and that this type of concern is an important motive for holding existence values.

Skepticism About the Containment. Even after being informed about the true speed by which contaminants spread, respondents continued to find it difficult to believe that contaminants could be restricted to a local area without a credible barrier. One type of barrier Mitchell used in the early groups involved

"double plastic sheets, special clay, and all kinds of stuff to protect an aquifer that's very unlikely to be used as far as we can tell" (B: 23). Several people in the Princeton group expressed skepticism about plastic sheets such as this man:

> Princeton Male: Well, the plastic at the bottom of the hole to prevent any leaks at all, I'm not going to say I don't believe, but I don't think it is trustworthy. (P:22)

Similar concerns were expressed in the Hartford group at the point in the discussion where Mitchell asked them to choose one of three alternatives; a conventional dump, a dump in a remote, low-populated area whose aquifer is confined by an impermeable natural rock basin, and a dump in the same remote area but which is also protected by a state-of-the-art plastic liner system. A number of people in this group rejected the number three alternative because they could not believe that the plastic barrier would work.

> Female: I chose No. 2. I basically chose it for the reasons that she did. Because of the low population and everything. I don't know, I just have a tendency to think that with the rocks being there ... push things out further than relying on the plastic. It depends upon what's being contaminated inside that can burn through the plastic eventually.
>
> R.M.: So you're worried that the plastic might not do what it is supposed to do. Just out of curiosity, how many people have a concern about the plastic?
>
> Female: I don't have enough knowledge to know about it.
>
> R.M.: Raise your hands. How many people are skeptical? Five basically....(H: 16)

Skepticism about containment mechanisms was not limited to plastic. Several people in the Worcester II group worried about whether the rock basin portrayed in a diagram Mitchell had

prepared to illustrate how the leachate from a municipal waste dump would be contained (p. 8) would really prevent the contamination from escaping as he had told them it would because the drawing showed some lines in the rock which they took to be cracks. (Subsequent diagrams showed rocks without lines.) Some focus group participants were willing to accept the subterranean containment but worried that the contamination would come to the surface in such a way as to harm wildlife or crops (WI: 26). One person in the Princeton group felt the remoteness of the proposed site, a characteristic that was intended to minimize any possible health effect, would result in sloppy monitoring of the site and therefore increase the risk of release.

A factor which played an important role in promoting incredulity about this and other assurances required by the scenario was the participants' decided lack of trust in government officials and politicians, a view that Mitchell has observed among focus group participants in other research projects and which is also reflected in national public opinion polls. Focus group participants assume that knowledge is imperfect, that politicians and experts do not always have their best interests at heart, and that surprises occur.

In the Princeton group Mitchell had the following exchange:

> R.M. So, what you're saying Clarence is that it would be very hard for you to assume that we would know with any degree of certainty that would be meaningful to you, that this stuff [a contaminant plume] would only spread a very little, and if it spread at all that these procedures would contain it.
>
> Male: Yeah, I don't trust politicians to begin with. They

> are always looking at an expeditious idea (sic) and the old thing about the economic factor, I think that's led a lot of people down the primrose path. (P, 17)

There following an extended discussion whose burden was that half the group shared Clarence's deep skepticism. In another expression of skepticism about the trustworthiness of public officials, several people in the first Worcester group expressed strong negative feelings whether the state health agency would tell them the truth about the quality of their drinking water.

> R.M. Okay so two people would unequivocally trust the [local water] company ... What if the State health agency did special testing? How many people would trust the State health agency, whoever it might be? One, a couple, you wouldn't trust the State?
>
> Male: We're cynical.
>
> R.M. Larry, why not?
>
> Male: I don't trust anybody that's been elected. I mean they're going to lie to you anyway, tell you what you want to hear. "The water is good. Drink it." That's what we wanted to hear.
>
> R.M. But, of course, the State health people aren't elected.
>
> Male: But they're political. They don't get their job by signing an application form and I've done this research work. I don't know. They know the Governor's son or something. (WI: 18)

Skepticism about officials also extended to the U.S. Environmental Protection Agency which was regarded as well meaning but potentially untrustworthy by some participants. One person mistakingly cited Watt's stewardship of EPA. As he put it,

> Worcester I Male: ...How can you even have a long term relationship with the Environmental Protection Agency after what he [Watt] did? All you have to do is get somebody else

> in there like him to run it and we've lost decades of progress...(WI: 20)

In another group a person expressed concern about EPA's long term trustworthiness without reference to Watt.

> Worcester II Male: Doesn't the integrity of all of these plans depend upon who's running the EPA, for instance, and that even the best plan could be badly administered is going to be in trouble some unless you try and get a really efficient and, I hate to say, final solution for garbage. All I'm saying is that the last eight years the EPA has been a shambles and there were things in place that weren't acted out the way they were supposed to be. Whether we have the technology or not, it doesn't mean we're going to have the will and isn't it better to - (WII: 17)

There is an important difference between skepticism about the future need for the aquifer and concern that geological containment in the basin will not be as impermeable as promised. If the scenario is to validly measure the existence values for groundwater it is essential that participants accept the containment as capable of preventing any contamination of the aquifer from contaminating other aquifers. Otherwise, given the widespread default assumption about transport time, there is a probability that some participants would want to protect the aquifer on the basis of use values or existence values for a much larger aquifer than intended. Fortunately, our research suggests that it is possible to communicate this understanding and have the participants accept it. In contrast, it is neither necessary to convince people that the aquifer will never be needed nor is it possible.

Skepticism that the Tradeoff is Plausible. The existence value scenario that seemed most plausible has people trade money

for almost certain protection of a GNN aquifer from contamination by leachate from a municipal garbage dump which their community has sited many miles from their city. On the whole, the focus group members were willing to accept the need for this tradeoff, presumably because municipal waste is increasingly regarded as a pressing social problem and new landfill sites are sought because alternative technologies to dispose of municipal waste such as garbage burning facilities have not won widespread citizen acceptance. There were several hopeful mentions of new technology, but its prospect seemed to be sufficiently remote to the participants to prevent them from dealing with the present tradeoffs embodied in the municipal garbage scenario. As a man in the Princeton group said:

> I think that in respect to the class two's, [aquifers not presently used for drinking water] as much as possible should be done [to protect them] now and at the same time research should be going on between industry and government to develop some timely solution to this trash problem and pollution problem. Heavens, if we've been able to go back and forth to the moon like a bunch of commuters, why can't we solve these kind of problems? It certainly shouldn't defy human intelligence to come up with answers to this. I don't think they're really serious about it, that's what disturbs me. (P: 30)

SUMMARY AND CONCLUSION

Five focus groups were conducted in four cities -- Baltimore, Worcester, Princeton, and Hartford -- to explore in depth people's groundwater knowledge and concerns, and their protection preferences for this type of groundwater. In each group it was found that people's knowledge about groundwater is limited and that they mistakingly assume that contaminant plumes

travel underground at very rapid rates. After steps were taken to correct this assumption, their preferences for preserving nonuse groundwater were explored. Many, but not all focus group participants placed substantial values on this type of resource. They are motivated by several types of existence values: (1) beliefs that the resource may be needed at some time in the relatively near or distant future (vicarious protection value and bequest value) and (2) a belief that preserving an unpolluted resource is a good think in itself (inherent value). Vicarious protection values are important because many participants are unwilling to believe that there is no likelihood of future use in the relatively near future, despite specific assurances to the contrary. Participants' skepticism about other elements of a possible CV scenario appear to be more amenable to change through proper design of the instrument.

These qualitiative findings support the views of those who have argued the importance of trying to measure existence values in a form appropriate for benefit/cost analysis. In the next chapter we consider the implications of the focus group findings for the design of a contingent valuation instrument. They also challenge Fitchen's (1987) individualism hypothesis. While it may be true that people take comfort in having their own well as a source of drinking water because it gives them control and that they like to have a say about the drinking water risks they accept or reject, to name two of the examples she presents of how individualism influences people's views of groundwater, judging

from our focus groups there are a significant number of people who have a strong concern for the well-being of others, even to the extent of being willing to pay something for their protection.

Chapter 3
DESIGN FOR A CONTINGENT VALUATION SURVEY

MEASURING EXISTENCE VALUES IN CV SURVEYS

As previously noted, contingent valuation surveys are the most appropriate method for measuring the values of amenities which have existence value. Using the method to isolate existence values from use values is another matter, however. We (Mitchell and Carson, 1989) have argued that contingent valuation surveys are best suited to capture the full range of benefits someone holds for an amenity and that using them to measure a specific benefit component such as use or bequest runs the risk of the fallacy of motivation provision. This fallacy is the error of assuming that respondents are aware, to the degree of precision desired by the researcher, of what motivates their value judgements (Mitchell and Carson, 1989: 288) and therefore can tell the researcher how much he or she values the good on existence grounds or how much of a total WTP amount can be ascribed to existence values. In our book we discuss the cognitive demands this type of request makes on the respondent who tends to respond wholistically rather by consciously or unconsciously summing across the various benefit categories and reject these approaches. We favor two alternative approaches, one of which is suitable for this study.

This approach, identified in our book as a variant of Strategy III and which we will call the existence-value-only-

scenario (EVOS). Based on the premise that resource value should equal existence value when there is no use value (McConnell, 1983: 260), this approach involves creating a scenario in which the only possible motive for valuing the amenity lies in a specific benefit class or category. If a respondent does not prefer this scenario, his or her WTP amount is assumed to be $0. The EVOS approach is superior to the alternative approach of treating the values given for an amenity by nonusers as an approximation of the existence value for the good which ignores the fact that users may also hold existence values in addition to their use values.

Before we discuss the design of a contingent valuation instrument for measuring groundwater existence values further, it is instructive to consider briefly an interesting contingent valuation study conducted by Steven Edwards (1988) which has the double merit of dealing with groundwater benefits in general and existence values in particular. This study was designed to determine the local citizen's willingness to pay to prevent uncertain, future nitrate groundwater contamination at Cape Cod.

A mail survey (Edwards, n.d.) was sent to 1000 households with 575 usable responses (approximately 20 percent of the sample returned the questionnaire but did not answer the income-valuation questions). Respondents were told that protecting groundwater can be costly but very little is known about the total benefits of protecting it. They were asked why they might want to prevent nitrate contamination in Falmouth and Cape Cod by

rating each of five possible reasons. In this connection, they were told that "Health risks were not included here because water quality is being monitored to protect us from using contaminated water." One of the five reasons the respondents rated in importance was: "Protect ground water for future generations," (bequest) and another was "Protect ground water for others to use" (vicarious protection). The payment vehicle was an annual tax to pay for a new comprehensive ground water management program that would prevent future contamination. Specific amounts, which were varied across the questionnaires, were proposed in a take-it-or-leave it format. The design was quite complex: in all, ten versions of the questionnaire were used which varied the year of expected future contamination, the probability of contamination without an aquifer management plan, the probability of contamination with an aquifer management plan, with a plan given a 5-year horizon, and the price of bottled water.

This study provides some suggestive support for the reality of existence values for groundwater protection. Edwards made a maximum likelihood estimation of a logit model which included a statistically significant term for bequest value based on the above mentioned attitude question weighted by the increase in the probability of future groundwater supply. He reports that option prices almost triple as the bequest scale increases from a "not important" response to a "very important" response. Furthermore, he finds that households with a zero probability of future demand

for groundwater on Cape Cod (presumably because they plan to move in the near future) also have positive option prices atrributable exclusively to the bequest motivation. He argues on the basis of his data that a large percent of total option price is attributable to bequest value. This may be so, but his design was not capable of isolating bequest value (or other existence values) because the bequest scale on which it is based is likely to be colinear with other motivations (including use)[1]. The present study is an attempt to follow up on his pioneering work by developing a different and, hopefully, more adequate CV framework for measuring existence values.

SCENARIO STRUCTURE

After assessing various alternatives, the following scenario was developed to measure groundwater existence values in a future CV study. It is intended to have the respondents place a value on a GNN aquifer for which, by definition, there are no use values in the sense of current or nearterm use by the respondent's household.[2] Every effort will be made to define the

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[1] It seems highly implausible, given the widespread skepticism about government officials described in chapter 2, that respondents would have put health considerations out of their minds solely because the researcher told them that their water is being monitored.

[2] The relationship between use and existence values is complex. As McConnell (1983: 258) points out: "Existence value occurs only insofar as bequent or altruistic notions prevail. We want resources there because they are valued by others of our own generation or by our heirs. Thus use value is the ultimate goal of preferences that yield existence demand, thought he existence and use may be experienced by different individuals.

amenity in such a way that stewardship values, especially inherent values, will be the primary source of value as these are the types of existence values most consistent with the GNN concept.

The amenity to be valued is preserving an as yet uncontaminated aquifer from contamination by a new municipal landfill. The aquifer is a Class II aquifer, not currently used for human purposes and not needed in the future for human use; thus it falls into the GNN category -- groundwater not needed for human use. It is confined by a geological barrier that isolates it from other aquifers. The landfill will be used for a community's garbage and trash only; no industrial wastes. It will be located eighty miles from the community in a sparsely populated area. It has been approved by state authorities as meeting strict regulations designed to prevent any contamination of present or future drinking water supplies.

Participants in the CV experiments will be offered the opportunity to vote in a town referendum between two options. Option 1, the standard option, involves locating the landfill where it will not contaminate aquifers that are needed for human use. The amount of leachate will be minimized by a clay cap. The leachate will contain some toxic substances dissolved from household trash by rainwater seeping through the landfill. Some groundwater contamination will occur over the years, but after fifty or more years the plume in the groundwater will not have travelled more than 600 feet beyond the landfill boundary and

this contamination will not affect any groundwater resource needed for human use.

Option 2, the protection option, involves the excavation of the site and the construction of a concrete waterproof structure capable of containing the leachate and a leachate recovery system which will pump the leachate from the landfill to a treatment plant for removal of the contaminants. Option 2 is intended to offer the maximum possible protection for the aquifer. Provided that participants in the CV experiments perceive the contamination resulting from the standard option as not threatening any human use of the aquifer, the WTP amounts expressed for option 2 will constitute a valid measure of existence value as the motivations for paying for the extra protection will limited to bequest and inherent values. Even if some participants disregard the assurances that the leachate will not affect groundwater that will be used by humans in the relatively near future the WTP amounts they give would still be motivated by existence values of the vicarious protection type. The eighty mile distance of the site from the participants' location makes it very unlikely that their WTP amounts for option 2 would reflect ordinary use values in any way.

KEY SCENARIO DESIGN ASSUMPTIONS

In what follows we describe some important assumptions that will need to be accepted by those who participate in a CV groundwater existence value survey if valid WTP amounts are to be obtained. This analysis draws heavily on the focus group

findings for evidence as to which assumptions the respondents will have the most trouble accepting. Where appropriate, we refer to features of our proposed existence value scenario that are intended to overcome the difficulties involved in getting respondents to accept some of the assumptions.

1. The participants must be convinced that the original aquifer is uncontaminated. If they failed to accept this assumption, their value for protecting it would not reflect their full existence value for protecting it. Participants in the focus groups had no difficulty assuming uncontamination. This condition did not require special attention.

2. They must find it credible that citizens pay to protect the aquifer. If the CV participants reject the idea of paying for the protection offered in the scenario because they believe someone else should pay, their WTP amounts will not reflect the values they hold for preserving this resource. The focus groups showed that citizens tend to regard aquifers as public property and believe there is no justification for companies and private individuals to contaminate aquifers. If these parties do contaminate an aquifer, the cost of protecting an aquifer or cleaning up a contaminated aquifer is regarded as the responsibility of the polluter and not the general public.

This situation dictated the use of a public source of pollution for which participants are financially responsible. Citizens directly bear the costs of public landfills. Focus group participants found the cost of a new public landfill for

their community a plausible and acceptable project for them to pay for.

3. They must believe the landfill's contamination will not harm their current use of any groundwater in any way. This condition is necessary to ensure that the values placed on the resource are restricted to the several existence values. If, for example, participants believed, contrary to the scenario's intent, that contamination of the aquifer under the standard condition would somehow affect their use of groundwater, the values they expressed would be likely to include some use values instead of the pure existence value which we intend to measure. The focus group findings revealed that this could occur unless careful steps are taken to make sure that the scenario's assertions fit with the participants' beliefs about how groundwater contamination occurs.

These beliefs were described in chapter 2. One is the widely held belief by the focus group participants that groundwater flows swiftly under the earth and their expectation that groundwater contamination spreads as rapidly underground as it would if a spill occurred and flowed into a lake or river. Another strongly held belief is a skepticism about assurrances of safety offered by politicians or even scientists about toxic hazards. Unless the containment method is highly credible, this belief will add to the difficulty of convincing respondents to accept the premises of the scenario about contamination transport times.

The solution we have developed to overcome these beliefs is twofold. First, the scenario will address the transport time issue head on by describing in words and diagrams how slow groundwater flows. This will help mitigate the respondents' propensity to assume extremely rapid transport, but cannot be assumed to eliminate it. Second, in order to ensure that as many participants as possible accept the premise of the scenario, it will portray the aquifer under the landfill as separated from all other aquifers in the area by an impenetrable geological barrier. The landfill will also be placed in a little populated area eighty miles from the respondent's city in order to further minimize evoking use values. The focus group participants accepted the geological barrier as credible when it was used in the later focus groups.

4. <u>They must believe that the barrier described as protecting the aquifer from any contamination will accomplish what the scenario claims it will.</u> If those taking part in a CV survey believed that the barrier described in the protection option would not prevent all contamination from affecting the aquifer beneath the landfill, but had a more than trivial chance of leaking, then any value people gave for protecting the aquifer by means of the concrete barrier would include a discount for the assumed probability of a leak. Treating a WTP amount obtained under this assumption as the value for full protection could significantly underestimate the existence value.

I became aware that this assumption is difficult to communicate when participants in some of the focus groups questioned the efficacy of a double plastic liner and drainage recovery system which was described as offering a secure barrier system. It was very difficult for them to accept this assumption because their own experience with plastic bags and covers suggested that underground plastic barriers would be readily punctured.

The solution we have adopted is to describe a concrete containment structure with a drainage system. People are familiar with concrete basements for office buildings and other facilities which are successful in preventing leaks. Focus group participants were able to imagine that such a containment structure would prevent significant leaks with a very high likelihood of success.

5. To the extent possible, they should believe that people living near the facility, including those who will move there in the future, will be protected from harm by groundwater contamination. If the respondents believe there is much possibility that new residents to the area would unwittingly sink drinking water wells into the contaminated aquifer and be harmed, they would not regard the aquifer as a GNN and instead value it on another basis. Although this basis (if assumption three is believed) will involve a type of existence value, vicarious protection, these values will so predominate that the types of existence value that most concern us, the stewardship values,

will be so overwhelmed that we will not be able to determine whether groundwater stewardship values in fact exist.

The focus groups revealed that people find it hard to accept this premise. My strategy in the design of the CV instrument is to provide the kind of assurances that a government agency such as the U.S. EPA can provide about this and to make every effort to ensure that the respondents understand these assurances. If they accept them, the values they give will be restricted to the two types of stewardship values. We will assess the degree to which the assurances are accepted by asking followup questions to probe the beliefs the respondent brought to bear in arriving at the WTP amount. This will help me to determine whether some respondents were taking vicarious protection values into account.

While the presence of vicarious protection values are seemingly incompatible with the GNN concept, we do not believe that they should be considered as invalid measures of existence value in this context. Provided the best possible effort is made to convince people that the aquifer is a GNN, respondents' unwillingness to believe this represents a reality which policymakers need to take into account. My format for the questionnaire probes the respondents' beliefs in such a way that it should be possible to distinguish between those who primarily hold stewardship values and those who hold significant vicarious consumption values.

6. They must regard the standard option as a legitimate choice even if they themselves prefer the protective option. CV

studies must be careful to avoid compliance bias or symbolic bias (where the person values a symbolic entity instead of the researcher's intended good) because participants in most CV experiments are vulnerable to perceived pressure to respond in a socially valued way. The very nature of the CV process, involving interaction between two people, can easily lead the participant to feel this kind of pressure where none was intended by the person designing the study. If CV participants believe that it is wrong for rational, environmentally concerned people to prefer the standard option to paying more for the protective option, the aggregate existence values are likely to be artifically inflated because people are giving what they believe to be a socially accepted response rather than one which reflects how they would actually behave if they had to pay for groundwater protection under the conditions presented in the scenario.

Evidence from the focus groups supports the view that "pure" groundwater has strong symbolic value for many people through its association with environmental and health protection values that are widely shared and largely unquestioned in contemporary American society.

The approach we have taken is to word the scenario in such a way as to minimize the possibility of compliance or symbolic bias. The scenario emphasizes that the landfill meets current stringent siting regulations and has the support of responsible officials. It will describe the no contamination alternative as supported by some citizens out of existence value concerns only.

It will also offer only two options, the contamination option and the no contamination option. If an intermediate option was offered -- say a plastic barrier system with a 50 percent likelihood of leaking -- the presence of two protective options might convey what would be perceived as a cue that at least some additional protection is normative.

The responses of the participants in the later focus groups to this approach suggests that we have been successful in describing the two options as legitimate alternatives. Some participants had no hesitation in choosing to contaminate the aquifer because the alternative was not worth the money. Others said they would pay more for a program that would offer more protection because of their concern for future generations.

7. <u>They must regard the selection of the site as legitimate</u>. If they react negatively to the idea of siting any landfill, the CV experiments would obtain protest bids instead of genuine WTP amounts.

Siting landfills, even when they are not bona fide hazardous waste facilities, is very controversial in our society at this time (Mitchell and Carson, 1986). Citizen protests have caused many siting plans, including some that were technically well conceived and skillfully presented to the local community, to be cancelled for political reasons. Unless the landfill is perceived as legitimate by CV participants, people's negative reactions to landfills in general could color their WTP amounts or lead to protest bids.

Our approach is to describe the need for the landfill as genuine. The site is then presented as already selected and secured. Both the standard and protective options involve the same site, secured under the same conditions. The only thing that varies is the degree of protection. Judging from the focus group discussions, these steps should be sufficient to avoid complications from the not-in-my-back-yard concern that many people hold.

8. <u>They must regard the market model as plausible</u>. Throughout the focus groups we used a referendum elicitation method which places the participants in the position of voting in favor of either the standard landfill or the protective landfill. Given the community-based nature of waste disposal programs, this procedure was easily accepted by the participants. The procedure for eliciting the WTP amounts involves having the participants give the highest amount they would pay before they would vote against the referendum. Determining an actual dollar amount is often hard for CV participants, but this open ended procedure shows signs of working well at this stage in the research.

9. <u>They must regard the payment vehicle as credible</u>. This is another condition that is relatively unproblematic in this study because of the close association between the cause of the contamination and those who will pay for its prevention. Higher waste disposal fees, with apartment dwellers and renters told that their landlord would pass them on, was accepted as a logical way for the town to cover the cost of the new landfill.

Focus group respondents appeared to consider their budgets carefully when arriving at a WTP amount and some complained that they would pay more if they had more money, a sign that they were genuinely constrained by their budgets.

10. They should not adjust their WTP amount to take into account what they think other people would be willing to pay. Instead of giving their maximum willingness to pay amount, we have noted a tendency on the part of some respondents to CV studies which use the referendum framework to given an amount that they think other people would be willing to vote for or which they believe to be within the range of what low income people could pay for. A woman in the Princeton group expressed such a view in explaining her WTP amount when she said: "...I was kind of focusing towards what a community would be willing to pay or what they would think..." (P: 14).

Our strategy to avoid biasing the WTP amounts of higher income households downwards in this way is to use a followup question to probe whether people were doing this. Those who say that this is what they did would be asked another WTP question designed to elicit their consumer's surplus.

DRAFT GROUNDWATER EXISTENCE VALUE SCENARIO

The following is a draft of an existence value groundwater contingent valuation survey for use in an in-person survey in Worcester, Massachusetts.

1. About how many years have you lived in Massachusetts?

_____ years

2. About how many years have you lived in the Worcester area?

_____ years

3. All things considered, how would you rate the Worcester area as a place to live--would you say it is an excellent place to live, pretty good, only fair, or a poor place to live?

1 Excellent
2 Pretty good
3 Only fair
4 Poor
5 Unsure, Don't know
6 No answer

Now I am going to read some phrases that describe different kinds of interests and activities people have and do. For each one would you tell me how well it describes you. The first one is "Someone Who Always Wears Seatbelts When Riding In a Car." Does this describe you definitely, somewhat, or not at all?

4. Someone who always wears seatbelts when riding in a car.

1 Definitely describes you
2 Somewhat describes you
3 Not at all
4 Unsure, Don't know
5 No answer

5. Someone who does not trust government to plan things so that future generations will be protected from environmental contamination.

1 Definitely describes you
2 Somewhat describes you
3 Not at all
4 Unsure, Don't know
5 No answer

6. Someone who is an environmentalist.

1 Definitely describes you
2 Somewhat describes you
3 Not at all
4 Unsure, Don't know
5 No answer

7. Someone who thinks people worry too much about chemical additives and preservatives in food.

1 Definitely describes you
2 Somewhat describes you
3 Not at all
4 Unsure, Don't know
5 No answer

8. Someone who trusts what experts say about science and technology.

1 Definitely describes you
2 Somewhat describes you
3 Not at all
4 Unsure, Don't know
5 No answer

9. Do you happen to know what a "landfill" is?

1 Yes
2 No
3 Not sure

It is a place where towns and cities like yours bury their garbage. As landfills get filled up, locations for new ones have to be found. Until a few years ago, the worry people had about landfills was their smell. Today there is also concern that pollution from city landfills might contaminate drinking water sources.

HAND RESPONDENT CARD A

Here's a picture of the old type of city landfill that we used to use. It shows how drinking water could be contaminated. The garbage was trucked it and dumped into a hole and covered with earth to prevent smells. Once filled, it was covered with more dirt. As rainwater seeped down through the garbage, it dissolves some of chemicals in things that people have thrown away such as old paint solvents or pesticides.

Gradually this material seeps down to the water table (POINT) where it contaminates the underground water below the dump. This groundwater is not found in underground rivers or lakes. Rather, it is water that fills the cracks and pore spaces in rocks and sediments that lie beneath the surface of the earth much the way water fills the open spaces and saturates a spongue.

Once it reaches the water table, the contaminants spread slowly underground in the direction the underground water is seeping.

It travels in a plume as shown here (POINT). Many people are surprised to learn that the seepage is very, very slow; usually less than 100 feet a year.

After many years the landfill could eventually contaminate water in this well. The contamination from city dumps is much less dangerous than the contamination from toxic or hazardous waste dumps where industries dispose of hazardous materials. Nevertheless, someone drinking the contaminated water from this well for a number of years might have a small chance of getting cancer.

10. Do you have any questions about this drawing of the old type of landfill or how the contamination occurs?

1 Yes
2 No

Now I would like you to imagine that the landfill your city is using is going to be full in two years. Even if your city begins a recycling program, it will need to construct a new landfill to meet its needs for the next thirty years. According to new state safety requirements, it must be located in a place where there is no chance of contaminating any groundwater that will ever be used for drinking water.

HAND RESPONDENT CARD B

This picture (B) shows how the new landfill will look on the land the city bought in a place eighty away from here. Geologists have determined that there is a thick layer of impermeable rock underneath the site which forms a natural barrier preventing any seepage from the basin. The city has purchased all the land covering the basin. The landfill itself is designed so that any seepage from the fill will not go beyond the boundaries of the area owned by the city.

First, this rock (POINT) would prevent any contamination from ever spreading beyond the local area.

Second, monitoring wells like this one (POINT) will be checked regularly just to make extra sure that this never happens.

Third, the city owns this whole area and will never allow anyone to dig drinking water wells in the basin area in the future. There is more than enough sources of groundwater outside the basin to take care of any future population growth.

Finally, there is absolutely no chance of the new landfill harming anyone in your areas because of these features and because it is so far away.

HAND RESPONDENT CARD C

This picture shows what the site would like like after 50 years. The landfill will be covered with a clay cap to minimize leaching by rainwater. The contamination will be restricted to the Basin area as shown in the picture. Even though there is population growth in the area, no one could be harmed by the contaminated groundwater and, of course, no one will be allowed to drill a well in the area.

A panel of outside scientists has reviewed the plan and agreed that it is safe and meets all the environmental protection regulations. The county where the land is located has held public hearings about the plan and the local residents have agreed to accept it provided the monitoring wells are checked regularly.

The additional cost to the average household in your city above what they are alreadying paying for trash removal will be $180 per year for this new landfill. This is $15 a month in extra trash removal fees.

11. Do you have any questions about this plan?

1 Yes INTERVIEWER WILL GO OVER THE QUESTIONS WITH THE RESPONDENT
2 No

12. If the facts are as I have described them, do you think it offers adequate protection to the people living in the area near the landfill site or not?

1 Yes GO TO Q. 15
2 No GO TO Qs. 13 and 14
3 Don't know GO TO Qs. 13 and 14

13. What is it about the plan that concerns you?

14. If the plan is carried out as described above, do you think the plan poses a large chance, a moderate chance, a small chance, a very small chance, or no chance at all of harming someone in the future?

1 Large chance
2 Moderate chance
3 Small chance
4 Very small chance
5 No chance at all
6 Don't know

15. Would the people who might be harmed live in your community or in the areas around the site which will be 80 miles away from your community?

1 Your community
2 Area around the site
3 Other (describe)

16. If the plan were put to a vote in your community how would you vote? If the facts are as I have described them, would you vote in favor of it or would you vote to reject it and instruct your town to search for another site?

1 Accept
2 Reject
3 Don't know

17. Some citizens have proposed another plan. Although they agree that the plan proposed by the town is safe, they want the plan to be modified to prevent <u>any</u> contamination of the groundwater under the site. They say they will feel better knowing that nothing has seeped into the groundwater even if it will never be used for any other purpose in the future.

The plan they propose will be identical to the first plan except that the site would be dug out and a thick concrete liner installed as shown in this drawing (D). HAND RESPONDENT CARD D

Pipes would be placed in the bottom of the pit that will collect all the water that drains through the garbage and bring it to the surface where it will be treated (POINT TO TREATMENT PLANT) to remove any contamination.

HAND RESPONDENT CARD E

This card shows what the alternative landfill will look like in fifty years. The site will still have to be inspected regularly and the town will continue to own the area covered by the basin in case of any problems with the concrete liner. But the groundwater in the basin will not be contaminated.

People in the city hold different views about these plans. Many oppose the concrete barrier plan because they say it is not needed. They say there are other more important things to do with the money. Others support it because they think it is important that all groundwater should be kept free from contamination even if it isn't going to be needed.

The city decides to hold a referendum to see if citizens are willing to pay anything more on top of the $180 extra a year the original plan would cost for the concrete barrier plan.

18. If the facts are as I have described them, how would you vote? Would you vote for the city's plan or would you vote for the concrete barrier plan?

1 Present plan GO TO Q. 22
2 Concrete barrier plan GO TO Q. 19
3 Don't know, not sure GO TO Q. 19

IF VOTE FOR CONCRETE BARRIER PLAN:
19. Just thinking about your household, what is the highest amount in extra taxes per year, if anything, that you would pay for the concrete barrier plan before you would vote against it because it is not worth that much money? This money would be <u>in addition</u> to the cost of the original plan.

$_____

20. In deciding what they are willing to pay, some people try to think about what amount would be fair for everyone to pay. Did you happen to do this or were you just thinking about what it would be worth to your household?

1 Just my household GO TO Q. 23.
2 Took other households into account
3 Not sure

21. We would like to know what this plan is worth to you personally. What is the highest amount you would vote for without taking other people's ability to pay into account?

$_____

22. Please tell me whether the following reasons were important or unimportant to you in making your decision about whether to vote for the concrete barrier plan or the original plan ....[followup] and is it very important (unimportant) or somewhat important (unimportant).

	VI	SI	SU	VU	DK
A concern that your city's drinking water will be contaminated by the dump	1	2	3	4	5
A concern that people living around the site will be harmed by the contamination	1	2	3	4	5
A desire to keep the groundwater clean					

for its own sake. 1 2 3 4 5

A desire to keep the groundwater clean for future generations 1 2 3 4 5

23. Which of these four reasons is the most important reason why you voted the way you did?

1 Fear your city's water would be contaminated
2 Fear that local people would be harmed
3 Desire to preserve groundwater for its own sake
4 Desire to keep it clean for future generations

This is the end of the scenario portion of the questionnaire. If implemented, the instrument would also include a full set of standard background questions.

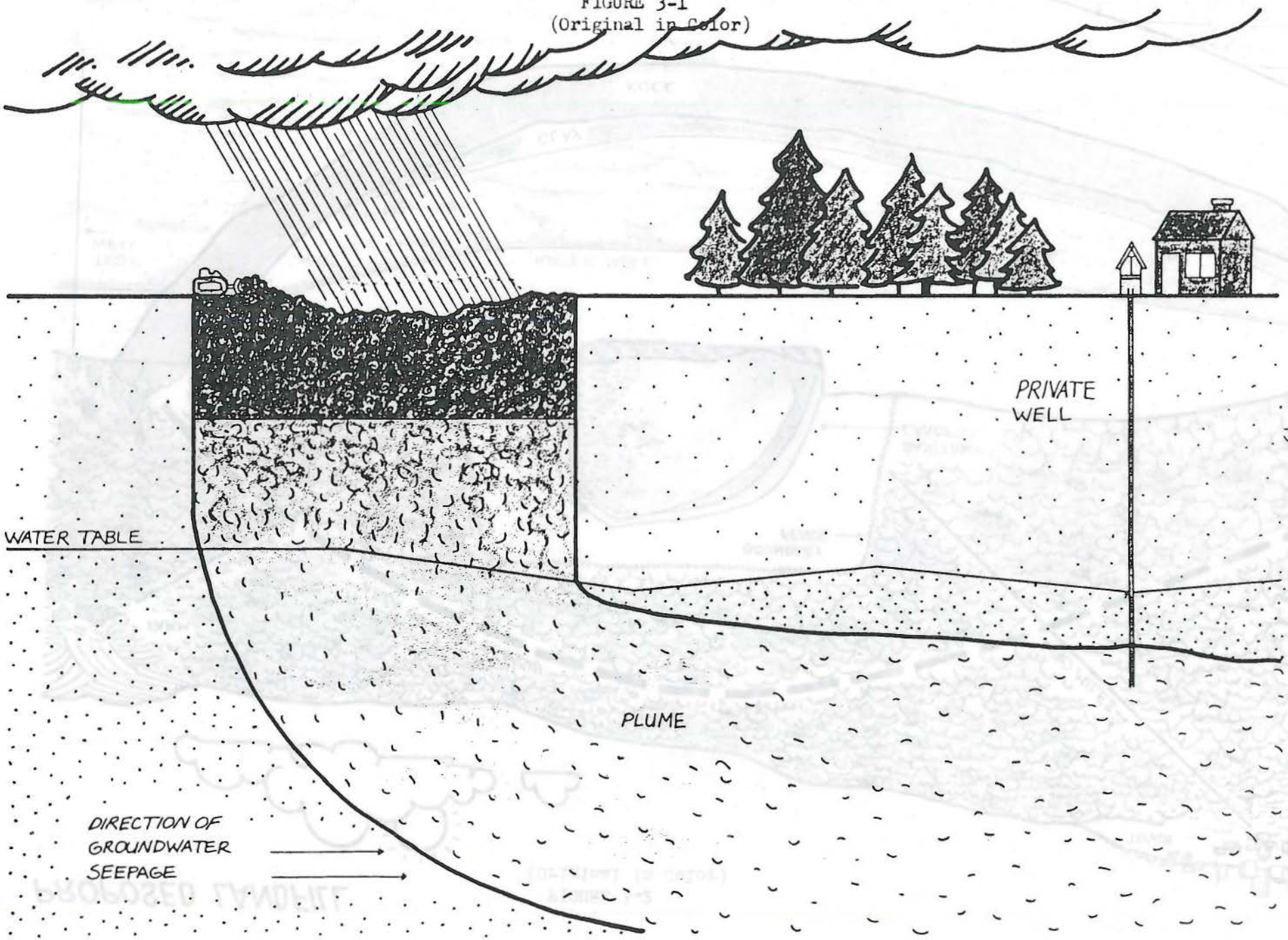
A NOTE ON THE DISPLAY CARDS

Early in this study we determined that visual aids would be necessary to help convey the concept of groundwater contamination and the features of our scenario. In all, five pictures are used in the draft scenario as shown in figures 1-5. We had a professional illustrator create these pictures in color to our specifications. The final versions, which are shown in black and white, are much modified from the original renderings as a result of using them in the last focus group and some trial interviews.

