FINAL REPORT

Recreational and Resource Economic Values for the Peconic Estuary System

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DISCLAIMER

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Recreational and Resource Economic Values for the Peconic Estuary System

EXECUTIVE SUMMARY

I.A. PURPOSE AND SCOPE

The environmental and natural resources ("natural assets") of the Peconic Estuary System--the bay waters, beaches, wetlands, ecosystems, habitats, and parks and watershed lands--provide many services to the public. Outdoor recreation, scenic views, and the productivity of wetlands that contribute to stocks of fish, birds, and other species used for commercial and recreational purposes are but a few examples of these services.

While the quality of PES coastal amenities is widely recognized, little information exists about the uses and users of PES natural resources. Even less is known about the value that the public holds for the natural asset services of the PES--that is, what they are "worth" to the public. This is because recreation, scenic views, and ecosystem productivity are not directly valued in markets. Lacking information on recreational and resources values, comparisons cannot be made of the benefits and costs of prospective actions to preserve or restore PES natural assets. This report is designed to help fill this major gap.

In this report, we present the results of four non-market valuation studies carried out by Economic Analysis Inc. ("EAI") to estimate the uses and economic value that the public holds for the natural assets of the PES. We provide estimates of (1) outdoor recreational uses and of the non-market economic values of key recreational activities, and (2) other resource values provided by the natural assets of the PES. The economic valuation studies described herein were done to contribute to benefit-cost analyses of proposed management actions.

This document is Phase II of a series of economic studies being done by EAI for the Peconic Estuary Program. A Phase I report (Grigalunas and Diamantides, 1996) (1) provided an assessment of the "economic impacts" of the PES, in terms of business revenues, employment, and wages of estuarine-related sectors, and (2) summarized available information on recreational uses. Subsequent work by EAI will include benefit-cost analyses of resource management actions and sustainable financing options for the selected, preferred actions.

I.B. ESTUARINE-RELATED USES, RESOURCES AND ECONOMIC VALUES

I.B.1. Introduction and Overview

No single method can capture the value of the variety of services provided by the natural assets of the PES. Recognizing the many uses of PES natural resources, we designed and implemented a suite of four non-market valuation studies in order to provide estimates of the value of particular services:

(1) A *Property Value* study examines the contribution of environmental amenities to the market price of property. Using the Town of Southold as a case study, the Property Value study was designed to measure values of amenities to residents living in the immediate vicinity.

(2) A *Travel Cost* study uses original survey results to estimate outdoor recreational uses in the PES and the economic value that users have for four, key PES outdoor recreation activities: swimming, boating, fishing, and bird and wildlife viewing. This study also examines the impact that (A) water quality has on the number of trips and the value of swimming and (B) the effect of the catch rate on recreational fishing, important recreational uses of the estuary and activities much affected by water quality and resource abundance.

(3) A *Wetlands Productivity Value* study, carried out in collaboration with Applied Science Associates, gives estimates of the economic value of eelgrass, intertidal salt marsh, and sand/mud bottoms, based on the value of the fish, shellfish and bird species that these ecosystems help "produce". The primary focus is on the nursery and habitat services of the wetland ecosystems in the production of commercial fisheries.

(4) The *Resource Value* study uses original survey results to estimate the relative preferences that residents and second homeowners have for preserving and restoring key PES natural and environmental resources: Open space, farmland, unpolluted shellfish grounds, eelgrass beds, and intertidal salt marsh. This study also provides a perspective on the economic value the public has for these resources, as indicated in their stated willingness to pay for programs to preserve and restore them.

Key results for each of these studies are outlined below. A detailed discussion of each method, its purpose, the data used, assumptions and limitations, and results is given in the chapters that follow.

A note on the style adopted for this document. We believe that the results of the economic analyses presented in this report provide a wealth of data to decision makers and to the public. To make the report accessible to a wide audience, we deliberately adopt a non-technical style. For those interested, Appendixes present the technical details of the methodologies used.

I.C. SUMMARY OF SELECTED RESULTS

I.C.1. Property Value Study (Chapter III).

Data for property sales in the Town of Southold were used to estimate the contribution of specific environmental attributes to the market value of nearby property. Using a property value model, we found that proximity to open space and other environmental attributes had a significant, positive impact on nearby property values.

For example, a parcel of land located next to open space has, on average, a 12.83% higher per-acre value than a similar parcel located elsewhere. To illustrate the how this result might be used, we estimate that a *hypothetical* contribution of a parcel of approximately 10 acres of open space would increase adjoining property values by $410,907.

The model results also show that density of development and other attributes affect property values. For example, 2 or 4 acre zoning (i.e., R-80 or R-120) has, on average, a 16.65% higher per-acre value than a similar parcel located elsewhere (i.e., in a 1/2-acre zone). Conversely, property located on a main road (highway 25 or 48), or property adjoining a farm, has a lower value, after taking into account other property attributes.

I.C.2. Recreational Uses and Economic Value (Chapter IV).

A recreational survey adminstered to residents, second homeowners, and visitors allowed us to estimate (1) participation in outdoor recreation, and (2) the economic value the public has for four key PES recreational activites. We estimate that in 1995:

- 127,762 people took some 3.3 million swimming, boating, fishing, or shell fishing, outings
- 156,184 people engaged in about 5.2 million beach use, bird watching, wildlife viewing, or hunting trips

Swimming and beach use were the most popular activities, followed by bird and wildlife viewing, boating, and fishing. Shell fishing and hunting had the fewest estimated number of trips. Measurement problems prevented us from including other common activities, such as hiking/walking and bicycling.

Among the PES Bays, Great Peconic Bay is the most popular, accounting for 28% of all recreational trips to the PES. Flanders Bay is the least frequently used, with 8% of PES trips. Great Peconic Bay is the most used for swimming (30%), fishing (29%), and boating (25%). For shell fishing, Gardiners Bay is the most popular PES location, with 33% of all PES shell fishing trips.

Outdoor recreation in the PES is enormously valuable to users. Using a Travel Cost model, we estimate the economic value per person, per trip, for four key recreation activities: Swimming, boating[1], fishing, and for viewing of birds and wildlife. The estimated values *per trip* range from $49.83 for viewing birds and wildlife to $8.59 for swimming (in 1995 dollars). These are estimates of what participants would be willing to pay, per trip, *above and beyond* the amount that they actually pay to participate.

Adding across all trips, in 1995 Viewing of Birds and Wildlife ($49.3 million) has the highest total *annual* value, followed by Recreational Fishing ($22.4 million), Boating ($18.1 million), and Swimming ($12.1 million). The corresponding *asset values* of the PES (over 25 years at 7 percent) for these key recreational activities range from $318 million for Bird Watching and Wildlife Viewing to $141 million for Swimming. The PES has an asset value of $276 million for Recreational Fishing and $210 million for Boating.

Quality is important to PES recreationists. Swimming was found to depend upon perceptions of water quality, and swimmers perceptions, in turn, were related to objective (i.e., SCDH field sampling) measures of water quality for nitrogen, water clarity, Brown Tide, and coliform bacteria.

To illustrate how the results might be used in a Benefit-Cost analysis, we simulated hypothetical, uniform improvements in water quality. For example, a 10 percent uniform improvement in water quality in each Bay increases the estimated number of annual swimming trips by 151 thousand and adds yearly benefits of $1.3 million. Most of the benefits ($754 thousand) are due to improvements in water clarity (as measured by Secchi depth). Swimming benefits increase further with a hypothetical, 20 percent uniform water quality improvement, although the added benefits from the second 10 percent improvement is slightly less than that due to the first 10 percent improvement.