The key problem was how to render the scenario's protection measures which include remoteness, an underground geological barrier, monitoring wells, and site security. Tests showed that a simple cross section of the dump would not suffice because some respondents were concerned about the proximity of human activity to the site and the natural geological basin which would segregate the contamination from other aquifers. We also learned

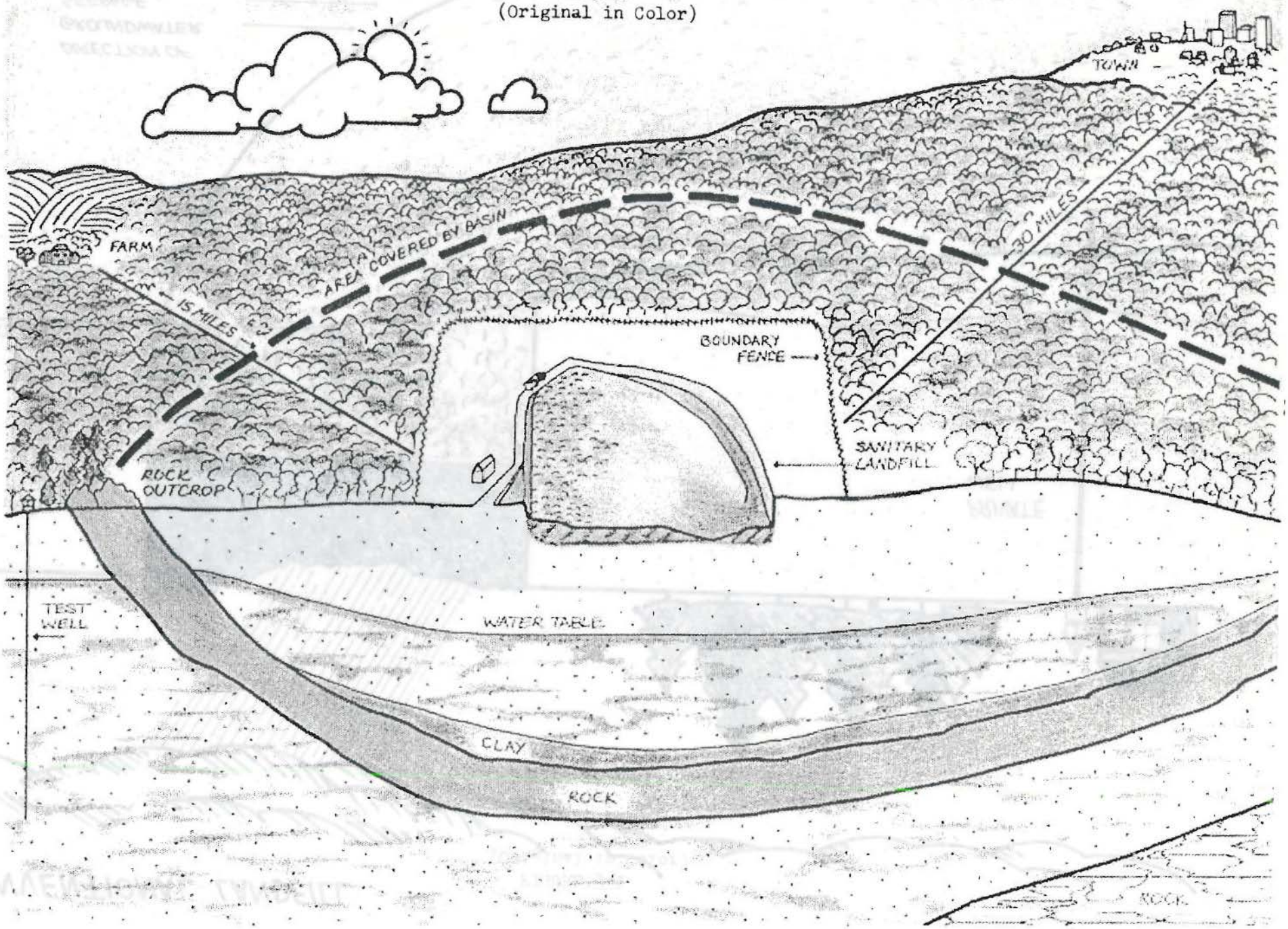
CONVENTIONAL LANDFILL

FIGURE 3-1
(Original in Color)



PROPOSED LANDFILL

FIGURE 3-2
(Original in Color)



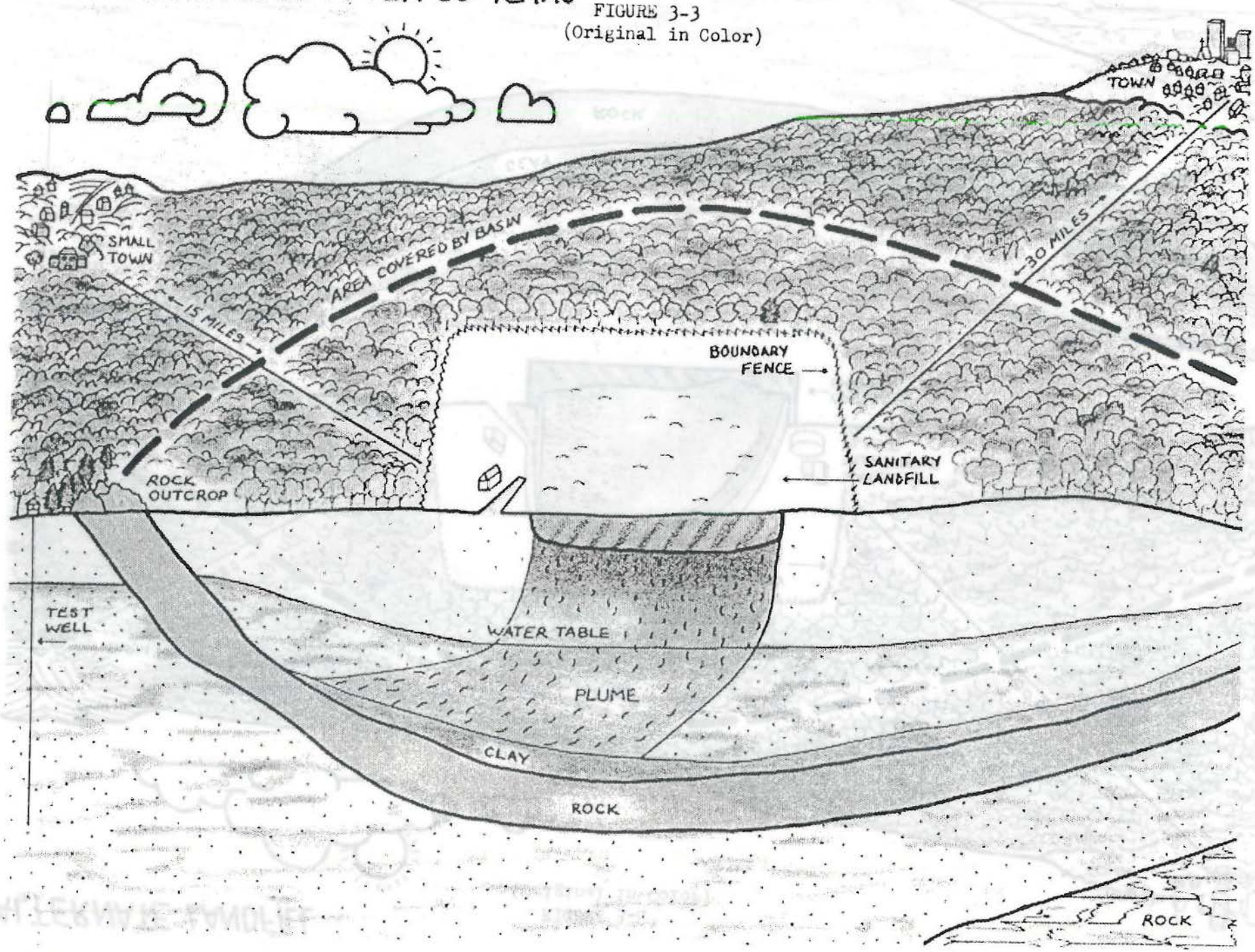
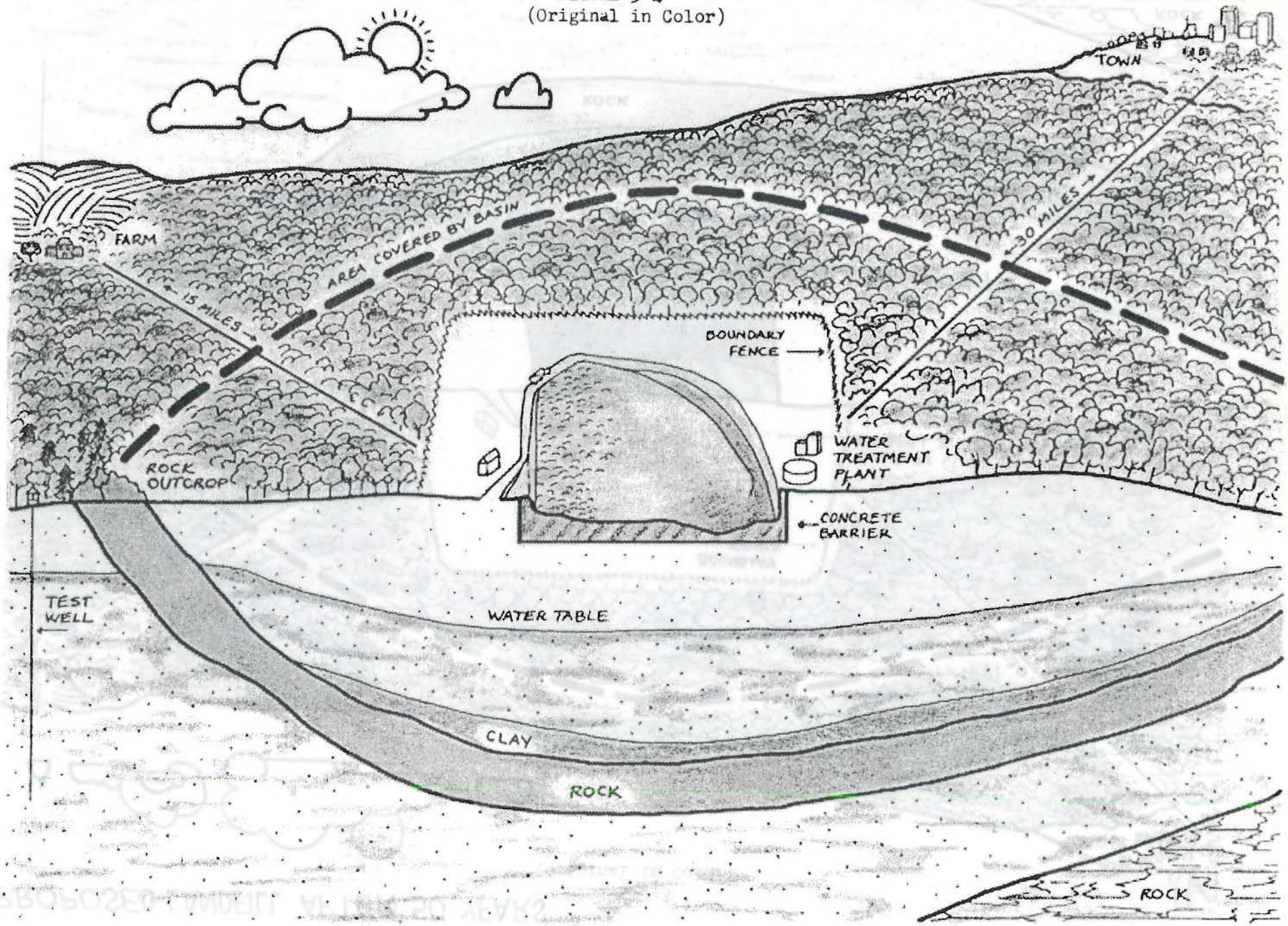


FIGURE 3-3
(Original in Color)

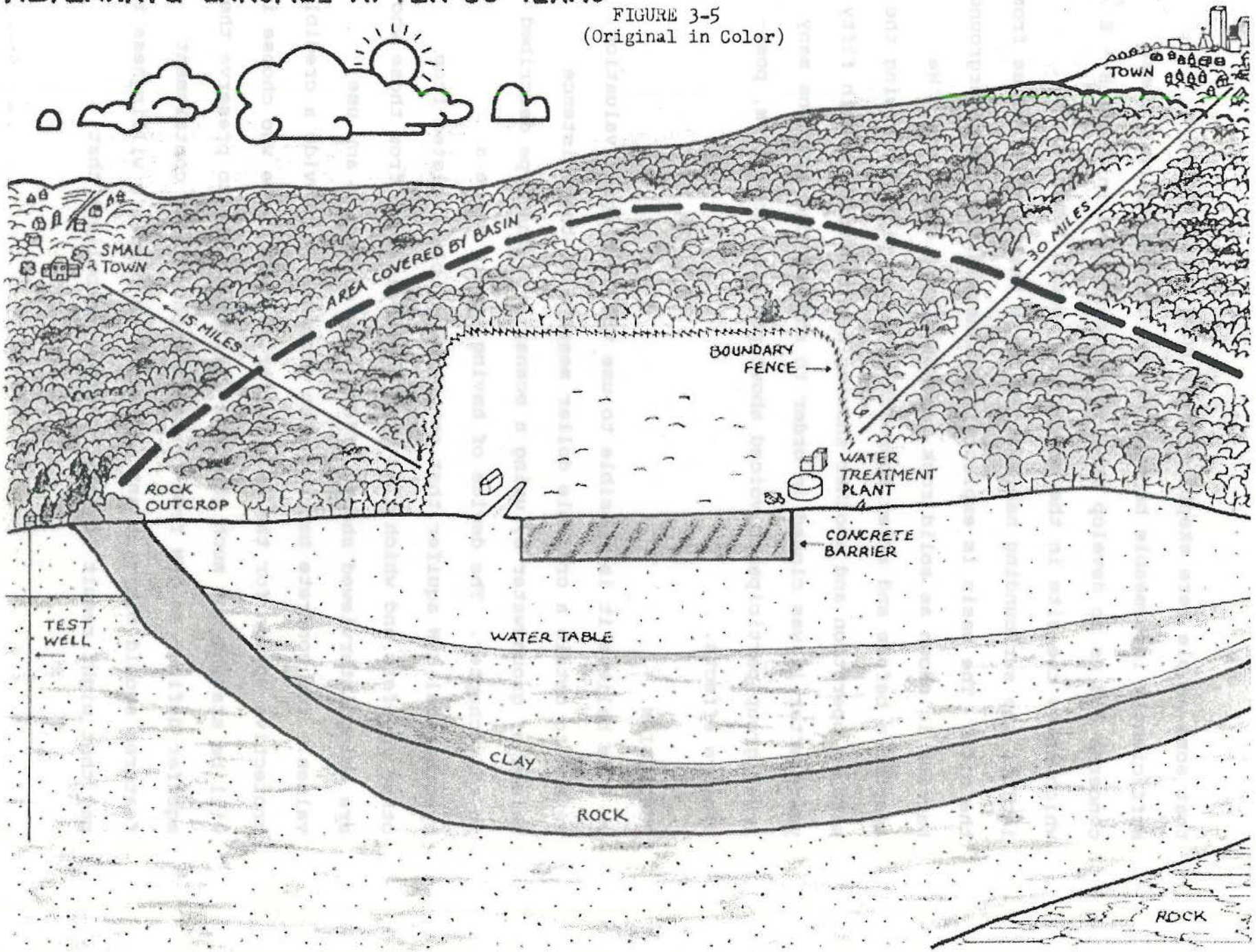
ALTERNATE LANDFILL

FIGURE 3-4
(Original in Color)



ALTERNATE LANDFILL AFTER 50 YEARS

FIGURE 3-5
(Original in Color)



that some people were skeptical that rock could act as a sufficiently impermeable barrier to the contamination. These concerns led us to develop the base picture used in cards B - E which shows the site in the center and enough landscape to include the surrounding habitations for a thirty mile radius from the site. The basin is explicitly delineated and the underground barrier is shown as solid rock augmented by a clay lens. We adopted a before and after approach with one picture showing the site in operation and another showing how it would look in fifty years after it was closed in order to address the concerns many focus group participants voiced about possible long term, post-closure effects.

CONCLUSION

We believe it is possible to use the contingent valuation method to obtain a credible dollar measure of the existence values of groundwater by using a scenario of the type described in this chapter. The device of having people value a hypothetical GNN aquifer that can be plausibly isolated from other aquifers and which lies at a great distance from those who are being interviewed should effectively eliminate any use values. The concrete barrier plan promises to provide a credible protective option for the GNN aquifer so that those who choose it will be stating how much they are willing to pay to preserve the aquifer defined as GNN from contamination. These containment features should minimize any influence on people's willingness to pay that might result if they continue to believe that

contamination in groundwater travels at a much higher velocity than is actually the case.

The instrument presented in this report is designed for in-person administration as we believe it requires the use of visual aids. It will need to be pretested before administration in the field. While we are confident that the instrument's basic design features are appropriate, only pretesting can determine whether the wording throughout is understandable by respondents of all educational levels and whether the information presented and the sequence of items best facilitates the administration.

The types of existence values that will be captured by this scenario include at least three of the four subtypes.[3] Given the difficulty of convincing people that the aquifer will never be needed for human use, a portion of the values will include the utility people get from vicarious protection. The vicarious protection values will be minimized by the scenario features that are intended to protect others from inadvertently using the groundwater in the basin. Judging from the focus group discussions, the type of existence value that will yield the greatest utility is bequest value. There is also evidence that inherent values will play a role, at least for some people.

There is no valid way to obtain separate measures of the several types of existence values in this study. First, it is

---

[3] The significant other vicarious consumption type is not likely to be included in their WTP amounts unless the respondent has many relatives and friends scattered throughout a region eighty miles from his or her house.

too difficult to overcome people's beliefs about future use by others to design a scenario that would only capture stewardship values. Likewise, we see no way to design a scenario that would only capture bequest or inherent values for groundwater. Second, it is cognitively unrealistic to ask respondents to state what proportion of their total value they ascribe to each of the three types of existence values. However, it will be possible to assess in a qualitative fashion the degree to which the respondents are influenced by these several sources of value by using the followup motivation questions (Questions 22-23).

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APPENDIX

FOCUS GROUP TRANSCRIPTS

Resources for the Future
Groundwater Existence Value Study
Robert C. Mitchell

TRANSCRIPT, BALTIMORE FOCUS GROUP, AUGUST 28, 1987

R.M. Thank you for coming this evening. Our purpose in having you come here is to get to understand how you feel about the issues we're going to talk about. There are no right or wrong answers. At the end of the discussion I'll be glad to answer any questions you may have, what I am up to, how this all works.

You can see that the discussion will be taped in order to help me go over what you say and how you say it. One of the things I do is to write questionnaires. When you write a questionnaire, it has to make sense to people who are hearing the questions. Knowing how you talk about things will help me use the kind of language that will make sense to people.

Now, I'd like to go around the table and find out how long you folks have lived in this area and where you came from before you moved here and how far your home is from this place. Please remember I am a stranger to Baltimore and don't know the local towns and subdivisions. Helene, would you begin?

Female: Well, I am originally from Ocean City. I grew up there and moved up here after I graduated from college and I've been teaching --

R.M. And which part of this area do you live in?

Female: Parkertown.

R.M. O.K.

Female: It's between Bel Air and Edgewood.

Female: I was born in Baltimore City and right now I live in Perry Hall, which is in Baltimore County.

R.M. How far from here?

Female: I guess about 15 miles -- 10 or 15 miles.

Female: ... Baltimore for about 55 years. Originally from Virginia. I live in the Towson area.

R.M. And about how far is that from here?

Female: About ten miles.

R.M. Bob?

Male: Originally from Pennsylvania.

R.M. Whereabouts in Pennsylvania?

Male: Mount Union. Up near Huntington and lived here about 44 years.

R.M. Where's here?

Male: Middle River.

R.M. Which is how far?

Male: Three or four miles.

R.M. I see, okay. Eve?

Female: Originally from New York City and then I came here by way of Columbus, Ohio, where I went to college. I've been here about 27 years, and I live in Towson.

R.M. Towson, too. Okay. Tom.

Male: I was born in Baltimore and I've lived in West Virginia, Pennsylvania and the last thirty years around the area; 15 in Catonsville which is about 30 miles from here; the last ten about two miles up the road.

R.M. Okay. Denise.

Female: I was born in Baltimore and I've lived here almost all my life. I lived in California for about two years and now I am living in Sparks which I guess is about 45 minutes from here. I don't know how many miles.

R.M. Walter?

Male: Born and raised in Baltimore. I still live in the city, about 10 - 15 miles away.

R.M. Yeah, Jane.

Female: I was born in New York, but I came here when I was ten ... so I've been here about thirty-five years. ... from Middle River.

Female: Currently I am living in Edgewood which is north of here in Hartford County very close to Aberdeen Proving Grounds and I was originally born in Northwestern Wisconsin and also been in Ohio and Pennsylvania. Have been a resident here almost three years.

R.M. Almost three years. Okay. We've got some Baltimoreans and some newcomers to the area; some that have been outside and come back. I'd like to pass these pads around and just have you write down one little thing to get things started ... (loud noises) ... What I'd like you to do is just to write down your answer to the following question. What are the one or two most important health or environmental problems in this area that concern you the most? If any? The things you think need attention to that worry you or concern you.
.....

R.M. Okay, Bob?

Male: ... bay and water pollution is one of the main concerns around here.

R.M. Water pollution in the Bay?

Male: Yes, and I've also got over-population in some areas. It seems that some of the back streets you try to get out on, especially weekends and sometimes during the day, is really rough.

R.M. Okay, Marion?

Female: The smog and the air causes a lot of problems and there are a lot of people with breathing problems and in health too, did you mean ...

R.M. Yeah, sure.

Female: Aids. Very, very concerned about that.

R.M. How many of you mentioned Aids when you ...? Just one other. Okay. ... we're thinking more about environmental kinds of things.

Male: I thought of it, but -- been married to one person, I'm not worried about it really... I should be because I am a retired fire fighter and I've handled a lot of people you know in the past. I should go on down and get a test for myself. ... you know I may be a carrier or something.

R.M. Well, probably not. Helene what did you have?

Female: Oh I had water pollution ... and also food additives.

R.M. What kind of food additives?

Female: Just things that you wonder what -- I just wonder what's in food.

R.M. Makes you nervous a little bit sometimes? How, about you, Jane?

Female: I put down water pollution and I don't know exactly how to word it, but why do they always have to use new land; why they can't just rebuild on land that isn't being used.

R.M. And it concerns you the kind of land that they're using for --

Female: Well, it just seems like they keep taking more and more trees and spreading out farther and farther.

R.M. I see. Okay. Tom.

Male: Well, mine was pretty much a combination of Bob and Marion. With the influx of people and industrial development, it's clean air and water pollution.

R.M. Walter?

Male: Yeah, the bay. A lot of people make their living down there and it's really getting rough. My second problem is blood supplies for the Red Cross. I've been a blood donor for years ... I am also a former city police officer ... that Aids threat ... and I didn't put down Aids because I feel that's more of a nationwide thing.

R.M. That's true. Denise?

Female: I put down pollution in the Bay, and when we first moved back from California there was an accident at Three Mile, the Three Mile Island accident, and that still alarms me.

R.M. The threat of nuclear power.

Female: Yes.

R.M. Ruby.

Female: The Bay. It has to be cleaned up. They clean up one section and it gets worse some place else. Big business.

R.M. Linda?

Female: I identified one environmental issue and one health issue. I am very concerned about hazardous waste disposal because I live so close to Aberdeen Proving Ground and because there are many chemicals, mustard gas and other various and sundry things that are buried on the proving ground, which could very easily -- they don't know if it's there -- it can contaminate our water. It's not healthy for those people who are living there and Hartford county is growing and becoming much more populated. I also identified Aids, even though it is a nationwide issue, because we are a metropolitan area. We are going to have to address it.

R.M. Perhaps more than some places. I see.

Female: Air pollution, traffic, overcrowding and irradiating food?

R.M. Could you explain that?

Female: Well, I had read that they're going to radiate food in order to produce more or kill bacteria on it.

R.M. Ah, so it has a longer shelf life. Yes, okay. And that doesn't really strike you as what you'd like to eat.

Female: I don't know much about it but I don't like it.

R.M. From the sound of it, it doesn't sound terrific. Okay. Linda, you mentioned ... your water being contaminated. I am interested in knowing how you folks think about the drinking water in this area. Is the quality pretty good?

Female: Baltimore basically has pretty good water, especially when you've traveled around and tasted some of the other.

Female: Of course, if you had it tested, you might feel different about it.

R.M. Marion, do you --

Female: I have well water and I love it. Terrific.

R.M. What do you like about it?

Female: Well, when I paid the city water I had all these different chemicals that are in it and it's very hard to take. I'm used to pure water and we've had it for twenty years now ...

R.M. Tom, how do you like the water?

Male: I have no problem with the water.

Female: I have well water and the only problem I have -- high in copper so it causes my sinks to turn green and my clothes, it discolors my laundry and things like that, but in California there was no way we could drink our water or even cook with it. I even felt uncomfortable showering in it, because if you poured a glass of water and looked in your glass, it just looked like tissue was dissolved in it. It was very poor quality.

R.M. Are there other --

Female: I think I am more concerned about the quantity of clean safe drinking water --

R.M. There's a shortage?

Female: Hartford County, I don't know what's happened with Baltimore County. I am really not as familiar but Hartford County is experiencing some water shortage. Helene, you can probably back me up on that because of the fact that we've had so little rainfall this year and last.

Female: ... yeah, I got a letter once about five years ago that there was a lot of salt in the water and they were warning people with high blood pressure. They do have problems occasionally.

R.M. Where do you get your water from?

Female: ... water systems.

R.M. How many are in the County?

Female: Oh the County water.

Female: The City and County are the same.

R.M. Remember I don't live here.

Female: Right. No, the City and County water is all the same.

(Everybody talking at once.)

R.M. If I could, it has to be one person at a time ... you were saying?

Female: I thought the County water came from Loch Raven reservoir and the City from Sherwood Hill Park reservoir.

R.M. Okay.

Female: We're in Hartford County, so it would be somewhere else, but I am not sure --

Female: There are at least three water sources upon which our county derives.

R.M. I see. What kind of sources are they?

Female: I cannot remember the name of the river. There is a river.

R.M. It's a river basically?

Female: One water source is the river and I cannot remember --

Male: Susquehanna!

Female: No, no. Yeah, we draw some from the Susquehanna, and then there's another river but I can't remember the name of it, and there's a private water company and I don't know where they get their water from.

R.M. I see. So there are two or three sources. Jane? ...

Female: In Baltimore County. Right. ...

R.M. Okay, but basically the water around here just comes from the surface, if you will, rivers, reservoirs, lakes, that kind of thing. Do you happen to know how it's treated. What treatment it has, if any?

Female: (Described going to local water treatment plant.) I guess we could all go out and take a look if we wanted to.

R.M. So it is filtered as far as you know. Does anybody know any more than that about what happens to the water? Okay. Good. Have any of you heard of the word "aquifer" per chance?

Female: I've heard of it, and aqua, of course, is Latin for water and that's all I know.

R.M. An aquifer is an underground source of water; it's a rock formation -- the rock could be sand or gravel or whatever; all different kinds of rocks. Some of them are able to hold water. When you put a well down in truth you're drawing water from that. Now that I've described it, what kind of words would you use to refer to that. Are you familiar with the idea that I described even though the word itself wasn't something you heard before?

Male: Well there are underground streams aren't there and water pockets ...

R.M. Walter how would you talk about it?

Male: Underground stream. How else would you describe it?

R.M. Anyone else have a different way of describing it.

Female: I can't think of another way.

R.M. Okay, so when you think of a stream -- sort of flows along underground. What's the concept here?

Male: In this area, Silver Spring Road. The development that I am in has quite a few underground springs, as we call them. Hollow Springs Road, all have "springs" in them somehow.

R.M. Yeah, obviously something coming up from the ground ... I guess you think of a spring as moving along.

Male: Well, the roads keep collapsing -- that's what you'd think of.

Male: There are several places up around Route 40 ... and I used to stop and get spring water ... coming up out of the ground.

R.M. There's two basic kinds of aquifers. One close to the surface of the ground; rainfall falls and goes into the ground and it stays there. If you drill a well down and hit water, and often the water is in the top layer. It's rainfall that eventually found its way there and then there's a water level; the water table which goes up and down depending upon how much water falls, so your well is under the water table and if you have a house that's too close to the water table you've got a basement problem. But, so that's called an unconfined aquifer; that is, it's on top and there's another kind of aquifer that again has water in it but it's beneath a layer of rock that's impervious to water, so to drill a well there you have to drill through this layer and then you get down to this other source of water, but this other source is protected from the top by this layer of rock and these are often called artesian wells. Artesian wells come from this kind of water table, so when I grew up on Long Island one of the few things I can remember in grade school, maybe it was high school, was where we get our water in Long Island. We get it from Connecticut. The rainfall, literally, in Connecticut comes under the Long Island Sound, protected from sea water by these rock formations and it gradually makes its way under the Sound and then when they dig deep wells in Long Island they're pulling out water that's really come from Connecticut. You know, it impresses you when you hear that ... so that's what an aquifer is. That's just a little bit of idea about an aquifer. Now what I want you to do at this point, because one of the things that I eventually want to do in a survey is to talk to people about aquifers. Right. Not easy.

Female: How do you spell that?

R.M. Okay, A-C-Q-U-I-F-E-R (?)

R.M. Sometimes when I say a word or when I say a name, it's easier to remember a name. And so what I am going to do is pass around a set of diagrams, each of which ... each of these diagrams sort of describes an aquifer and I'd like you to look at each one and then if you could give me your quick impression on which one

seems to you to sort of help you get the idea or to illustrate the idea the best and which one the worst, if you can rank them in any way or if they're tied simply indicate that. Each of them has a letter, A, B, C, D, and you'll have seven different sequences, so if your set looks different than the one the person next to you has, don't worry about it. Just take a few moments to look at each of these. Remember that they did come out of books, so they'll look a little strange out of context. Try and see which of these might be the best as a way of illustrating the idea of an aquifer.

.....

Male: Is a recharge area always higher. Is that water under pressure when you do drill into --

R.M. I am not a real expert ... a recharge area is an area where the water enters the aquifer. So if you have a confined aquifer, the one below the rocks, the water has got to get in there somewhere, so Connecticut is the recharge area for Long Island; that is really the way it works.

..... (Group is evaluating the charts) .....

R.M. When you judge these think basically which one is the clearest and you find most helpful. You know conveying the idea of an aquifer.

R.M. Yes, you can write the letters down beginning with the one you find the best or seems to be the best ...

R.M. Okay. Now, to the right of your letters if you would write the letter of the chart that was on the top of your stack when you began to look at it. If I was doing it, I would write "D" ... put a circle around that letter and that will tell me which one you had first.

R.M. Okay, how many rated "A" as the chart they found most helpful? None. Yes, as the best. One. And how many rated "B" as the one they found -- two. Okay, "C"? One, two, three, four. And "D"? One.

Female: No, wait a minute, I did "C".

R.M. Okay, so five for "C".

R.M. Two for "A"; two for "B"; five for "C" and one for "D". You can see no one chart would easily do the job. What was it you folks liked about "C"?

Female: It just seemed a sensible explanation.

...

R.M. Other comments about "C" why it seemed clearer than the others. Walter?

Male: It showed the exterior water better than "A" did. There's a lake and a river.

R.M. I see. Okay.

Female: It had symbols that I could understand, like the clouds, precipitation and the words you used were recognizable and I think that it's a clear picture, very simplified.

R.M. Okay, yes.

Female: It didn't have a lot of extraneous writing on it which distracts you. It was simple.

R.M. Now those of you that didn't pick "C", why did you prefer another chart to "C". What was it about your preferred chart that you particularly liked. Helene?

Female: I picked "D".

R.M. "D". Okay.

Female: Particularly the top picture I thought was very ... for all the reasons they said that "C" was good.

R.M. Fair enough. Other comments on "C".

Female: Well I did not pick "C" ... because ... sandstone aquifer and I didn't know what that meant, why the sandstone would make a difference.
I don't know.

R.M. Okay, who are the non "C" people here. Let's see Denise, you were a "B" person. Why did you like "B" more than "C"?

Female: Looking at it to me it seemed very clear and shaded and everything was written out so clearly. I could look at it immediately and I didn't have to ... to me it was very clear, shaded.

R.M. Yes, the shading - three dimensional a little more. Okay. Other people that chose "A".
Male: I chose "A".

R.M. Alright, Tom.

Male: It was a more symmetrical presentation of the topography than "C" was, and I just felt it was clearer and it also had the words out to the right hand side that I was particularly interested in looking at.

R.M. Yes, yes, okay?

Female: I have "A" too, and I thought it was very easy to understand, clear to me.

Male: By the way, what is the spelling for aquifer?

R.M. Oh, did I screw up? I see, it doesn't have a "C". If I'd spelled it right you'd have immediately known what the word meant. (laughter)

R.M. Okay, other comments ...
One of the things that can happen to the water in an aquifer is that it can become contaminated. That is, something know that's released on top of the soil or in a well or something that can chemically contaminate the water underground. Is the term "contamination" a term that's familiar to you.

Female: Oh yes, there's been many problems around here. Especially where the government had those missile places. The whole area was contaminated.

R.M. That's in this area?

Male: ... Baltimore county.

R.M. Baltimore county? What was the nature of the contamination?

Male: Wells.

Female: ... I think that was because of chemicals the Army had been using in the area and evidently it rusted through or whatever. Are you more familiar with what they did out there.

Male: I am familiar because we had training up there ... but I know there was contamination there; what caused it other than just the chemicals that they did have around there, probably in drums and so on leaking into the ground.

R.M. And what was in the drums? Do you know?

Male: God knows.

Female: They had a big fight as to who was going to pay for the cleanup.

R.M. And what was contaminated? What was the effect of the contamination?

Female: Well, I think it was basically getting into the drinking water and in some areas they couldn't build or do anything. They were hauling water in for drinking.

R.M. I see. If you had to think about something like that spilling and getting into the water, why don't you write down your best guess as to how fast it would take something that has spilled on the ground to travel a mile once it gets into the ground and into the water in the ground. How long would it take to travel a mile. Just your best guess.

Female: This is once it gets into the water?

R.M. That's right. Once it gets into the ground and into the water under the ground, the aquifer. O.K. The unconfined aquifer ... how long it would take the water to move a mile, so that at a place a mile away you could detect some trace of the contamination. Just your best guess. Just write down how long, whether it's days, months, hours, years, centuries.

Female: Would it have any effect on the time ... considering how many people would be drawing water through the area.

R.M. Well, consider a populated area, like here. O.K. Eve, what's your best guess.

Female: I wrote probably about a day.

R.M. Uh huh, to go about a mile. Walter?

Male: Less than a day.

R.M. Less than a day. Jane.

Female: One hour.

Female: I think an hour.

R.M. An hour. Okay. Denise.

Female: I'd say one half to one hour.

R.M. Tom?

Male: I say two hours.

R.M. Bob?

Male: Well, within a day.

R.M. Within a day. Ruby?

Female: I was way off, I figured it would be a month but I think not having ... (loud laughter) ... if you are in an area like where I am thinking about, you can't build unless you're building on a two or three acre plot of ground, of course.

R.M. Right, O.K. So, your best guess is a month. And you may be much closer than they are for all we know. Right. Marion?

Female: I said days.

R.M. Days. O.K.

Female: I said no more than a few days.

R.M. No more than a few days. O.K. Thank you. I'm not going to discuss it any further right now, but we'll talk about it more later. Now, in our earlier discussion we talked a little bit, especially Marion, I think, commented about how she liked well water because it seemed really clean. And I'd like now to sort of pull back from that notion of contamination to see how you tend to think of the water underground as being particularly pure - "well water", let's say.

Female: Well, where I am, my husband is a builder and I know he has to go through a lot of processes, inspections and things, and they have a test of water that, of course, your well has to be tested before you can proceed to build and even after your water is tested and you have permission to go ahead and start building,

six months after you've been living in that house, you have to have your well water re-tested. We just recently built a house and the person that came out to inspect said that it has to meet certain qualifications or, of course, they tried ... there are certain chemicals and pesticides that can cause damage to an unborn baby and, or even to a young baby, a nursing baby and that's also why they have to re-test it. You know after a certain amount of time after people have been living in it six months, but I don't necessarily think well water is as pure as expected.

R.M. The testing leads you to think that maybe it's not quite that pure. Helene?

Female: Well, up here I am on the county's water but my parents are not. My parents have a well and they've had problem after problem. They have to get a silting system ... they bring it every month and my mother says she can tell when the water is getting bad. Her wash is not clean... so I feel like her. I don't know that the ground water is all that - although I've had very delicious ground water and I have had other that ... sort of depends. The people right across the street from my parents have wonderful water. My parents who are right across the street from them do not, and it's that close. I don't understand it, but they don't have to have any kind of system and they love the water and my parent's water sometimes has an odor. Very strange.

R.M. So when you say "bad", it's bad tasting. Is that the trouble?

Female: Yes, it can be bad tasting; it can have an odor; it has something in it which will rust (?) on the dishwasher ...

Female: I have a house in the county where my son now lives. And I lived in that house for thirty years and we have well water and I liked it when we ran it, it was always cold; we didn't have to have ice in it and you could let it sit and it was fresh and clean tasting a day or two later. Now in the city if you poured a glass of water and you let it sit a day or two, you can smell the chlorine in it the next day. And I know it turns things a funny color, cause the bathtub did turn color and things do rust out, though we were told it was because of the minerals in the water and that it's healthy water. And then I have read in the past where even dirty water by the time it runs over the ground and the rocks and over this and over that, it gets clean,

but I don't know, I only read that.

R.M. But your image --

Female: I like well water.

R.M. Yeah, okay. Tastes good. And you have a sense that it has been cleaned by being in --

Female: Well I think it's more psychological too, but my grandfather lived to be over 100 and he came from Connecticut. His water tasted like iron and we --

Male: I seem to think that it is like everything else. When it is good, it's good, you know it's really got the good taste, but not maybe on a confined, in other words, down further, it's got more of a tendency to be pure I think -- you take a chance I think on the unconfined with all the pollution that seeps through the ground. You know what happens in this six month period while you're waiting for another test. You might be drinking iodine.

Female: Oh and I think the ads you read about beer and they'll say "Made from spring water."

R.M. O.K. That suggests that --

Female: That suggests that it is pure.

Male: Better.

R.M. Okay. What if there's an aquifer that somehow became contaminated by let's say a spill of chemicals, how important would it be for the U.S. Environmental Protection Agency to clean up an aquifer like that?

Female: Well I think it would be very important because it could spread to other areas I would think. Like you said Connecticut .... New York has got a lot of people in it.

R.M. How many of the others of you would share that concern, that it could speedily spread elsewhere. Let's see, Denise, Tom, ...

Female: That goes on around here all the time.

R.M. Yes. Do you think it would be easy to clean up?

Female: No it must be very difficult.

Female: I read an article a long time ago about some polluted water and they had a certain kind of fish they put into the water and the fish actually cleaned up the water so that it was pure and yet the fish could be eaten at the end of that test. I don't remember where I read that. That was probably Scientific American. So there are ways of purifying.

Female: Underground.

R.M. A spill that would go into the aquifer, underground, so it wouldn't be a stream or something like that but where people would bring up wells or something like that.

Male: Do you think it's possible to clean up water that has been contaminated like that, either drinking water ... so that you could pull it from the ground and then it would be contaminated but then it could be purified so that it would be okay for people to drink?

Female: Don't they do that on boats?

R.M. Okay, so you think it could be done?

Female: It would depend on the kind of contamination.

Female: I would think so too. Yeah.

R.M. Okay, but let's say some kind of toxic chemical, such as that spill that I guess happened around here. Do you think that sort of thing could be taken out of the water? You seem to be skeptical?

Female: Well it seems to me it would depend upon the contaminant, I don't know if you can make a broad statement like that, you know.

R.M. Yes, but I have described toxic chemicals that are fairly similar in their nature, so whatever process could clean up one could probably be able to clean up the others, but do you think those kinds of things could be cleaned up? How many of you are skeptical, if any?

Male: Could be done. Some would take longer than others. Would have to get a few more processes.

Female: I am not sure ... what is the word. I am not sure it would contain it; some would go on and part of it would get pumped up, but some of it would get away surely.

R.M. Okay. Would it matter that some of it got away?

Female: Yeah.

R.M. Why?

Female: Because then that would spread on to other areas.

R.M. Well, what if they could clean up their water when they pumped it out?

Female: ... and all the time it's being diluted also ... depends on how ... it was

R.M. But, it would still worry you. Okay. Why, what would you worry about?

Female: I would just worry that it wasn't being completely done away with.

R.M. Okay, somehow some of the contamination would slip through. How would you feel about that situation, Denise?

Female: I would agree. I don't know that it could be completely cleaned up even in different areas. I mean, would whole areas be going through the same process, purifying process, or this area would and this area wouldn't?

R.M. Okay, so it would be important to make sure that every area knew about it. What if that was the case? Yes?

Male: What about the farmer that just goes out and drills his own well and he doesn't go through any purification plant?

Female: ... and populated area too. It might get into an area and twenty years later some developer goes into the area and by this time they've forgotten all about it.

R.M. How many of you feel that would be a problem?

R.M. ... Tom?

Male: I am not too sure about that. I think the concern that everyone has with all chemicals that might exist in the ground, no matter where they are in the water system, is not only how they might effect the water as it is today, but the effect that chemicals will have 10 years from now or 20 years from now. You know, you just don't know.

R.M. Don't you think they could be monitored in some way?

Male: Well I think they'd have to be if ... definitely.

R.M. So, if there was a monitoring program -- that is, you would drill wells in certain areas and regularly test the water so you could see if it had been contaminated by something or other -- and you could warn everybody to treat their water if it became contaminated. Of course, the cities and towns could do that easily. Farmers or others could be required to test the water.

Female: I don't know about that. Because, as Helene says, the water from her parents' well doesn't taste good yet the water from the people's well across the street does. Now they may be getting it from a different vein. Now if this vein is polluted, and this other one is not, even if they tested in this area, it may not show up. I know when you can have several lots and when you drill for the water this area may pump two gallons every five minutes and another one may pump 25 gallons in five minutes, so you know they could be from different veins.

R.M. Walter, what do you think about that? Would you worry about that?

Male: Yes, if I was living in a place that had a well, armed with this information, I'd probably take it upon myself to have some sort of testing. Whereas if I had a coloration or an odor or a taste, I could test it like I test my pool water and say, hey, something is wrong.

Female: Baltimore County is very careful with well water and such being tested. Of course, children don't get what they need from well water and they give pills for their teeth.

R.M. I see, fluoride. Okay, what if the government had a testing program for those people that have wells and paid the money for it?. Would there be a need to protect aquifers that were used by only a few people? Let's say we have an aquifer and relatively few people get their water from it. Would we need to spend a lot of money to protect the aquifer or wouldn't it be better to save the money and have a program of testing. Then if there were problems, people could get water from other places or in other ways such as drilling another well. If the government would pay for that, it might be cheaper than simply spending a lot of money trying to protect an aquifer that might never be used or might be used only occasionally.

Male: Yeah, but it might be used by a big housing development within the next so many years. Like so much red tape, it's laid on the side and forgotten about and then somebody comes in and uses it.

R.M. So, while promises will be made now, you'd be a little nervous that --

Male: Take care of it now and then you don't have to worry about it.

R.M. Tom?

Male: How do you protect an aquifer?

R.M. (Explained how barriers are used for waste disposal sites.)

Male: So the protection is really a prevention is what you're saying.

R.M. Exactly. That's it. Then you can have other kinds of regulations that tell people how to handle waste and try and keep them from getting into aquifers. These kinds of programs can be very expensive and the more you guarantee that nothing will get into the aquifer, the most expensive it costs. Nothing is perfect, but to have an almost perfect guarantee is extremely expensive. To use a less elaborate protection system for a site with monitoring wells around it so that they can tell if anything gets in might be much less expensive. So one question is how important is it to simply protect the aquifer, no matter what?

Male: Why would you place the responsibility for all that cost on the government?

Female: Why not on all the companies that are doing this?

R.M. Sure, and the government does make the companies pay. Of course, the more the companies have to pay the more they have to increase the prices of what they make and the less competitive they get with companies in other parts of the world that perhaps don't have such a high standard of protecting groundwater. So in the end we all pay.

Male: Not only that, you start pushing a company for too much and they're going to sneak around about it ... dumping at night and stuff due to the fact that they were getting so strict on them.

R.M. It's cheaper that way.

Male: Sure.

R.M. (Explained how aquifers vary and how transport typically is measured in inches a day rather than miles a day as some of them had thought.)

R.M. What interests me is how much money you think we should spend simply to protect aquifers even if it doesn't affect how we can use them. In other words, we can draw the water and treat it if we need to use it. Some aquifers we don't even need to use if they're down deep. It's very unlikely. We have plenty of aquifers and some where the groundwater travels so slowly that to prevent it really might cost much more than simply monitoring and treating it as necessary.

Female: We need to control the companies that have these chemicals. They very freely dump them any place they want. Certainly that would be cheaper than clean-up.

Male: And where can you take a chance because these drums out there at Jacksonville were from the Second World War.

Female: Right!

Male: When there was no development out there. Now there is and that's when they're being affected.

Female: ... You can't go back.

Male: Well, that's right.

Female: Unless some of them are still ....

Female: I worry a lot about the world that we are leaving to our children. Not always through intent, but through ignorance, things have been done. We didn't know until fairly recently that asbestos is dangerous and now we know and it's very expensive to clean up. Is it not conceivable and possible that we are unaware of some potential dangers in the future and does it not behoove us then to take all the precautions that we can to leave the cleanest, safest possible world for the next generation? It's expensive. I know it. But I think we have to do that.

Male: Well, that's something that's easy to say, but everything goes back to the almighty politicians. If you're going to protect a couple people out here using this water and it's costing millions of dollars, somebody sooner or later is going to get to the politician, and say here, we can use this (money) over here where we got thousands of people living. No matter how much you try, you're not going to control these companies and you're not going to have the manpower to go around each company and see that they don't take the short cut. You know, dump and --

R.M. So you think it's naive to think that we can protect; to keep the water as pure as that -

Male: I believe what the solution would be to do what they're doing in Baltimore County. There's areas right now that within the last couple of years that's getting water supplies that's never had them before, from other sources, other ways of getting water; by putting hydrants and water mains on further out. They've got 'em all the way to Hartford County now on Route 40 and they used to stop right here at Moore's Lane. {eople used to have to rely on wells and now they're putting more water mains and getting city water further out all the time.

R.M. Other reactions? How many would agree with Linda that it should be done at any cost? Jane.

Female: I am not really sure.

R.M. Fair enough. Eve.

Female: I think you talk about the big expense of it and you can't just say, well at any cost, because people complain about taxes now. I think the thing has

to be handled through research and purifying that water. Because there are companies that are dumping and in the middle of the night. I like your idea of the individual testing in your home, because when you think about the Peach Bottom water plant and they were sleeping on the job and then they had to fine the company, well it's getting to the point where you have to trust yourself and I would want to test my own water. But I would want real research done so that we would be able to purify the water when it's found to be contaminated.

R.M. Okay, who would you trust to do the research? When would you have confidence that the research is real?

Female: I have to say the government.

R.M. Okay. The government?

Female: Because it is the government finding out about these plants that are doing this sort of thing.

R.M. When you say the government, what government?

Female: Our government. The Federal Government. Because these things will happen. Contamination will, pollution will happen. I mean it can happen from insecticide from the farmer seeping down. Anything can happen. We have to guard against the water getting bad and then clean it up.

R.M. And to clean it up at any cost?

Female: I think once the research is done, the cost won't be prohibitive.

R.M. What do you want research on? We know it's contaminated. We know it's underground.

Female: I suppose the research would have to be how to purify it, depending on what it is, whether it is metal toxic or poison toxic. And then it would have to go through pumping stations to clean this out once it's diagnosed what it is in there.

R.M. What if the research showed it would be extremely expensive to clean out, but that we know where the contamination is and then we can monitor it and at present it's not being used by anyone for drinking water or it is not threatening anybody's health, it's just simply underground. The contaminant is spreading very slowly and gradually becoming more pure as it spreads.

And that's what the research told us. The government said "let's don't worry about it, we know where it is, it's spreading very gradually, we're monitoring it, we'll tell people if there's any danger when they're using it. Would that be okay or do you think they should spend the money and clean it up?

Female: I guess I have a different idea as to what research is. I know that when they test their water; they put pills in it to get rid of whatever it is that they can't drink. Okay. That came from research. So once the water is diagnosed as having something wrong with it they should know, the scientists should know, what it is and how to handle it.

R.M. So we shouldn't clean it up underground at any cost if we have good research that tells us we can really clean it up when we need to use it and it's safe, and the government says it's safe. Any reactions?

Male: A couple other things have to go hand in hand with that, such as if you've got a contaminated source of water you have to find out what the source of the contamination is and cut it off, so that you're not going ... to find water that's going to be continually contaminated. You cut off the source of the contamination and then you start purification, and then somebody, somewhere ought to be able to give you a time-table as to how long it's going to take until once again that contaminated amount is cleared out and the water will start again being purified naturally.

R.M. So you would feel uncomfortable if you were simply pumping this stuff up, treating it so it was safe to drink, but still if it wasn't getting cleaned up --

Male: Something that's cost effective. You are talking about adding chemicals to the water that's already contaminated to make it pure so that you can use it. Find out why it's contaminated, where that's coming from so you won't be doing this for a 100 years --

Female: -- really first step.... (everyone talking)

Female: We need controlled ....

Female: I get the feeling that we're taking a very complex problem and trying to make it very simplistic and you really can't do that.

R.M. Okay, where it is more complex?

Female: ... I am indeed concerned about the next generation. I am concerned about the world. I did not at any point say at any cost.

R.M. Oh, okay.

Female: Indeed it has to be a very expensive proposition, I would suspect, because if you're going to monitor and if you're going to expand what is happening now in terms of pollution control, you are probably going to have the government do it and it's going to require more people to monitor and it's going to be an expense and it kind of snowballs. It could indeed be a very, very expensive proposition. I feel like I'm trying to think about an issue that I really don't have a lot of background in and deal with all the ramifications and the expenses and all that sort of thing. I think if you sat down and logically went through all the steps there would be a whole lot of things to get from Point A to Point D. Am I making sense?

R.M. You really don't have enough information to feel you can make an authoritative statement on?

Female: -- or intelligence.

R.M. Or intelligence ... quite apart from authoritative. And that's fine. What I want to get is your reaction to these kinds of issues when you hear about them. One of your reactions is that in truth it's not at any price but it would depend on an understanding of the situation. But under some conditions you would not think it would be worthwhile to clean up a contaminated aquifer.

Female: It would depend on the circumstances. I think that Walter probably ... got to stop contamination at its source. ...

R.M. Okay, now we've been talking about aquifers that have been contaminated and we've been talking about whether we should clean them up, what are the options, and how to deal with it. But let's go back to the situation that I described where the government is setting out regulations for new situations where there might be some contamination. The question is, if there is an aquifer that's not being used by other people, and it's extremely unlikely that it would ever be used, and if it <u>were</u> used, it could be tested and the water treated to remove whatever happened to get into it, how

important is it to make sure that no contamination reaches that aquifer? How important is it that the government make the company use double plastic sheets, special clay, and all kinds of stuff to protect an aquifer that's very unlikely to be used as far as we can tell. How important is it to keep it absolutely pure or almost pure?

Female: I think it's important that none of it ... be contaminated.

R.M. Even if it's not one that's being used.

Female: Because at some future date maybe it would be, so why let someone destroy that at this stage.

R.M. But what if there are almost always aquifers you can use? If you can't get your water from here, but twenty years from now you can go three miles away and get it from here and pump it and it wouldn't be contaminated.

Male: I'd pay the cost of the extra pumping too.

Female: I just don't think we should -- well, any kind of pollution if we can possibly prevent it.

Female: Whether we think we are going to use it or not. If we can possibly prevent it, we should not allow it.

R.M. Bob?

Male: What happens to all this waste material. I mean after a period of years it stockpiles and stockpiles. And the company keeps going and keeps coming up with all this waste material. It keeps coming up with all this waste material. I mean there is only - somebody is talking about using up all the area now for buildings and so on. What are they going to do with all this waste? Nobody wants to take the waste. Nobody wants to let them build an incinerator in their area to burn it.

R.M. So unless they make the site as absolutely secure as possible, stuff is going to keep coming into it and it would be --

Male: -- still going ....

R.M. Okay, but what if --

Male: Even land fills fill up eventually, you know.

R.M. But then they -- .... Denise?

Female: The thing, instead of the research being done for the effect, why couldn't research be done for the cause. Why couldn't research go to these industries and corporations to see what is causing this pollution and how to produce what they're producing in a cleaner way or a way that's not harmful to the environment. Why can't they treat the cause instead of the effect? You know, after the pollution has been done, we're worried about what it is doing. Why can't we go to the source and?

R.M. What if, however, going to the source means that we make the company pay to make almost totally sure that nothing gets into the aquifer when nobody is using the aquifer. And if it got into the aquifer it would travel in inches a week, and at most, it would spread out over a few hundred yards from the site and wells would be around the site to monitor and keep track of it and the water could be treated. So it's a matter of dealing with the source, but how much money should we spend to keep something almost absolutely pure that wouldn't be used anyway.

Female: ... that's not what my question was. You're still dealing with the effect, not the cause.

R.M. I was saying there are different ways of dealing with the cause and some cost more money than others.

Female: That's still not what I mean. I mean go do the research, go right to these industries that are producing electronics or whatever, whatever is producing the contaminants, whatever is producing the pollutants and to produce the product without producing contaminants.

R.M. In other words, why should they even have these wastes at all?

Female: Exactly.

Female: You can go one step beyond that. If they had to have the waste, then perhaps research could work on trying to find a way of dealing with those contaminants without them getting into the ground .... detoxify them or whatever before they had to be. That's

where research could come in.

Male: Well there are already commercial firms that do that.

Female: What have they done in Europe, cause certainly they've been --

R.M. -- putting the stuff in the ground --

Female: -- handling .... (too many people talking) ...

Male: I was talking about an isolated area where nobody is going to be using this thing in the next 15 or 20 years. Speaking as the government, if you put industry as a whole that produces these types of wastes on a scale of 1 to 10 everybody would say ... everybody has to abide by the same regulations ... doesn't matter where you are; how isolated the area is, how populated your area is in regards to residences, who is going to be using the water and what it's going to be used for, and of course, depending upon those circumstances and those variables, then the regulations would get tighter, and would be more of a cost to that particular industry who wants to produce their product. It would have to spend that money to safeguard against that getting into the water in a highly populated area that is going to be used on a day to day basis.

R.M. So if I understand you, water that's going to be used on a day to day basis would have stricter standards.

Male: Oh, yeah, of course.

R.M. Right. And the kind of water I was talking about, if we think about water, let's say we have A, B and C aquifers. Okay. A aquifers are those that are used on a regular basis by people for water and for other important things that contamination could threaten their health, let's say, so it's really being used. B are those that potentially would be used but aren't being used or aren't being used very much now; and C are aquifers that are located in situations where they're not being used and it's unlikely they're going to be used in the future and where there are alternative sources of water around them. So if we have three types of aquifers, then it's the C ones I was trying to think about because those are the ones that are really worrying the Environmental Protection Agency. Okay, Walter.

Male: Talk about the C ones. You've got industry moving into the area where they're going to be using the C aquifer. If you think a company is producing waste material that can at this point in time be purified, the regulations would not have to be as tight on that particular company as it would be on one that's got something that we can't touch in regards to purification. ... this is something that we're going to have to look out for because we may need this water in the future and if we let you have it now it's gone, because there's no way we can purify it.

R.M. Okay, but what if we said we really didn't think we needed that water in the future.

Male: Ah, there's no guarantee. You can't guarantee that. ... who's to say C isn't going to go to A as the environment grows. I heard a comment the other day that the newspaper industry is in jeopardy. There's not enough trees. That's why they are re-cycling paper.

R.M. So the threat of a shortage of water seems very real and the notion of C being really never going to be used seems incredible really.

Male: To people in this area that's true.

Male: I personally wouldn't want to bet on it.

Male: ... give up that piece of insurance.

Female: You may not think you're going to develop a place, like Los Alamos and places like that. That was out in the middle of the desert and then they put a big plant out there. You know, no one ever thought that that desert would be used for anything, so we never know. Water is always in short supply.

R.M. So it would be worth higher taxes and higher prices to you to protect C aquifer.

Male: ... think about Linda and her point. You're talking generations down the road. We're paying for what our kids are going to have.

R.M. Okay, ...

Female: Our population is increasing and where it may not be used now, in five generations it probably will be.

R.M. Even though they could test the water and purify it?

Female: We're hoping.

Male: Suppose it's not bio-degradable. Suppose it's there and it's ...

R.M. Well, let's say it's going to stay there. Five generations from now the contamination will still be there. All right, you drill a well down, test the water and you find the contamination. But there are ways of purifying the water, so if people need drinking water for that area, they can purify it, and it would be usable.

Female: Is it fairly certain? Suppose they throw heavy metals into it that have half lives that are very -- or lives that are long.

R.M. No, no, radioactivity is a different thing. We're not talking about radioactivity, that would be quite a different matter. Walter has a gleam in his eye.

Male: We can look back ... can relate it to what we've already done in the past. Hopefully the world will continue as it has, research scientists and people who work at purifying contaminated water will grow and expand and come across new things to combat things that we can't beat now. Industry will also do what it has been doing and will continue to do what it's been doing in finding ways to produce their products without having that waste. So you're working at both ends.

R.M. So what you are saying is that in the future it will be better because industry will be creating less of this stuff and we'll be better able to purify the water ... so that would be an argument for not worrying so much about it. You know, if there are wastes and requiring industry, of course, to take care of it, this isn't just dumping into the ground because we have a C aquifer, but rather it's whether we should have the highest level of protection possible at a great cost for C, rather than say a medium level protection for C and monitoring and so forth. It's a choice of levels rather than all or nothing.

Male: Then the third variable to that whole scope is that when you are protecting C today, and talking maybe a hundred years, and then tomorrow being a hundred years later, you've got better ways to purify the water.

You've got industry who doesn't produce as much toxin; then you've got government who slacks up on its tightened reins, and says O.K., we know what we can beat and we know that you're doing a better job producing your products with less waste, so we will be easier on you; cut the cost and the economy gets better.

R.M. Okay, now what's the implication - I don't quite see the point.

Male: - talking about regulations.

R.M. ... so is that an argument for spending the greatest amount to protect C or ...

Male: ... you've got both parties working toward the same goal. Industry producing their products with less waste; protecting C and science coming up with better ways to purify whatever industry has put in to C.

R.M. The government slacking off didn't seem like that was something that was going to protect people very much.

Male: Yeah, you've got industry who's working toward protecting C and you've got science working towards protecting C, so the government can say, well, we feel easier now about C not being contaminated beyond our resources of purification in 50 to 100 years from now.

R.M. I see, so then government can go with a medium level protection and feel okay about it.

Male: Let's go back to C. Suppose one company puts certain things in the ground and then another company comes in next to them and they put other things in. Suppose the two don't get along with each other? I mean not the companies, but the chemicals?

Male: You come up with something that can be cured. The common cold, how long has it been around? Nobody can cure that, right?

R.M. So the uncertainty factor - that's what you are introducing.

Male: You know each time somebody puts something new in there.

R.M. Let me introduce the guy who is sitting in the corner over there. His name is Bill O'Neil. Bill why don't you pull your chair up and join the discussion. Bill is someone who knows more about these things than I. Bill is an economist who works the U.S. Environmental Protection Agency, which in fact is grappling with the issues of what kind of programs do we design to protect ground water and how much money do we spend on it. This A, B, C business I mentioned is just a sort of a potted version of a way that EPA has of thinking about aquifers. Could you explain that and what the issue is that's worrying the EPA?

Bill: There's a group of people who are trying to figure out what everybody thinks about their drinking water and what kinds of things are of most concern, what kinds of things you'd like to know about it because there's a lot of public information and education that we have to do just so that everybody knows what's going on; what to be afraid of, what not to be afraid of, etc. So one point of this research project is just to find out what people think about their drinking water and how satisfied they are with it and whether or not they think they're paying too much for water or too little for water and what, and this is the real point of it, what you think we ought to be doing to protect it. Robert was getting at some of the strategies we've been toying with figuring out how to protect it. You can put down strict controls on factories and try to make sure that nothing leaks out of the factory at all, but sometimes that's real expensive. Or you can make the factory build a big fence around their property with a 1 mile radius and make sure that nothing leaks beyond the perimeter of their property. Maybe that would be a little cheaper if they could put a sludge lagoon out there in their backyard or something and confine it within a five acre area. Or you can just let them go on about their business and possibly ground water contamination occurs, and then we can pump it up and have the engineers try to clean it up for us before we drink it. Some people would say keep it inside the factory; other people would say don't worry about keeping it inside the building, but certainly keep it on their property; other people would say, I don't care where it goes, so long as when it gets to my water supply plant they take the chemicals out of the water before they send it to my tap. Some people would say they don't care what it is.

R.M. Do you have questions about those options? (Pause) ... Okay, which would you prefer?

Female: I realize the cost would be high, but I still think it's important to save the earth ... of course, we hear that all the time but I think ...

R.M. ... to just keep it from getting into the ground ...

Female: No. 1, keep it contained.

R.M. Ruby?

Female: Well, try for it anyhow.

R.M. Well, but that's the most expensive option?

Male: I think it should be up to the company. They are the ones making the mess. It should be up to them to take care of it, but also --

R.M. -- take care of it by not releasing, by keeping it within the fence, or by letting it sort of go beyond their own property that they've been required to buy.

Male: They should be having to keep it confined I think, but also --

R.M. -- within their area or within --

Male: Within their area or know the results of what's going to happen if it does get out, and also want a check point when it comes up to my drinking water tap.

Female: I think they should be forced to keep it on their own ground, but we should be ready to deal with it scientifically if it gets out.

Male: Yeah, I would agree with that. I would also think that with the regulations we have now, it's fostering some competition in industries that treat these types of wastes and I don't see that as bad either, actually some good come of that, so I think the confinement is important.

R.M. Would it be okay to let it get into the ground as long as it was contained within a ...

Male: I would think that would depend on what type of guarantee you have for prevention.

R.M. Okay, what kind of guarantee would you like?

Male: Total.

R.M. A total guarantee. Okay, and how can you be assured? What would you like?

Male: Well, that would depend on, again, research. It's been proven that under certain conditions this is what happens.

R.M. So would you trust the government to say if they checked it out and said O.K. what they're doing and the way they're doing it could be kept within the company --

Male: I would certainly trust them more than the industry.

R.M. Yeah, but would you trust them enough to think that's a good policy or would you not want it to be released into the ground at all to avoid having to place any trust in anybody.

Male: Well, I think that can go back again to the treatment. If it's required that it not go into the ground at all, I think you can promote and foster competitive business for that, so I would --

R.M. So while it's expensive now, it would become cheaper in the future --

Male: Well, that's true; that's a way of keeping it.

R.M. Denise, what's your reaction to this?

Female: If it happened to be released, I think they should.

R.M. But should it be released?

Female: No, it shouldn't. I think it should be confined as much as possible, but I still go back to the thought that they should work on a way to produce without pollutants, without contaminants. Why treat the effect all the time. Why not go back to the cause and --

Male: -- just don't let it happen.

R.M. But the last little bit of pollution really gets expensive. I mean to squeeze, turn the bottom sludge into something that's wonderful, to make it as fertilizer, that's expensive; that's really expensive. I am sure we could do it, but only if we gave up lots of other things in life just to get that last little bit out, so that's the problem with that. Walter.

Male: I'd say in the fence.

R.M. You feel comfortable with that?

Male: Yes, because if you make it too tight, they're going to dump it at night. They'll dump it any where they want.

R.M. So this seems to be a workable policy that would prevent --

Male: -- it's a give and take situation.

R.M. And Linda?

Female: I would go with one. First clean it up.

R.M. Yeah, right. ... fence. Okay.

Bill: Well, there are actually a couple issues that have come up tonight that I am real curious about. One of the positions we're making is, who should be responsible for managing this program to protect the ground water -- the states or the federal government? There's a big battle going on at the EPA right now. We're designing all kinds of plans and ideas but when it comes right down to it, do we tell the states it's their responsibility to go out and search for their aquifers and do all the testing and set up programs to make sure that the contaminants are contained or should we take the responsibility on at the federal level and try to stick our little fingers out all over the whole country using our superior expertise, of course. You know it is a hard problem. They are up there. They know all the local conditions but at the federal level we have more money. Which level of government do you think has the ...

Male: I don't think that's really the issue. I think equal treatment for all is what we are talking about and I think you only get that with federal regulation.

Female: Sure because you can have Pennsylvania messing up part of Maryland now.

Female: That's right.

Female: And you can't have Maryland saying, well we're going to do this and Pennsylvania has said, well we're not going to do it, you don't make any headway. Their water is coming down.

Female: The kind of personnel that would have to be hired would have to be chemists and physicists and they come high, only the government could afford a force like that.

R.M. Which government - state or federal?

Female: Federal. You know the federal could have a team of chemists and physicists and let them be working in the states rather than the state trying to find physicists and chemists and keep them on the payroll themselves.

R.M. Walter?

Male: How about a little bit of both? You find that the smaller the government, counties, towns, Pennsylvania is accused of that, politicians in those little areas seem to be (I spent some time in Pennsylvania) seem to be real tight with the community; I mean this is their home so they want to do everything they can. How about having the local governments, even at the state, being like the police department and blow the whistle on a problem they find and then calling the federal government. This regulation federally does exist and you guys aren't holding up to it, so if you don't clean it up and we have to call on the federal government then you're in a heap of trouble.

Female: It would almost have to be that way because the federal government couldn't be everywhere at once.

Male: Exactly.

R.M. Should the states or the federal government run the programs?

Male: I think it's being done now to point out that we're told that they couldn't do this and they couldn't do that, and so what they'd do, they sneak out at night and open it up and let it run.

R.M. So okay, which would be better - the federal or state for that situation?

Bill: Let's break it down a little further. Suppose we set up a situation where the federal government did the basic research, hired the physicists and the other high money people and then gave out the results of the research to the states. Would you feel comfortable if we let the states then make their own decisions about the level of regulation so, for example, Illinois might say it's really important to us to have the employment, we'll suffer a few more risks of contamination, whereas Pennsylvania might say no I want really clean water? It would be each state's choice.

Female: Well, you know it seems to me that if I were a company and I wanted to dump a lot of waste at night, being in trouble with the state of Maryland wouldn't worry me half as much as being in trouble with the U.S. government, you know --

Male: -- look for a state with lenient laws.

Female: Yeah, but I mean with the federal government, once you mess you them, you have prisons and fines and everything else to worry about.

R.M. Would everybody agree with Eve? ...

Female: I think the federal government has more clout and frightens companies. They can withdraw contracts.

R.M. Linda, do you agree?

Female: I think assistance in regulating would be very important. If the federal government ... I don't know.

Female: ... like today with the pollution coming down the Susquehanna from Pennsylvania and we have the problem ... Virginia. We are already have --

Female: -- So you think the government ought to set the regulations?

Female: Yes, because in Pennsylvania, like someone said before, Pennsylvania doesn't want to do as much as Maryland and Virginia ... Virginia would probably do quite a bit and Pennsylvania might say, well we don't have the money and we don't have this and we don't have that, we don't want to.

R.M. Well, with an aquifer is different than a river. The underground water really doesn't sort of stream into states the same way as a river does in just a matter of hours. You've got massive amounts of water coming through but, in fact, it's slow in coming. Given that, would you feel with Linda that it'd be very important that every state have the same level of protection, or to allow the states to have somewhat more or somewhat less protection within the guidelines.

Male: All the same. Once you start that, then somebody is going to start taking advantage and let this guy slide because he's a friend of his or --

Male: Then you're talking about protecting C again.

R.M. Protecting which?

Male: C.

Male: If every state in the Union is left up to its own decision as to how tight they're going to be then somebody out in the midwest may say, well we're sparsely populated ... we don't have that out here. What are they going to say?

R.M. What's wrong with that? Why would you want to worry about that? You're in Maryland.

Male: Yeah, but suppose my son and grandkids move out to Missouri?

R.M. I see. Okay, so you'd worry.

Male: Sure.

R.M. That somehow in the future contaminating C would worry you?

Bill: Would you worry about that because they might not know it was contaminated? What if Missouri put up a big sign and said, "Jobs Here - Dirty Water - Come If You Want, But It's Your Choice."

Male: Missouri would die...

Female: I think it's the same thing as is going on down in the Amazon. They're cutting down the trees in the Amazon at the rate of what - 3,000 acres a day. I understand that some unbelievably large number, like a

third of our oxygen comes from the Amazon region. Well, here goes all these trees that are providing our oxygen and no one seems to be trying to do much about it.

R.M. I am going to have to cut the discussion off at this point because time is up. I'll be glad to stay and Bill and I will answer any questions you have about what we're up to. Thank you very much for coming out tonight and talking about these issues with us.

Resources for the Future
Groundwater Existence Value Study
Robert C. Mitchell

TRANSCRIPT, WORCESTER, MA. FOCUS GROUP, JANUARY 21, 1988

R.M. Let's begin by going around the table and if you could just tell us what you see as, for you personally, the most important local problem. Okay. Just thinking of this area and the various problems that it has. What to you is the most important problem? Let's begin with Kathy.

Female: You would start with me, wouldn't you?

R.M. David. Well, we'll get back to you Kathy.

Male: The most important ... I can think of a lot of ones ... the first one I think of is the traffic on State 290 and a lot of ... that's why I put my mind, accidents ... work in a building right off the express-way and I see traffic all the time ... road and it needs to be re-done. That's definitely a problem as far as I am concerned.

R.M. Okay.

Male: I thought since you contacted me ... I have been thinking about things, crime, Aids concerns me having a couple of young kids and things like that.

R.M. Okay, but traffic --

Male: Traffic seems to be the thing I can't ... bothers me the most.

R.M. Okay. Larry?

Male: Like he said Aids and trash disposal. It's going to ruin the land.

R.M. Okay. Heather?

Female: I feel drug trafficking and awareness is one of the major problems of the area.

R.M. Okay. Kathryn?

Female: Yes, I am concerned about the schools; concerned about the old schools in the city and where are we going to put the children that are coming along. I am also concerned about

pollution of the lakes, Quinsigamond, Indian Lake, mostly the waterways I am concerned about.

R.M. Okay, I am new to the area. This is my first year teaching at Clark. Where is Indian Lake?

Female: Indian Lake is at the north end of the city. We always used to go swimming there. I don't know if they whether they can go swimming there now.

Male: It's an open sewer.

Female: It's an open sewer, yeah, well ...

Male: Why do they drain it every year. You know, every fall ...

Male: Try to kill the weeds ...

Female: Right, right ...

Male: They are letting the frost level get into the roots.

Female: It was a wonderful place for children when we used to go and swim. I don't know whether they go now.

R.M. Okay, Joe, how about you?

Male: Over-development and destruction of open space. That's probably my primary beef right now.

R.M. Okay, William?

Male: Well, I am probably biased since I've been a student for a while, but I would say it's ... the people, the ones I deal with, don't want to advance themselves financially.

R.M. Okay, Paul.

Male: I have two concerns. One is the quality of our drinking water and the other is lack of licensed local hazardous waste treatment facilities where we can all take our very questionable items for proper and safe disposal instead of putting them out in the local trash to go in the incinerator every week.

Female: ... that I have been thinking about earlier ... water supply and water pollution and traffic.

R.M. Okay, how about you John?

Male: Well, the things I am concerned about are drugs and crime and homeless people, especially in the Worcester area and I think the cold spell that we had last week really kind of brings that home. Also there is quite a good article in tonight's paper about people, older people, lonely people, that are being kicked out of, people in the lower socio-economic class are being kicked out of the places they have to live to make place for condos or one room apartments.

R.M. Okay, Joan.

Female: ... (mumble).

R.M. Can you hear it down there?

Female: ... and the mentally ill that are being turned out of the hospitals and into the streets ... living conditions concerns me.