The present value of the $1.3 million increase in benefits due to the 10 percent hypothetical water quality improvement is $15.1 million, using a 7 percent discount rate and a 25-year time horizon. Thus, if the present value of the costs of the policy (or set of policies) to improve water quality did not exceed $15.1 million over the same period, it would be a good investment of scarce resources.

Recreational fishing also was found to depend upon the quality of the experience--in particular, the catch rate. A hypothetical 10 percent increase in catch rates raises the economic value per trip by $0.80, the number of trips by 11,249, and total annual fishing benefits by $472,359. The present value of this increase in catch rates--the increase in the asset value of the PES in providing this service-- is $5.5 million, using the 7 percent rate and time horizon of 25 years used for all cases.

On another issue, to address a data gap identified in EAI's Phase I study, Phase II survey respondents were asked how much they spent at road side farmstands and at vineyards and for rental accomodations. In total, in 1995, the public spent some $19.4 million at East End roadside farmstands and $5.4 million at vineyards. Using the same assumption as in the Phase I study that 45 percent of these activities are PES-related (Grigalunas and Diamantides, 1996), the annual PES-related expenditures for these two activities are $8.7 and $2.4 million, respectively.

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[1]Boating for the primary purpose of fishing is valued under recreational fishing.

I.C.3. Wetlands Productivity Values (Chapter V)

Eelgrass, saltmarsh and intertidal mud bottoms provide food web and habitat services for many species of fish, shell fish, waterfowl and birds, and thus directly or indirectly benefit people who consume, hunt, or view these species. A simple food web model was developed that used available biological data, commercial fish and shell fish prices, and viewing values for birds to provide a perspective on the economic value of the productivity of these habitat types.

The results suggest an asset value *per acre* for *existing* wetlands of approximately $12.4 thousand for eelgrass, $4.3 thousand for salt marsh, and $786 for mud flats, using a discount rate of 7 percent and 25 year period for the services valued. Restored wetlands are worth somewhat less since it may take several years to restore fully their natural functions as a food source or habitat.

I.C.4. Resource Preferences and Economic Values (Chapter VI)

Early discussions revealed that the public has a strong attachment to environmental and amenity resources of the PES, even if they do not use these resources directly. As outlined above, the Property Value study captures the value of amenities (or disamenities) to nearby properties, the Recreation study estimates use value for key outdoor recreational activities, and the Wetlands Productivity study yields estimates of the value of wetland ecosystems in the "production" of fish, shell fish, and birds. However, none of these studies reflects the value residents and second homeowners hold for the general ambience of the PES--the "sense of place" it provides, a phrase used often by participants in EAI's focus groups.

To try to capture these elusive but important non-market resource values, a survey developed and administered to 968 residents and second homeowners was used to learn which amenities are most important to people in the study area, and the amount that they would pay to preserve or restore them. Our purpose was (1) to account for the preferences many residents have for resources, even if they do not use these resources directly, and (2) to measure these preferences in dollars, if possible, to compare with other study results.

Most respondents to the resource survey (97 percent) supported at least one hypothetical action to protect resources, and indicated they would financially support such actions. The relative priorities of respondents, in order, were for farmland, eelgrass, wetlands, shellfish, and undeveloped land.

We also estimated the monetary value that the survey responses imply for the resources concerned. The estimated per acre dollar values were about $14.0 thousand for undeveloped land, $30 thousand for unpolluted shellfish grounds, $56.7 thousand for saltmarsh, $70 thousand for eelgrass and $74.5 thousand for farmland, using a 25-year time horizon and 7 percent discount rate. However, we believe that the resource priorities or relative values of resources are more reliable than are the dollar estimates of values and recommend that relative values, rather than dollar values, be used in the process of selecting management actions.

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II. BACKGROUND AND INTRODUCTION

II.A. BACKGROUND

Located within Suffolk County at the East End of Long Island, the PES is comprised of the Peconic-Flanders Bays system, Gardiners Bay and part of Block Island Sound, and the adjoining watershed lands (Figure II.1). Included within the PES are five towns: East Hampton, Southampton, Riverhead, Southold, and Shelter Island, as well as a small part of a sixth town, Brookhaven. In total, the five towns comprise about 38 percent of the land area and 8 percent of the year-round population of Suffolk County (SCDHS, 1992; Long Island Business News, 1994).

Important characteristics of the PES include: (1) the generally high quality of its coastal estuarine environment, (2) its economy, which is strongly influenced by seasonal, estuarine-related activities, particularly tourism and recreation, and (3) the population, which is highly seasonal and for year-round residents is comprised of smaller, more elderly, and lower-income households than for the County or Long Island as a whole (Long Island Business News, 1994; Grigalunas and Diamantides, 1996).

Water quality in the PES generally is very good, and the study area contains many beaches, parks, open space, and habitat for birds and other wildlife, including some endangered species. These and other environmental and natural resources of the PES can be viewed as natural assets. A significant feature of assets--natural or otherwise--is that they can provide a stream of valuable services ("interest") over time, if maintained.

Some of the natural assets of the PES, however, are not being maintained, and others are at risk. Localized water quality problems exist due to runoff, failing septic systems, and inadequate sewage treatment. Substantial areas of open space and farms have been lost due to development; and pollution has closed thousands of acres of shellfish grounds used for commercial and recreational purposes. Further, large areas of ecologically productive eelgrass and saltmarsh ecosystems have been lost due to development, Brown Tide, and water pollution. Fin fish and shell fish landings have declined substantially over time, in part due to these problems. The combination of all of these adverse developments threaten the quality of life of residents of, and visitors to, the PES.

Management programs being developed by the Peconic Estuary Program would preserve or restore key PES environmental or natural resources. None of these programs is free, however, and some could be very costly. Deciding whether, where, how much, and when to invest in preserving or restoring PES natural resources requires consideration of many factors. One of these is the economic benefits and cost of such actions.