R.M. Cynthia?

Female: My concern is the crime in this area cause there is a lot and with the drugs in the area.

R.M. Okay, crime and drugs. Mary?

Female: I would say the quality of the water, because I don't drink it ... crime and drug traffic and then the homeless too. I think that's a tough problem.

R.M. Okay, Kathy ... (laughter).

Female: Yeah, I would personally be most concerned about the homeless. That's a real toughie and the traffic and the quality and condition of the roads; Route 20 and too many deaths. I don't drink the water either.

R.M. Actually the water is of interest to me, although in a different kind of way. But let's talk about drinking water. A couple of you have mentioned drinking water as something that is a concern to you. Where do you folks get your water? How many of you are from Worcester itself? Okay, how many aren't from Worcester then? Let's see. Where are you from?

Male: Milbury.

Female: I am from Worcester, but I haven't lived here that long.

R.M. Okay, so a new resident. Who else? Yes.

Female: Shrewsbury.

R.M. Shrewsbury.

Female: Auburn.

R.M. I know where Auburn is ... on 290. So where does the water come from in Worcester? Is it from surface water or under the ground.

Male: A large portion of it is surface water. Reservoir ...

Female: From Wachusett ... (?).

Male: No, no, mam.

Male: All the Wachusett water goes to Boston ... from reservoirs up at Holden basically; Holden and Paxton. I don't think the reservoirs are the problem. It's the pipes. Well, I am not an expert. I think it is the piping.

Female: Corroded. Right?

R.M. Now how about Auburn. Do you have the same problem?

Female: We have a lot of different water districts in Auburn. I happen to be in the ... hill end of Auburn which is near the Worcester line, so we buy our water from Worcester.

R.M. Oh, I see.

Female: We get ours from town wells and our is very polluted ... because the wells where we get our water in the center are located right by the Massachusetts turn pike. In the winter the sodium content is outrageous.

R.M. I see. Okay, and let's see ...

Female: Yeah, that's wells but they keep finding things that don't belong.

R.M. Do you happen to know what?

Female: No I wish I could remember.

Male: ... pretty good.

Female: ... supposed to be but then they found, I don't know, probably three months ago when I last heard anything. Read something that there was some elevated level of - I don't know if it was something that was toxic. I don't think it was, you know the kind of shrimp cocktail problems that they talk about Worcester water.

Male: Well, ... some sort of other property, cause you have the highest rate of hot water tank failure in Shrewsbury.

Female: Oh, it's very corrosive water.

Male: Corrosive, it just ruins everything.

Female: No, ... that.

R.M. I see.

Female: Yeah, I drink the hot springs. I don't know what's in that bottle, but I decided I'd trust it.

R.M. Let's see. Shall we do Milbury?

Female: I'm not quite sure where the water originates from but there was a report in the last water bill rating the water very good and I don't have any problems with it.

Male: Okay, I can give you an update on Milbury. A lot of it is wells and some of the wells are actually along the Blackstone River. I've watched some of the wells being built over the years. Now you say, along the Blackstone, I mean they are not tapping surface water from the Blackstone, but the stations are on watershed basins.

R.M. You seem to be particularly knowledgeable in this area. Is this your professional line of work?

Male: No, it's not. I grew up on a dairy farm and since I was maybe as high as this table water quality has been an issue because we had to submit a water sample for analyses at least once a year, so you know, I have grown up with it. It's been the one thing in my life where it was most crucial. Bacteria counts, water quality, things like that, and also the other issue I brought up was hazardous waste. It's a concern. I am involved in a very small way, but there are a lot of us involved in a much larger way.

R.M. When you say 'involved', what do you mean?

Male: My occupation.

R.M. Which is?

Male: Painting and papering.

R.M. Oh, I see. So you have these materials and you have to get rid of them?

Male: Very, very small quantities fortunately, but nevertheless it's getting to be a problem.

R.M. Right, right. Okay. How many of you have heard of the word aquifer? If you have heard of the word aquifer just raise your hands. One, two, three, four, five. All right, and what do you understand an aquifer to be or how would you define an aquifer?

Male: A large underground supply of water ...

R.M. Okay. Any other descriptions of an aquifer? Do you happen to know if there are aquifers in this area?

Male: Springfield is a big one.

Female: How do you spell that?

R.M. A-Q-U-I-F-E-R. ... (loud noises.) Basically an aquifer is a geologic formation under the ground that, like you said, is capable of storing water, so aquifers can take various forms; some of them are just under the surface of the ground and catch the water immediately after it rains, so when you dig down into the water table, you are hitting an aquifer. Other aquifers may be very deep under ground, buried under layers of rock and may be composed themselves of some kind of rock, like limestone or other kinds of rocks that somehow absorb water, so there's water there, and this water is stored sometimes for long periods of time and when we want to use water underground, we just drill down and take the water out of an aquifer at some level. I am interested in just getting an impression of what your own conceptions of an aquifer are. I'd like you to write down, you know, your own impression, something that you know, maybe you know a lot, maybe you don't know much, but your best guess on the following questions. Alright, number the first one No. 1.

R.M. Generally speaking is underground water clean enough that you can drink it directly without any kind of treatment?

(Pause)

R.M. Okay, the second question is, what's your own best guess in an area like this, would there be just one aquifer underground or would there be more than one?

(Pause)

R.M. Alright, the third question: is an aquifer more like a river, like a lake, or like something else? When you think of it, if you have thought of it, or as you think of it now, these

underground storage places, do you tend to think of it as more like a river, more like a lake or neither. That's No. 3. Okay.

(Pause)

R.M. And No. 4 is: if an aquifer were contaminated by a leak of some toxic waste at the surface and it found its way underground; if it percolated through the ground and found its way into an aquifer, how long would it take this material to go 10 miles. How long a period of time would it take do you think for material like that to spread from the place where it went underground to a place 10 miles away where, if you dug a well, you'd come across it.

(Pause)

Female: After it's already hit the aquifer?

R.M. After it's soaked down and it's come into the aquifer? How long would it take the contamination? What's your best guess? To travel 10 miles, so if you dug a well 10 miles away, you know, after a while you might come across the contaminant. Joel, do you have a question?

Male: No.

R.M. Just something you haven't thought about? And as I say, your best guess. You know if you had to be put on the spot. How long would it take to go 10 miles? What's your best guess?

(Pause)

R.M. Okay, everybody is committed themselves. As you can see, these are things that many people haven't much idea about and I was interested in knowing just what you think about it before you heard other people talk about it. Okay, let's just take the last one. I am curious, let's go around the paper and I'd like you to give me your papers, but not right now. Before you leave and give them to me. Your names aren't on them. There are really no right or wrong answers to anything we talked about but in this case, I am just curious. So let's hear your best guesses.

Female: About 5 hours.

R.M. Five hours? Okay. Mary?

Female: I have never heard the word before, so I said a half hour.

R.M. Half hour, okay. Kathy.

Female: Oh dear, I thought it might be a matter of a few months. If it is something heavy filtering slowly then it might just drop to the bottom and ... depending upon how much movement there was in the water.

R.M. Right. David?

Male: Pretty much the same thing. It's an impossible thing to answer to think, because there are so many things that could get into ground. I said a few months.

R.M. Yeah. Larry?

Male: ... less than a year.

Female: I said several days.

R.M. Okay, Kathryn.

Female: I said two weeks.

R.M. Joe?

Male: I said a month.

R.M. Okay. William?

Male: Less than a day.

R.M. Paul?

Male: Less than a year.

Female: Twenty-four hours.

Male: Six months.

R.M. Six months. Okay, we've got a variety (laughter). Let me just ask about the lake/river thing. How many of you think of an aquifer as a river.

Female: I did. I also put like an underground spring.

R.M. Okay, that would be a different kind of notion because a spring sort of comes up where the river is flowing ... so Mary you were the only one who that really ...

Female: I felt it could be both depending on the area.

Female: I did too. I thought there might be various types.

R.M. Yeah, which is quite true but I was just wondering if people tended to think more - about a lake?

Male: Didn't you say it was a stable body of water - something about an immovable or ...

R.M. I didn't say. I don't think I said that.

Male: I looked at it like a hard sponge is my best guess.

R.M. A hard sponge. That's an interesting way of thinking of it. Actually aquifers are very diverse. As I mentioned there are different kinds of rock and everything, but the water travels in an aquifer very, very slowly so in some cases it might just be inches a year, as slow as that. Incredibly slow! In other cases it might take several years to go 10 miles, but definitely it would not be a matter of a few days and those of you who thought that are in good company. A lot of other people share that idea. They've told me they think of an aquifer as sort of an underground river, so it's like you drop the stuff in and then, you know, because it's a river, whoosh, it's going to move along, but in truth an aquifer is a very solid kind of material. Even sand is packed together and the water moves just like a big filter so the water moves very slowly through it. Some kinds of aquifers deep underground, it goes very, very slowly indeed. Now I would like to show you a couple of things. Just look at the picture, please. (Presented each participant with a color diagram of underground water sources that also shows wells and various sources of surface contaminations.) Look at the drawing which shows you a landscape on the surface and it shows you bodies of water on the surface and then there is a cross-section underground that shows you aquifers. You didn't think you were going to learn about aquifers when you came here tonight, did you. Just take a while to look at the different arrows and things that are there.

Male: You mentioned that it is something like a filter. Is it possible to estimate a contamination point and distance away from that contamination knowing what that is, when that water would be clean? Would it filter it out?

R.M. Yes, engineers can do that. They would have to know what the nature of the aquifer is and what the nature of the contamination is but they can make an estimate of that.

R.M. Okay now focus on the different levels underground and sort of look at the diagram showing a number of different ways in which aquifers can become contaminated. On the right hand side there is a (?) line and then there is a waste site that you can see, located where the drawing shows the rain. The rain is falling on the waste pile which is gradually leaking material which is called leachate into the groundwater. And as

to the arrows, the infiltration is when the water goes underground. The water table is where the ground is saturated with water. Above it it's not. So that's where the water ... (coughing) ... the water is aerated. It encounters oxygen above that and then that zone that's colored a kind of brown is a sand and gravel aquifer (noise) saturation. Moving to the other side of the lake you can see a sanitary landfill where, because of rain water, there's material that goes underground, that arrow, into the aquifer immediately above the stone. Then we have a little red underground tank that if it leaks whatever it has in it, like gasoline or whatever, is going to go into the ground. We've got road salt that we've already heard about going into the ground. Then we have a municipal well, as you can see, that's going very deep under the ground and then we've got run-off from agricultural fields. We also have a livestock waste storage pit and we've got stuff that soaks in the ground from that and then we've got the septic systems from homes. Of course, the very nature of the septic system is that it uses the ground as a filter. On the left hand side we have a private well. You can see it doesn't go down as deep as the municipal well. Then we have the direction of the groundwater movement, so this is an aquifer that the ... then there is a rock here. It is also another kind of aquifer and the water is moving in this direction. See the arrows? The engineers can sort of predict what direction the water is going, and we've got yet another kind of aquifer down below. You can see there are a lot of things going on, but basically aquifers are these underground areas that hold water. Now, do you think we should we should spend money to keep aquifers from being contaminated? That's a tough question but let me ask it. Should we spend money to keep aquifers from being contaminated.

Female: Yes.

Male: Very definitely.

Female: Yes.

R.M. Okay, now what really interests me ...

Female: As opposed to assessing the polluters, you mean?

R.M. No, no. Just somebody paying money to clean it up, quite apart from whether the polluter or the government pays or whatever. What really interests me is why you think we should protect aquifers. And if you could go to your sheets of paper now please write down why you would pay to protect aquifers. If there is more than one reason, just write them down. You might number them - which is the most important reason to you if there is more than one.

(Long pause.)

R.M. Okay, what kinds of things did you write down?

Male: It is a valuable resource for clean drinking water and the second guess would be that if the aquifers got destroyed through over-demand of surface bodies of water such as lakes, reservoirs and rivers we'd exhaust those.

R.M. So in other words, we may need it now for drinking water but if we don't need it now, we may need it in the future.

Male: Oh definitely.

R.M. I see. Okay. Yes, Kathy?

Female: I was ... if they should be drained. I don't know if wells can drain an aquifer. I really don't know that much about them. Could there be sink holes and that sort of thing appearing. I don't know if that ...

R.M. Well, if an aquifer is contaminated, it would still have water in it.

Female: No, I mean - I didn't know if overuse ... we're just talking about contamination?

R.M. Yeah, but you're quite right. In fact, in parts of the U.S. where they're drawing groundwater faster than it can be replenished, it doesn't do great things for the surface and in some areas it can really cause problems. No I was just thinking contamination and protecting groundwater from contamination.

Female: I was thinking in terms of, you know, obviously the drinking water, crops and animals being affected by it and I didn't know if recreational water was affected. I don't know how it would come into our lakes if the water is not coming up through a well.

R.M. Did others of you write down recreational or was it mostly drinking water that you had in mind?

Female: Future generations if we don't protect the aquifers, future generations won't have clean water.

Male: Exactly.

Female: Mankind and animal life won't be able to survive.

R.M. What effect could it have on animals if it's underground.

Male: I don't suppose trees can live on DDT. It would kill them.

R.M. So some plant life would be contaminated by the water as a ... underground.

Female: Some of the plant life, vegetables and crops that we eat, some of the animals around ... for food and ...

R.M. And how would they be affected by it if it goes under the ground?

Female: Well, aren't we talking about is that eventually this is what we would be drinking on the farms and being fed?

R.M. Well, that's a possibility and that's your concern; that it would be drawn upon for use and ...

Female: The future of the race.

R.M. Yeah. Did you have in mind people being poisoned particularly.

Female: Yeah.

Female: Is it true that the earth now has one supply of water from the beginning of time and that's it?

R.M. It's a ... pretty much. Yeah.

Female: And this the only water we're ever going to have.

R.M. Right, but it does circulate so even though we're made of water and when we die the water gets dried out and used again. It is all one closed system. And, of course, a lot of the earth's surface is covered with water.

Okay, now what if I told you that, what if we had an area like this (pointing to the drawing showing groundwater) but the area wasn't quite so busy with so many things going on. What if we had an area where and this is actually the way it is in some places, where the layer of rock right here [horizontal layer below the ground sepating aquifer] that would be what geologists call non-permeable; that is, water couldn't seep through the rock. It would be a very thick layer of rock. We're talking hundreds and hundreds of feet underground, so any contamination that took place on the surface wouldn't get into the water that's deeper underground and what if it would be possible to put wells into the deeper part. Would we need to protect the upper part of the groundwater if we didn't really need to use it for drinking water or other uses like that?

Male: In the process of drilling a hole through all that rock there would have to be some leakage.

R.M. Well, actually, believe it or not, no. You can seal the well. It is amazing to me too but when you put the well down, sure, you're going through this stuff but they put a casing around the well, so it is literally watertight until it gets all the way down to the bottom.

Male: That's very much true, because I've seen wells drilled and you can stand there with the drilling machine running and see water sitting right around the side of the drill casing, which is surface groundwater, and yet the tools may be down 100, 200 or 300 feet and there's still no water down there. Yet, you look at the outside of the drill casing where it is in the soil and there's water. And the man says, "Gee, I haven't hit water yet." You say how come. There's water outside here. "I don't care what's outside," he said. "I care what's down in the bottom of the hole where my tools are." So it does work.

R.M. Of course, what he's drilling for is to hit an underground rock formation that will contain a good supply of water. Now, so what if there was, what if the geology was so that you could put this municipal well and it would go down but it would tap water that would be separate from the water up above, so there's going to be plenty of safe drinking water. No problem. Big supply. Would it be possible then not to have to be quite so careful about protecting the aquifers above? Would this be an okay thing?

Male: No.

R.M. Heather, you're saying yes?

Female: I think it would be okay because nothing would be able to get through it. I still think it's important to protect what's up above, but I don't think there would be a danger of the water becoming contaminated below.

R.M. Okay, Joel, what's your view?

Male: My gut feeling is that the contamination above the bedrock will eventually go someplace. It has to be controlled. It's either going to hurt something on the surface or eventually find itself down to an aquifer at a different location. It will travel. It may take forever, but.

R.M. But forever could be a long time. I mean if it took 1,000 years and by the end of the 1,000 years the contamination was diluted and wasn't harmful any more.

Male: You have to take a look at each situation obviously.

R.M. But what you are saying is it would have to be shown to you and demonstrated very carefully before you'd ...

Male: Buy off so it didn't have to be cleaned up.

Male: It is also more practical to get the water from a much more, a surface aquifer, than to go way deep, because the further down we go the more difficulty we have in drawing the water out of the ground. If we're only dealing with a relatively low volume. If we get too deep we may end up with one where we can't afford to really pump the water out of the ground, so this is why really surface aquifers or those more nearly near the surface are the ones that really need to be protected because those are the ones where the majority of the wells are actually being located.

R.M. Joe?

Male: Yeah, well basically your deep aquifers, is it not true that they're not inexhaustible; that the real large one in the country that runs from South Dakota to the Texas Panhandle is dropping two to three inches a year from overuse?

R.M. It doesn't get a lot of rain. In the East we don't really face that problem, so as far as the actual supply of water goes, we've got a lot of water under us, if we want to go for it. Mary, what's your feeling? In a situation like that would you worry about the surface contamination if there was a good supply of groundwater underground?

Female: I have some doubt about it.

R.M. Doubt? In what way?

Female: Well, this water (noise) people just don't drink it. Do you know what I mean?

R.M. The water would be tested and then if it needed purification, it would be purified. As you know, drinking water companies regularly test the water to see what the story is and if it needs something they can do it, so there would be that protection.

Female: I don't really know too much about these. I never really heard the word before.

R.M. Of course.

Female: I think I need to read up on it a little more.

R.M. So in other words, you'd still worry?

Female: Yes, I would.

R.M. What would you worry about?

Female: Well, I think, you know, the contamination. Minerals that come out of the ground are dangerous really for drinking and I don't know. I think I'd have my doubts.

R.M. Cynthia, what's your reaction?

Female: I would be worried that the contaminants would eat through the well. You know, you said they were protected but who is to say in five years that the contaminants wouldn't corrode the piping and just end up contaminating the whole, going down further.

R.M. Who would you trust to tell you that wouldn't happen?

Female: Who would I trust? Maybe someone from the National Environment ...

Male: Not the government.

Female: Not the government. (laughter)

R.M. [noise] that would be the government. That would be the Federal Government.

Female: Yes.

R.M. But you'd trust them more than local people?

Male: You'd have to go to a non-profit organization sometime.

Female: I guess I would trust the local government more than the Federal government. To me they're about the same. I like the water ... in Worcester.

Female: I don't believe it if they tell me it's safe. I really don't, because I don't believe it is.

R.M. John?

Male: The thing I want to say about that is that I don't know about you but what we do, what's happened to me, I live in Worcester and in September I'll get a postcard in the mail from the City and it says that the ... (?) bacteria count was exceptionally high for the month of July and August.

Male: A little late.

Male: This has happened to me several times and I think to myself well, this is a helluva time to tell me! I've drunk it now for two months and now they're sending me a card saying what I've had in my system for two months is unsafe to drink.

R.M. That doesn't inspire confidence.

Male: Not me.

R.M. How about you?

Male: From your diagram, it seems like it's an on-going process. The top water would evaporate and eventually would have to seep to the aquifer and be contaminated.

R.M. I see, so you'd worry about contamination too. Kathryn, who would you trust if somebody told you a system was safe?

Female: I trust them now. I use the water in Worcester because I think it's okay. I don't think they would give it to us if it wasn't. I drink it right out of my faucet and I think it's ... (coughing) ... know enough about it and have studied it and say it's alright, then I think it would be ...

Female: Sometimes you can turn your faucet on at home and you get this odor of, I don't know ...

Female: Chlorine.

Female: I can't stand it. I mean ... what does that do inside of you?

R.M. Actually that's protecting you. (laughter)

Female: It's really heavy. Like the week after the notices come ... a big heavy ... can't even brush your teeth with it.

R.M. Chlorine, as you know, is added to kill organisms ...

Female: (voice too faint)

R.M. Or other organisms that would be in the water and that would cause dysentery or various kinds of stomach problems. Chlorine doesn't, of course, clear up the toxic chemicals. It is a biological disinfectant that keeps you from getting various kinds of stomach problems.

Male: You talked about trust, who would you trust to clean up. This is a local issue and I don't know if it's true but Don was talking about the cards they sent in the mail, and I heard they send those cards to property owners but the tenants never get them.

R. M. They probably send them to whoever pays the bills.

Male: That's correct. I don't know if that's entirely fair either. Can I make, two things that on this but they're different ... something is bothering me. Why are we on the subject of water. It seems like we came here to talk about what the problems were and we're spending the night on water. I don't have a problem with that. I am just wondering. It seems like you're trying to educate us to the problems of water. Is this just coincidence?

R.M. Well, the purpose of the discussion is to talk about water problems, but I wanted very much to see what interested you before you knew the particular problem I was interested in. Actually, a couple of you mentioned it. Drinking water ... whereas if we'd told you ahead of time we're going to talk about aquifers you probably wouldn't have come.

Male: You tricked us, that's what you did! (laughter)

R.M. Well, no, we didn't want to trick you. We told you what we were after in general terms to avoid any chance that people might tell us what we wanted to hear, so that was the purpose.

Male: The second thing is that this is so funny because I just joined on what is, at least at this time, a part-time basis, a water purification company. A friend of mine got into a water purification company out of Tennessee. It's National Safety Associates and they make these carbon filter purification systems, mostly for homes, and he called me up and said "Look I bought into something I want you to try." I said "Fine, what is it?" He said, "Well, let me come over to the house." And it's about the size of a thermos. You can't get into it. You can't open it up or get into it. He said "I want you to try this. It's a water purification filter." You know the ones you go to Spag;s [local store] and buy for $10.99 and you hook on to the faucet, and he came over one Sunday morning and hooked it up. He said, "I want you to try this for a week and I guarantee when I come back you're going to want to buy this from me." What it does is that it removes the chlorine from the Worcester water. He did some tests and taste tests and my wife and I swear by it now. We have not bought bottled water in over two months. We're drinking it out of the tap and using it for everything. We don't have it in our shower or our laundry. It's guaranteed for three years or 5,000 gallons, whichever comes first. The main thing that it does is that it removes all the chlorine. I had, without him knowing it, I had water tests done. I took a 2 pint sample from my tap, because there's a little button you turn on to get the regular tap if you want. If we just rinse plates off we just go ahead and use the regular tap water but for drinking it or cooking we use the filtered water. And I had tests done. I took a 2 pint sample up to a place in Leominster. The results were amazing, the difference between the two.

Absolutely no chlorine. The amount of chlorine in my water in Worcester in my Sample #1 is not dangerous, so to speak, but it is pretty heavy and over a long period of time, it could be. In the Sample #2 from the filter, there was absolutely no chlorine in it. Same thing, it took out all the chloroform, I think it was. It lowered the sodium content substantially. The amount of what did they call it, I think they either said materials or actual solids in the water went from like 35, there were 35 different types of solids they tested for in the Worcester water, and the amount in the filtered water was around 20. You can taste the difference. It's ridiculous how easy it is to taste the difference, and I am just sitting here. This is unbelievable. I've got 13 potential sales here (laughter) that I just got into this thing. I'm trying to get my parents to try it, my brother and his family. This type of thing. We swear by it. We are not buying any bottled water.

R.M. What David is talking about is a point of use filter system. At Worcester the water is just chlorinated. They don't filter the water but it's possible to use carbon filtration in a water treatment plant itself and take other things out so this is an example of another kind of system.

I've been interested in why you would want to protect groundwater and also who you would trust. Let me just come back to that. If the local water company said the water was safe to drink, how many of you would trust the local water company?

Male: Well they're telling us it's safe now because they're letting us drink it.

R.M. Okay so two people would unequivocally trust the company ... What if the State health agency did special testing? How many people would trust the State health agency, whoever it might be? One, a couple, you wouldn't trust the State?

Male: We're cynical.

R.M. Larry, why not?

Male: I don't trust anybody that's been elected. I mean they're going to lie to you anyway, tell you what you want to hear. "The water is good. Drink it." That's what we wanted to hear.

R.M. But, of course, the State health people aren't elected.

Male: But they're political. They don't get their job by signing an application form and I've done this research work. I don't know. They know the Governor's son or something.

R.M. I see, so you think they may not have the expertise needed.

Male: You mentioned National Geographic. I kind of trust them.

Male: Or Jacques Cousteau. One or the other.

Female: Well, I don't trust them because you go back ... he said that he found out two months later. ... why did it take so long for them to report that the water was bad? I personally have read about that in the paper where they'll tell you in September that the water was bad in June and July. Why did they take so long to tell us. Why don't they alert us as soon as possible, so how can you trust them?

R.M. Okay, who would you trust? Mary?

Female: Some private research that I myself would hire to have them do it and I was there.

R.M. That would inspire confidence? How about you?

Female: I want to say "Fair Share" people, but I don't know if that's -- who else is it that does, publically funded.

Male: The Sierra Club or something like that?

Female: Yeah, because I feel they really can't do a heck of a lot about protecting, you know if have got rotten pipes you've got rotten pipes. If they haven't fixed, I think there's sort of a mentality that says let's not panic the public for something we can't do anything about. If it got really, really dangerous, I am sure there would be an alert or some kind of rush to get us tanks full of clean water from somewhere, but overall I feel they let a lot of stuff just go by because they can't do anything about it and they don't want to panic the public so I don't trust it and I buy bottled water. And I don't know if my bottled water is safe either.

(Too many people talking at once.)

Male: But you can sue them easier.

Female: Right, yeah.

Male: Well, your bottled water comes from underground springs that could be going through these aquifers, whatever. So it could be dangerous. I would trust the same thing, a private independent research company, such as the company I told you about. I didn't trust my friend. You know he came and told me all about it and asked me to try it and you know, knowing

that he hasn't been in it long, he doesn't know much about it. So I went to an independent source, had the water tests done and they told me the difference was incredible, and I am sold. And rather than like the government or that type of thing I'd rather trust an independent research firm or something like that.

R.M. Jack?

Male: The only thing I was going to say is, I won't mention the town because this happened down at ... the town shall remain nameless, but down in Cape Cod in Massachusetts my son worked ... now they had a public beach and this is the ocean now. The coliform count was like 200 parts per million, which I guess is extremely high for the ocean and the resident's beach on the other side of the Bay, the count was like maybe 85 parts per million. So in other words, where the residents were swimming, that was okay. But where the general public was swimming was really contaminated and I guess it's because there are so many houses where they have septic systems leaking into the ocean and so on. That wasn't public knowledge because what they do is they have maybe 250 to 300 cars a day at this particular beach for $4.00 a throw and on Saturdays, Sundays and holidays, they get $5.00. So that was a local town --

Male: You've got to be talking about Sea Gull Beach in Yarmouth.

Male: No, next town over, actually.

Male: Sea Gull Beach and Yarmouth is the same way. I know about the problem. It's the same over there.

Male: They wouldn't close down the public beach. I don't know if you are familiar with it or not. Do you know where it is?

(Change of tapes)

Male: So that's what I am saying about local government, you know.

R.M. Okay? I have talked of the State. What about the U.S. Environmental Protection Agency or some other agency like that? Would they be trustworthy or not?

Male: So often ? wild men drill for oil ?

R.M. Is that the Environmental Protection Agency?

Male: They're not doing much to stop this.

R.M. I see.

Male: Look at what James Watt did when he was in charge of that. I mean, how can you even have a long term relationship with the Environmental Protection Agency after what he did? All you have to do is get somebody else in there like him to run it and we've lost decades of progress.

R.M. We don't have a lost of trust here, do we? By the way, Watt headed the Department of Interior, not EPA.

Male: The educational establishment and obviously someone like yourself might be trusted to take care of the water supply. (laughter)

R.M. But more seriously I am not a scientist, I wouldn't trust me, but if you had a biologist at Clark or Holy Cross or some place, would that be -

Female: I'd bring the water there and trust them ... any of the government.

R.M. Why?

Female: No interest outside of "Here are the facts, lady." Everybody else, the politicians and the other groups have all kinds of outside interests.

Female: How much is it going to cost to pipe the entire city of Worcester or --

Female: Would a small group like that have the money to do something like this?

R.M. The problems are very real. Let's talk about another aspect of groundwater or aquifer that's a problem the country faces and this is, as you can see by this little diagram, lots of things can contaminate the groundwater. For example, now the U.S. Government has a big program to regulate underground storage tanks at service stations and places like that. Many of these tanks are very old and need to be replaced, otherwise they're leaking gasoline and whatever they have in them in the ground. So the government is aware of it now and really putting pressure on people to take care of these problems, but in the past it really wasn't recognized as that serious a problem. Just like hazardous waste is a fairly new problem. It's only in the last ten years that people have been thinking about it and worrying about it. Okay so there are certain areas where parts of aquifers are contaminated. Now, and one of the things the government is worrying about, is whether it's worth the money to pump the water up out of the ground, we're talking lots of water, treat the water and then pump it back into the ground. In some areas in particular, the area contaminated isn't threatening any other water supply. People aren't pulling their

water from it. It's like a little pocket of water near the surface and they can drill test wells to see how far the contamination has spread. And they can calculate how fast it's spreading. And in many cases, it's spreading very, very slowly. Then if worse comes to worse, they can even build a wall that would keep the water from seeping further beyond, say, the boundaries of a factory where there's a tank leaking, for example. But some people say "Well, no matter what, you ought to clean the water. You ought to pump it up and make it clean so you can drink it out of the ground if you want." Whereas other people say "Why waste the money if the water isn't going to be used and we've got plenty of other sources and it's contained in an aquifer that's not threatening other people, and furthermore, if it does seep into water that the people drink, it will be caught by the testing and you can put in a filtration system or other ways to make the water cleaner. So if you really needed that water, you could clean it up then. But why spend all that money to clean it up now when you're not sure you'll need it or you may not even need it at all." So how would you feel about that? Do you think the government should always spend money to clean up water that's been contaminated in the past, or under certain circumstances, is it okay to leave the contaminated water where it is.

Male: My own feeling is that it's going to be far cheaper in the long run to worry about controlling the new sources and we can draw a line if we want to and stop the new sources. We've got a limited number of sources now and we can identify most of them. We've got a lot of ticking time bombs that are going to develop over the years. Those are the ones that are going to simply multiple the problem dramatically, so if we institute a program now to eliminate them with proper facilities, as I said before, then we can concentrate our efforts on cleaning up. Otherwise, we're going to be chasing our tails. We're going to clean up one site but we're going to be allowing something else to go on. We're not going to accomplish anything.

R.M. What if we had, as I think the government is working on now, a strong program to prevent more contamination from occurring and the money's going into that. Should we <u>also</u> spend money on cleaning up all the other places where it has leaked? Kathryn?

Female: I think yes. Clean it up now and then it won't contaminate anything else. Get this cleaned up and then continue the prevention end of it and it all depends upon how much is contaminated right now. If it isn't that much, then get it cleaned up now and then go on with the prevention with the hope that what you have cleaned up will stay clean and ... will continue to be clean.

R.M. So it depends a little bit upon how much it will cost?

Female: How much it will cost and how much there is right now.

R.M. I see. And how much there was. Yes.

Female: And it would also depend upon how much water you had available. Someone was saying in the midwest they don't have the water supply that we have and their aquifer is much more critical in terms of needing protection.

R.M. We're talking here about a situation where there would be plenty of other sources of drinking water. No problem. But where there is localized contamination and there's a little plume of material that's going into the ground and spreading very slowly.

Female: I would be in favor of spending the money on science to say "beware" and not cleaning it up until it became a problem. You know we're talking about tons and tons of tax money to even touch this problem.

R.M. It would be very expensive, yes. All right. Larry, what's your ...

Male: I think the price is irrelevant. If we don't clean it up, the earth's life support system could fail and if that fails you'd have no place to live.

R.M. Okay, so you don't see a situation where any contamination could, could --

Male: There'll always be something because we've just screwed it up royally, but if we do not try to keep ahead of it, we'll lose.

R.M. So we should clean up what we know is contaminated now.

Male: Clean it up, maintain steady programs, punishment for people who contaminate it, do everything we can. This is not a short term problem. Ten thousands years from now, human beings will be here hopefully and this radioactive waste that we put into the planet and hazardous waste and all kinds of toxic stuff is still going to be here.

R.M. Because people in future generations may want to use it, it poses a danger that should be removed.

Male: It doesn't go away.

R.M. Any other reactions to this policy issue of whether we should clean up water that's already contaminated if it's in a situation where we don't need it and it can be monitored? Joan?

Female: I think I would hold off on contaminated water ... I mean you're talking in an area where there is no ... I would rather see the money channeled into improving the quality of the water we presently have and somewhere up the road ... as long as you know that the contaminated water would be tested and filtered before anybody could use it ...

R.M. Okay, so a monitoring system would be very important, but given that proviso you would ... Joan, how about you?

Female: I would agree with that. I think the important thing would be to take care of what we use right now.

R.M. Okay, so how many would take this position that if we monitored carefully and spent the money on protecting and keeping further contamination that it would be okay to leave the contamination where it is?

Female: For a while. Well, not forever.

Male: I think you're talking priorities here. I mean I am in disagreement of not getting at it. I am in agreement first of all, yeah, let's curtail any new pollution we've got going, any new hazardous stuff that threatens, try to improve what we have is good but certainly don't put this too far on the back burner because you've just ruined an alternative. You may not need it today but you may want it in the near future if something goes wrong and if you don't get off your rear ends and fix it now when you know it's a problem, you're not going to have that alternative.

R.M. So you would delay it, but you would definitely --

Male: I wouldn't want to say delay. I mean you have to take a look at the entire situation and prioritize; cut off a few sources, improve what you've got so it's drinkable and at the same time, if you have the financial resources get at this as soon as possible and fix it so that you have that as an alternative if you need it in the future.

R.M. Let me pose a more concrete example than this just to get your reaction. Let's say we have a local computer industry in this area and as part of the processes of dealing with transistors and things there's a toxic waste flow that you have to handle and let's say that this local factory has some holding tank or something that had a leak and contaminated some water underground, but it was a relatively localized thing and it was

quite a distance from the boundary of the factory and the government came in and fined the company and put in monitoring wells so they could tell exactly where the water was and that, if it was necessary to keep it from going across the boundary, the government could require the company to build a barrier. Okay, so it would be within simply the area of the factory fence. The alternative would be to spend the money to clean the water up by pumping the water up, and cleaning it with a process that might actually, when the chemicals are exposed to the air, there might be a little air pollution, pumping it underground. In this kind of situation, which would you prefer? To monitor it and just keep it where it is or spend more money and clean the water up. You're shaking your head.

Female: Well, that's because I feel they should clean it up right away. They shouldn't wait, take their time. You know, stop them from leaking any more into the soil but they've got to clean it up. They can't just leave it there and let it seep for years and years. They should clean it immediately.

Male: What have you gained? Really, you've spent money to monitor, to build a barrier, and you still don't have clean water and if you're like me you know the opinion that you want that alternative water clean for possible use in the future. You've just spent a lot of money and time without addressing the real problem. You've thrown bucks away. It's going to cost you twice as much by the time you get around to cleaning it up. Get in there and clean it.

R.M. What if the expense of cleaning it up would be much, much more than the expense of monitoring it.

Male: Is it? I mean I am not an expert, but it seems to me that digging down and putting barriers around it has a price tag too that should be pretty high.

Male: How long do you monitor it? Ten, twenty years or ten thousand? How long does it take it to bio-degrade?

Female: Who would be responsible for cleaning that up in this situation we are talking about?

R.M. Who would pay for it? In this situation, let's say the company pays. This is all hypothetical, okay. The company pays a fine and then after that it's up to the company to do whatever.

Male: How was the fine calculated?

R.M. How should it be calculated?

Male: It should be calculated at the cost of cleaning the water.

R.M. Okay.

Male: That would really stop new sources of pollution.

R.M. All right, but what if there was a vigorous, but still let's say the fine was $1,000,000. That would be plenty to cover the cost of the barriers, but to clean it up would be $2,000,000 or $3,000,000, and the company is employing people and obviously it's not going to want to have a million dollar fine again, so the government is going to be watching it, so the likelihood of them doing it again is very low.

Male: It's more expensive. You said a million dollars and now you're spending my tax money to have the government watch these people when you could spend one price, it's a little bit more but you get what you pay for, and then instead of having a thousand years from now a piece of earth is no good, you have land that you can grow food in and eat.