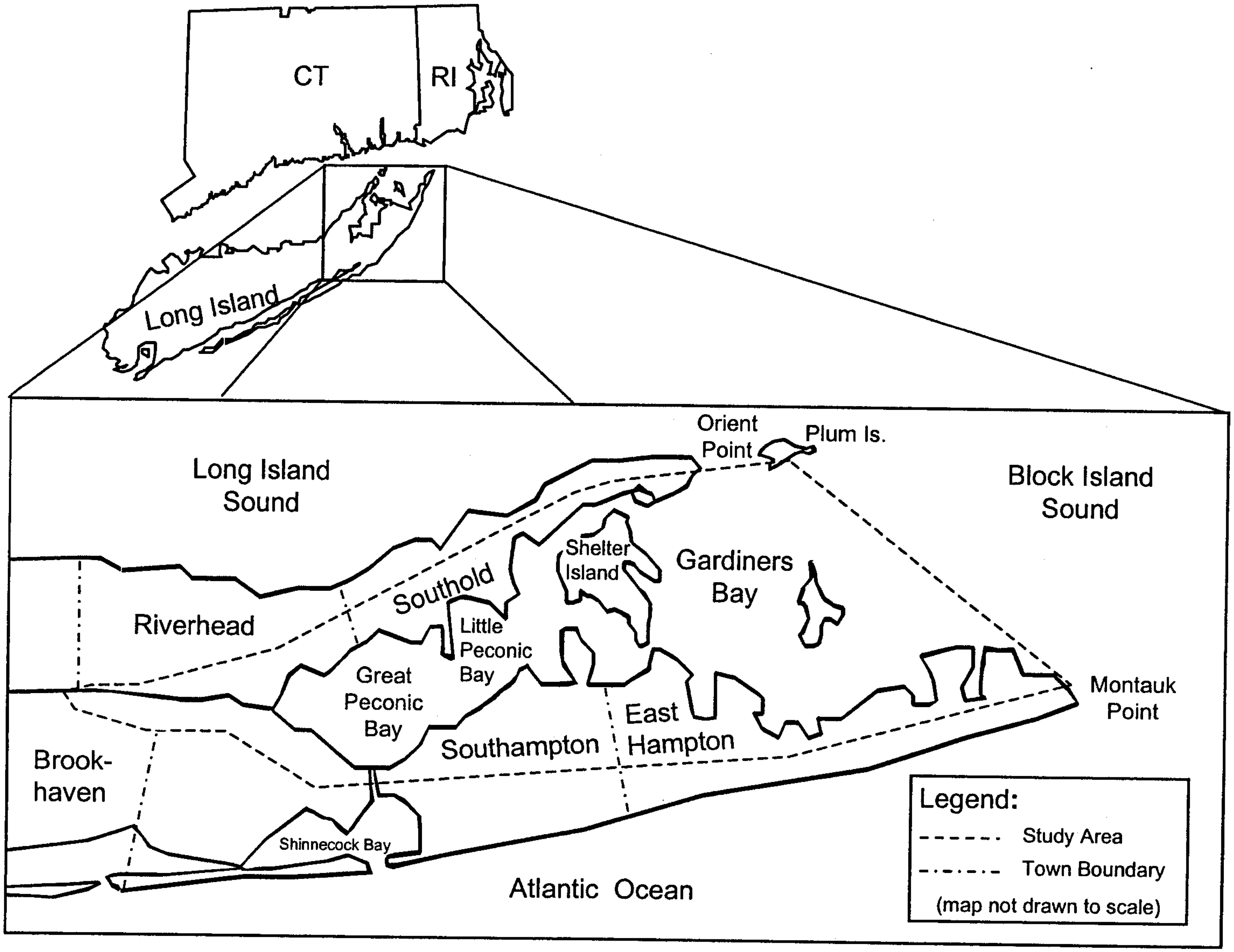

Figure II.1. Depiction of the Peconic (Long Island) Estuary System

II.B. NATURE AND IMPORTANCE OF NON-MARKET RESOURCE VALUES

II.B.1. Overview of Studies and Basic Concepts

Economic benefits provided by natural asset services show up in at least two ways:

(1) As *market benefits* to the owners, operators and employees of over 1,000 businesses that engage in or support recreation and tourism, commercial fishing and seafood activities, and other estuarine-related economic operations (Grigalunas and Diamantides, 1996).

(2) As *non-market benefits* to the thousands of recreationists, visitors, property owners, renters, and others who use or otherwise enjoy the quality of the PES's natural amenities.

EAI's Phase I study summarized available information for the first of these two categories by quantifying "economic impacts" of estuarine-dependent economic sectors (Figure II.2). Estimates were made of employment, wages, sales, and number of establishments for 29 economic sectors identified as estuarine-related, in whole or in part. These sectors include commercial fishing, marinas, eating and drinking establishments, hotels/motels, and other estuarine-related activities.

The Phase I results show that estuarine-related economic activity is a major component of the PES economy and an important part of the livelihood of over 10,000 residents who own, operate, or are employed in more than 1,000 marine and tourism-related businesses (Grigalunas and Diamantides, 1996).

Market data alone, however, give only a very limited view of the overall benefit or value of the services provided by PES estuary-related resources. This is because much of what people enjoy in the PES--for example, natural amenities, like open space, attractive views, good beaches and high levels of water quality--are not bought and sold in markets. Benefits cannot be counted in economic impact studies if they are not bought and sold on markets; and many benefits that do show up on markets are indirect and hence not linked to the natural asset that provides the service (e.g., fish or shell fish "produced" by PES wetlands and later harvested by fishermen).

This Phase II report focuses on non-market benefits provided by amenities in the Peconic Estuary System ("PES"). We adopt the view that the natural resources and environmental amenities of the PES can be looked at as natural assets (Freeman, 1993; Kopp and Smith, 1993; Tietenberg, 1995) that provide a flow of benefits over time, if maintained.

Several standard economic concepts are used throughout this report. Two of these are *Consumer Surplus* and *Present Value*. To avoid later confusion, these concepts should be explained at the outset.

Consumer Surplus. People buy goods or engage in activities like recreation when the benefit they receive is at least as great as the cost to them. For example, if I can buy a discount airplane ticket

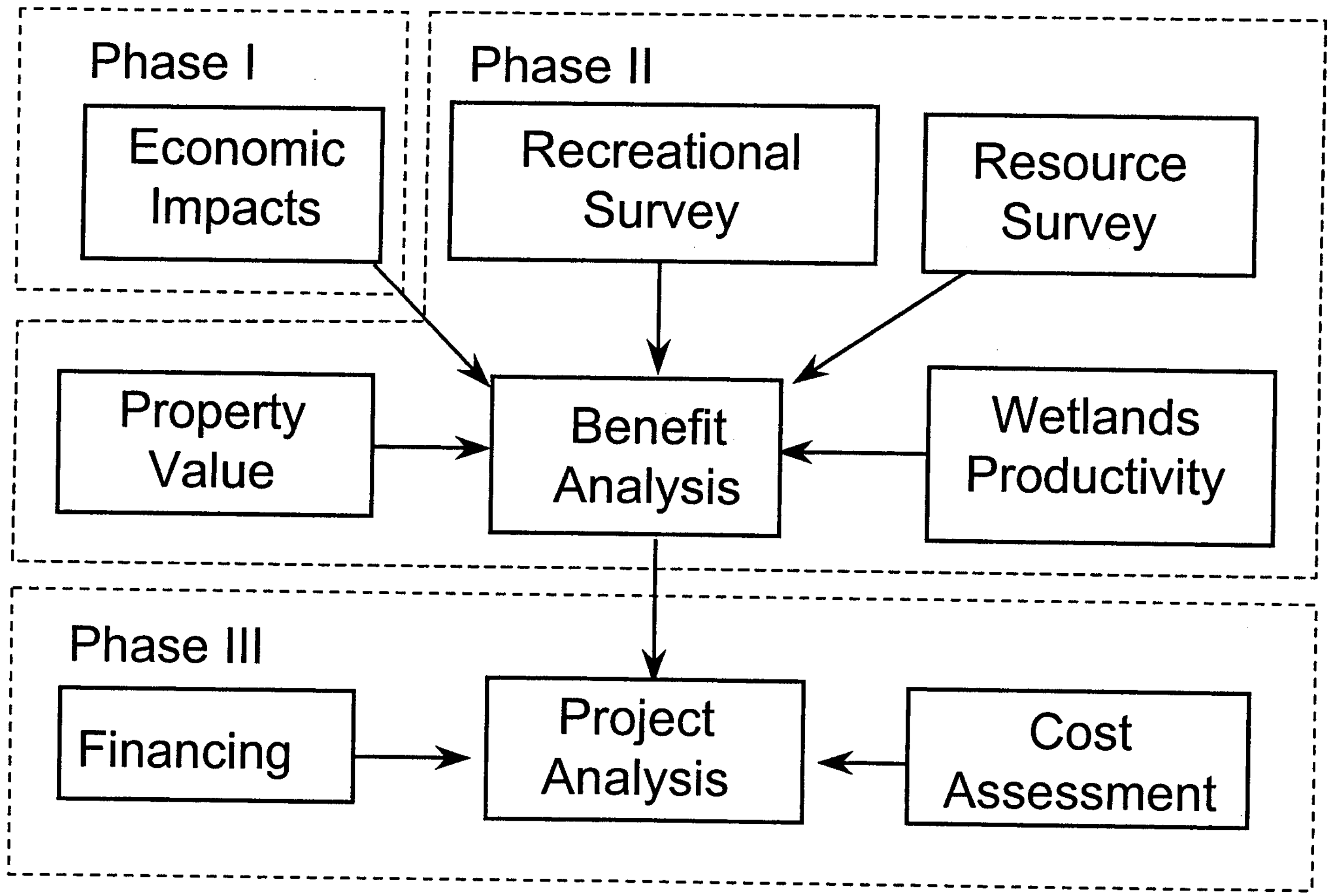

Figure II.2. Economic Studies by EAI for the PES Program for \$200, I would do so only if it was worth at least that amount to me. If I would pay up to \$500 for the flight, then I will buy the ticket and receive a net benefit--an unpaid-for benefit--of \$300. Similarly, on a nice summer day I might be willing to pay as much as \$15 to use a beach for the day, but if using it costs me only \$5, then I receive an unpaid-for benefit of \$10 for that trip to the beach[2].