R.M. But you could use the land for those things without any problems. That is the contamination doesn't really come up through the roots of plants but the loss is definitely a loss of the drinking water without treatment, but you can still pump the water up and treat it and it would be, the experts tell us, usable. So you're not really using the drinking water as a resource. You are losing water that can be easily taken up and used straight off without treatment.

Male: Are you saying that if you destroy an aquifer out in the middle of a large forest that this is not going to have an effect on the wildlife because the wildlife doesn't absorb these chemicals up through the roots or whatever.

R.M. Yes, of course, there are situations where clearly if the water got into a lake, if the organisms in the lake, and let's say it was something nasty like PCB's that are very long lasting, and the organisms in the lake acquired PCBs it went up the food chain, to fish, and then it could affect the birds, stuff like that. Under some circumstances that could happen.

Male: Are not those animals deserving of being taken care of? Destroy everything on the planet just so we can be happy?

Male: You know, Robert, I am getting the opinion that you keep trying to refine your example or your situation to finally get a few of us to say, "Yeah, okay, put a barrier up. Don't clean the water." I mean you're talking to one million, three million scenario people going to get knocked out of work. You keep refining and say "Hey, you can still use it for drinking

water if you filter." Why don't you just say "Hey, they can pollute the water, but you can still drink it." Now maybe at that particular point I would say "Fine, don't clean it up, if I can drink it after they've ruined it."

R.M. Would you believe that?

Male: No.

R.M. Okay. So it would be fine.

Male: Not to me. If you come down and say a company has accidentally leaked 50,000 gallons of turpentine in the groundwater under their plant but it's okay to drink. It's all examples and I'm just taking the hard road. I believe, in my own opinion, that if the groundwater is ruined and it can be cleaned, it should be cleaned and I think going the monitor/barrier route is a waste of money because we will want it cleaned, in my own personal opinion, I want that water cleaned sometime.

R.M. Of course, you're quite right I am pushing you because I want to understand how much protection you want and why you want it.

Male: It might not even be a question of protection as far as your own moral makeup. I don't think we should destroy something and then leave it there forever. Really we should return it back to its natural state if we can. Hey now there's a big price to pay and I am a taxpayer, so there's a lot of give and take. But I work for a company that does produce some hazardous material and we make sure that we use certified companies to take care of it and we pay that price. It's in our overhead rate and it's passed on to the consumer. We play the ballgame right. I see this problem as really just being we've only discovered the tip of the iceberg and we have to get real tough now and in my opinion the way to get tough is to say we have to clean that water.

R.M. But your position is one of giving a warning to people; that is making companies pay. That's important because it will help to make sure that they do it right. Is that correct?

Male: No, it goes further than that. I think we should return the water to its correct state.

R.M. And not because we need to use it.

Male: Maybe not us personally in this generation, no.

Male: Who are we to destroy the world's resources?

Male: ... pass it on to the next generation saying if you want to use it, you clean it. Passing the buck.

R.M. Joan?

Female: I just don't know if any of it is realistic to try to preserve or correct what we may be using somewhere way down the future when we sit here and we're talking about ... and we can't even get clean water in these small towns. I mean we're talking about preserving something which, and I agree with you, we're going to need, but we can't get clean water now out of our faucets.

Male: Well we'll start there.

Female: Start there yeah, but I mean have all this money channeled, which I am sure, we wouldn't get from the government anyway, channeled into what could be something we're going to use later on and drink the kind of water we're drinking now doesn't make a lot of sense. I don't think realistically there's that kind of money to do what we're talking about. I think it's a good idea. I don't think it's realistic.

R.M. John, what's your view?

Male: Well, I think it all comes down to dollars and cents and I think it all depends on what it's going to cost and who's going to have to pay for it, and I think generally speaking probably when you sit down and you talk in a small group of people like this they realize how important something like this is, and I wonder if the general public isn't a little bit apathetic about some of this.

Male: I agree on that. If you say let's clean up the water for future generations, but can we afford to do it and the government can do it. They are all just people too and they're limited in what they can do and we've got to look at the dollars and cents standpoint as well. But I agree with Joe. I think it should be done.

Male: Oh absolutely. If it can be done.

Female: I agree with Joe.

R.M. Is there anyone who thinks it shouldn't be done. (No one) We have agreement there. But if I understand you right, the question is, how much it would cost to do it, given other priorities? Is that a fair way of ...?

Female: Mine would be the priority to clean what we are actually drinking today and like I said it doesn't even look like we have enough money to do that. Now if that could be done

and there were in fact money available to do all these other things to clean for future water, I think that's a super idea. I just don't think it's feasible. I am only going on what I see in our small towns here. If we can have clean water here, how are we going to protect what we're going to use up the road?

R.M. Mary, what's your feeling about this?

Female: I agree with that. I agree we should clean up the water we got now which is in bad shape and also agree with ...

R.M. Okay, we should clean up the water we have now and whatever's left over. Other views? Other people that haven't talked? Kathryn?

Female: I agree it should be done and I think if you made the companies, give them a real hefty fine and made them pay it and if they continued with the idea of preventing any more, then I think the word would spread from company to company and I think eventually you wouldn't have as much of a problem as you do now, but I think you have to start somewhere.

R.M. Okay, let me change the example from a company to a town. As you know, unfortunately, our cities sometimes have pretty bad problems. Boston Harbor is a good example of some of the problems that can occur when towns and cities don't do to water what they should. But let's say if a community had a landfill and the landfill resulted in contamination of groundwater aquifer that was localized. It could be monitored, identified, it wasn't needed for drinking water, the town realized what was going on and now was taking care of its wastes in an appropriate way so the likelihood of that happening in the future is not there but they still have the contamination of a local aquifer. Should the town spend the money to clean that water up?

Female: I would definitely. I was very, very upset when I found out a while back that Shrewsbury had just been dumping its sewage into the ? River, just making life agony for people in Northborough and some of those communities. It's outrageous ... Shrewsbury, the lack of response. They're finally dealing with it, but I was appalled to find out that it even happened, that it was Shrewsbury, one of <u>the</u> polluters of the ? River.

R.M. Okay, but in this situation we're not polluting a river that would --

Female: Yeah, I don't know if that would affect an aquifer.

R.M. Here's an hypothetical example. It would be very localized, it wasn't affecting an aquifer that was being used by

anyone else, but the contamination was there and you would not want to drink that water out of a well without treating it, so you know it's not good stuff that's in the water. But the issue is that the water isn't needed and won't be needed and if it is needed it can be treated to be drinkable. Should it be cleaned up? Heather?

Female: In Auburn we have a problem ... polluted the lake and they are working towards cleaning it up and they're going to ... and all the trash is going to be transported there and disbursed of and the dump is going to be closed and they are working on cleaning it up. I'm in full agreement with that.

R.M. Okay, in this situation of course we're not contaminating a lake, which, of course, could hurt people that are in it but rather simply an underground aquifer that's not draining into a lake or other --

Female: There are wells and things around the lake.

R.M. Right, whereas in this case there would not be an area covered by wells or if there were wells the town would give the people another source of water. Yes.

Male: Shrewsbury is facing a situation right now with the pyramid wall, where its major water supply is right at the bottom of that beautiful asphalt slab the pyramids talking about putting in and I just kind of wonder how much garbage - well, I wonder how come Shrewsbury ever gave the permits to begin with. I mean the old sand and gravel yard there I can see because there at least we had the land around it where we could do something. Here we're no more than the other side of main street above the wells. That scares me. I'm not a Shrewsbury resident. I get frightened.

Female: Yeah.

R.M. Okay. But we're talking about a prevention situation aren't we, where maybe Shrewsbury hasn't --

Male: I don't really think they've done their homework properly because Worcester has one well in that same field. We don't get that much water out of it. The rest of the wells in the field provide Shrewsbury's main source and Shrewsbury is allowing what I see, from everything I've read, a potential major source of contamination to go in right above its only water supply. Now if they think they're going to buy water from Worcester, well, I got news for them. We have just about enough to go around now. We can't talk about supplying Shrewsbury, so the Board of Selectors should be doing something about protecting itself.

R.M. If I can, let me try my hypothetical example and get your reactions to it. The example is a localized contamination of an aquifer that's not needed for other uses, that can be monitored, it's contaminated by a town so the community would have to pay for the clean up and the clean up would not be cheap. It would be expensive. Should the community clean that water up or is it okay to leave the water and use the money to prevent other problems and so forth?

Male: I think you are asking the wrong question. You are asking can we afford to clean it up. The question should be can we afford not to clean it up?

R.M. Okay, now why couldn't we afford not to clean that particular thing up?

Male: He has been trying you all night that we might use it some day; we might need it; there are future generations; there are other beings on this planet than ourselves. We should take care of the messes we make. When you're in the house and dirty the kitchen table, you clean it. You don't leave it. It should be the same with the resources we have.

R.M. Although in this case we could clean the water up afterwards and we could - probably it wouldn't cost more money.

Male: To clean the water later?

R.M. No. To run a filtration thing.

Male: Is that cleaning the aquifer?

R.M. No, no. It's only cleaning what you are picking up and using. The aquifer would still be dirty. That's the issue.

Male: I am not in favor of leaving the land poisoned.

R.M. Okay. How many would agree with Larry? Most everyone except three people. Well you're sympathetic with him.

Female: ...

R.M. I think we're all sympathetic with his view. I mean it's much better not to have something contaminated than to have it contaminated, but in a world of policy choices the Environmental Protection Agency in Washington, D.C. is worrying about these kinds of issues. Should it require communities like that to always to clean their water up so that you can take it out of the ground straight without treatment? And if the U.S. Environmental Protection Agency makes that requirement, communities and other areas are going to have to spend a lot of money not just to keep other contamination from occurring but to

have to clean it up, and some people say this is crazy, it's so very expensive. We don't really need the water and if we do need it we can clean it up, so why require everybody just to clean it up? Other people would say "Well, look we should clean it up no matter what."

Male: I just don't see that you'd buy a house and sign your unborn child's name to the mortgage and figure you'll live here and let them pay for it when they grow up. Same thing. You don't do that. You take care of your problems as they come up. You pay your bills when they're due. It is a problem that needs to be solved now.

R.M. Yes, Kathryn?

Female: You know just being realistic, there's not going to be enough money to do that, so I can see it would be practical to clean up on it on a as-needed basis and spend most of your money in trying to clean up the things that you do need and do preventive measures, make sure that people are not polluting.

R.M. Okay, and when we said preventive measures would be undertaken, under what conditions should it be cleaned up. You're saying the government shouldn't require everybody everywhere every time to clean it up, but only -

Female: You wish it could be if there was enough money. I am just saying that you know jolly well that it's unrealistic that there would be enough money.

R.M. But should it ever?

Female: Yes, eventually if we can get to a point where we can catch up and people aren't polluting then hopefully we can then eventually do it in stages and --

Male: Well, when do we start? The year 2000, or 2110? When?

R.M. Yes, Kathryn?

Female: I think it should be universal though. If the agency decides that Town A should clean up, then Town B should clean up also. I don't think it should be 'well you have enough money, you can clean up and you don't have enough money, so we'll let you slide by.' I think whatever is decided I think should be decided for all.

R.M. Okay, one decision would be to require everybody to clean it up, no matter what; another would be to require it

under certain circumstances which I think Kathy was alluding to, but the question then is under what circumstances?

Female: If anybody's water was endangered, if their health was endangered.

R.M. Okay, in cases where the aquifer was needed for drinking water, what if you could treat the water?

Female: That idea bothers me.

R.M. Why does that bother you?

Female: I just wonder if they can really get it all. I would really feel semi-strongly about having the aquifer clean if it were needed for drinking water, rather than filtering.

R.M. Rather than relying on treatment after? How many others share that point of view? You'd worry about that? I see. Most people. Okay, so if the water was needed for an aquifer and there weren't substitute supplies that would be one condition. In communities contaminated under that condition, definitely they should be made to clean it up even if it could be treated in a water treatment plant. Are there other conditions like that for those of you who are unwilling to decree that every bit of contamination should be cleaned up no matter what?

Female: I think it indicates ... great danger of a water shortage in a very short time.

R.M. So you could really say that you probably need it in the foreseeable future.

Female: Definitely.

R.M. Okay, and so it would be the same thing as the current needs now. Okay.

Male: We're just keeping up with one disaster after another now. We're just barely keeping ahead. I think it would be better to have an insurance policy and a couple extra things taken care of than just barely trying to keep up.

Female: Where would the money come from?

Male: I don't know. We put a man on the moon. We spent billions of dollars on defense. It seems like we always have enough money to build another bomb. We should be able to find enough money to clean up the water.

Female: What would happen to Worcester now. We have bad water in Worcester. ... all those pipes are contaminated ... imagine if the government came in right now and said 'clean up your water and clean up every supply of future water.' It's not feasible.

Male: Well do you want your children to have the same quality of life that you have?

Female: I want the same thing, sure, I really do, but I don't think it's realistic.

Male: Oh, I don't think there's the money either, but I am hoping.

Female: You're dreaming.

Male: ... if somebody told the city of Worcester twenty-five years ago that your pipes are falling apart and you're going to be in real deep trouble in twenty-five years whether our political-government structure would have had the sense to start a twenty-five year rebuilding program so to get to the point where we have lousy water now and we have to have a big crush. They just installed new water lines where I live, so I know they're working on it but I think they're way too late and the cost is phenomenal now. Whereas if they'd started twenty-five years ago we wouldn't be in the mess we are now.

Male: It is unpopular to spend money on the infra-structure. I understand what you're saying. We don't see it. As far as the water pipes are concerned, if you check the reservoirs you're going to find the contaminants in the reservoirs. A lot of what we get in Worcester water as far as contaminants, we're getting directly from our reservoirs. We're not getting it out of the pipes. The pipes are adding to it, but if you check the water quality back at the reservoirs and go back to the main pump station, I think you're going to find a lot of what you're getting out of the tap is in that water before it ever gets to the pump station.

Female: Then shouldn't we be spending all of our money taking care of that right now?

Male: We have right now if you press the City Council, you're going to find that we've got on the drawing board a water filtration system, but you're going to have to press the City Council long and hard. We have several people on the City Council that absolutely don't want to spend a bloody dime. Right now, we've elected several people that would love to take the water filtration system and dump it. And I'd love to dump them because I think we need it. There are several people

sitting on the City Council right now that would love to trash that filtration system.

Male: Well, my point is the same though. If the contaminants are coming from the reservoir, if the City of Worcester knew twenty-five years ago that contamination was going to come into the reservoirs, they could have embarked upon a program of buying more of the watershed around the reservoir to avoid this. Now they're stuck with high property values and whatnot. I mean there are houses right now near the reservoir up around there that have been built within twenty-five years. They could have started taking action. I don't know I just get fearful that if we keep delaying it and delaying it, from the kinds of examples you're giving, hey there's no problem. I mean this isn't going to contaminate anything. We don't need anything so why pay the bucks to clean it up. I don't know if I can buy that twenty-five years from today, because you may be sitting at the table telling me, gee I guess we've had some really bad droughts. Now it's going to cost, not the three million to clean it up, but seven million to clean it up. Secondly, really in this area how secure are you in your professional opinion that you could have an isolated and polluted aquifer that doesn't affect anything. I mean we haven't really had any sort of bad earthquake in this area and probably won't, but the potential is there. What are other things that could make this aquifer move a hell of a lot faster than what people thought of? What if somebody allows someone to dig a trench for a new pipeline to bring it up to Shell Oil tanks or something and they hit just the edge of this and it runs along. There are a lot of if's there and I don't think you can guarantee me that this thing isn't going to move and pollute other sources or that we'd never need it.

R.M. But if you did need it then you could --

Male: You're not going to filter anything that's lousy.

R.M. Okay, let me just get a division if I might. There are two basic views. One is that really it would be good to require everybody to clean it up everywhere even if it would be very expensive because it might be even more expensive in the future to deal with it. It might be ... in ways you can't expect. There might be problems in treating it later, so you couldn't trust the water if you treated. Then there are others who are saying well that's nice but it's unrealistic to require everybody every time to clean it up. That's a very large cost that probably the money could be used for other purposes. So we have two extreme views. How many are more sympathetic to require everybody to clean it up and how many are sympathetic to the idea that you only clean up those that meet some sort of test of presenting a hazard? Should E.P.A. require every community to clean up all the contamination, no matter what?

How many would agree with that? Six. Then the others of you are sympathetic to that view but worry about the cost and whether ... alright, what I want to do now is just give you a little questionnaire to fill out to get some background information on you and then I want to thank you and also give you a little honorarium for joining us and answer any questions. Then I want to explain the study to you and answer any questions that you may have about it. Thank you very much for helping us out tonight.

Resources For The Future

Existence Value Study

Hartford, Connecticut

Leader: Robert C. Mitchell

R.M.: Thank you very much for coming out tonight. I am a professor at Clark University and I am conducting this study that you will hear about as we go along. At the end of the time together, I'll be glad to answer any questions that you may have about this study. The session is going to be tape-recorded so by having a transcript I can consider it and learn from it. Your names will all be changed on the transcript. The things that we talk about have no right or wrong answers. What I really want are your own views, what you really feel about it. Everybody take a pencil and write down what local situations or problems concern you the most in your community at the present time. Be sure and put your ID number on it.

R.M.: Donald, why don't we start with you? Tell me the town you live in and how far away it is from here?

Male: I live in Newington which is about a 10 minute drive from here. It is west. Yeah, it's one town over. Do you want my response?

R.M.: Yes.

Male: I haven't been here that long yet in this area, but one of the things that is a concern is the cost of housing, the availability of affordable housing. That's a big one. That still remains a big one in our town. It's pretty saturated in terms of the housing situation; not a lot of new starts and those that are are basically starting up at the saturated point in terms of the cost of living that people can rent things for or sell things for. Being a young family that concerns me.

R.M.: You.

Female: Well, I was thinking (coughing) about -- backyard is somewhat wooded and I am seeing where they're building a new shopping center and I am afraid they might cut a road there. I don't want any houses in there.

R.M.: I see. Where do you live?

Female: Bloomfield.

R.M.: Bloomfield. How far is it?

Female: That's going north --

R.M.: North towards Hartford?

Female: Yes.

R.M.: About how far?

Female: It takes me about fifteen minutes.

R.M.: Okay.

Male: West Hartford. About a twelve mile ride. ... was close to a half hour. Now it's taking close to 45 to 50 minutes to my office which is here in ... I think that in itself is a big problem where it used to take a short time, now it is taking quite a bit longer.

R.M.: Crowded roads?

Male: Yeah, very much so. It's getting worse ... we see in the next four or five years the traffic pattern is going to be terrible until they get straightened out.

R.M.: Shirley?

Female: Building too many condos in my small town of East Hampton, Connecticut. It's about 25 miles from here east toward ... New London area.

R.M.: Why are the condos a problem?

Female: Well, ... the traffic (coughing) in town. ... are being built and drainage is going right into the lake. There are a lot of problems with all that stuff. It is just ruining the land around that area. The pretty land, the open land, more people are coming. The town is expanding too rapidly. It is a small country town. That's the purpose of my being out that way. The other thing is also the pollution in the factories in our town.

R.M.: What kind of pollution?

Female: Well, the chemicals going into the lake and also there's a neighbor down the street ... the factory ... pollution to the town wells, the city water, and they had to move. This is a serious concern.

Male: The neighbor had to move?

Female: The neighbor had to move from his place. I don't know what the situation is now. It is down the hill lower than myself coming out of a local factory ... (can't understand).

R.M.: Why did your neighbor have to move?

Female: Because chemicals in the well, drinking water problems.

R.M.: Couldn't they get their drinking water from somewhere else?

Female: I believe they did. I don't know the neighbors well. I didn't have any conversations with them, but read a lot about it in the paper and such. Also you do see pollution coming to work at factories driving through that smoke. It just worries one.

R.M.: Jim?

Male: I was born and raised in Hartford and I am a current resident of Manchester which is about 10 miles from Hartford east of the river and I guess the thrust of it is with the traffic congestion too. They designed and redesigned the highways to alleviate it, but yet it's almost worse. ... the amount of land the highways consume, you have these six lane highways, parallel access roads and yet still it's almost a half hour ride whereas on an off day, Saturday or Sunday, it's a 10 minute ride. I guess it's just the general nature of the public too that they've lost common courtesy, in a sense, if you know you're coming into a funnel and yet you'll have these guys coming past you at sixty in the right lanes and so forth. It's like 'head you off at the canyon' type thing. It's also getting to be more congested now with the developers coming in ... 25% of the town is rural and it's still open for development and yet they are proposing high density, and yet the side effect is sewage and water facilities wouldn't really handle that at this point. Yet the developers just propose ... roads and so forth. Then the schools where they have had schools existing, because there is a declining birth rate, you have the former schools converted into senior citizen homes or community project areas, and yet now with the influx of parents, families, we'll have to start the same cycle again each generation faces.

Female: I live in Hartford ... but drugs are one for me. You know how they are being created, all this damaging of lives of others and other ... and the general area that I live in is basically what I am talking about. I have three kids that I am raising and it's hard for them to go outside, you know, where they are having killings being done in our backyard and some of the things that's happened in that area.

R.M.: Is this crack or?

Female: Just drugs, period.

R.M.: Yeah, okay, Shirley.

Female: Well, having two teen-age children and being a former educator, married to an educator, I'm very involved in all aspects of education especially, as she said, in drug and alcohol free activities for teenagers; recreational facilities which do not exist, PTA work and that type of thing. I think that's really my main concern right now.

R.M.: And you're from?

Female: Oh, I am sorry. West Hartford. Yes.

R.M.: Linda.

Black Female: Well, I am resident of Bloomfield but I grew up in Hartford. My concern is really different from a lot of other people's concerns. Hartford I grew up in; you knew the people around but it wasn't like a friendly type thing. Nobody came over ... and I am finding in Bloomfield the people seem to be so friendly. You know the neighbors around come and talk to you and I am raising three children. I am wondering how genuine it is and I find things to be different. Like they come to your house to get you to register to vote. They swear you in, everything at your house. Like I've been in Hartford all my life and this has never happened and they ask you to be on the town committee and they told me about the (?) program for my children, and someone is always coming to my door and I have a concern with that. I mean I guess it's a good concern, cause they seem to be genuine but that's my concern.

R.M.: A little too friendly?

Female: Yes.

R.M.: Okay, Bob?

Male: Well, the garbage depot down right next to Wethersfield. It's bringing in a lot of rats and everything and this is going to be infested pretty soon, because they're loaded with them down there. I know people that work there. They say rats are crawling all over, so I mean they're bringing garbage in from twenty towns to burn it up over there.

R.M.: You're from?

Male: Wethersfield.

R.M.: How far away is the garbage?

Male: About a mile and a half from me.

R.M.: It's a transfer station or is it a --

Male: Well, they dispose of all the garbage from 17 or 18 towns. They kept bringing in garbage.

R.M.: Is it a new facility?

Male: Yeah.

R.M.: Pamela?

Female: I am from New Britain which is on the other side of Norwich. You have to go through Norwich to get here, and off the top of my head, I thought of two concerns. One is the crime - just like the burglaries and physical attacks. You never feel as though you're completely safe. You can't walk anywhere even during the day-time. I am always aware that something might happen. I am always ready especially with my kids around. It's always, you always got to watch them. You think they're going to get stolen. That's just a concern of people with kids anyway. Also, more local irresponsible drivers in the neighborhood. We don't have much of a yard. They play mostly on the sidewalks and we take walks and people are crazy. It's ridiculous. They have no concern for other people and you know they're going to come up on the sidewalk eventually the way they drive.

R.M.: Let me ask you about a particular aspect of your communities? That's your drinking water. How satisfied are you with the drinking water in your area? Do you have any problems with it, or is it satisfactory? Bob.

Male: It's no good. I don't drink the water. I buy it.

Male: Sometimes you see rust. They tell you to run it for 10 minutes. I've called them up and they say it's nothing. I won't drink it no more. I'll bathe in it, but that's it. I've been buying my water for two years now.

R.M. Is it because of the taste or because -- (coughing)

Male: From what I see I don't think it's safe. I don't know.

R.M.: Do you know where your water comes from?

Male: Our water from the faucet, you mean?

R.M.: Right.

Male: New Hartford.

Male: I don't know where it comes from.

Male: I think it comes from New Hartford.

R.M.: Where do they get their water from below the ground or --

Male: You're right. Yeah, they have a big lake there.

R.M.: I see. How about you Shirley?

Female: I am very happy. I drink it all the time.

R.M.: Okay.

Female: It appeared to be fine until an incident last month. A pipe had burst some place in Bloomsfield and I noticed the water in the toilet was colored and right after that me and my children and my husband all got a virus and I was very concerned with that and I was wondering if it had come from the water and it took them almost two days to fix the water and I was calling. I called the Info (?) line. Before that it was okay and after that it seemed to be fine but I always wondered if the virus came from the water and I thought I should have been notified or something.

R.M.: Les?

Male: I drink between six and eight glasses a day. A lot of water and I travel quite a bit and there's nothing better than West Hartford water. I can tell the difference when I travel some place else so I am very satisfied with it. In the morning I start off with at least three and I end up the day with two or three, so I drink a lot of water. It flushes my system ... (laughter) ... excellent.

R.M.: You?

Female: I have no problems. We drink it.

R.M.: Pamela?

Female: Absolutely.

R.M.: Jim?

Male: No. I live in Manchester ... we have reservoirs and shortly after we bought the house 10 years ago, I guess they opened some veins and flushed the water and it turned out that a vein had been dormant for 10 years. We had sediment in the tubs and everything. From that point on, a lot of the neighbors were buying bottled water ... whatever, and we still drink it, of course, but it has a strange taste with all the additives and if you're washing

or shaving you can smell the chlorine and ... like you say, I lived in Hartford and Hartford water ... there's a noticeable difference.

R.M.: So you are spoiled?

Male: Yeah. I was in Philadelphia and there's terrible water there.

Male: The reason it's so terrible I think is because of the change of --

Male: Yeah. Someone said New York has the best water.

Male: It comes from 200 or 300 miles.

R.M.: That's actually true. They did a blind testing of water, including bottled water, but nobody knew where the glass of water came from and here it was ...

Male: Was Number 1.

Female: Why is it so white? I am always ...

Female: That water there ...

Male: Air in the pipes.

R.M.: Yes, probably for some reason it has air in it.

Female: Fine for drinking, but it does stain my toilet with rust in it and when I wash clothes it's just a dingy grey. I have to use a softener ...

Male: It's a little bit hard.

R.M.: How many of you have heard of groundwater? The word groundwater? Just raise your hands. One, two, three.

Male: I have heard the expression.

R.M.: Four, somebody else? O.K. How many think they have an idea of what ground water is? O.K. Four people. Five. Okay.

Male: I guessed. It might be that it has to do with water that's derived from a well.

R.M.: Pamela?

Female: Water that stays in the ground ... point of saturation. Just kind of stays there. Never comes out in the dirt.

R.M.: Any other ideas or does that capture it pretty much?

Male: Just natural water from the ground. That's all.

R.M.: Basically it is underground water and, of course, it gets there eventually from the rain that falls on the surface; some of it runs off, some of it evaporates, some of it sinks into the ground and then forms this underground source of water called groundwater. You're quite right. If you dig a well at a certain point there's water in the bottom of the well; that's groundwater. Now how about the word "aquifer". How many of you have ever heard the word aquifer? O.K. One.

R.M.: Well, an aquifer is a formation of sand, gravel or rock that's underground that holds enough water, so if you put a well down it will give you enough water for your well. When you dig a well and it comes in, in a sense then you're tapping an aquifer. It's a geologic formation that may be packed sand, rock that has crevices in some way that can hold water like limestone or sandstone, or it may be just be gravel and sand mixed up. And the water fills all the tiny pores between the sand and the gravel, so it saturates that area. Now what I'd like to do is to give you some pictures and have you look at them if you would. The picture describes groundwater and shows some aquifers.

[Distributed EPA brochure, Protecting Our Groundwater, "Groundwater and Land Use in the Water Cycle". Participants spent five minutes or so examining the picture.]

R.M.: Feel free to help yourself to coffee. There are iced drinks, water for tea, things like that. PAUSE

R.M.: It's not every day you get to look at the underground like this, but this is an attempt to show how ground water is formed. You can see the rain falling and it seeps into the ground. Of course, some of it goes down into the lake that you see there and the river that flows into the lake, but if you look on the right hand side of the picture you'll see an area called a zone of aeration and below that you'll see something called the water table. The water table is where all the spaces in between the gravel and the sand are filled with water; saturated with water. You'll see several different kinds of aquifers. There's a sand and gravel aquifer. There is the crevice limestone aquifer - that big band of rock underground - and way below that there is a porous sandstone aquifer. The arrows show the direction of the movement of ground water. Now, is there anything you're curious about or questions or things that don't seem to be clear?

Female: No.

Female: Feel like we're having a geography test here.

Male: I have a question. What determines how deep they dig their wells, just out of curiosity?

R.M. That's a good question. I suppose it's a matter of cost to the flow from the well. The municipal well needs a lot of water and to get that much water it's worth it to drill deep for that.

R.M.: Bill, any questions?

Male: Interesting though.

R.M.: O.K. now I am going to ask you a question. We'll discuss it later but I want you to first write your answer on the sheet. Look at this little red tank here. Imagine there's a leak of oil from that tank into the ground, deeper into the ground. The question is, how long would it take to travel 10 miles. I am just asking for your best guess. How long do you think? The groundwater goes in the direction of the arrows shown on the picture. So what's your best guess about how long would it take to move to a place 10 miles away.

Male: The water table ...

R.M.: Yeah, it would go down to the water table. Then how long would it take to travel 10 miles? PAUSE Okay, when you've written it down, if you would write below it, how confident you are about your best guess, are you very confident, confident, somewhat confident, only a little confident or not confident at all. Fair enough. Okay everybody have a crack at it?

Female: Do we have to say this out loud?

(Much laughter)

Female: Okay, 27 minutes.

Male: I said two years.

Female: One week.

Male: I said two weeks.

Female: Two weeks.

R.M.: What did you say? You said two weeks. Les?

Male: Three or four weeks.

Male: I said two days - 48 hours.

Female: Eight and a half days.

Female: Twenty four hours.

R.M.: Okay. It turns out that underground water flows very slowly, so we're really talking -- it varies according to the nature of the rock and this and that -- but we're really talking 10 to 500 feet a year. 500 is pretty fast. 50 feet would be a good average guess. And 50 feet a year for 10 years ... a mere thousand years.

Male: ... gravel.

R.M.: Yes.

Male: So, therefore, if the water table was like close to the bottom of the tank ... for example, I live in Manchester ... we cut down 10 Blue Spruce near the house. We had no problems. All of a sudden we can hear that water coming through and we have a sump pump as a result of that. From December to the following September, nine months of the year, that thing is running every 15 minutes. If you are in the cellar, you can hear the water going under the cellar. O.K. It all depends I suppose and you don't realize the power of water because my mother had a house on a hill near Ridge Road, but yet with water it was just coming through - forced its way through the cellar ...

R.M.: ... pressure is really phenomenal.

Male: Generally speaking, but there's exceptions.

R.M.: But when the water is in the ground itself, each little molecule of water goes very slowly. David?

Male: No.

R.M.: I thought you had a comment.

Male: In the area like we had floods in '86 two years. The neighbors had an in-ground cement pool, 17 x 34 foot, and I guess a pound of water is eight pounds or something like that. The water pressure pushed up the bottom of the pool. That shows you.

R.M. What was happening was that the water table itself rose because of the rains; up it came and it has got tremendous power. So you're just real close to the top of the water table. How many of you sort of had the image of underground water as a river or a lake? Did any of you? Did you have an image at all?

Male: More of a slow stream.

Male: Trickle.

Female: A dribble. Little drops.

R.M. So no one was thinking of a river or a lake? Let me just tell you a little more about the seepage, how it happens. This is the top of the ground. [Drawing on blackboard.] This is our underground tank and then let's say here is the water table level. We're underground here. If the tank was to leak in the direction of the water here, the leakage takes place, it's like a plume. Okay. You know you drop stuff in a lake and out it goes, or in a river, it just spreads, but underground water because is so tightly compacted and that the contamination itself stays together, so you have this plume of contamination like this and then gradually it would spread more broadly. Then eventually if you had a well down here whenever it came that far, then if you tested the water in the well, if it got this far, then the contamination would show up. But it would only be in whatever direction it is. This plume travels very very slowly. That's sort of how underground contamination takes place. Any questions about anything on that sheet or about underground water or aquifers?

R.M.: Okay, why don't you pass your yellow sheet in. Now I want to talk a little bit about aquifers. In the Eastern part of the United States we have lots of water underground in these different aquifers. The government divides these into three types when it thinks about making regulations to protect groundwater. Type 1 aquifers; Type 2 aquifers and Type 3 aquifers. The Type 1 aquifers are aquifers that are irreplaceable. Basically they are aquifers that have been used for drinking water or in some very special cases ore aquifers that drain into important natural resources like say -- the everglades. So these are groundwaters that you can't replace; you can't get your drinking water elsewhere decently. Basically there's no question about protecting them. The government the last ten years has developed a great concern about groundwater protection and is committed to doing this. Okay, the Type 3 aquifers are aquifers that are so screwed up that they really are not useful. Usually they have a lot of salts in them - some of them because they're near the coast have salt water. In other cases the rocks are in are very deep underground; and groundwater leaches out minerals and salts from rocks. If you pumped this stuff up, you really wouldn't to drink it, but that's a small percentage of the aquifers. The No. 2 aquifers are aquifers that aren't irreplaceable but they are aquifers that we could use for drinking water if we wanted. You know we may not need them, but they are usable and it's this kind of aquifer I'd like to talk a little bit about tonight and then get your opinions about the kind of procedures we should use to protect them. But anyhow, the No. 1's are irreplaceable, No. 3's are unusable ones and the 2's are potential sources of drinking water. If we needed them we could use them.

I'd like to describe to you a hypothetical situation in which a town or community has to establish a waste dump of some kind. You know no matter how carefully we try not to use wastes, it's inevitable that we're going to have wastes and they have to be put

somewhere. So towns in America more and more are having problems with waste. Assume that this is a community waste facility. Most of the waste comes from garbage, some of it comes from chemicals we use to kill weeds, so some of it is nasty stuff and you really wouldn't want to start drinking it; but most of it is ordinary waste. The community needs to locate this new facility and it has three different kinds of locations - three different options - things that it could do. All three of them involve a Type 2 aquifer. This community gets its drinking water from other areas, so there's no question about messing around with an aquifer that it needs. The three options are (1) to establish a regular sanitary waste fill where basically they dig a hole and put the stuff in it and cover it up pretty quickly to keep the smell down and do it very carefully. The site is located in an area where it's zoned for business and it's away from people's houses, so the smells wouldn't be a factor. Let's say it would be located on an area that would be one quarter of a mile square. Here's our dump area [drawing on blackboard] and the dump is in the middle. In the case of the first option inevitably with the rain and everything, some of the waste material will dissolve in the water and leach out into the groundwater. It's very unlikely that the plume would get as far as the border of the site, but in order to make sure that there's no spread of the material outside of this quarter mile area, there would be test wells done - spaced around the facility. Let's say the groundwater is going in this direction and the wells would be here. If they found contamination, then it's possible to treat it by pumping it up and running it through a plant. In this way you can prevent it from going beyond the border. Here is the water table. So you would contaminate the aquifer but it would be limited only to this area. It wouldn't affect anybody's drinking water. There are plenty of other sources of drinking water for the future. So that's option No. 1.

Option 2 would be not to site the thing here but to go farther away from the community to a place where fewer people live and to a place where the geology is such that there is a natural barrier that would make it much more difficult for the material to seep into the aquifer. Then, of course, it would be treated to keep the smells down and everything like in Option 1. That would be the second option.

The third option would be to put it at this same place (as Option 2) but to use what's called maximum containment procedures. You would dig the whole thing out. Put a double layer of very heavy plastic liner down. Below the liner you put in a drainage system, so if anything gets through the liner the drainage system picks it up and all the water that comes from this drainage system is treated. So in other words, you're simply not going to get anything into the aquifer at all. O.K. The sheet I am going to pass out describes this. Read it over and then answer the question at the bottom. If you come up with questions you would like to ask about these scenarios as you read the sheet, write them down.

Handout used in group discussion

A. Consider a proposed community waste dump where some household and small business hazardous wastes will be disposed of although most of the material will be household garbage. The dump will be situated over a class 2 aquifer which is not used for drinking water by anyone. There are plenty of other sources of drinking water in the area for future population growth. There is an urgent need to establish the facility. Which of the following types of groundwater protection do you think the government should require the town to follow?