In the above examples, the most that I am willing to pay is my own assessment of the economic value of the airplane ticket or the day at the beach--what each is *worth* to me. The net benefit to me in each case is the difference between the most I would pay, *less* what I actually pay. This "unpaid-for benefit" realized in each example captures the notion of "Consumer's Surplus". Consumer Surplus--the benefit people receive above and beyond the cost to them--provides the basis for the measurement of economic benefits used in this document.

Of course, the "trick" is to use sound methods to discover the Consumer Surplus the public receives for the services provided by the natural assets of the PES. Fortunately, standard methods are available to do just that. These methods, and how they were used to value the services of PES natural assets, are summarized in the next section and explained in detail in succeeding chapters.

Discounting and Present Value. A second important concept involves discounting. Many benefits or costs occur over time; discounting is the process used to convert future benefits and costs to an equivalent, lump sum value today. This discounting process is used, for example, to convert a retirement of lottery annuity (an equal cash amount each year) to a lump sum equivalent today. The equivalent, lump sum value today arrived at by discounting is called the "present value".

To estimate the present value of a stream of dollar flows over years 1 through "T" we discount each annual flow using the formula:

$$\text{Present Value} = V_1/(1+r)^1 + \ldots + V_T/(1+r)^T$$

where V is a dollar value and r is the discount rate--the interest rate used to convert future flows into a value today. For example, if the total Consumer Surplus from swimming is \$1,000 in year 1 and \$1,000 in year 2, and the discount rate is 10 percent, then the present value of these annual amounts is \$1,735 (= \$909 +\$826) today.

The present value calculated with the above formula depends upon three factors: (1) the size of the annual monetary values, V_t, (2) when they occur, and (3) the discount rate, r, used. We estimate the annual monetary values, V_t for non-market services in the chapters that follow, employ a time horizon, T, of 25 years, and use a discount rate of 7 percent, a standard rate recommended for use in many resource management projects[3].

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[2]Of course in some cases the price is more than we are willing to pay, and we will not buy the item because it is "too expensive" or "not worth it".

[3]In later work the effect on results of uncertainty in choice the discount rate and other variables will be examined.

II.C. PURPOSE AND SCOPE

This report describes the four non-market valuation studies comprising Phase II of a series of studies being carried out by EAI for the Peconic Estuary Program. The Phase II studies provide estimates of recreational uses and the economic values that the public holds recreation and for a variety of other services provided by key PES environmental and natural resources.

The Phase II studies reported on here are a major component of a larger program to assess the benefits and costs of proposed management actions as part of the Peconic Estuary Program (Figure II.3). Phase I was designed to estimate market effects provided by the PES. As discussed above, Phase I measures "economic impacts" of the PES, including employment, sales, wages, and the number of establishments associated with 29 economic sectors identified as estuarine-related. Phase II provides estimates of non-market benefits. Our studies were carried out for the purpose of eventually contributing to benefit-cost analyses of proposed management actions by the PES Management Committee in Phase III of the project.

Phase III analyses will (1) provide cost analyses for specific management actions designed to protect or restore PES amenities, (2) combine this cost information and the benefit information from Phases I and II to provide benefit-cost analyses of potential management actions, and (3) compare various financing options for the proposed management actions.

We designed a suite of non-market valuation studies in order to be able to estimate the value of key services provided by amenities in the PES. Multiple non-market valuation studies are needed because of the many different types of services provided by PES environmental and natural resources. For example, recreational participants directly use Bay waters and beaches; hence, for these activities we want to measure participants' recreational *use values*. In other cases, PES resources may provide amenity or aesthetic benefits to residents, which will be captured in property values, another type of use value. Additionally, some may also enjoy just knowing that PES environmental amenities, such as open space and salt marsh, are being preserved or restored, whether or not they directly use these resources. For these resources, *other* values, not involving direct use, may also be important and should be included. In sum, our use of a variety of methods was designed to allow us to gain a better understanding of the non-market values provided by different resource services, information that will prove useful for later benefit-cost studies.

The key Phase II studies are the property value study, the recreation survey, the wetlands productivity analysis, and the resource survey. The property value study was designed to estimate benefits that PES amenities provide to individuals who own adjacent properties. The recreational survey allows us to estimate recreational use and use values for a variety of outdoor activities. This survey was designed fill data gaps identified in Phase I report, and to estimate recreational uses and use values to contribute to assessment of management actions in Phase III. The wetlands productivity analysis uses available data to estimate the productivity of specific habitat types, and to place a dollar measure on the ecosystem services provided. The productivity study includes only food web and habitat services and focuses on the "production" of commercial species, and to a lesser