1. Choice of a site that is zoned for business use and is away from neighborhoods. The garbage should be buried quickly to avoid smells. Monitoring wells would be installed at the edge of the quarter mile dump area to detect any spead of contamination beyond the site boundary.

CONSEQUENCES: The aquifer immediately below the dump will be contaminated. If any further spread beyond the quarter mile area is threatened (this is thought to be unlikely) it will be monitored and prevented. No one's drinking water wells will be affected.

COST: No extra cost to the local taxpayers.

2. Choice of a site that is in an area of low population density where the aquifer is not close to the surface and is protected somewhat by underlying rock. Monitoring wells would be installed at the edge of the quarter mile dump area to detect any spead of contamination beyond the site boundary.

CONSEQUENCES: Much less chance that the aquifer underneath the dump will be contaminated. Very little chance that preventative measures would need to be taken to prevent any contamination from spreading beyond the quarter mile dump area.

COST: Large extra cost.

3. A site as described in 2, plus extensive preparation measures including removing all the earth and placing multiple sheets of thick plastic at the bottom of the hole. Below the plastic will be a drain and any seepage through the plastic will be captured and treated. Monitoring wells would be installed at the edge of the quarter mile dump area to detect any spead of contamination beyond the site boundary.

CONSEQUENCES: Extremely low chance that any part of the aquifer will be contaminated.

COST: Very large extra cost.

Government should require: _____

B. What if there was a town referendum where everyone could vote for the type of garbage dump they preferred. People have different ideas about whether approaches 2 or 3 are worth any extra money. What is the most <u>you</u> personally would be willing to pay in special trash fees above your current fee if they were required to cover the cost of approach 3? This money would effectively prevent the aquifer immediately below the quarter mile square dump from being contaminated.

$_____ per month.

C. What is the most you would be willing to pay in special trash fees if they were required to cover the cost of approach 2? In this case the money would significantly reduce the probability that the aquifer immediately below the quarter mile square dump area would be contaminated.

$_____ per month.

Things that concern you, things you aren't clear about. Any questions that you have we can deal with them later. O.K. So write those on the white pads.

Male: But you still want us to make a choice. [Asked for on the sheet that was passed out to the participants.]

R.M.: Absolutely, yes. I want you to go ahead and make the choice, but I also want to get your questions.

(Long pause.)

R.M.: Whatever you think should be done. Not what you think I think should be done or what you think other people think should be done.

(END OF SIDE 1)

R.M.: Okay. Shirley, what did you choose? What do you think the Government should require?

Female: Well, I think there are a lot of factors that are not answered in that before you could definitely say which one should be required. For the answer I put definitely No. 2, but if there were more qualifications listed then I might choose another one. Who is going to bear the responsibility for the cost? Will it be the government itself or will it be the town? You don't say anything about the overall outlook in the state, the population, what kind of a state it is, whether it is strictly a farming community, whether they have a lot of industry.

R.M.: Why would that make a difference? Well, the answer to your question would be the local community would pay.

Female: Would bear the entire cost?

R.M.: Yes. Right.

Female: Well, you know I think then you'd have a great deal of difficulty even in the state of Connecticut, you know, telling a country way down in the western part of the state that has enough trouble paying just their own teacher's salaries and things like that, that all of a sudden they're going to have to put in this big system when they can't really afford and probably there's not even enough need for it because there's no industry. It's a very rural community.

R.M.: So the idea is if there's industry there, there's more pressure.

Female: I would believe so. And what about maintenance? If something goes wrong, even though the government says you must put

in this type of system, you must maintain it and we won't help you at all.

R.M.: Right. It's the town's garbage.

Female: And will that ... all of their garbage or will they be required to recycle some of it, for instance, to separate the paper from the glass or this from the plastic?

R.M.: Right. That I guess would sort of be up to the town, how they'd want to do it, but even if they recycle they still need a place to put the ...

R.M. Linda, how about you?

Female: I chose No. 1.

R.M.: How come?

Female: Well, I guess I was thinking about the taxpayers' money and I felt the government could probably fund it and they would be responsible for the garbage and everything, whether it would create more jobs or whatever but I was really thinking about the money of the taxpayers.

R.M.: Donald?

Male: I looked at it just on the basis of the data you had given on the sheet and compared the variables within the three situations that you had given. If what you say is true, there are plenty of aquifers in the area for future drinking water and the risk of seepage is low, then it appeared to me that what you are basically choosing - the basis upon which you're choosing is what you want to pay, either not see it or smell it, or secondly, to feel safe. Namely, they're telling you there's this plastic pit going in and it's supposed to make you safe and so you're saying then I feel safe. So are you going to foot the bill to feel safe? Because you basically still have a low risk on all three of those, so I tried to look at it just from an analytical standpoint. I said No. 2 just for the sake of getting it out of sight. You know, get it further out of sight basically. That's strictly on that basis. I am sure there's an extra cost but if it's a choice of saying "Okay, do we want to put it further out of sight for the extra cost?" as the town would grow and everything like that. That way you wouldn't be faced with it later on.

R.M.: So you sort of found yourself in the middle when you did your analysis?

Female: Choice No. 1. I wanted to know who would do the monitoring? Are we trusting someone to monitor this?

R.M.: Okay, that would be important to you?

Female: Yes, a lot.

R.M.: Who would you like to do the monitoring?

Female: I really don't know. I'd have to have advice on who was qualified and have someone prove to me that people were monitoring my drinking water were skilled in the field.

R.M. Alright, what could you be told that would make you feel good about it?

Female: Some meeting, I suppose. Some engineers getting up and discussing ... the why and how it would be done and how frequently it would be done.

R.M.: Alright, would this be .. engineers, state engineers?

Female: I would think it would have to be a group of people from our town who hired ... they evaluated the situation and ...

R.M.: You'd want to make sure they were experts?

Female: Exactly. Who is monitoring what. That is one question on choice No. 1. On choice No. 3, will there be a further expense in the future to replace this plastic?

R.M.: No, once it's down, it's down. It is a permanent kind of thing. That's why you have that system under it, because there can always be something that can get through. That would keep most of it from getting through. The system under it would collect the water and it would be treated to make sure, but that kind of double barrier system - after you put one layer of plastic down, you put ... over that.

Female: Okay, I voted for No. 2. I guess basically the fact that I am making use of natural rock, underlying rock there, and also I don't mind ... if it's going to make my drinking water more clean and I like the idea that the area was low population.

R.M.: How would it make your drinking water more clean?

Female: What, the large extra cost? Only based on the fact that I thought because it had natural underlying rock it might be a better - I don't know.

R.M.: Okay, cause in truth your drinking water wouldn't come from this area at all. It would be way away somewhere else, so this wouldn't affect your drinking water at all. But it would affect the water under the ground right there, but it would be restricted only to this area for No. 1. And then with No. 2 and 3

there'd be an even less likelihood that anything, even this part of the aquifer [pointing to drawing on blackboard], would be affected. Let's say if your well is 10 miles away, it would take 1,000 years for the water there to be affected, but there would be these monitoring wells to make sure ...

Female: It was basically also the fact that it was in an area of lower population.

R.M.: Which is even further encouragement. Shirley?

Female: I chose No. 2. I basically chose it for the reasons that she did. Because of the low population and everything. I don't know, I just have a tendency to think that with the rocks being there ... push things out further than relying on the plastic. It depends upon what's being contaminated inside that can burn through the plastic eventually.

R.M.: So you're worried that the plastic might not do what it is supposed to do. Just out of curiosity, how many people have a concern about the plastic?

Female: I don't have enough knowledge to know about it.

R.M.: Raise your hands. How many people are skeptical? Five basically. How many of you five choose No. 2? So you all, no, you choose No. 3, but you are worried about the plastic, but the rest of you chose No. 2. And Shirley, did you feel it would protect your drinking water?

Female: No, I didn't even think of it.

R.M.: So even though it wouldn't protect your drinking water, you still think it's worth the money for No. 2. Why is that?

Female: Population ... a low population, but it's just like it's not basically in a general area where more, the low population area would give it more expanded space.

R.M.: Pamela?

Female: When you're picking something like No. 2 ... know much about taxes and all that, but you're just thinking of the present and not thinking of the future at all, because right now there's low density population but what about future generations to come? No. 3 is idealistic. I put it down. I know it's not realistic at this point, but if anything cost-wise No. 1 sounds ... safer than No. 2 as far as the environment goes. At least you can monitor it.

R.M.: No. 1?

Female: Yes, don't you think. Well you're going on nature on No. 2. Right.

R.M. But you'd have the wells around No. 2 also.

Female: Okay, monitoring wells and then you're going to have pumping out and filtering of the water also if it happens to leak through.

R.M.: If it got to the edge of the site. Yes.

Female: What about when population is out there? When it becomes heavily populated.

R.M.: Well, there wouldn't be population allowed to build on that site.

Female: [Can't understand].

R.M.: Jim?

Male: Yeah, I was just wondering ... build a general purpose dump. Is it possible to canvass the population which would be the source of the pollutants and contaminants to determine the type of things that are available for disposal. [Coughing] ... chemical engineer or whatever, you know, established no how, I guess they could determine which items should be limited or prohibited from being dumped on that site. Then encourage specific side collection of those items for disposal in a separate dump as opposed to like glass bottles, papers and so forth. Well do the same thing for some of these things that have severe consequences; collect them separately for disposal in an appropriate site instead of having A, B, C here, you could have like No. 1 would be appropriate for neighborhood type garbage and then Pratt Whitney, United Technologies, etc. that stuff would be collected separately ... cause recently we've had United Technologies, Pratt Whitney, and East Hartford ... Corp. do alleged dumping of contaminants, chemicals and they were aware of it. They knew what was going on. They are top knowledge people and you know they ... side effects later. That's my concern.

R.M.: Okay, I can understand. That might possibly be an alternative, but of course, the toxins have to be put somewhere but basically I'd like you to think about this particular example and to choose among these options.

Male: Yeah, I am thinking like No. 2.

R.M.: Given that, you would choose No. 2.

Male: Yeah. It seems the rock is more permanent as opposed to the plastic.

R.M.: I see, so you would prefer the best possible protection, but you don't think the plastic would be better than the rock.

Male: [Can't understand].

R.M.: That's okay. It's very helpful to me to know what --

Male: ... proposed ... at this time, but in the long term effects. We've had a generation of ... steel pipes. Now we have plastic ... and the side effects ... generation again. Is it working or not.

R.M.: Donald?

Male: I was just thinking about your initial comment about how fast that waste would move in the water table. You said between 100 and 500 feet per year. Is that correct? But you lived on the edge of that quarter mile --

R.M.: I said between 10 and 500 feet.

Male: Okay, I took it at about 100. Say if you took around 100, if you lived on the edge of that quarter mile tract of land and were drinking out of those wells which would be highly unlikely, it would still take about what, 13 years, for it ever?

R.M.: Well, let's see, at 50 feet, a quarter mile is 220 yards, 600 - 700 feet, divided by 50 would be about 15 years.

Male: Yeah, but given constants, like ... know for a fact, 20 years ago ... houses there were built on shale. Now they were about 20 years ago putting sewers in. After they put the sewers in, they had to blast or dynamite or whatever they do and subsequent to that time, the houses which had been dry for since they were built were getting water problems, so you know with all the construction in New England too, highways and so forth, they are fracturing the shale. Okay now, given that this method would be sufficient at this time, however, if they came through with a shopping mall or highway or what have you, then that would detour the water table somehow, perhaps, and then it might not be as successful in the long term.

R.M.: So you just think it would be safer not to make things vulnerable to being affected by future developments, so by spending more money it would be better to keep that from happening?

Male: ... spending money isn't always the best method. Do whatever is appropriate and it could be maybe spending lesser money because, like I say, perhaps if you canvass the population to determine what we have available to be dumped then, okay, if we are talking about like a rural community with houses and so forth,

their garbage would be different than like say in this area where we have chemical companies or whatever. ... river, paper mills, the rivers were green from the chemicals they were dumping ...

R.M.: How about you, David?

Female: I choose No. 3 ... [Can't hear].

R.M.: But why would you want the extra protection, if we're only talking about this very small area?

Female: ... future population ...

R.M.: Even though there would be monitoring wells and --

Female: Yes, I feel that would be safer.

R.M.: Okay.

Male: I chose No. 2. I think probably because cost is the factor that concerns me. Just as previous generations have ignored the problem that they did not consider to be a problem and today we are in a situation where we have to face up to a situation where at any cost we have to do something to protect future generations from a problem that could be very serious. The water that we take for granted could very well disappear and I realize that this here will not affect the drinking water but the environment also is a factor. I can say 100 years from now, who cares, I am not going to be around. ... my children, but I think it's something we have to consider down the road. If we just keep ignoring these things as we know it life will be a ...

R.M.: Let me pass out another sheet of paper. Les mentioned the issue of cost. What I'd like you to do is accept the premise that I have sort of laid down here. Bill has suggested some alternatives. [Papers rattling - can't hear]. Put your number at the top. Did everybody get a copy of this one? Basically, what I'd like to know is which of these alternatives you would be willing, if it came to your town, but what I'd like to know is whether either of these alternatives, the second or third ones, are worth something to you or not. They may not be. They may be worth something.

Male: Would this be an amount that would be an assessment on a monthly basis ... our taxes?

R.M.: That's correct. What I'd like to know is the most extra that you would be willing to pay. Don't think about other people and what they can afford, but just in terms of yourself, what's the most extra you would be willing to pay, if anything. It may be zero dollars, fine, for the first one asks about the most stringent one, the plastic and so forth; and C asks about No. 2

which would be moving it out to a less populated area. What's the most each one of you think you would be willing to pay, if anything, for these programs as compared with No. 1. In every case, only this area [pointing to blackboard] would be affected. Okay? So it's a quarter mile area. In every case there would be wells around it that would be monitored. It wouldn't affect anyone's drinking water and the area would have plenty of other sources of drinking water.

R.M.: Okay, was that a hard question?

Male: It is.

Female: Yes, because we don't know. To begin with how can I tell how much would be worth it to me to pay per month. I don't know the initial cost of the project to begin with and how many people there are ...

Female: ... divided into the cost.

Male: Why would you need to know that?

Female: I need to know that on every purchase I make. You know those kinds of things.

R.M.: Sure, but in this case it's like, you know, if you had a referendum in the town, what I'd like to know is when you would vote against it. When the cost to you is so high then you'd say, well gee I'd like this, it's just too expensive. Sometimes school districts put up a real expensive bond issue and you think, well, gosh I want better schools, but I can't afford it. What I want to know if how much it's worth to you - not how much you'd guess that it would actually cost. The money would only be used for this purpose and then if what you wanted to pay is more than the cost, of course, you wouldn't have to pay that extra amount. Does that help?

Female: Well, I came up $25.00 extra per month because I just assumed that the service was for the good of the town and seemed reasonable.

R.M.: So if it cost $30.00? This is for which?

Female: Yeah, the second one.

R.M.: And if cost $30.00 that would be too much?

Female: You said maximum? To tell you the truth I could go another. I should have gone $30.00. You could say to me $35.00. That might be starting to get a little high. I'll stay with $25.00.

R.M.: Linda, how about you?

Female: I wouldn't be willing to pay anything because I feel that the government should fund it. I mean they can create jobs and they can have people looking after it, especially if it's not going to directly affect the drinking water around me or the population, I feel the government should take care of it, so I wouldn't be willing to give a penny for either one.

R.M.: So if the government wants to require it, the government should pay for it?

Female: They got the money.

R.M.: Okay, Les.

Male: Let's not get government involved in this situation, except ... I put down $15.00 for each one ... certainly would be willing to pay probably a little bit more to safeguard that.

R.M.: Okay, so when you push for a maximum and I said what about $20.00?

Male: Yeah, I would say $20.00.

R.M.: $25.00?

Male: You might as well say $20.00. You might as well say $50.00. I don't think -- No, $20.00 - $25.00, maximum. If it can't be done with that, then we have a serious problem.

R.M.: I think what Linda was saying was when she thinks about it, you know what you get for this really isn't worth anything considering all the things you have to spend money for, just to worry about this little bit of ground water. It's not worth that much to you, fair enough? Okay. Then for you it would be at least $25.00.

R.M.: Betty, how did you come out?

Female: I don't know. $3.00 would be. (Laughter).

R.M.: $2.00?

Female: Yeah.

R.M.: It's worth that much to you. $3.00 would be --

Female: I just want to give something.

R.M.: Well, what are you getting for your money? What is it that you like about the program?

Female: ... not cheap.

R.M. Okay. In truth, as far as I am concerned ... from zero to "X", but what I am trying to get is a way of finding out what people are willing to pay that I can use as a survey. That's why I am getting you to think about it, because I want to figure out a way that I can put this idea before people that they'll feel comfortable saying it's not worth anything or it's real important to me, I'd be willing to pay this much if I could get this.

Female: It's not that important ...

R.M.: Right, for you. Okay, but for Les --

Male: It is important, yes. Yes, it is important, but for a different reason. Her reason may be very valid. I just feel very strong about the whole situation. We've ignored it and I think something has to be done, and I am not being an idealist and say well I am going to do it or I'm going to start --

R.M.: And so even protecting this little bit of ground water --

Male: Sure. It may not even be near me. Maybe 10 - 15 miles away.

R.M.: Even though nobody would use it for drinking water.

Male: It's still important enough.

R.M.: Donald?

Male: I said zero, based upon the information that you gave. You know, basically we are trusting the judgment of what you're saying that this is true and that's basically what you have to go on. You know, you're the ones doing the monitoring, you're the ones that set it up, you're the ones that say this, you give the data. What do you want to pay to say, well, I feel more safe now. And I say, if what you're saying is true I don't need to pay any extra money to feel safe. That's basically it. So I don't want to pay anything for it.

R.M.: Pamela?

Female: I said $8.00 and $4.00 the second time. I'd be willing to give a little bit more to make it more environmentally sound, but I also based it on what I could afford too. I mean, everybody wishes they were a millionaire or fund the whole project or a billionaire.

R.M.: But unlike Donald to you it's worth something.

Female: Yes, it is in the long run. I mean, not to me but to generations on down the road. It might not be my children. It might be, you know, somewhere along the line.

R.M.: Betty, you're nodding your head.

Female: Yeah, generations down the road. I feel pretty strongly about that.

R.M.: So contaminating even this small area would have an effect. David, how did you come out?

Male: $5.00. Everybody puts down $25.00 or $30.00 a month. I think it's ridiculous.

R.M.: Well, that's their own figures. For you, it's $5.00.

Male: That's a lot of money. $5.00.

R.M.: Of course, that's $60.00 a year.

Male: If there were thousands of people doing that, it would be a lot of money.

R.M.: But remember what I want is the most you would be willing to pay quite apart from other people.

Male: I wish I could pay for the whole thing, but --

R.M.: Right. I understand. Now why are you willing to pay $5.00 and not zero.

Male: Because it's involving people. It would be my children and everything. We should contribute something.

R.M.: But even though it would just be this small area that we really wouldn't need. We wouldn't need the water from that area in the future. I mean there's plenty of other sources there.

Male: I still would ...

R.M.: Why?

Male: I don't really know.

R.M.: Okay.

Female: How do you know we won't need it. I mean we won't need it, or other people won't need it?

Male: It is going to be used some day.

Female: The world is only so big and it's just getting trashed ... How are you ...

R.M.: Well, because in this area there is an enormous --

Male: Amount of water.

R.M.: Yeah, it's really -- very, very large.

Female: For now.

R.M.: Yes, that's true. And the groundwater contamination goes so slowly that if it is monitored, you have some assurance ... of a surprise that this stuff is going to shoot out a mile a minute, because you'd catch it, so you'd know.

Female: Would you catch all of it?

R.M.: Yeah, because the plume is a very narrow thing, so if you have the wells located in right area the geologists ...

Male: Is this fact?

R.M.: Yeah, they do it all the time now.

Female: If it's fact, then why go into No. 3 at all. I mean why have such safeguards if you're so sure about No. 2?

R.M.: Well, I'd be pretty sure about No. 1. But you know that's me. Right. I am interested in what other people ... (laughter) so that's my question. Why would you want No. 2 if you could have the monitoring and it would only be that area? And I think some people have said, well, look, even though it's just this little area, future generations, they would feel better if they didn't screw up that area.

Male: Is that wrong?

R.M.: No, no, no.

Male: 'Cause you're looking for something for us to say.

R.M.: What I want, if that's the way you feel, that's terrific, but I just want to know why people want No. 2 and 3 and make sure that it's not because they're rejecting the premises I have put forth. Because, you know, if people said gee this is really -- you may say that, but in a month it's going to ... (laughter) ... go 10 miles, I need to know that because then the value comes from something else. On the other hand, if you just feel better and you'd be willing to pay for it, that's terrific, so that's what I am going after.

Male: Because water is a diminishing resource, like we're taking it for granted now, when we talk about pollution or something, so I think we should even protect our secondary sources that are supposedly unobtainable right now, but they should be reserves, like before when we had the petroleum crises and then they were starting to delve into taking the oil from shale. It's almost the same principle.

R.M.: So you would worry about the future in terms of the availability of water and that we may need this water, so we shouldn't screw it up.

Male: Our water supply is really vulnerable. If you look at our resources, like you say, ... or whatever, all the highways go by and you've got the burn-off in the soils from the chemicals in the winter or you talk about terrorists. I mean it would be so easy for a terrorist to plant a bomb in Grand Central Station with some type of chemicals that they must know of to contaminate our water resources (?) ... a lot of major corporations are somewhat irresponsible and do stuff on the "Q.T." that you don't know about, or like if you lived in Loveland. Remember in New York they had that area: Love Canal area. Supposedly there was no problem and then all of a sudden by the time it happened the people couldn't sell their houses ... the relevancy is that if you're living there well if the government buys them out, as they did in the end, you can say money is no object but if your kids have cancer ... whatever the source is you need to alleviate it ...

R.M.: So when you think of that things always seem to be a little worse?

Male: Things are worse. Yeah.

R.M.: So you'd like to -

Male: Prepare for it. Be conscious.

R.M.: Okay. That would be worth the money to you?

Male: Yeah. There are experts but there were areas they didn't contemplate, like you have buildings falling down here or whatever, bridges and so forth and so on, whether it is computerized or whoever is determining it, there is always flaw they didn't comprehend at the time. Like I say, water is a diminishing resource or it's subject to a certain area where the extra buck at the time ... trying to save a dollar ...

R.M.: I understand. Let me explain why I'm doing this so that I'd appreciate any further comments you have. Basically, we're doing this for the U.S. Environmental Protection Agency. The U.S. E.P.A. is involved with national groundwater policy, and the issue is what do we do with these No. 2 aquifers. It's very

expensive if the E.P.A. sets up regulations and requires everybody to put the maximum protection. The question is, is it worth it? If in certain areas we've got a lot of groundwater, and we don't need this particular source and we know that we're not going to need it, should we have the maximum protection there as well as the places where we know we need it. So they're interested in seeing if there's some way of measuring what people are willing to pay to preserve aquifers that simply aren't going to be needed; that's the question. It's not an easy question and from our discussion here, it would appear that for some of you it really is worth money to you, but for others it's not, which is fine. Personally, I have no stake in whatever it's worth to people, my only stake is in finding out ways of making sure that people really understand the issues. And if they understand the issues, then what they are willing to pay is fine. The only way the E.P.A. can get at this at all is to do a study where they give people a chance to give their opinions, so I have the job of ultimately trying to write a questionnaire that would give people a chance to say what it is worth to them. The value people place on it would be used in a benefit cost analysis. A benefit cost analysis is where you measure the cost of a new program and then you weigh that against the benefits. The government can't do everything, so we need to figure out when the benefits are more than the cost. Of course, always protecting Class 1 aquifers. Those are high priorities. There is no question about protecting people's drinking water, just how much protection we want to have for the other water resources.

Female: I don't know how you can say though that we won't need the water there. I don't quite understand that. Is that based on some kind of study that you've done?

R.M.: Well, it's based on the fact that the ground water resources around here are so mammoth and the contamination would be so local in this case, especially if you monitor it.

Female: Even more densely populated areas?

R.M.: Sure, in fact, a lot of areas get their drinking water from surface water and if things get desperate you can treat the water; pump it up and treat it, so there are a lot of options ... but it is because the contamination is so defined and moves so slowly that makes it a very local problem. It's not spread all over.

Male: But the government is thinking in terms of what will be in the future. This is something that must have been proposed and thought about many years before anything could be done. But there is thought about future generations; they must be concerned about them for you to do this marketing research program.

R.M.: No, if there was any thought that this water would be needed within 100's of years, then, of course, you'd want to

protect it. So the idea is that you really wouldn't need it as far as we know. We're pretty certain we won't need it. Of course, nothing is totally certain. But for some of you, that uncertainty, because there's no way we can absolutely guarantee it, reducing that uncertainty is important to you, I think, and so given all the screw ups and things that happen, unforseen things, you'd be willing to pay to protect the groundwater if there was an extremely small chance it would be needed in the future?

Female: Yes.

Male: How would they be assessed? Would everybody be assessed the same ...

R.M.: Well, actually you wouldn't assess people. Somehow people would have to pay but it would trickle down in taxes.

Male: Industry would pay ... proportionately more.

R.M.: That's true. Okay, let me pass out a last little questionnaire that asks for some background information about yourselves. Why don't you fill it out and fold it over and pass it in with all the other material. I'd be glad to answer any other questions you have about what I am up to. Thank you very much.

Resources for the Future

Existence Value Study

Princeton, NJ Focus Group, May 17, 1988

Leader: Robert C. Mitchell

R.M. I'd like to say that my name is Robert Mitchell and I'm a professor at Clark University in Worcester, Massachusetts. Has anybody been in a focus group before? No one? Ok, that's good. Basically what I want is to ask you some questions, to hear you discuss things, so I can understand your ideas and how you talk about the things we're gonna talk about. The things that we are discussing there are absolutely no right or wrong answers. Please give your best guess and don't feel shy about having a wrong answer. At the end of the discussion I'll be glad to answer any of your questions about the study.

Let me begin by asking each of you to say where in the area you come from. June?

Female: Summervale, about five miles maybe.

R.M. Which way?

Female: That way, I mean it's north.

R.M. Shirley?

Female: I'm from Rocky Hills. I live about two blocks away.

Male: Trenton, New Jersey.

Female: South Brunswick, five miles from here.

Female: East Windsor.

Male: Lawrenceville.

Female: Princeton.

Male: Trenton.

R.M. I'd like to begin by finding out what situation or problems in your local area concern you the most at the present time. If you could just jot down one or two that come to your mind, a local situation or problem that's going on in your towns.

PAUSE

R.M. Ok, now what have you come up with?

Female: Well, our area, it's the building and it seems as if there's little regard for the problems with this constant building. We were in a little area that was just relatively country and now there's town houses, condo's, new house development everywhere. The traffic is horrendous, we have three new shopping malls right in that area and it's becoming a situation that's creating other problems, like schools, and the traffic is amazing. Before you could drive from my place to Quaker Bridge in 15 minutes, but now it takes you about 30 or 40 minutes to go from ..... to Route 1, and it's become very dangerous. Every time I go out it seems I see an accident, or some tempers are very bad for people in trucks. This is just a few of the little problems, but I think it mainly started with no check on the constant building. They discovered all this farm land all of a sudden, and how pretty it is.

R.M. Steven, how about you?

Male: Mine is aimed mostly at the youth, increase in drug use, main drug called Crack, Cocaine and most of the kids take that stuff from anybody. They can't function and decrease in educational standards at the schools. I go back and visit my school and there seems to be no control over the kids, like the kids are running the school, and the teachers are scared to teach or whatever. And, a lack of extra-curricular activities for youths after they come out of school. A lot of them hanging on corners. When I was in Jr. High and High School, after we came from school there were basketball, YMCA, things like that to go to. There's no more.

R.M. Ok. Shirley, how about you?

Female: Essentially the same thing. Traffic concerns, any direction you go you're in a lot of traffic, and I work on the other side of Princeton so I go through a lot of it. And, one thing that makes traffic congested is in Princeton, or getting into Princeton is the bridge that has been out for years. And I am concerned about substance abuse by the young people. And then, locally, not just in Rocky Hills, in Princeton no place for teenagers to go for social things to do. You know, there's no recreation center of any kind. That's a concern.

R.M. June?

Female: Well, I'm a commuter into New York and my major concern is transfers, the 206 becomes a bottleneck where the community access to major highways just ..... unless you want to go through the towns. And again, construction seems endless, constantly building and no consideration at all.

R.M. Mary?

Female: I agree with the traffic. I remember when we first moved to Eastland (?) that I remember we didn't have a McDonald's. And now, like you say, it used to take me exactly 20 minutes to get from home to Princeton, now that I work in Princeton, I have to leave an extra 10 or 15 minutes because of traffic.

R.M. (Man's name)?

Male: Well, I had noted the lack of planning for land use and the constant elimination of the open land and farms and the general deterioration of the environment, pollution. Some of the nearby communities, their wells are becoming poisoned by various types of chemical runoffs from factories, garages, heaven knows what. Cancer producing agents are being found in the water and it just seems to that there's a lack of responsibility on the part of the politicians. I don't know what the local government guys can do, but I think sometimes it comes, it stems from the lack of direction from the state itself. The governor prides himself on how great New Jersey is and the tremendous amount of employment in New Jersey, but living conditions don't seem to be so hot. I mean, you can just go on and on. The density of the population in general, as everybody's referred to here, precipitates a lot of these problems. And, the growing taxes are a concern, real estate taxes are becoming abominable for many people. Cost of housing is out of sight.

Female: Can I add a couple of things to what he was talking about? About the pollution?

R.M. Ok.

Female: A man in our area, a few years back made a short film that was up for an academy award nomination on water. His name was William Kaeler. And, even with that publicity it doesn't seem like there's been anything done or seems that anyone really cares. We've had illegal dumping of toxic waste in the farm lands in our area, they've even dug up the barrels but there doesn't to be anything that anybody's doing about it.

R.M. What kind of water was the film about?

Female: Contaminated water.

R.M. Rivers and streams?

Female: Well water was his concern, because he was, you know that was his main concern. The film was well done, it didn't win.

Male: The problem with the water pollution now isn't just your rivers and your streams, it's your aquifers in general that supply the water that people drink, and that's become a very serious problem.

R.M. Susan?

Female: I count all the above, the parking, the traffic, the bridge, because anybody that lives near here knows it. Having come through Route 206, many years ago, and living out in this area and finding, going from a hick town, there was nobody out here, and now in addition to which I'm concerned in our area about affordable housing, there's a lot of talk about it, not so much action about it. The prices most people pay are unreal, and I think that's wrong. And, the other thing kind of goes along with pollution, kind of like that, it's the sanitation, litter. It's not, we don't keep things clean enough. Those things really bother me, I walk a lot all over and I see stuff flying all over, it's people who just don't care.

R.M. Carl?

Male: Crime, drugs, disregard of law and decay of the cities, where the cities, they just let them go ....., the state moves in - tears them down, developers come in - tear them down, put up big office buildings. The state moves in, nobody can park, it takes 3 days to park, they forget about parking, they just leave apartments - everything's apartments.

R.M. We're talking about Trenton?

Male: Right. I'm sure Princeton doesn't have that problem you know with the big buildings, but I know they have a .....

R.M. Several of you mentioned drinking water and water contamination. How would the others of you rate the environmental quality of your area? Is it generally pretty good?

Female: I don't drink water, for that reason. It's got a taste to it, I just buy water, soda - the taste is, I don't like it.

R.M. I see. How many of you don't like the taste of the water where you're living? Ok, you, Carl, Susan; anybody else?

Male: I like it but I worry about it.

R.M. Ok. That's a different question, of course a lot of people don't like the taste, and don't worry. How many of you worry about the quality of your drinking water?

Female: I don't like the ocean anymore either, forget it.

R.M. Let me just mention for the tape that everybody raised their hand and said that they were concerned about the quality of their drinking water.

Male: The best water I ever tasted, honestly, around this area was Atlantic City.

R.M. You sound surprised.

Male: No. It's just the best water I ever tasted. Tasted the purest, didn't seem like there was any salt or anything.

R.M. Let me ask how many of you don't drink water out of the tap, but consistently, not occasionally, but consistently buy water to drink from. One, two, two & a half.

Where does your drinking water come from? Do you know?

Female: Good question, I have no idea.

Male: We get it from wells. So the aquifer that they draw from is polluted, that's what you're getting.

R.M. Shirley, what about your water?

Female: Rocky Hills has its own water well, just right up here.

R.M. So I see, it's groundwater.

R.M. Steven.

Male: We have a big reservoir, it comes from the Delaware.

Male: It comes from the Delaware, heavily dosed with chlorine.

Female: We have wells and two of them have been closed in the past.

R.M. Why were they closed?

Female: They've been contaminated.

R.M. I see. So where does your water come from now?

Female: Well, I guess it comes from the others, there were five of them.

R.M. Oh I see, ok so three left. Judy?

Female: I don't know.

R.M. Clarence?

Male: I have my own well at home.

R.M. You do.

Male: Yeah, a lot of people do. We don't want piped in water, we have our own artesian well.

R.M. How deep is it, do you know?

Male: I guess about a hundred feet.

R.M. Susan?

Female: Until ten years ago I always lived where there were wells on the property, both on the other side of Route 1 and out this way, and the water was always delicious. No problem. But Princeton, as Elizabethtown, ... brown, it looks like it's got mud in it, and it probably has. But, we've found recently that the testing of well water, well we had bought a piece of property which contained wells which are contaminated and the tests for those wells showed less contamination than the acceptable level that Elizabethtown gives you all the time, and people were concerned. But we closed those wells.

R.M. Yes. Carl, do you happen to know where your water comes from?

Male: Delta River.

R.M. How many of you have heard the word "groundwater"? One, two, three, four, five - five have heard, three haven't.

Female: Isn't that water that's collected from rain in reservoirs? I'm not sure what it is.

R.M. Groundwater is underground water that you would tap if you put a well down, and of course originally comes from rain, but the rain goes through the ground and gradually spreads underground. How many of you, besides you, have heard of the word aquifer? One, two, three, plus Clarence, four. Shirley, what do you think of when you think of an aquifer?

Female: A natural reservoir.

R.M. Technically speaking aquifers are underground formations of sand, gravel or rock that contain enough water that you can tap the water for a well. If you can put a well down, but didn't get enough flow to have the use of a well, you wouldn't have an aquifer. But in other areas the sand and the rock holds enough water that you can put a well down and the water seeps into the well and you can take that water out. This water fills the spaces between the sand, the gravel, and the rocks. Ok, I'd like to pass out this picture that shows a number of things about aquifers. If you'd just look at the picture and ignore the text and so forth,

that would be a help. (Passed out pictures in EPA Groundwater brochure.)

PAUSE

Male: It's a very good one.

R.M. Look at the red tank underground in the middle of the picture. Let's pretend that it is an oil storage tank, an underground storage tank. I'd like you to write an answer on your sheet, actually two answers. What is your best guess as to how long it would take oil leaking from that tank to go underground across to the end of the picture for a distance of one mile? What's your best guess about how long it would take the oil seeping out to go underground for a mile, so if you put a well down you'd get a contamination in the well?

Female: We don't know how fast it is leaking or how much?

R.M. How fast? Not just a trace, it's pouring out. How long would it take to go a mile? The second question is, how long would it take to go five miles? Write that one under the first one. Five miles would be way off this picture, way down the road. Then the last thing I want you to write on the sheet, after you write your guesses down, is to tell me, and I know this isn't fair, but, to tell me how confident you feel about your guesses. Here's the scale; are you very confident, somewhat confident, only a little confident, or not confident at all. How's that? Are you very confident, confident, somewhat confident, only a little confident, or not confident at all. You aren't confident about how confident you are? (Laughter) Ok, everybody got their best guess down? Carl, how long for mile?

Male: Six to seven hours.

R.M. Sixty-seven?

Male: Six to seven.

R.M. Six to seven. Ok, Susan?

Female: I hate to say this, I thought it'd take a couple of years for it to affect an area a mile away.

R.M. A mile away, ok.

Female: I guess I'm not thinking of a profuse leak.

Male: My guess is one mile, one year.

Female: That's mine, one year.

R.M. Steven?

Male: I put two months.

Female: I have a year and a half.