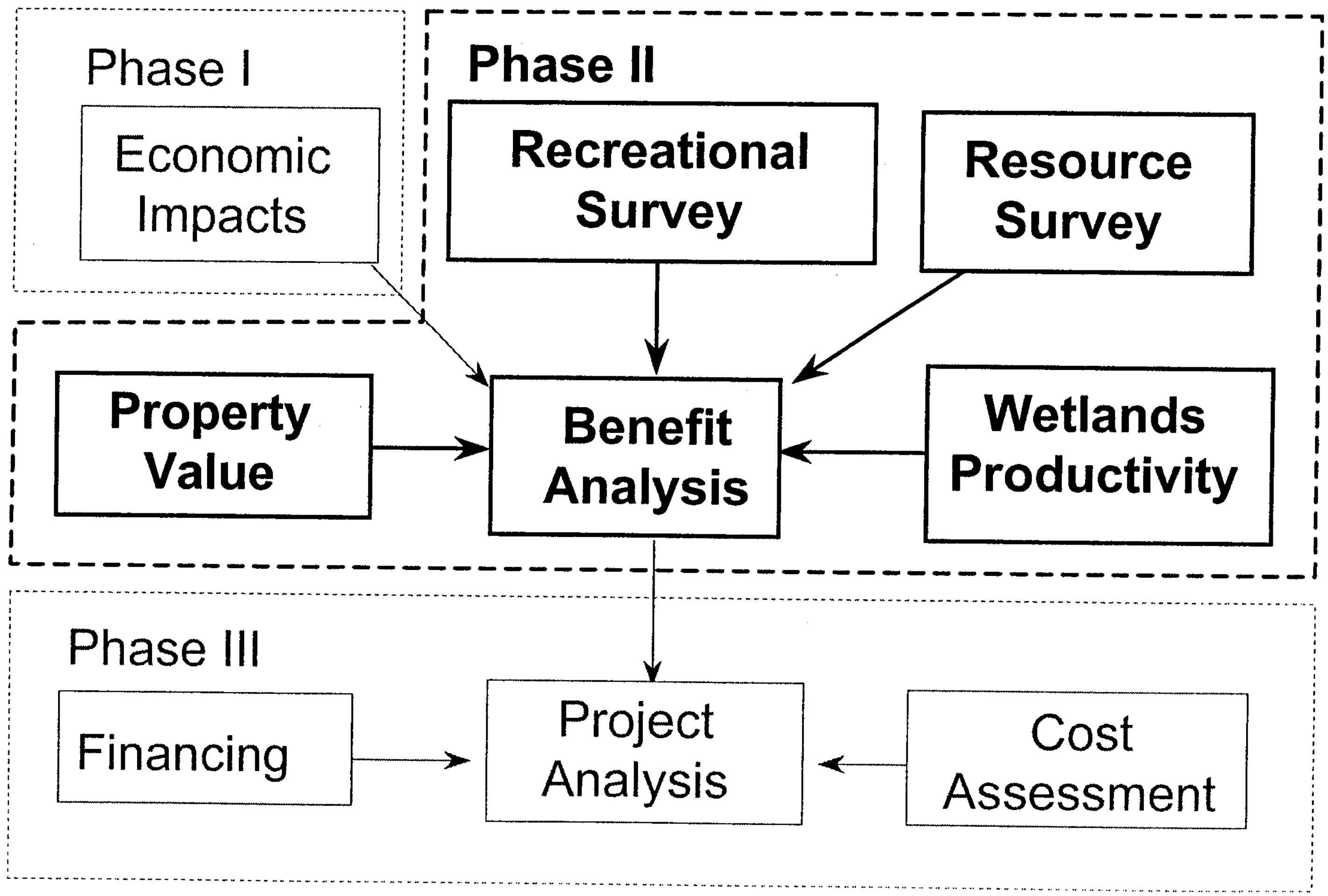

Figure II.3. Depiction of EAI's Phase II Non-Market Value Economic Studies extent, on non-commercial values (viewing and hunting values). Finally, the resource survey is used to identify public priorities and values for specific environmental amenities. The resource survey used a contingent choice model to learn which amenities are most important to the public and the amount that respondents indicate that they would pay to preserve or restore them. Summary information for each study is give in Table II.1; each study is described in detail in the chapters and appendices that follow.

II.D. REFERENCES

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Table II.1. Summary of EAI's Phase II Non-Market Valuation Studies for PES

Study	Purpose	Data and Method(s)
Recreational Uses and Use Values	1. Estimate Resident, Second Home Owners & Visitor Recreational Uses: ● Activities ★ 8 Key Activities ★ 8 Locations 5 PES Bays Atlantic Ocean LI & BI Sounds ★ 5 Towns 2. Estimate Use Value for: ● Swimming ● Boating ● Fishing ● Bird & Wildlife Viewing	Convenience sampling/ Intercept Survey Self administered 1,354 completed surveys Travel Cost Method Demand for swimming and recreational fishing depends on quality
Resource Values	Estimate Residents' and Second Homeowners' Preferences and Economic Value for preserving and restoring PES: ● Open space ● Farmland preservation ● Unpolluted shellfish beds ● Wetlands ● Eelgrass beds	Convenience sampling/ Intercept Survey Self administered 968 completed surveys Contingent Choice Method
Wetlands Productivity Values	Estimate the Economic Value for Nursery and Habitat Productivity functions for: ● Saltmarsh ● Eelgrass ● Intertidal mud bottom	Based on Productivity approach and results in available literature.
Property Value	Estimate the effect on Property Value in Town of Southhold of attributes, including: ● *Site* ★ Lot & home size ★ Garage ★ Special features ● *Neighborhood* ★ Main road ● *Environmental* ★ Wetlands ★ Open Space ★ Farmlands ★ Zoning Size	All property sales in Town for 1996 374 sales transactions Geographical Information System Property Value ("Hedonic") Model

III. ENVIRONMENTAL AMENITIES AND PROPERTY VALUES: A CASE STUDY OF THE TOWN OF SOUTHOLD

III.A. INTRODUCTION

Property values in coastal communities depend upon many factors. These include not only the size of the property and the characteristics of the home on the property, but also on environmental amenities, such as open space and proximity to the shoreline. For example, we would expect a home located near the PES waterfront to be more valuable than another home, *identical* in all respects, but located a greater distance from the shore. If we could find two such homes, we could simply compare the prices at which they sell and, by that, calculate the value of being near the shore.

Of course, rarely are two homes identical in all respects except for one attribute. Instead, as anyone who has bought a home knows, the price that a property commands on real estate markets reflects a great many factors. These include: lot size, size of the home and its location, the characteristics of the surrounding neighborhood, and a wide range of other environmental factors. Nevertheless, if all of these important factors can be taken into account, it is possible to isolate the value of individual factors, much as a real estate broker or tax assessor does when appraising a property.

This Chapter exploits these simple insights. We analyze data from many residential housing transactions using a standard property value model, as we explain in detail below. The model allows us to estimate the value--as captured in market prices--that people attach to various environmental attributes, such as proximity to open space and farmland. If efforts to estimate the value of environmental attributes are successful, the results can be used to assess the potential benefits of possible management actions that would affect any of the factors studied. That is, we could estimate the potential benefits from a proposed management action, as measured through changes in *market prices* for property.

We use the Town of Southold, located on the North Fork of the PES, as a case study (Figure III.1). Southold is an interesting example, for several reasons. First, it has a wide range of environmental amenity levels and neighborhood conditions. For example, Southold has large areas of farmland and open space, although its population density (0.67 persons per acre) is highest among all five PES towns. In addition, Southold has a long and varied coastline, both on the Peconic Estuary and on Long Island Sound, and is characterized by a variety of development densities and types. About a quarter (26%) of the town is currently in agricultural use, compared with 30% in residential use, 12% is preserved as open space, and 18% is classified as vacant. Less than 3% is classified as commercial or industrial (Suffolk County Department of Planning 1997a).

Southold's population increased 8.9% between 1980 and 1990, yet the number of housing units increased at nearly twice this level (16.6%). Thus, the growth of housing and the associated loss of undeveloped lands has far out paced population growth (Suffolk County Department of Planning 1997b). Given the recent rapid pace of development, the protection of open space, undeveloped