R.M. A year and a half, ok. And, then Steven, how long for five?

Male: I put twelve months.

R.M. Shirley?

Female: 30 months.

R.M. June?

Female: I don't want to say, eight years.

R.M. How many, eight years?

Female: Eight years.

Female: Ten years.

Male: Three years.

Female: Ten.

R.M. Carl?

Male: Twelve to fourteen hours.

Female: Do we ever get to know how wrong we were?

R.M. Well, we're going to talk about it right now. Groundwater basically moves very, very slowly, because the sand or the gravel is pretty tightly packed in the rocks, it just gradually seeps through these materials. And, of course, the rate of flow can vary, depends on the pressure and the type of material, but, a lot of the flow would be between 10 and 500 feet a year. 500 would be the upper limit, it would be very unusual, so 50 feet per year would be a fairly rapid rate, the groundwater can go slower. So at 50 feet it would take a 105 years to go a mile.

(Chatter)

Female: Does that mean I got the highest rate?

Female: Well, I think actually I was. Not two years, but ten years. But I should be ashamed to be that far off because I'm working right now on an underground storage tank.

R.M. So now you're learning.

Female: Yeah, right. And, I know it's slow, but .... that slow?

R.M. For five miles it would take about 500 years.

Group: WOW!

R.M. I'm going to mention three images you might have had in your mind about groundwater. One is that it is like a sponge. Another is that it's like a river, underground river. Another is that it is like an underground lake. Did any of you have any of those images when you were trying to think about it in your minds?

Female: Well, not a picture actually, but more or less, ... going down this way, kind of a pressure or whatever just pushed it down..... more of a conducive kind of material that actually pushed the stuff down faster.

R.M. But not a river?

Female: Not a river.

R.M. No? But just what image did you have?

Female: I don't know. Aquifer sounds ..... and the water was one of the things you really have to worry about and I can remember as a child, because we always had wells, and they would hunt places, you know, the old kind with a stick finding the water, but it wasn't everywhere. You know, difficult to find in some areas, so I didn't have any picture of any lake, I guess like pockets of water, is what I had the image of. Probably wrong, but..

R.M. Clarence, did you get an image at all?

Male: Kind of a spongy area, you know, more or less rather than a river. But, rather saturated, my vision was very saturated, porous area, sand or rock.

R.M. So it would spread pretty quickly.

Male: Yeah.

R.M. Ok. Let's just look at the picture a little bit more. As you can see, on the right hand side you have precipitation, rain comes and it penetrates the ground, the big arrow on the right, so it shows it going through a zone called the filtration zone and that's a zone where there's moisture but there's also air, and then there's a certain point you get all water and that's below that line showing the water table. That's where the level of the well

would be, where the water table is. And, you can see that the water table, when you get down towards the river, it gets real close to the surface, but generally speaking it is some distance down, you have to drill a well down to get water. The water table is in a sand and gravel aquifer. Here you have all this rock but the water can move through the rock as well. Below that you get another layer of sandstone aquifer which is basically a rock, but the water can move through it. And, it's going under so you get a very complex aquifer and things that are under ground. Now, any other questions that you have in looking at this, about groundwater, aquifers?

PAUSE

Female: This water, is it purifying from going through all this stone and sand?

R.M. It can be purified to some extent, it depends on the contaminants, and on what it's going through. But, to some extent it can be. But the oil, for example, wouldn't be purified, it would travel.

Female: It would just travel. The way that I'm ..... to visualize this, the oil itself, I guess, will penetrate down to this underground aquifer, wouldn't it make this go faster through and contaminate the area faster than the rate that you just gave?

R.M. Why?

Female: Well, it seems like that's more of, I don't know, an environment that would actually flow a lot easier than we have up here.

R.M. You mean the sand and the gravel should be faster than the rocks we have up here.

Female: Yeah, it would actually make the water move faster.

R.M. It just might be slower in the rock -- just 5 or 10 feet a year, which is really slow. Other questions?

Female: They show the municipal well going way down into the porous sand, whereas peoples wells, private wells, stop way up there. Is that normally done just for volume? Because you would get more water always down here for a municipal well, I mean is that the reason it's done that way?

R.M. I would think so, I'm not an expert on groundwater, but I would imagine that's the reason why.

Female: And, would there be a likelihood that the deeper one is purer or not, that wouldn't matter, I don't know?

R.M. It would depend on the source of contamination. The likelihood is probably greater that this would be uncontaminated.
Female: What is this ..... line in the middle?

R.M. That's that municipal well line. It's going down, you can see it's going way down to the sandstone aquifer.

Female: Oh, I see.

Female: There isn't any indication on this, how much problem septic systems cause, I mean, it just shows it's there.

R.M. That's right.

Female: And, depending what type, whether it's the pumped out cans or just leaching fields, but, I would be curious.

R.M. That arrow, you can see the septic system on the left is by the farmhouse there? ..... the arrow shows the flow for the septic tank ..... down into the underground .....

R.M. Now, a bit of information about the way contamination occurs. If we could look at our red storage tank there. If oil escapes into a river it would spread out very rapidly and it would be sort of diluted and so forth, but always float on the surface. But, when a contaminant goes underground it sort of stays together in what's called a plume (draws picture of a plume on the blackboard). So if we have our tank and there's a leak there, then you would get a spread like this, underground. In a very definable way; it doesn't just spread out like in water, but in fact, it would go slowly in the direction of the groundwater flow. In fact this arrow should be a little tilted to show how the plume would go. When there is a contamination instance like that, generally speaking what's done is to put in monitoring wells. If the water from the well is tested and there's no contamination, then that tells the engineers that the plume hasn't gone in this direction. They would do a circle of wells and then if one of them turns out to be contaminated they can begin to trace the plume. They can track the plume to understand how it's going and how fast it's going by doing these test wells.

Female: Do all contaminants, we're talking about oil going underground, what about other contaminants .....(?)

R.M. If you had a hazardous waste dump, whatever stuff leaches out of the garbage would be a plume the same way. But it's definitely not like a river where it just spreads, because it's fairly concentrated, and it has a very slow motion.

Ok, now I'd like to tell you how the government classifies aquifers. The government has basically three categories of aquifers, they classify for protection purposes. Type #1 is an

aquifer that is an irreplaceable source of groundwater. There's no alternatives to using that aquifer for drinking water, and or the aquifer is ecologically vital. The #2 aquifers are aquifers that could be used for drinking water if they were needed, but they're not irreplaceable and they're usually not currently being used. There are aquifers in this picture that might be classified as a #2 aquifer. And, the 3rd type of aquifer, we don't have an example of it here, would be an aquifer that is so contaminated say, by salt, that it can't be used for drinking water. Sometimes aquifers have mineral deposits and things in the water, so that they are not usable. Basically you have these ways of distinguishing between aquifers and providing different levels of protection. #1's are the ones that receive a high degree of protection, industries and others aren't allowed to contaminate them at all. #2's don't have the highest priority of protection because they're alternatives to the other aquifers. #3's are basically so contaminated now that they're not usable and therefore are not protected.

Now, what I'd like you to do is to read the very long question on the sheet of paper that I am passing out and give me some answers to the question. Let me describe it first, then I'll pass it out. I'd like you to assume that a community is faced with a decision to site a waste, basically a waste dump. The community needs a place to put its trash, the garbage and so forth. Most of the trash would be from households, some of the trash would have pesticides and stuff that people throw away. So, some of it would be technically as hazardous, but most of it would be regular garbage, and as you know it's getting harder and harder to find places to site these kinds of facilities. Because of that it's getting more and more expensive to site these kinds of facilities. Then there's the issue of how much protection should the government require the community to have for this dump to keep this material from entering the groundwater at all. I'd like you to assume that there are basically three different types of sites available for the community to use. One of them is scrt of an ordinary type, such as was used in the past. The second kind of site would be located in an area where the geology would be such that it would be much more difficult for the any of the waste to penetrate into the groundwater. And, the third site would be where it would be difficult to penetrate, plus the community would have dig up all the soil, put heavy plastic liners down and construct a system where any leakage that does occur through the plastic is pumped to a particular place to treat it. As you can imagine the third one is very expensive. The second one is pretty expensive because you have to locate it far aways for the community. The first one is the least expensive. All of these three sites are located near an aquifer of the class 2 type that is not being used for drinking water now. It's not irreplaceable at all, it's not being used at all, and if there was some contamination there would be plenty of alternative sources of drinking water. In <u>each</u> case, the landfill site would have monitoring well sites around it, so if there was contamination, the nature of it and the extent would be known. So

Handout used in group discussion

A. Consider a proposed community waste dump where some household and small business hazardous wastes will be disposed of although most of the material will be household garbage. The dump will be situated over a class 2 aquifer which is not used for drinking water by anyone. There are plenty of other sources of drinking water in the area for future population growth. There is an urgent need to establish the facility. Which of the following types of groundwater protection do you think the government should require the town to follow?

1. Choice of a site that is zoned for business use and is away from neighborhoods. The garbage should be buried quickly to avoid smells. Monitoring wells would be installed at the edge of the quarter mile dump area to detect any spead of contamination beyond the site boundary.

CONSEQUENCES: The aquifer immediately below the dump will be contaminated. If any further spread beyond the quarter mile area is threatened (this is thought to be unlikely) it will be monitored and prevented. No one's drinking water wells will be affected.

COST: No extra cost to the local taxpayers.

2. Choice of a site that is in an area of low population density where the aquifer is not close to the surface and is protected somewhat by underlying rock. Monitoring wells would be installed at the edge of the quarter mile dump area to detect any spead of contamination beyond the site boundary.

CONSEQUENCES: Much less chance that the aquifer underneath the dump will be contaminated. Very little chance that preventative measures would need to be taken to prevent any contamination from spreading beyond the quarter mile dump area.

COST: Large extra cost.

3. A site as described in 2, plus extensive preparation measures including removing all the earth and placing multiple sheets of thick plastic at the bottom of the hole. Below the plastic will be a drain and any seepage through the plastic will be captured and treated. Monitoring wells would be installed at the edge of the quarter mile dump area to detect any spead of contamination beyond the site boundary.

CONSEQUENCES: Extremely low chance that any part of the aquifer will be contaminated.

COST: Very large extra cost.

Government should require: _____

B. What if there was a town referendum where everyone could vote for the type of garbage dump they preferred. People have different ideas about whether approaches 2 or 3 are worth any extra money. What is the most <u>you</u> personally would be willing to pay in special trash fees above your current fee if they were required to cover the cost of approach 3? This money would effectively prevent the aquifer immediately below the quarter mile square dump from being contaminated.

$_____ per month.

C. What is the most you would be willing to pay in special trash fees if they were required to cover the cost of approach 2? In this case the money would significantly reduce the probability that the aquifer immediately below the quarter mile square dump area would be contaminated.

$_____ per month.

it would be monitored, it wouldn't just be allowed to do what it wants. In other words if there was any threat to the drinking water area in the area then it would be known.

Female: Ok they'll be monitoring it, what will they do about it if they discover it?

R.M. Well, they should - there are ways to, first of all of course, you stop the use of the site. Secondly, there are ways to treat groundwater, actually, by pumping it up. It's a big operation, but you can pump it up and treat it. Some places they can actually build underground walls to block it from flowing, you know because you can see where the plume is going. And, certainly you would not allow anybody to drill drinking water wells in the area where the plume is leaking into the ground. Read the description carefully, and then if you would please, answer the several questions. Take your time.

Male: Answer right on this paper?

R.M. Yes, please.

Female: Put our number on that?

R.M. Yes, if you would, put your number on the page. I'm sure and think about this, I'm sure things will come to your mind that, questions you want to ask me, but I don't want you to ask me now, but I want you to make a note of what information you'd like to have to answer the questions. Write these on a separate piece of paper, that would be very helpful for me. Just any questions that you have, anything you'd like to know about the situation.

PAUSE

(Focus group is answering questions on paper.)

R.M. Ok, be sure and put your number on both sheets. Things I'd like to know sheet and questionnaire sheet. Ok now, looking at your answers to question A, which asks you which of the three types of sites the government should require, how many of you said the government should require number, the first type? The second type? And, the third type? Ok, Pam, why did you choose number one?

Female: Well, what worries me in two, I really liked two, but the thing that worried me is the low population density. There is no such thing around here anymore, or in a lot of places and at least if its zoned where businesses are the majority of people living are not there, I mean you're there but you're not really eating and living there. That's why I chose one with reservations. Our population changes and that's why I chose one.

R.M. Steven, how about you?

Male: ..... zoned for businesses, away from neighborhoods but at the same time I tend to think that when things are near you, you have a problem in general, and it concerns you. If they put it out in a low population area, so to speak, then people tend to forget about things, oh well, it's out there, but if it's somewhere near their neighborhood then I don't think they would worry and maybe shoot politicians or the engineers or whoever ..... keep it up. Anything that could go wrong in the area pollution wise, there would be more concern. That's why I picked number one.

R.M. Now Clarence, you picked three.

Male: Yeah, three. Well, I happen to think that protection of the environment is probably the most critical thing that faces the world population today. And, that taking a parochial view of just what goes on in your community is passe. I, my own philosophy is that the population is growing so rapidly all over the world that sooner or later we're going to have to pay the piper. And, that's why I chose three. Because I think that we're just putting off the inevitable. If it's going to cost a lot of money to protect the environment, sooner or later we're going to have to face it. And, I think we'll have to make some pretty tough decisions on shifting priorities, and I see it as a top priority.

R.M. (Woman's name), how about you, you were at number two weren't you?

Female: Yes. Well I was trying to decide between number two and number three. I thought three was ideal but I also thought that most people, probably when it came down to the cost, probably wouldn't want to pay for plastic liners. But I thought, and I went with two because I thought it was probably a good in between choice.

R.M. Because you wanted to have some more protection and you were willing to pay some money for that?

Female: Yeah. See I, well I think that everyone should be concerned about the environment no matter what it costs, but I was kind of focusing towards what a community would be willing to pay or what they would think, so I chose two.

R.M. How about you, Carl, you were at two too.

Male: Yeah, I picked ..... I kind of liked number one, but I went with two because, well it seemed like it best, I thought the best way to go, and because you would have people living there, but by the same token you have to make some provisions to protect these people from the rodents, the smell, the traffic and the contamination. You'd have to make some ....., you wouldn't

be affecting a whole lot of people and it seemed, you know, the easiest way to me.

R.M. Two would be the easiest way?

Male: It seemed to me, to me it seemed like the easiest. I mean you won't be affecting a whole lot of people, I mean actually, I felt that ..... a business zone. It's not always going to be a business zone. Sooner or later, some ..... will do something to change it.

R.M. So you're talking about a low populated area.

Male: Low populated, yeah. It would be like, but the same time, you know, protect the people that are living there.

R.M. Now why didn't you pick three?

Male: I didn't pick three because I saw the cost and it looked to me like the cost involved in moving all this, putting liners in, what happens if that liner sprung a leak? Once they start putting that trash in there, that liners going to break.

R.M. I see. Judy, you have the same feeling?

Female: Yeah, I thought that if there are the monitoring, monitoring wells are there, if a leak is going to occur, I just thought it would occur, I don't know how much the plastic would, for the cost that would be there, I didn't know how much of a difference it would make.

R.M. (Woman's Name)? You were two.

Female: I looked at number three and I thought the economics was bad, I didn't think most people would opt for that. Number one, you're looking at an area where you have a business environment, ... that worked there, that's the way I thought about it. You're looking at number two, a low density of population, well, that and you're going to have some contamination in that area also, but, it seemed to be most economical although there is some cost involved in moving that garbage but not as much as number three, and again, there ..... as number three. If there was another, number four, where they were looking for some scientific way of getting rid of the garbage, I would pay a hundred dollars a month and go for it.

R.M. Ok, let's keep that in mind. That's an interesting idea. How about you Shirley?

Female: I chose number two, based on the location where I at would be what this community ..... With the low population, if you locate garbage dump in the area, it's going to, generally the

population is going to be low because people around the dump generally move, or the developers buy the land next door. You can't hide that kind of facility in your area.

R.M. What about three?

Female: Three? I thought it would be more costly. I would need to have more information on it, maybe cost benefits, study analysis, that kind of thing.

R.M. Susan?

Female: I had two. That's, I just didn't particularly see any point in one, I don't think that's a sound way to go, and I'm not sure I trust number three as being worth a lot of money. I just don't know that that's the answer. If there's a guarantee here that, yes, that would really do it and it couldn't ever leak and all that, but it sounds like it's not a whole lot better than what you're doing just above. Actually, I don't approve of any of it, I think it's high time we quit hauling garbage around. Two things; quit creating so much and, two - quit hauling it away. I think we should start more of the garbage to steam to electricity thing. There are some that are working effectively. I know nobody wants them next to them, I know that, but I have seen a couple of reports on their effect, ones that don't smell and are working and there's the energy for which we're paying for European oil, so I think that burying is not right so I wouldn't want to pay a lot to do it if it were my move.

R.M. Ok. Now, let's play with this idea. We have our site, let's say we have site number two. We have a situation where we can, as you know the groundwater would move very slowly, a few feet a year, in that kind of situation. So the chance of really harming an aquifer that we would need in some way would be very, very low. And, if it was harmed it would only spread, say a quarter of a mile, so at the most you'd be harming a very small area, and it could be monitored so that risk to people would be very low. Now, given that situation, how many of you would be willing to pay, out of your own pocket through higher taxes, would be willing to pay money to reduce that contamination even more from what I've described. If you accept my premise, how many of you would still be willing to pay something to reduce, to install a plant that would reduce the amount of stuff that would be disposed of there so the stuff wouldn't get in the ground at all. Would that be worth something to you? All of you? Why?

Female: My environment, I live in it.

R.M. Ok.

Female: I don't think it will affect us as much, but in the years to come I think we should now take stock of that, because you

see we're only just finding out that what has been done to the environment over the years. People didn't, I don't think, deliberately set out to damage the environment, and we're just suddenly figuring it all out in the last, say hundred years or whatever, we keep learning more. As soon as you have knowledge you have more responsibility, that's sort of the way it comes out.

Male: Well, taking off on Susan's point, look how many years it took before they decided that cigarettes were injurious to your health. Doctors would swear on a stack of Bibles, there's no harm will come to you from smoking. Catch a doctor now and they won't say that. I think the same thing is true with this stuff. Recently in Pennington, recently - well it was about ten years ago, there was a new development built near Washington's Crossing Park, I was living in that area then, and within less than two years after all the people had moved and bought houses there, they found that their wells were contaminated. Now where did it come from? You look at the area, it's all open country for miles around. Now if that stuff traveled 50 feet in how many years? Where did this come from? So I view a lot of this stuff as specious. I don't believe a lot of these things. I don't really think they know that much about.

R.M. So, what you're saying Clarence is that it would be very hard for you to assume that we would know with any degree of certainty that would be meaningful to you, that this stuff would only spread a very little, and if it spread at all that these procedures would contain it.

Male: Yeah, I don't trust politicians to begin with. There always looking at an expeditious idea and the old thing about the economic factor, I think that's led a lot of people down the primrose path.

R.M. How many people really share Clarence's point of view.

Female: Which part?

R.M. The lack of trust and the feeling that it's probably worse than I would make it out to be.

R.M. Two people really share his view. How many people somewhat share his view, one, two, three, more; ok. And then, you're not ....., why not?

Female: Because I -

Male: She buys her drinking water. (Laughter)

Female: Drinking water, but I also think that it's coming to the wire where politicians can't lie anymore. People are too smart and they're starting to be more active in this kind of problem.

It's too serious and I don't think they're going to lie anymore. A lot of people like you are speaking up and saying things to them, that are going to say, hey, you're lying to me. So I am pretty comfortable with the idea that they're doing something about it.

R.M. Shirley?

Female: I think the population in general is more educated and more concerned about what we today might be doing to future generations, than in the past.

R.M. So you feel there's more scrutiny; because of that there's more scrutiny.

Female: Right, that the public puts more pressure on the powers that be, to be more conservative or more concerned.

Female: I think the ..... that now are in place, that were in place fifteen - twenty years ago, I mean we're getting pressed on all sides with things that normally would be simple to do and now you must do them according to all kinds of very complicated and very expensive systems to prevent just this sort of thing. It's unreal to me to see that .....

R.M. (?)

Female: Yeah, and on industry and so forth, for instance, if you're demolishing a property for other purposes, you can't do that now, just knock the building down anymore.

Male: Is that just true in New Jersey, is it true in Kansas, is it true in Indiana or Iowa? Because if it isn't true throughout the United States, you know, it doesn't mean a whole lot.

Female: DEP (New Jersey Department of Environmental Protection) is national, DEP is going to - that's runs national doesn't it? No, oh DEP is New Jersey, ok, so maybe it is local, I don't know.

Male: I think you'll find that it is.

Female: I agree with what you're saying in theory, but then I live in a community that's had two wells in seventeen years closed because of pollution, where were these people monitoring all this? I mean, why were these businesses getting away, ...(Town names), and all of these areas that build out in the country because it was so lovely off of Route 130, which it is beautiful, they have lovely lawns, but they were polluting the water, how did they get away with it?

Female: I worked at (name of local company) for about a year and a half, and they were watched very closely to the point where

they were out there every six months doing tests. They're really cracking down, they're not letting people get off with letters like they used to years and years ago. I feel they've got more control lately.

Female: I hope so.

R.M. Now, for those of you who are skeptical, is there any way that you could be convinced that, let's say these choices have these consequences and that what is spread beyond the boundary of the site would be monitored and so forth, would there be any way that, any guarantees or any procedures or anything that would make you feel better about it?

Male: Don't bring the politicians into it. (Laughter)

R.M. If you had a choice, who would you trust beside the politicians?

Male: I would probably, if you had an experienced environmentalist who had a good track record, he had, hopefully it would be someone from the community we also knew, and you also being here too and reason from what you know yourself and have your gut feeling, that's what I'd go from, how my gut feeling is after those factors are known.

R.M. But you would, your gut feeling would be a little better if there wasn't a politician, in other words, people from the area and especially environmentalists or people who were outside of the -

Male: Well, maybe you could have a politician in there but I would watch him.

R.M. Carl? (Everybody talking) One at a time please.

Male: I feel the same way Steven does, I feel the same way he does. I say keep the politicians out, because once they get their hands in there, that's the end. That's the end, because the almighty dollar can buy anybody. I will say that, I don't care who it is.

R.M. Alright, so who would you trust?

Male: I would, the community, people in the community, some kind of action group or something, you know, from the community.

R.M. Now, would they have the expertise?

Male: Well, you know, they would have to get somebody to represent them in the community, from the community.

R.M. Susan?

Female: I don't have a total distrust of politicians, I think that they're still regular people and they are not born experts or trained experts in the number of fields they have to address, so they would have to have authorities, consultants and I'm sure that's the way they operate most of the time. There would be consultants to tell you what's happening. When I looked at this map I thought, well how do we know where these different ..... are, the safe aquifers as opposed to the unsafe, who knows that, who figures that out?

R.M. (?)

Female: ....., this is somebody's job somewhere and I'm sure these consultants exist and consulting is a big business today because we have so many problems to solve.

R.M. These are the geologists and the state geological surveys, and also the Department of Environmental Protection, they would be the technical people that would make these judgments. Now would you trust geologists that worked for the state government who had this responsibility?

Female: Yes.

Female: Yeah, I would.

Male: I'd like to know their track records.

R.M. Ok.

Female: It would be hard to find out I think.

R.M. Steven, you wanted to know their track record. Anybody else have concerns about state geologists?

Female: Are you one of them? (Laughter)

R.M. Ok. How about geologists or experts with the state university? Would they have more credibility than the.....?

Female: Yeah, I would think so.

R.M. Susan, why are you laughing?

Female: I wouldn't ... grants.

Male: As long as their not receiving grants from the state.

R.M. Ok.

Female: Absolutely, our state university does a lot of bad spending, I'm well aware of that, you can get a grant there to study how many ants there are on a flea, or something. That's not creditable.

R.M. Ok. So you're assuming .....

Female: Absolutely, better than anybody in industry.

Female: ..... the university itself or about the .....

Female: The state university? Oh, no, I'm not talking about state university/state(?) funding something. No way, they'd mess up.

R.M. What about the federal government? The Environmental Protection Agency. Would they have more creditability to you than the state or what?

Female: I think the state would be better for the state.

Male: It would still be controlled by politicians.

R.M. Still controlled by politicians. State or federal?

Female: State control there.

R.M. More credibility?

Male: I'm afraid I'm too much of a cynic.

R.M. State or federal?

Female: I don't know, I have a feeling the government tries to cover up a lot, because I never feel like, you never feel like you get the whole truth when it's something political or something with the government.

R.M. Why?

Female: I don't know why. I just think that they, if there's a mistake somewhere it tends to be covered up more than announced publicly. I don't know, ... getting off this subject.

Male: I think there's a real dilemma here. You have to trust somebody, that's obvious. My trust would rise measurably if I heard the federal government take the lead in recognizing this problem and diverting, changing some of its spending priorities and diverting <u>real</u> money to this problem to solve it and coming up with some new way of getting rid of trash and garbage, rather than just burying it or dumping it out in the ocean contaminating the fish

that we eat and the ocean. And, that's why I'm cynical about them, because they're not doing that. I think government and industry ought to get together on the problem, and I'd have faith in that.

R.M. Do you have more distrust of the federal or the state?

Female: ..... the federal.

R.M. The federal. (Woman's name) federal or state?

Female: Federal's bigger. I really don't know, it depends on what state you're in. I know, I'm not too trustful.

R.M. You're not sure?

Female: Yes I am. The state more than the federal.

R.M. Steven?

Male: I chose the state.

R.M. (Name)?

Male: Federal.

Female: Federal.

Male: Federal.

R.M. June?

Female: I'll trust any scientist that's willing to take their job seriously. I don't have any distrust, I don't see the connection between that and ....., maybe from the fact that they do get grants at the university and not personally. I think that they would try to ..... the fact that there is a problem here, and it's being tried to be covered up. My opinion is, maybe I'm idealistic, I don't know, but I would say I would take your data and believe it.

R.M. Ok. Let's think about cost. As you can see, the more protection we have the greater the cost, there's no getting around it. The community has to pay for ..... its putting out. If it's going to prevent any contamination at all of groundwater, it's going to be much more costly than locating it in a place where there's very moderate contamination that would hurt people and even cheaper if you simply put it in a place as we've done, and maybe monitor it but not worry about it too much. So, as you can see from the sheets you have I asked you to think about your choice in terms of how much you would be willing to pay extra to have greater degrees of protection of groundwater. Ok, because if it was free there would be no question, but it's not free. I hope that if in

truth, more protection wasn't worth any money to you personally that you'd feel free to put a zero. I just am very interested in your own choice in this area, and it's an uncommon question. You're not usually asked to put a dollar amount on different degrees of protection. Unless, you vote, sometimes in town referendas, like for school system bond issues, they will actually vote whether it's worth it to you to have an extra school, nature of the school, stuff like that. But here we're talking protection of groundwater in an area where the groundwater is really not used and probably won't be needed in the future. So, Pam, would you be willing to pay something for ..?

Female: Sure.

R.M. What would it be?

Female: I said fifteen per month, not because, I thought most people could afford that. There would be a lot of people that are without hard times, you know, making extra money for anything and I figured most people could afford that amount.

R.M. Ok, but in truth, you were thinking about most people rather than thinking about the most you would be willing to pay.

Female: I guess I was thinking more about other people than myself.

R.M. Ok, how many of you were thinking of other people instead of the most that you would pay? Anybody else besides Pam when you answered the question?

Female: Well, that influenced my thoughts.

R.M. Susan, you said that influenced you so, you and Pam were constrained by not wanting to impose too big a burden on other people.

Female: I think that it, you know, they were talking about it being a community product, and I think when you go too high you're going to get a reject.

R.M. I see, ok. But in truth, what I would like here would be to see what it's really worth to you personally. Just for this purpose, the money wouldn't be used for anything else, and it would be the maximum, so if it costs less of course, you wouldn't have to pay that much, but for what the most is, if it did cost that much, how much would you'd be willing to pay. So those of you who thought that way, put a line through your original amount and try and come up with the most <u>you</u> would be willing to pay, if there is a referendum that said your family is going to cost you two thousand dollars a month or whatever, what is the most that you'd go up to before you'd say no.

Female: And, this is a special fee just for this, not your total per trash.

R.M. The politicians wouldn't use it for anything else, because I know, people are concerned that a few politicians would let it go for other things.

Female: Yeah, ..., mansions.

Male: Mansions?

R.M. Ok, Pam , what did you come up with?

Female: I picked twenty dollars.

R.M. Twenty dollars as what? As a maximum for that, but that would be worth it to you?

Female: Oh sure.

R.M. Knowing that even though the aquifer wouldn't be needed and it just be a limited area of contamination.

Female: As long as there were the right people controlling it.

R.M. Yes, that would be guaranteed.

Female: Sure.

R.M. Ok, Shirley, how about you?

Female: Twenty dollars.

R.M. Each month?

Female: Yes.

R.M. Two hundred and forty bucks a year. That's what you would pay just to - June, worth anything to you?

Female: Yeah, I'll tell you something, I'm used to paying an association fee and getting nothing for it, so I figure I'll pay sixty dollars a month and get something for it.

R.M. Sixty a month!

Female: That's what I figured, I don't know.

Female: For trash?

Female: Yeah.

Female: Fine take it.

R.M. That would be seven hundred and twenty dollars a year!

Female: Yeah, commuting to New York costs me a hundred and ninety bucks a month plus a hundred and twenty five for ..... and they don't even plow it when it snows. It's like a waste of money, I mean if you tell me that I'm going to do something for this and there is a value to it, I wouldn't mind paying that kind of money. So this is for the one that is number three, right.

R.M. Yes, that's right. Now, what are you getting for it then?

Female: For what?

R.M. For number three. What would you accomplish?

Female: I guess a safer environment or if there is guarantees that this thing will work.

R.M. Ok. Now, -

Female: I guess I'm more concerned in terms of what it is that's waiting for us in the future. We all took things for granted in the past, I'm guilty of it like everybody else, like throwing things, one of these cans in the garbage like we're not supposed to, nothing ..... a little more, and be a little more responsible, and my way of doing it will be by through paying this.

R.M. But, now what you get though with the -

Female: Ok, I'll pay forty bucks! (Laughter)

R.M. I just want to make sure that you understand what you're getting for your money. Now if you want to pay that, that's terrific. But, what I'm trying to do is learn how to communicate this so that when people are willing to pay a hundred, I know what they think they will get for the money. So we have an area where, there would be no wells at all in the area for miles. The rock structure would be such that if there was any leakage it would really be very, very slow, slower than fifty feet a year, which is a hundred years per mile. And, there would be monitoring wells so that you would protect the aquifer, in an area of about a quarter of a mile around, that would be protected, and with that system there really wouldn't be any leakage: But, at worst, if there was leakage it would simply contaminate a very little area of the aquifer and wouldn't threaten anybody's health. Ok, and that's worth a lot of money for you?

Female: What you're telling me, what about the cost that would be involved in implementing this, I mean am I contributing to that too or are we contributing to the service on a monthly basis after its established?

R.M. No, no. What you would pay would cover the cost, that would be the most you would be willing to pay if you could guarantee that when the garbage was taken away there'd be virtually no contamination. Infinitesimal vs very minor.

Female: Ok, I'll break it down to -

R.M. But, June, what did you - maybe I'm just not very good in explaining what you get for your money. So I don't -

Female: I don't think you did though because I thought I was getting a lot for my money.

R.M. What did you think you were getting?

Female: Somebody coming into my house and taking my garbage away, no. I thought I was going to get -

R.M. That's already taken away, so your already paying that. This would be on top of that.

Female: I think I was contributing to the cause of the implementation.

R.M. To what?

Female: To implementing the system. I thought it would be extra to .....

R.M. It will be.

Female: That's the way I figured.

R.M. And even though it would protect a little area of the aquifer that's not going to be used, that would be important to you?

Female: Yeah, I thought it would. I guess I'm kind of high. What do I know about garbage anyway. I don't know much about what's involved in -

R.M. Really, the cost is irrelevant. What's important to me is what it's worth to you to protect this dump from this small degree of contamination. And to some people it's worth money. So that's exactly what you're buying, you're preventing a little bit of, the possibility of a little bit of contamination in this area. That's what you're getting, what you'll get. Susan, how about you?

Female: Well, I don't think I would want to be ..... more than ten dollars a month for something like this. I know that isn't going to cover a great deal, but there are so many things that are important to me that, ... which things I put my money in, I think that's about what I would say. That's about the amount of faith I have in it. I still prefer another way of getting rid of trash and so I can't say I really go with it.

R.M. ..... approach because you don't think the system would work.

Female: Not perfectly, that's right. I don't think it would work perfectly, and I'm really not sure that I would want to see it all go that way, I would like to see more initiative in other directions.

R.M. Alright, Carl?

Male: I put in twenty five.

R.M. Ok, and you had in mind pretty much what I was describing.

Male: Right.

R.M. Ok, Clarence?

Male: Twenty five a month, just like Carl. But I think the relevance is not so much the amount for number three, but rather the proportion that one is willing to pay for a number three vs number two. That's two and a half times as much that I would be willing to pay. That's what I see, that's the tone for how you perceive the value.

R.M. So two is worth to you, how much?

Male: I said ten dollars, not knowing what trash would be. But I say it's worth two and a half times at least to me to have number three type plan.

R.M. Judy, how about you?

Female: I put thirty dollars.

R.M. Thirty?

Female: Yes, and well I was thinking of several things. I was thinking of the amount of money that it would cost to put the liners in, and I had a hard time coming up with a figure because I really don't know it much it costs to run a whole household and how much extra is left over and how important, and how much of that money is left over is important to give to other things. I had a

hard time with dollar amount. I didn't know how much of a dollar figure would be placed on the importance of, I found it complicated because it was complicated in my mind. But I definitely thought that there should be a dollar amount.

R.M. Then it would be worth something to you to, as I described it to June?

Female: Yes.

R.M. Even though if it were something .....

Female: Just because it would be protecting the environment and I, this was brought up before, that maybe five years or ten years or fifteen years down the road who knows what's going to be at this particular spot or what people are going to find out and I would think about the family that I would have, for my children or for their children. And, some are saying well, we have a big problem here now and I would think that the money I would put toward that would help to prevent a problem or diminish it in some way.

R.M. Ok, so the possibility of something causing a problem in the future is important to you.

Female: That's more of a concern.

R.M. - is something that you would worry about.

Female: Because I would feel kind of guilty if fifteen years down the road they would have said, if you would have just paid your thirty dollars a month.

R.M. Steven?

Male: I put twenty dollars a month.

R.M. Ok, and for this, despite this small ..... aquifer and all the rest of it, that's still worth something to you?

Male: Excuse me?

R.M. Well, despite the fact that it would only prevent a small area of the aquifer from being possibly contaminated, that would be worth it to you?

Male: Twenty dollars a month to me, no more. Maybe less.

R.M. How much less?

Male: Five dollars.

Male: You're being compromised Steven.

R.M. And, then why would you want to spend the money for that?

Male: I don't know.

R.M. Why would it be important to you?

Male: Well, the plastic at the bottom of the hole to prevent any leaks at all, I'm not going to say I don't believe, but I don't think it is trustworthy.

R.M. Then why would you pay five dollars for it?

Male: Because right now looking at it, that's the best you can do at this time and that's what I'd be willing to pay for it.

R.M. So, in other words, it would be worth something to you to get the benefits that's offered.

Male: Right.

R.M. To keep the contamination from occurring.

Male: Right. Hopefully technology -

R.M. Could do more.

Male: Right. We talked about maybe converting it to energy, maybe we'll get to that later, but this is the best you can do at this time, then that's what it's for.

R.M. Shirley?

Female: Twenty dollars.

Female: Can I ask a question?

R.M. Yeah.

Female: We pay water bills and we pay garbage bills, why couldn't some of the water companies and the garbage have a little interest in contributing to purification of water too?

Male: They'll do that by raising your rates.

Female: I mean we're contributing and why can't they contribute too, I mean, we keep getting higher and higher bills, my water bill is astronomical.

R.M. Regrettably the laws of economics is such that if they pay more for that, they're going to have to get the money from somewhere -

Male: And guess who's going to pay.

R.M. Here we are, that's sort of the way it works. As you can see, what I'm trying to do here is find a way that I can understand what value people place on protecting these kinds of aquifers. At this point I have to bring the discussion to a close. I just have this little questionnaire for you to fill out for background information.