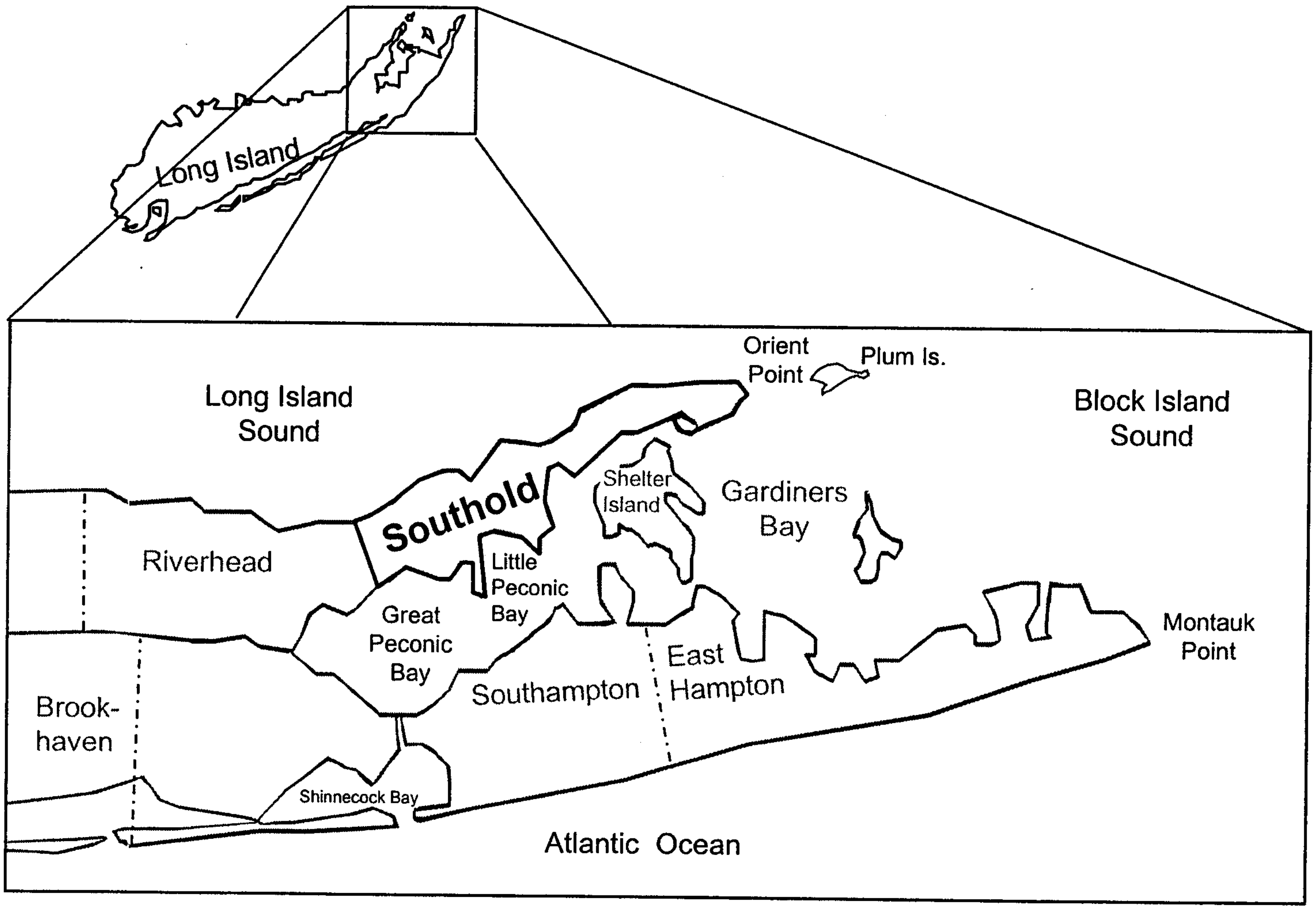

Figure III.1. Town of Southold Used for Property Value Case Study land, and other environmental amenities will play an important role in determining future quality of life in the Town and, perhaps, in the PES area.

The impacts of environmental amenities on Southold property values, and the impacts resulting from possible PES management actions, will depend upon the unique characteristics of the town (and perhaps the quality of surrounding waters and land areas). To assess these impacts, EAI conducted a property value analysis specific to the town of Southold. We apply economic methods using the property value (or "hedonic" method) to a database comprised of all Southold real estate transactions in 1996 and GIS parcel coverage data for the town. Briefly, the analysis estimates correlations between property values and levels of valued environmental attributes, including open space.

The policy relevance of the results lies in the assumption that established relationships between environmental amenities and property values estimated using the property value model will continue to hold in the future, as future events (including policies) lead to changes in the level of these amenities. Through the detailed study of existing property values, we seek the best possible statistical estimate of the environmental impacts on local property values, given the available data.

III.B. RELATIONSHIP BETWEEN ENVIRONMENTAL AMENITIES AND PROPERTY VALUES

Environmental amenities provide valued services to residents of local communities. For example, open space contributes, in a physical sense, to the character of local communities, while providing a wide variety of services, including scenic views, outdoor recreation, insulation from noise and other aspects of the urban landscape, and protection from erosion, flooding, and other physical hazards (Johnston 1997a). These amenities are valued by local homeowners, making communities with a high level of valued environmental amenities (i.e., environmental quality) more attractive than similar communities without such amenities. As a result, home buyers are willing to pay more for land or housing with higher levels of environmental quality. The property value method (also called the hedonic model) can be used to estimate the impact of environmental amenities on the values of local property, thereby estimating the value of these amenities to local residents, as evidenced by their actual willingness to pay higher prices for properties with higher levels of desired environmental characteristics.

A well-documented example of the relationship among environmental amenities and property values involves open space. Many studies show that nearby open space increases property values, reflecting home buyers' values for the services and character offered by open space (e.g., Freeman, 1993). In a recent, coordinated property value/geographic information system study conducted in Middletown, Rhode Island, Johnston (1997) shows that positive property values impacts of open space can range from less than 1% to greater than 13%, depending on the size of nearby contiguous open space parcels, the total amount of open space in a region, and the distance of property from open space parcels. Larger property value impacts are associated with larger contiguous parcels, larger acreage of open space, and a closer proximity between valued parcels and open space

(Johnston 1997a). Similar results hold elsewhere in the New England region. A study in Worchester, MA, for example, found that houses located less than 20 feet from a community park sell for over $2,000 more than similar houses located more than 2000 feet from the park (More, et al., 1982). In an analysis of cluster zoning in Amherst, Massachusetts, Lacy (1990) estimates that cluster-zoned housing with permanently protected open space appreciates at a faster rate that similar housing in conventional subdivisions. As of 1989, this difference had created an average $17,100 difference between the average selling price in the two types of developments.

Comparable results concerning the value of open space also have been found in other coastal areas. For example, a study of land values adjacent to Chesapeake Bay shows a positive relationship between the percentage of preserved open space in a 250 acre area surrounding a parcel of land, and the per-acre selling price of that land. This study also shows that agricultural pasture land and forest land increases the per acre value of nearby land, other things being the same (Bockstael 1996). Similar results are shown by Geoghegan *et al.* (1995). Parsons (1992) estimates that land use restrictions in the Chesapeake Bay watershed cause a 14-27% increase in housing prices within 1,000 feet of the bay, and a 4-11% increase up to a 3 mile distance. Garrod and Willis (1992) conclude that housing prices are positively related to the existence of nearby broadleaf forests. Correll et al. (1978) find that, on average, residential housing prices in Boulder, Colorado decrease by $4.20 for each additional foot of distance from a central green way, up to a distance of 3200 feet.

Of course, the impacts of environmental amenities on Southold property values depend on the unique characteristics of the town, and may be greater or less than those cited above. To assess these impacts, we conducted a property value analysis specific to the town of Southold. We apply economic methods (hedonic methods) to a database comprised of GIS parcel coverage data and real estate sales data. In simple terms, the property value model estimates correlations between property values and levels of valued environmental attributes, including open space. The steps involved and data used are described next.

III.C. APPLICATION OF PROPERTY VALUE MODEL TO SOUTHOLD

This study applies the property value model to real estate parcels sold in Southold during 1996. The analysis estimates how various site, neighborhood and environmental characteristics affect the value of individual properties. Property value analysis is a common means of estimating the effect of environmental changes on land values, as described in detail by Freeman (1993) and Garrod and Willis (1992), among many others.

III.C.1. Explanation of The Property Value Method

People buying homes in effect purchase many site, neighborhood, and environmental characteristics. For example, the characteristics of a residential property include: the size of the house, the number of baths, the square footage of the structure, the zoning classification of the land, whether the land is served by public sewers and water, the existence of wetlands on the property, and the proximity of the property to amenities such as open space, coastlines, and farms. These and other characteristics define the property, and make it more or less attractive to potential buyers. Other things being the same, home buyers are willing to pay more for properties that they find have desirable characteristics, and less for properties with undesirable characteristics. These likes and dislikes across many prospective buyers and sellers are reflected in market prices. The Property Value Method attempts to estimate the portion of a property's value related to each relevant characteristic, by that providing an estimate of the (implicit) value of each characteristic. The model works by statistically comparing values of a large number of properties with differing levels of the identified characteristics (e.g. lot sizes, number of rooms, proximity to roads, farms, open space, etc.) (Freeman, 1993; Johnston, 1997a).

The Property Value technique is based on the assumption that a relationship exists between the market value of a property, and the characteristics of the property. The Property Value method uses a statistical technique called "multiple regression" to assess the impact of each characteristic on the market value of the property. The technique simultaneously compares a large number of properties with different prices and different levels of each characteristic. The method establishes which characteristics are associated with higher values, which are associated with lower values, and which have no significant impact on values. The model also estimates the dollar magnitude of these impacts--that is, it estimates *how large* an impact is likely to be caused by a specific level of a specific characteristic. Using this technique, the impact of different environmental amenities on nearby property values can be estimated.[4] The technical details of the property value model (or hedonic technique) are presented in Appendix A.

Actual 1996 sales prices are used in the analysis of Southold property values. The data for the analysis is drawn from two sources:

(1) Town of Southold property record cards for all properties sold during 1996; and

(2) The computerized geographic information system (GIS) maintained by the Suffolk County Planning Department.

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[4] The accuracy of hedonic analysis depends on a well-functioning real estate market, in which consumers have accurate information regarding all home characteristics. The technique also assumes that a large number of different housing types are available for purchase, so that consumers can choose the "package" of housing characteristics that is most to their liking, and can "mix and match" different types of characteristics. Finally, the technique assumes the availability of appropriate data, concerning all characteristics that influence property values. Bias can result from the application of hedonic techniques to ill-functioning real estate markets, in which few different types of housing options are available, and/or in which consumers do not have accurate information regarding housing characteristics (Johnston 1997a).

Although sales data were available for 401 parcels, complete GIS coverage data exists for only 374 of these parcels. Thus, the Southold data set used in the analysis has full information on 374 parcels.

III.D. STATISTICAL ANALYSIS OF SOUTHOLD LAND VALUES

Model variables are the characteristics that influence buyers' willingness to purchase a land parcel, or pay higher prices for that parcel. These include proximity to amenities such as open space and coastlines; the size of the parcel; the size and other characteristics of the structures on the parcel; applicable use restrictions such as zoning codes; and the existence of features such as wetlands on the parcel. These variables may be grouped into three general categories: *parcel characteristics*, *neighborhood characteristics*, and *environmental characteristics*. To distinguish the effects of parcel size on land values, we consider the effect of the characteristics on *per-acre* value. This is calculated by dividing selling price by the number of acres in the parcel. Note that these per-acre land values include the value of all structures built on the land. For a full description of the 23 variables included in the final analysis, see Appendix A.

The statistical analysis uses the ordinary least squares (OLS) multiple regression approach. This approach estimates the direction, magnitude, and statistical significance of correlations between each of a set of independent variables (the characteristics of the property), and a single dependent variable (per-acre property value).

To establish the nature of the specific functional relationship between these variables and assessed land values, the study relies on the findings of prior research. In particular, the regression analysis applies a "transcendental" or "translog functional form".[5] The transcendental form is chosen for its ability to capture realistic relationships between parcel characteristics and land values (Chicoine 1981). Such functional forms are also preferred for their statistical properties in cases where data concerning certain relevant variables may not exist in the data set (Garrod and Willis 1992). For a technical description of the statistical model and its properties, see Appendix B.

III.E. ANALYSIS OF SOUTHOLD LAND VALUES: RESULTS

The hedonic analysis provides information on the effect of 20 characteristics on per-acre land values in Southold. Final model results are illustrated in Appendix C. Overall measures of model fit indicate high levels of correlation between land characteristics and property values. An R^2 value of 0.8352 indicates that over 83% of the variation in per-acre value is "explained" by the model, or is correlated with model variables. An F-statistic of 75.945 indicates only a .01% chance that the set of correlations reported by the model could be observed through random chance alone. The signs

[5] Wichelns and Kline (1996), Chicoine (1981), Shonkwiler and Reynolds (1986), and Garrod and Willis (1992).

associated with model variables are consistent with prior expectations and with the findings of earlier hedonic studies (e.g., Bockstael 1996; Johnston 1997a; Des Rosiers and Theriault 1992; Garrod andWillis 1992).Of those variables with demonstrated impacts on property values, seven have potential implications for environmental policy. These include the following:

- *openspace*: This variable identified parcels adjacent to open space land, as defined by the GIS database. *A parcel of land located next to open space has, on average, 12.83% higher per-acre value than a similar parcel located elsewhere.* Parcels adjacent to open space are defined as those with a border within 25 ft. (7.62 meters) of an open space parcel. As defined by the GIS for Suffolk County, open space includes: parks; nature and wildlife preserves; recreational fields; unbuildable swamps or wetlands; large tracts of land associated with schools, cemeteries, or other institutions; and selected large parcels of preserved farmland.

- *farmdistance*: This variable represents the distance between a specific parcel and the nearest farmland (farmland on which agricultural crops or nursery products are grown), in meters. *For every meter of additional distance between a parcel and the nearest farmland, average per-acre property value increases by 0.0017% (i.e.,* the magnitude of the impact is quite small).

- *onfarm*: This variable identifies parcels contiguous to farmland. *A parcel of land located next to farmland has, on average, a 13.32% lower per-acre value than a similar parcel located elsewhere.*

- *onroad*: This variable identifies parcels within 20 meters of a major road (defined as Rts. 25 and 48). *A parcel of land located next to a major road has, on average, a 16.16% lower per-acre value than a similar parcel located elsewhere.*

- *largezone*: This variable identifies parcels located in districts zoned R-80 or R-120 (two- or three-acre zoning). *A parcel of land located within a district zoned R-80 or R-120 has, on average, 16.65% higher per-acre value than a similar parcel located elsewhere.*

- *wetland*: This variable indicates the percentage of a parcel classified as a freshwater wetland. *For every one percentage point increase in the percent of a parcel classified as wetlands, average per-acre property value increases by 0.27%.* (However, this variable is only significant at the 14% level.)

III.F. SIMPLE ILLUSTRATION OF PROPERTY VALUE IMPACTS: VALUE OF OPEN SPACE

Given the definition of the open space variable, the impact of open space on neighboring property values will differ depending on the characteristics of the surrounding property. However, to illustrate the basic implications of the model results for policy, the following section simulates the predicted property value impact of the hypothetical loss of 10 acres of open space, in a highly simplified scenario. Given specific locations for the open space land under consideration, and the characteristics of the surrounding parcels, similar results could be generated for actual areas in Southold.

According to the model results, properties adjacent to open space land (or within 25 ft.) are an average of 12.83% more valuable than those not adjacent to open space. Within the Southold data sample, the average parcel sales price was $213,514, with an average parcel size of 2941.95 square meters (0.72 acre). Given this average value, a loss of 12.83% (related to the loss of our hypothetical 10 acres of adjacent open space) implies that average property value for the adjacent parcels would decrease by $27,394, all else held constant.

To estimate a hypothetical total impact in a simple case, assume that the lost open space was ten acres in a square shape, surrounded by parcels of average 0.72 acre size (the average in our sample), also square in shape. Assuming a square shape for the open space parcel, it would have a perimeter of 805.2 meters that would be bordered by other parcels. Given an average per-parcel area of 2941.95 square meters (also assumed square), the length per-side of these bordering parcels would be approximately 54 meters. Given these measurements, approximately 15 parcels would fit adjacent to the 10 acre open space parcel, assuming each had a full 54 meter side bordering the open space (805.2 ÷ 54 = 14.9). Accordingly, for this simple example, we assume that 15 average parcels would be affected by the loss, or development, of our square ten acres of open space.

As stated previously, development of the open space parcel would result in a loss of 12.83% of average value per lot or $213,514, according to the calculations made above. Thus, the average parcel would lose $27,394 in total value. Multiplied by the 15 parcels adjacent to the newly developed parcel, the total property value loss is equal to $27,394×15=$410,907. This equates to an average loss of $41,090 in total property value per-acre of open space lost. Looked at another way, the estimated *benefits* of preserving the ten acres of open space thus would be $410,907, as this is the increase in nearby property value associated with this open space parcel.