R.M. Let me explain the purpose of my study. The money comes from the United States Environmental Protection Agency because the US EPA is involved in national policy to protect groundwater. The issue is, is there a value that people have for groundwater, even if it's not being used now. In technical terms, this is called the existence value of groundwater, that it has value simply by being there, not by being used. And so, as you can see, I'm trying to find a way it's possible to offer ordinary people the opportunity to express the value for them of protecting this particular kind of groundwater. It's a very difficult thing to convey, ideally I'd have to convey it in a survey, not spend a couple of hours with some diagrams and a chance for give and take, but I'd have to write out a questionnaire that would be clear enough that people could understand what it is that they're protecting and that they could be willing to accept the assumptions that are put down and they could express a dollar amount for it, then that would give me some basis to tell the government, look there's been kind of a protection program, protecting ..... groundwater, that's not going to be used, it wouldn't be needed as far as we know, that has a value to the American public of roughly X or Y dollars.

Male: Well, what worries me a little bit, is this reference to certain aquifers being redundant. Is the next thing we're going to hear is that certain areas of fresh air are unnecessary, ... for them to pollute that?

Female: You're right, absolutely right.

Male: Of course, you know water is precious to life just as air is precious to life, how can you take the life support systems and say well this piece of it isn't all that important, it's like being a little bit pregnant. I don't, that's what I have trouble with.

Male: That's inevitable and as the population grows it will be more, but I think the governments have an obligation to take more and more direct hand in what there is and despoiling it as little as possible, which they certainly are not doing now. The

profit motive seems to dictate everything that happens now, and I think that's terribly wrong.

R.M. There's so many things to protect, the issue is, is it worth it to protect all of it, in other words to require cities, whenever they have a dump, to have maximum protection no matter what, even if it's an aquifer that is in an area that not needed, the contamination wouldn't go very far, if there was contamination, it would be monitored. The question is, should we require all the tax payers to pay the maximum dollar under each and every circumstance, or should we require ..... for class one aquifers, no question that these are vital to use, they are irreplaceable, so forth. But, should we make distinctions to save some money in areas that might be used for other things, that's really the issue.

Male: Well, the way I think I'd answer that is, definitely as far as the so-called classification one, you have to, you have absolutely no choice, but I think that in respect to the class two's, as much as possible should be done now and at the same time research should be going on between industry and government to develop some timely to this trash problem and pollution problem. Heavens, if we've been able to go back and forth to the moon like a bunch of commuters, why can't we solve these kind of problems? It certainly shouldn't defy human intelligence to come up with answers to this. I don't think they're really serious about it, that's what disturbs me.

R.M. So, by telling me that you are willing to spend twenty dollars a month for this purpose -

Male: I said twenty five.

R.M. Sorry, then you're saying in effect, you're not only saying it's very important but you're expressing in dollars your sentiment.

Male: Your willingness to pay.

R.M. Exactly, and as far as you're concerned, if you can get this kind of protection for your tax dollars, it'd be worth it to you.

Female: I think, you have to respect the land, number one, it's the only thing we have, and it's becoming, not a commodity, I mean, it's precious. We ..... development anymore, because around here it's so crowded, the ..... houses they're building, they all look like ants living around here.

Female: Where would you put them?

Female: Exactly, so it's, I think it's ..... you're paying for number three, how much would you pay for, not how do you do ..... earth ....., how do you have a better way of disposing of this garbage, rather than having - all we're doing is modifying an old solution, why don't we come up with different ways? ..... ecologically right now with computers and all kinds of things, I think we can come up -

Female: We got laser beams, we got all kinds of things.

Female: I mean, it's beyond me that we can't come up with a way of getting rid of garbage.

Male: It is a question of perceiving priorities, you know, in the end it all boils down to the quality of life, really, just as the young lady was saying about building all over. It certainly has destroyed the quality of life in this area. I've lived in Summerset and Mercer County all my life and, it's not very desirable to remain here anymore. And, I think that's what the government, if this is who you're doing this for, I think has to look at the whole issue of quality of life, a little more careful planning of land use and the rest of it, and diverting monies from some other areas that are highly questionable. This is something that they should view with a much higher priority than it has been.

(General talking and handing in papers)

R.M. Well, I'd like to thank you very much. I am very grateful to you for participating in the group.

Resources for the Future
Groundwater Existence Value Study
Robert C. Mitchell

TRANSCRIPT, SECOND WORCESTER, MA. FOCUS GROUP, AUGUST 17, 1988

RM: First we're going to pass out these forms and if you would just put them in front of you and not open them until I tell you to. We'll pass the pencils around. Alright, the interview concerns the decision that people would have to make about what kind of a sanitary landfill they would want their town to construct. So I'm going to read the material to you and I'm going to show you illustrations on this overhead projector. I also have 4 sets of colored illustrations which I would like to share. Here is a picture that shows the kind of landfill that cities and towns like yours used to use. The garbage was put in a deep pit and covered over with earth with a bulldozer. For many years this approach was considered acceptable. Recently government has become concerned about the potential for some landfills to contaminate drinking water sources. Here is how it can happen. Rain falls on top of the landfill. By the time the water reaches the bottom of the pit some months later, it has dissolved small amounts of chemicals from paints, paint thinners, toilet cleaner, bug sprays, and many other things people put in their garbage. Because it leaches things out of the garbage, it is called leaching, so this leachate that seeps slowly through the soil until it reaches the water table. The water table is that point underground where the spaces between the grains of soil are filled with water, and if you dig a well you've got to have a water table to draw your water up from. The water table is shown right here. Then the leachate travels slowly, in the direction the groundwater is seeping. It doesn't spread out like it would if it was spilled into a lake, but it forms a plume such as the one shown in the picture. Now if you turn the picture and look at the next one, this picture shows how after many years, it can move far enough from the landfill to contaminate some of these private drinking water wells. If in fact that's what the original picture showed, if you go back to that one. You can see that the well happens to be going and the leachate is hitting the well. Alright, here's how that problem begins. Okay, In the first year, looking at this diagram, the second one, you can see the leachate goes toward the groundwater. After five years it reaches the groundwater, and after ten years it goes a couple hundred feet beyond the place where it entered, the next twenty years it's gone 600 feet. The leachate is traveling at something like 30 feet a year, seeps very slowly into the ground and it seeps along with the groundwater itself, so it's a process that's quite slow. Now, the contaminants in the groundwater have the potential -- if someone were to put a well here and draw off this water -- to create a very small chance of the people drinking

that water of getting cancer, say if they drank that water for five or ten years. There would be a one out of ten thousand, or one out of five thousand chances that someone might get cancer. So there is that potential for cancer if you drink leachate that goes into the groundwater. Now, in order to prevent landfills harming drinking water supplies, plants or animals, let's assume the state now requires all landfills to meet two requirements. The first is that the garbage be covered by a three foot clay cap after it's been put in the ground. The clay cap slows down the process of leaching. This drawing shows you the difference if you had a clay cap on and you didn't have a clay cap. As you can see, in twenty years it's only gone half the distance that it would have if the clay cap wasn't there. So the clay cap slows the process down, keeps a lot of rain water from going through the garbage. The second requirement that the state would make, is that the landfill be located in a place where there is no chance of contaminating any groundwater that would be used for humans or for animals or plants. And this requires a careful assessment of the geology, and the available underground sources of water each place where a landfill is proposed. So, we've got these two requirements, located in an area where the groundwater is not being used, and never will be used by humans in any foreseeable way, and to use the clay cap and to construct the landfills in such a way that the leaching is minimized.

I'd like you to imagine that your community landfill is almost full and the community must find a place to build a new landfill. Although this is not currently the case here as far as I know, many towns like yours are having to do this. Now, let's suppose that after considering many possible sites, the community has bought its site that has been approved by the state environmental health authority. It is located in the countryside about 80 miles away from here. If you'll look at the next picture, you'll see a picture of why that site has been approved by the state. And, what you can see there is that there's a landfill located in an area where there aren't a lot of houses or anything, farming or things like that. But in particular, underneath this particular site is a layer of rock that isolates the groundwater here from other areas of groundwater, this is what makes it a particularly choice site. Rock prevents the seepage from occurring. So, if such a landfill were constructed it would look pretty much like this after 50 years. The clay cap is on top, the garbage is packed in there, the leachate gradually seeps down and away from the site but remains within the boundaries of the site, because it seeps very slowly. The site would meet state regulations. There's no wells that go into the ground here, either in that area or even near it. In other words, the groundwater in this area is simply not used for human use. Now, please turn the page and answer that question.

Male: What is the potential of years for the use on this land site?

RM: I'm sorry, what's the potential?

Male: Yeah, for the use of it and how many years?

RM: It would be restricted, so there wouldn't be any, the groundwater itself could never be used.

Male: I mean, how long would they be able to use this site?

RM: Oh, how long could they use it? 50 years.

Male: 50 years and then they cap it?

RM: Yeah, the cap actually goes on as the stuff goes in. As you fill in an area, you put a cap on top of it. Are there any other information questions?

Male: Just one. On the previous illustration, there was like a little bowl, a little stone bowl under the landfill.

RM: That's it.

Male: That's it, okay. Alright then, by the same token, if they were going to bury it in the ground, why not just make great big concrete basins and let it stew in that for a few hundred years?

RM: Well, this particular plan doesn't have that. I'd like your reaction to this particular plan.

Male: Alright.

RM: Any other questions?

Male: What type of garbage is going in, radioactive?

RM: Oh no, not radioactive, definitely not. Pretty much your ordinary town garbage, some of which includes the poison people throw out so you wouldn't really want to drink the stuff that comes out of it, because it does contain small amounts of toxic substances. There would be no industry garbage, and so it would be classified as an ordinary waste site. Okay, everybody finished writing their answers to this question? Alright, don't turn the page. Now, some citizens in the town argue that the plan should be modified to prevent any contamination of the aquifer below the site. The aquifer is the groundwater. They agree with the environmental health officials, that only a very limited amount of the ground water will ever be affected, and that this groundwater will not be needed in the future, but these citizens say that they will feel better knowing that nothing has seeped from the landfill. They propose that the town have the site dug out and a thick concrete liner installed. Here is a picture that shows what would

be involved. Pipes at the bottom of the pit would collect the water that drains into the garbage, would bring it to the surface where there would be a water treatment plant, that would treat the water. Other people in the town are opposed to this idea. They argue that the present plan meets stringent state regulations and it's completely safe. They see no need to raise taxes even higher just to protect a small portion of an aquifer that poses no danger to anyone. The town decides to have a referendum to see whether the landfill should be built as planned, which was the previous one I showed, or whether additional money should be spent to construct the concrete barrier and water treatment plant on the site. How would you vote the referendum? You can turn your page. Would you vote for the present plan or would you vote for the concrete barrier plan?

Male: Are we talking about the town that's 80 miles away from us that we're voting in, or are we talking about living in that town?

RM: No, we're talking about your town.

Male: We're living in this town where the fill is going to be.

RM: No, you're living 80 miles away from it and the town has bought the land, so everything is all set to go and as far as the people living in the area goes, they'll accept either one. So the people that are in the town are sitting 80 miles away and they're saying, hey, we'd feel better if there really wasn't any contamination of the groundwater even though it's in an area that's far from them. [Everyone is answering question.]

RM: Alright, now turn the page and answer the last question.

Male: Is there a personal tax on this or a total tax on all?

RM: No, this is what you a taxpayer, the most that it can cost your household before you'd say it's too much. And, the money would only be used for this purpose, no other.

[Everyone is answering this question.]

RM: Okay, how did you feel about the first plan when I asked you whether it was safe enough?

Female: I thought it was until you introduced the concrete fill, and then I though that would be preferable.

RM: But, without consideration of concrete barriers, the first one looked okay?

Female: It did to me.

RM: Okay, Carl?

Male: I feel the same way. I think the idea of having it in an unpopulated area, also .....(?)..... that rock. I was wondering whether to expect any leaching out of that rock in five to fifteen years.

RM: When you say, any kind of leaching?

Male: Well you said, expect it after 50 years, you wouldn't have anything in the .....(?)..... Is it possible for it to leach through the rocks, or the cracks in the rock?

RM: Oh, I see. Here's a picture of the first plan. What concerns you is whether it would go through the rock?

Male: Yeah. Where the second plan looks more, I would imagine it would be safer and you would expect it to last a lot longer.

RM: Yes. John?

Male: My problem with that, you're talking about farmland there?

RM: Yeah, right.

Male: You're also looking at a two-dimensional picture of a three-dimensional situation. You're just getting a cut-angle view of it. You can't see what's around it this way, lengthwise .....(?).... That's what's bothering me?

RM: I see. So you're thinking the farmlands' going to be affected by it?

Male: The possibility exists much more than if it wasn't in such an area.

Female: The runoff water through the hills down below when it's really raining .....(?).....

RM: .....(?)..... the water's running down like this?

Female: Yeah, right off of the landfill, ...(?)..... a hill, come down the side of a hill and you get a little bit of the washoff.

RM: But, basically they're all being contained within that basin and the waters under the ground, so it wouldn't affect the crops.

Male: That's if the basin is a true basin all the way around. In that picture you can't tell that. You'd have to actually have a it like a ditch for what you're saying to be plausible. I don't know how, I'm not really up on my geography but, how many real bowls are there like that?

RM: Well, they're relatively rare. Okay, now what if I said that it was a true bowl. Would you believe me?

Male: I would still have a lot of problems with it. To give you an example, every year federal government comes up with something new that's bad for us. When you were growing up you were told to eat eggs and cheese. Now don't eat them. You're not supposed to have them. Bad for you. What are they going to find ten years from now when they get all that stuff stuck underneath the garbage, oh well this one seeps through. And again, you're talking farmland there, there's going to be contamination.

RM: Okay, in truth as far as the farmland goes, this stuff, it really seeps very, very slowly. So this kind of procedure would prevent any kind of problem with the farmland.

Male: Does the leaching ever rise back up to the surface?

RM: No, it would be so deep that it simply wouldn't, you can see the water table is way out here.

Male: Like farmland .....(?)....., in other words, the soil on the farmland would stay -

RM: Okay, here's the water table, I mean the water table goes up and down but if it came up to the farmland it'd turn it into a swamp. So, it wouldn't really -

Male: If it ever seeps through that first layer of rock, it wouldn't eventually work it's way back up to the surface?

RM: I see, no. Shirley?

Female: It would depend too on what part of the country you're talking about. If you're in California there's a good chance that earth graders might shift things around.

RM: But around here -

Female: You're talking around here.

RM: Yes. Only a very, very remote chance of an earth grader although I guess anything's possible, but that would be, one hopes, really small.

Female: I guess my concern would be, I wasn't sure that the plan would be safe enough, but what would happen if the area around the spot would be changed or developed. Would the contamination area possibly spread and change, and still affect drinking water somewhere else?

RM: Well, the area would be identified in such a way that people wouldn't be allowed to dwell, basically the state health department wouldn't allow anyone to dwell there and there's plenty of water elsewhere.

Female: But no one would be able to change any of the land that would be around there. There would be some sort of regulation.

RM: Well, if they used it they couldn't put wells in, that's the main thing. And of course, you also monitor these things, there are wells you can put on the edge of it that will tell you exactly what's happening, how far it's gone. It's even ultimately possible to pump the stuff up to the surface and treat it. It's possible to do that to prevent it from spreading further. How many of you would feel better about this if there were test wells around it, to double check to make sure that the rock, nothing was getting through the rock?

Male: I'll tell you the truth, I don't like the whole plan. I don't like the idea of making little poisonous wells in areas all over the planet. Every little town is going to have one and two and three and then five and someday we're going to be as crowded as Hong Kong and half our areas going to be contaminated. I'd much prefer, and I would support recycling it better, turn it into ash and water from the beginning, recycle it, take the minerals and the glass and everything else that can be used and turn the rest into energy and get rid of it and don't bury it anywhere. And, if it raises the cost of packaging and people have to bring string bags to the supermarket, so be it.

RM: If you had a choice between these two plans, is either one acceptable to you?

Male: Well, the one with the cement basin seems to be the most easily controlled and the one where if they ever did try to go recycle it, they'd have the easiest time getting the stuff out of it.

RM: So, of the two you preferred that one, but you prefer there not to be any waste at all?

Male: Well, I prefer that the disposal of waste not contribute to the poisoning of the planet, even in little bits, because little bits add up. They used to think the ocean was vast and you could throw anything you wanted into it and it would just

disappear, but it doesn't. They're getting cancerous fish, the shellfish aren't fit to eat, there's needles washing up on the beaches, and the ocean isn't that big if everybody in the world dumps stuff in it. And, the same with the planet, I think that we should find ways to either recycle and get rid of stuff, rather than just sweep it under the rug. What kind of housekeeping is that?

RM: Grace?

Female: [Too far from microphone to understand]

RM: Most of the garbage would disintegrate, but these other substances would not.

Female: We're not talking about industrial waste?

RM: No, we're not.

Female: None, ...(?).....

RM: Right, there'd be a little bit of that, but just because that's part of household waste.

Male: Well, small businesses would do it too. I know I paint and hang wallpaper, and I know I throw cans full of used thinner and stuff in the trash and who knows where it goes from there.

RM: Yeah, that's the kind of stuff that we're finding, right. But it wouldn't be like a corporation that's getting tons of this stuff every year.

Male: Alright, I have no qualms with the first one and I have no trouble with the farms because by the year 2000 there's not going to be many farms around anyway, and most of our problems with groundwater -

Male: That's why we'd better protect the ones we have.

Male: Yeah, but we don't have any, they're selling them out, the state's buying them out. That's one of the things across the country, but a lot of our groundwater pollution is coming from the farms using artificial fertilizers, that's where a lot of your problems and the farms are also being affected by acid rain, so I have no problem with that kind of a landfill. I would have a problem with the kind of a landfill where it's cemented and has a plastic bottom because garbage thrown in plastic bags in these industrial, you know different kinds of things thrown in plastic bags tied up tight. They're not wasting away anyway, they're staying anyway. You put plastic underneath it and a clay top on top, in the size they're building, you're not going to have any waste lost. It's just going to stay there and stagnate anyway so

without the plastic underneath, there's a possibility that that stuff is going to dissolve and disappear in the future. They may have to ...(?)... and refill it again, but I have no problems with the -

Male: No, it doesn't disappear, it just spreads out. The thing is you contain it from spreading out. You let it go on the ground it spreads out.

Male: Yeah, it will disappear.

Male: No, it doesn't disappear, it just spreads out and thins out, but it goes over a wider area.

Male: But anything that is biodegradable will disappear.

Male: If it's biodegradable, yeah.

Male: That's what I'm saying. What you have to do, you have to get rid of the plastics. And, people aren't going to get rid of the plastics. Your plastic plates or your styrofoam, that stuff isn't biodegradable and that's the stuff that sticks around for a long time, that's why a lot of these landfills sink, so you can't build on them.

RM: So, Joe, the first plan was okay with you?

Male: I think the first plan was okay, as far as that goes. Within 50 years you're going, they're going to find another way of getting rid of disposal anyway, they probably will start recycling because more and more they're recycling into power plants and they have to do that because all the landfills in the world aren't going to take all the garbage we make.

Male: Yeah, right.

RM: Chuck?

Male: There's an easy way that .....(?)....., I don't know how many people have ever thought about it. Out in Nevada we have test sites, pile it up there and nuke it.

[Laughter]

Male: Nothing will be left of it.

Male: Yeah, but you'll compound the problem with the nuclear waste that you've made.

Female: .....(?)..... nuclear waste.

Male: Yeah, it's still there, but in an invisible form.

Female: Different.

RM: How many of you, when I asked you to choose between the first one and the second one, how many of you chose the first one? So, the rest of you preferred the more rigorous containment.

Male: I liked the first one until I saw the second one. The second one had safeguards.

RM: Now, the second one would definitely cost more as you can imagine, because you're going to have to have the pumps under it, the concrete thing, dig the whole thing out, it's a big effort. Taking cost into account, how many of you are willing to pay more than $50.00 a year? One, two, three, four, five. Okay. And, then why? Grace?

Female: I don't think cost should be a very important factor.

RM: Okay, Grace what would be the second one protect, what would you gain by having the second plan, the concrete barrier?

Female: Partly, ...(?)... contained materials that might harm.

RM: But, they would only go into the earth at that one place, and they wouldn't contaminate anything that's in use, or that would be used in the future.

Female: What if things do change and .....(?)..... in the years to come so I would .....(?).....

RM: Because in thinking about the future, it's just hard to think that that groundwater might not be used by someone, or it might harm them. Okay. Why did the others of you prefer the concrete guard?

Female: In some ways I agree with Greg. If you're thinking about your kids and your kid's kids, and what they're going to be drinking when they're older, if this is a way to protect the future for them, I mean I don't want to pay $2000.00 more a year in taxes, but I'd be willing to pay more in taxes than somebody putting sewers in the street like some of the cities, some places are doing. Me, I don't see that it is a great benefit where they live with what they've had for a long time, but something like this, you're talking about future generations that may benefit by it.

RM: But even though it would all be contained in a limited area -

Female: I still think that it's a benefit for future generations, you're not going to contaminate the water. There's a way to help prevent that by putting the concrete barrier up, you're

helping your kids, your kid's kids. Someday there may not be that much drinking water around.

Female: I'd like a comparison on what it would cost for the concrete barrier versus what it would cost years down the road to clean it up.

RM: If it turned out later that this water was needed, would it be much more expensive?

Female: Yeah, or something went wrong and they had to dig down, and dig beyond, and gather it all up, I'm sure that would be more than using concrete barriers in the first place. It would be nice to see a comparison.

RM: Yes, Charles?

Male: Well, what if .....(?)..... builds up with gases, and it builds up and builds up?

Female: The gas would [can't hear her]

RM: The water would be collected and recycled so you wouldn't have a buildup.

Male: And, the gases could be immediately recycled, all they gotta to do is bottle it. I've seen things on television where the Indian peasants have, they put their cow dung in a 50 gallon drum and cap it, and the gas circles through this little hose and they cook their food off of it, just directly. That gas can be bottled right up.

Female: What about the dumps you hear that start fires way underneath and just burn out of control?

Male: Whatever underneath, if there are fires I think there would be some other action going on under there too.

RM: Unfortunately I don't know very much about that. They would have to construct the landfill in the right way.

Female: It's happened twice around here.

RM: Oh, has it?

Female: Once out in the central west area about 3 years ago, and then once when .....(?)..... that sat and smoldered and burned underneath. They just had to let it burn out. And, it smelled terrible.

RM: We would assume that both would be well designed and

maintained and so the chance of a fire would the same. John, you had chosen the second?

Male: I chose the second one.

RM: But you're not willing to pay much for it, why not?

Male: I'm not sure that either one is very safe.

Male: Either way you're saying they're both perfectly safe, but ...(?)... the rock moves all the way around, it's a no win, no lose situation.

RM: Some people think one is safer than the other.

Male: Not given the circumstances you've given them. You've given us, they're both perfectly safe with no possible problems ever arising.

RM: But, [ambulance went by - couldn't understand]

Female: You know what it boils down to, what it really boils down to is believing the person who is telling you about this. First you have to have all the education, you know, what this is doing, what that's doing and things that could happen and then you have to believe the person who says, we don't have to do what looks the safest, just do it the easiest way. Because we've been fooled so many times, sure do it the easiest way and all of a sudden we shouldn't have done it, we should have done it the more cautious way.

RM: In truth, I meant to describe both of these as safe. The second one would be even more so.

Male: Well, the thing is I just don't like the idea of the psychology of burying it. They should turn it into something else, you know right off the bat. Turn it back into useful material or don't generate so much of it to begin with. We've been going along too long just burying our mistakes and it always comes back to haunt us, whether it's garbage or any other number of things that we do. You know, it's like me, right now I've got gout and I had a Bloody Mary before I came over here anyway because I thought I could get away with it and not get the pain. You're going to bury poison in the ground because you think you can get away with it, but sometimes you won't. And, it just has a cumulative effect, just like the gout. So, it's better to do the right thing to start with and try to do it that way all the time the best you can and then when you fail to live up to your ideal way of doing things then the damage you do is going to be a lot less than when you settle for a second best method to being with, and try and hope it's not going to go awry somewhere.

RM: You and John share a powerful skepticism, perhaps looking at it in different ways.

Male: Yeah, different angles.

RM: A different point of view, both of you very skeptical of the ability of government to figure it out, do it in a way -

Male: They mess up everything else. Look at the Love Canal, they're finally starting to clean up a few lakes and rivers. Somehow, all of a sudden after a couple hundred years of dumping into every conceivable waterway we realize we're in trouble, and we've killed all the fish and now we're cutting down the South American jungle's for toilet paper so our children won't air to breath and we're making the ozone bigger so everybody will have skin cancer. And, all sorts of things that I don't understand the mechanism of, which the indians just left alone, and maybe the better psychology is to find the way to either leave it alone and create as little of this waste as you can, in other words if you're going to create it, circle it back into something useful and use it again and again and again, and ultimately cut down on the amount of junk you're going to have to hide somewhere and poison some locality with.

RM: The more expensive it is to get rid of the waste, the more incentive there is to recycle.

Male: So pick the most expensive way and fight for it.

RM: So that would be one argument for the country's sake, it would be very expensive, although the other one will also be very expensive, more expensive than what garbage disposal costs now.

Male: I like John's way of doing it. Bring it up to one of these active volcanoes and throw it in.

Male: Well, you can get rid of some of it that way.

Male: But given the two ways, like they're skeptics about how even one way, given the two ways that we were given and the information we were given, I liked the first one better because I understand that some of the things that are happening on farms, most of our problems are coming from farms using industrial chemicals for fertilizers. And even down in, I think it's Georgia or Alabama, they're teaching populace how to use natural fertilizers and getting away from the industrial fertilizers because that's getting into the Chesapeake Bay, and they're trying to clean up the Chesapeake Bay. They can't even get fungus to grow in the Chesapeake Bay right now, it's just sits fermenting now in the Chesapeake Bay. But replanting what was already grown there naturally, but with all the chemicals going into the ground through the ponds, because there's so many ponds on that area, that it's

getting into the Chesapeake Bay. Algae is growing on ferns and all the plants in the Chesapeake Bay, it's killing them. The fish is too contaminated to eat and so it's the fish down there. They don't use Chesapeake Bay for crabs now, people who used to fish there for bass, they can't get bass because the bass won't go in there anymore. So basically, no matter what we do with our garbage, if you make a chemical fertilizer out of it you're going to do the same thing with it. We have to get rid of plastics. People want plastics, you have to get rid of plastics, plastics do not dissipate, the same way with rubber. That's the problem with the tires, you were talking about the fire in the tires. That may have been set, they're not too sure how that started. But tires, when they used to bury the tires in landfills, the tires would work themselves up. Plastic will do the same thing. We wrap our garbage in plastic, the air doesn't get into it so the garbage does not disintegrate, it doesn't rot like it should. You've got to eliminate pressure cans, paint and stuff like that, oils and stuff like that from the landfills, using some other ways. How you want to get rid of that stuff I don't know. But a garbage pit should be used just for garbage and that's all and it would be perfectly safe that way.

Male: They could make compost out of garbage and reclaim desert land if they really wanted to.

Male: That's not too great either, because they're having trouble where they irrigate the desert in Egypt and now they have an ecological problems over there.

RM: Let me ask you a question since we've raised some issues about the assurances I gave you. If you accept all my assumptions and the leachate would not harm anyone because it would be confined. How many of you would still, accepting those terms, still prefer concrete barriers?

Male: I just don't think we can go on contaminating areas.

RM: Okay, that's good, that's what I want to know. Serita?

Female: [Too far from microphone](?)

RM: Okay, so two of you said that even if all the assumptions are correct, it would feel better protecting these groundwater resources. The rest of you would also feel better doing the concrete burial thing simple because you can foresee the possibilities of contamination, things like that. Is that right, Carl?

Male: Is there a way of getting down and seeing how the rock is in this area of seepage?

RM: Oh yeah, sure, the geologists do that.

Male: They'd be able to tell you exactly .....(?)....., if it spread out, repair it somehow.

RM: Well, that'd be a little hard, but geologists can tell how thick it is and the nature of the rock, what the likelihood of seepage is, and how deep the seepage would be. And, since the leachate moves so slowly even if there were minor cracks, it wouldn't create any problems. But repairing, no, that would be -

Male: So the rock basin is really is as safe as it would be if they poured in the concrete.

RM: Yes. The concrete barrier would cost more but it would definitely give you more assurance, give you a ....(?).... definable barrier that would prevent it entering any groundwater at all.

Female: It all boils down to how much of a risk you want to take.

RM: Yes, and part of that is your own confidence in our technology and the ability of government to figure it out, to do it. Some of you see a greater risk than I've described, fair enough?

Female: I think it's looking back at what people before us have done, they didn't even know they'd done it and they didn't care. And we just .....(?)..... do a turnaround, the next generation would really be safe.

Male: Right, there's a whole different attitude. Yeah, I agree with her.

Male: They even made paint out of milk. Milk paint.

RM: Okay, let me see if I can summarize. Two of you value the concrete thing for what we call distance value. That is really you feel better knowing that no water is contaminated even if it wouldn't affect people greatly. And then the rest of you who preferred the concrete barrier had more of a feeling that it would avoid potential problems; there's always a risk of more people being harmed and it's the harming people that concerns you.

Male: It concerns me just as well, the harming of the planet, the -

RM: And those of you who had the first also had the second. But those of you with the second, if it could be shown it would be perfectly safe, you could accept, and here's where I want you to tell me if I'm wrong, you can accept the seepage if it can be shown that this rock really would be a barrier?

Male: Only as a temporary measure till something better came along.

RM: Carl?

Male: Well, it's definitely ...(?)... improvement, a better way of doing it, this way. We're both faced with the same thing, because one would probably be safer and I like the idea that it's an improvement.

Male: What you've made there is a natural cement basin. There's no difference between that manmade one that we're proposing if some disaster happens or anything like that. Except that the manmade one is nice and square and oblong and you can scrape it out real easily to do something with that muck someday if you find another use for it. This one is all crevices.

RM: Yeah, but it's a larger area. But if both of them -

Male: I mean, you're talking a permanent waste site, right? Is that what we're talking? We're talking fifty to a hundred years down the road so that's permanent as far as my life's concerned.

Female: Are they all permanent? Any kind of landfills, no matter where it is?

RM: Well, of course all landfills contaminate the water to a degree.

Female: But they'll always be there. Is that the point you're trying to make, that they'll always be there no matter what you do?

RM: In both cases, yes.

Male: Well, that's why most of us buy that spring water.

Female: That's right, I bought some Tuesday.

Female: If you're going to put in the rectangular one and have a pump down there to pump up water, would it be a good idea to put a well down there as far as it would go?

RM: It could, but it would be much harder because you have to rim the whole thing with wells and -

Female: You couldn't put one in an inch below the lowest point?

RM: Yes, you could but the other is that the leaching, the concrete would be constructed so that the water would essentially stay in place so it would all be contained.

Male: Doesn't the integrity of all of these plans depend upon who's running the EPA, for instance, and that even the best plan could be badly administered is going to be trouble some unless you try and get a really efficient, and, I hate to say final solution for garbage. All I'm saying is that the last eight years the EPA has been a shambles and there were things in place that weren't acted out the way they were supposed to be. Whether we have the technology or not, it doesn't mean we're going to have the will and isn't it better to -

{END OF SIDE 1}

RM: Okay, let me explain a bit more what I'm up to and then I'd like you to fill out a little questionnaire. Just some background information on yourselves. Basically, I'm probing to see the value that people place on protecting groundwater that has no foreseeable use as far as we can tell. The United States Environmental Protection Agency is very interested in these questions because they have to set regulations on how waste is disposed. And, the question is, is there any value to protecting groundwater that's not going to be used?

Female: [Can't understand]

RM: Well, we can be awfully sure, you can't always convince people, like you folks, which is fair enough. I've found in running groups like this that there is a great deal of skepticism on the part of the public about the ability of scientists and government to do the right thing. So, it's hard to be sure.

Female: I should be more skeptical. My son works for the federal government testing the environment.

RM: Really.

[Laughter and talking]

Female: We're a society of middle aged people that are probably more guilty, have guilt feelings about what we're passing on to our children. But people are beginning to do something about it now. We haven't done anything up to this point, it's all on our shoulders, why does it happen that we're sending our kids out into this world to get cancer, whatever and then their kids are going to have a rough time of it. They're going to be skeptical no matter what you tell them.

Male: Okay, my question would be regarding the EPA, it's kind of a trick question but I'll sum it all up this way. Why is the EPA interested in finding out what, how much sloppiness will get them get away with, instead of going right to science and finding out the very best and cleanest way to get rid of it and doing it?

RM: Because of the cost.

Male: Exactly. Well, if we don't spend it now it will cost more later. Everything's like that.

RM: Okay, Chuck?

Male: Shirley just said about the guilt and all this, I don't know why people feel this, but this is just a probably off the wall kind of deal. People are living longer now than they've ever lived before. The world's increased it's life span and all that kind of stuff.

Male: Well, that's because we've got penicillin now.

RM: Joe?

Male: I'm more worried about the water supply being polluted than I am, like you're saying, about being guilty about bad water supply's and getting cancer from that. There's too many things out there that you can get cancer from and a lot less likely of getting it from water. You have smoking, you have coke, you have all kinds of drugs out there, kids are getting into drugs younger and younger, they become drug addicts at the age of six in some of our local schools. These things are more important than what the water's going to be doing in the future because you're going to have problems with acid rain. I stayed at a lake up in Vermont, Lake Barley, and that was a dead lake, big huge beautiful lake, it's a dead lake, they're going to have to drain. You're going to have pollution from all kinds of chemicals that are being used in the house, kids can get at them easily unless you have a childproof house. Your water supply, you know, you don't have that much water to begin with, you're going to have to manufacture ways of getting water out of the sea from Greenland, places like that. We're getting all kinds of pollutants in the air besides water. I don't worry about garbage. Garbage is going to be with us as long as people want to make it and people are making more and more garbage every day. We have a person ....(?).... puts out seven bags a week of garbage, people in the house. Where they get seven bags of garbage each week, I don't know, but most of it's plastic. A lot of it is aluminum cans, you know this stuff doesn't rot, this is the stuff that's gonna hurt.

Male: Here you're saying everything's poison so it's okay to go do it a little bit more.

Male: Nope, I'm less worried about that because I don't think it will be that much poison, because as the seepage does go through the ground it does filter out.

Male: What I'm saying is it's a whole thing of attitude that

we have to start to change and not settle for second best anymore with this stuff.

Male: Start with the worst not the least.

Male: Well alright.

Male: Start with the worst.

Male: Yeah, well this came up today so -

Male: But if there's nobody alive in the next fifty years -

Male: Oh there will be.

Male: I wouldn't worry about fifty years from now.

Male: Fifty years from now, I think we've got a good shot of making fifty years.

Male: I know I haven't.

Male: Well, I think there'll be people around in fifty years.

RM: Thank you very much for coming out and I want to give you each a check.

Male: Oh, fine! You know I think part of the reason why the kids are so messed up is that they see everything being messed up and they just have no positive attitude and they have no spiritual positivity because everything, we don't respect anything, the planet, the sky, ourselves, anything.

Male: Children are imitators.

Male: Sure.

Male: My kids have some of the worst habits, puffing away on cigarettes.

Female: I think children are more depressed about what's going on in the atmosphere.

Male: I don't think they're impressed about anything.

Female: Depressed.

Male: Oh, depressed, I thought you said impressed.

Male: What age are you talking about? .....(?)..... six week old baby, I'm talking children.

Female: Ok, mine are 18 and 20, and since they're 10 or 12.

Male: So are they still worrying a lot about the H-Bomb or have they finally realized we're probably not going to do that in Russia.

Female: They did at one point. It's really something that you have to sit down and talk to the kids anymore, they're getting too much of it.

Male: That was my big worry at 18.

Female: .....(?)..... a little of it. There's so many other worries they have that, you know, at my age I think, well you know, it's not going to come about in my lifetime, cancer isn't something I have to worry about. I've lived a good portion of my life, they're too young to have to worry about that.

Male: Right, our big worry was the H-Bomb and world annihilation through war. Well, I don't know, I don't really think we're going to do that, but what we might do is just choke ourselves to death.

Male: I don't think so.

Male: Maybe, but that, no but they don't have the capacity to do much damage outside their own area.

Male: They have more than we had five years ago.

Male: No, that's another whole issue.