For this illustration we do not compare costs with benefits since we do not have information on the costs of acquiring specific undeveloped property for open space. However, in the illustration, if the 10 acres of undeveloped property for open space could be acquired for less than $410,907 or $41,097 per acre, then the benefits would be greater than costs. Note that even if the property to be acquired for open space costs more than $410,907, benefits still may exceed costs. This is because not all of the public benefits of open space are captured in our hedonic analysis. For example, our results in this section do not capture general amenity benefits enjoyed by all local residents, regardless of the location of their homes (see Chapter VI for discussion of this issue).[6]

We note that the impacts illustrated above should not be regarded as exact results expected in any single instance, and are included for illustration purposes only. A full benefit-cost analysis would require much more detailed analysis of the proposed project and its impacts, including impacts on surrounding property values. However, the illustrated results do indicate the general types of benefits and costs that may be expected, on average, over the entire community. Although the results require various assumptions as noted above, they are robust with respect to the quantity of open space preserved.

III.G. LIMITATIONS IN PROPERTY VALUE ANALYSIS

As noted, the model provides a good fit for sales data for the town, and the results of the Southold property value analysis correspond to prior expectations and with the results of similar analyses. Nevertheless several potential limitations should be noted. The most important of these limitations is that the results of the statistical analysis are sensitive to characteristics of the data set. The combined property card-GIS database may exclude information on certain variables that may affect property values. Although numerous environmental variables may influence property purchase decisions, data limitations allowed us to include only a sub-set of these variables in the model. For example, the data set includes water quality monitoring data for the Peconic Estuary, conducted at numerous sites. However, no parcels in the 1996 sales database are located within 100 meters of the Peconic Estuary. Thus, for those parcels in the current database, water quality is not expected to have an impact. However, were data to exist for parcels close to the estuary, one would expect that water quality might have an impact on property values. Other variables for which data was unavailable included fresh water (including groundwater) quality; beach erosion (likely only important for beachfront properties); and proximity to creeks, all of which would be expected to affect property values. If in fact important variables are excluded from the model, statistical results may show upward or downward bias. Omission of important variables can either increase or decrease the estimated effects of environmental amenities on property values, based on the extent to which these variables are correlated with environmental variables. (If these omitted variables are uncorrelated with the environmental policy variables of interest, then their absence should not influence reported results.)

For all of the above reasons, the estimated Property Value model results should not be interpreted as "exact". Rather, they provide the best possible estimate, given available data, of the impacts of *existing* environmental attributes on current per-acre land values.

A second limitation is that increased property values, related to improved environmental quality, may not be favored by all residents. For example, residents may resist open space preservation on

[6]In this regard, we note that recent support for an open space initiative in Suffolk County suggests that the electorate has a strong preference for open space as a public good.

the grounds that it tends to increase property values, thereby increasing the costs of housing for young home buyers. Others may reject increases in property taxes that accompany higher property values. Still others may object that higher property values tend to "squeeze out" low income residents. Real estate agents may oppose additional open space on the basis that fewer housing units are available, despite the act that average property values in the area affected will be higher with the additional open space. Such arguments should be acknowledged when considering environmental policy changes using the results of property value methods.

Finally, we note that many people beyond the immediate area may derive benefits from open space but their benefits are not included in numbers given in the above illustration. For example, residents of the town who live outside of the grid used in the illustration may value open space elsewhere in town (see Chapter V).

III.H. SUMMARY

Environmental amenities increase property values of nearby parcels, reflecting the valuable services offered by these amenities. An analysis of Southold property values supports this contention, and corresponds with the results of prior studies. In Southold, existing open space increases the values of adjacent properties by an estimated 12.83%. In addition, average per-acre property values are higher in parcels located further from farms and major roads. Finally, higher property values appear to be associated with the existence of wetlands on the property, and with large lot (2- and 3-acre) zoning. These results indicate that environmental policies can have significant impacts on property values, reflecting the influence of local environmental amenities on local quality of life.

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APPENDIX A. Variables in the Hedonic Analysis

All model variables were generated from one of two sources: 1] Official Southold Property Record Cards for all parcels sold during 1996; 2] GIS coverages maintained Suffolk County Planning Department, updated 1995.

Dependent Variable:

LVALACRE: The natural log of per-acre sales price, in dollars. Based on Southold property record cards for properties sold during 1996.

Independent Variables:

LNACRES: the natural log of acres in each parcel. Estimated using GIS coverages.

WATFRONT: dummy variable: value of 1 assigned if property is located on the waterfront (Long Island Sound or Peconic); value of value of 0 assigned if property is not located on a waterfront. Value assigned based on waterfront classification of property record cards.

BULKHEAD: dummy variable: value of 1 assigned if property has a bulkhead on the waterfront, value of 0 assigned if no bulkhead. Value assigned based on property record cards.

LARGEZONE: dummy variable: value of 1 assigned for parcels located in districts zoned R-80 or R-120; value of zero assigned to all other zoning classifications.

YEAR: year the house was built, based on property records, minus 1950.

YEARSQ: YEAR * YEAR (year squared).

GARSQFT: the number of square feet in the garage, based on property records. If no garage exists, value of 0 is assigned.

PATIO: dummy variable: value of 1 assigned if the house has a patio or deck; value of 0 assigned if there is no patio or deck, based on property records.

BATHS: the number of bathrooms, based on property records.

NOHEAT: dummy variable: value of 1 assigned if the house has no heat, value of 0 assigned if house has heat, based on property records.

FIRE: dummy variable: value of 1 assigned if the house has a fireplace or woodburning stove; value of 0 assigned if there is no fireplace or woodburning stove, based on property records.

SQFT: square footage of the house, based on property records.

SPECIAL: dummy variable: value of 1 assigned if the house has a "special" feature (tennis court, swimming pool, etc.); value of 0 assigned if no special features are present, based on property records.

DSOUNDT: The linear distance to Long Island Sound, truncated at 800 meters (i.e., the maximum possible value is 800). Based on GIS coverages.

PECON100: dummy variable: value of 1 assigned if the parcel is within 100 meters of the Peconic Estuary; value of zero assigned if the parcel is further than 100 linear meters from the estuary. Based on GIS coverages.

SOUND100: dummy variable: value of 1 assigned if the parcel is within 100 meters of Long Island Sound; value of zero assigned if the parcel is further than 100 linear meters from the Sound. Based on GIS coverages.

ONROAD: dummy variable: value of 1 assigned if the parcel is within 20 meters of a main road (Rts. 25 and 48); value of 0 assigned if the parcel is further than 20 meters from a main road. Based on GIS coverages.

FARMDISTANCE: the linear distance between the parcel and the nearest farmland (farmland), in meters. Based on GIS coverages.

ONFARM: dummy variable: value of 1 assigned if the parcel is contiguous (distance=0) to farmland; value of 0 assigned if the parcel is further than 0 meters from farmland. Based on GIS coverages.

WETLAND: indicates the percentage of the property covered by freshwater wetlands.

OPENSPACE: dummy variable: value of 1 assigned if the parcel is adjacent to open space (where adjacent is defined as a parcel whose border is within 25 feet of an open space parcel); value of 0 assigned if the parcel is further than 25 feet from open space. Based on GIS coverages.

The Southold GIS coverage classifies the following land uses as open space: fish, game, and wildlife preserves; public golf courses; private golf courses and country clubs; improved beaches; camps and camping facilities; parks; nature trails and bike paths; cemeteries; private hunting and fishing clubs;

state owned forest land; reforested land and other conservation land; public parks; other wild or conservation lands; and taxable state owned conservation easements.

Farms and undeveloped private property, in general, are *not* considered open space.

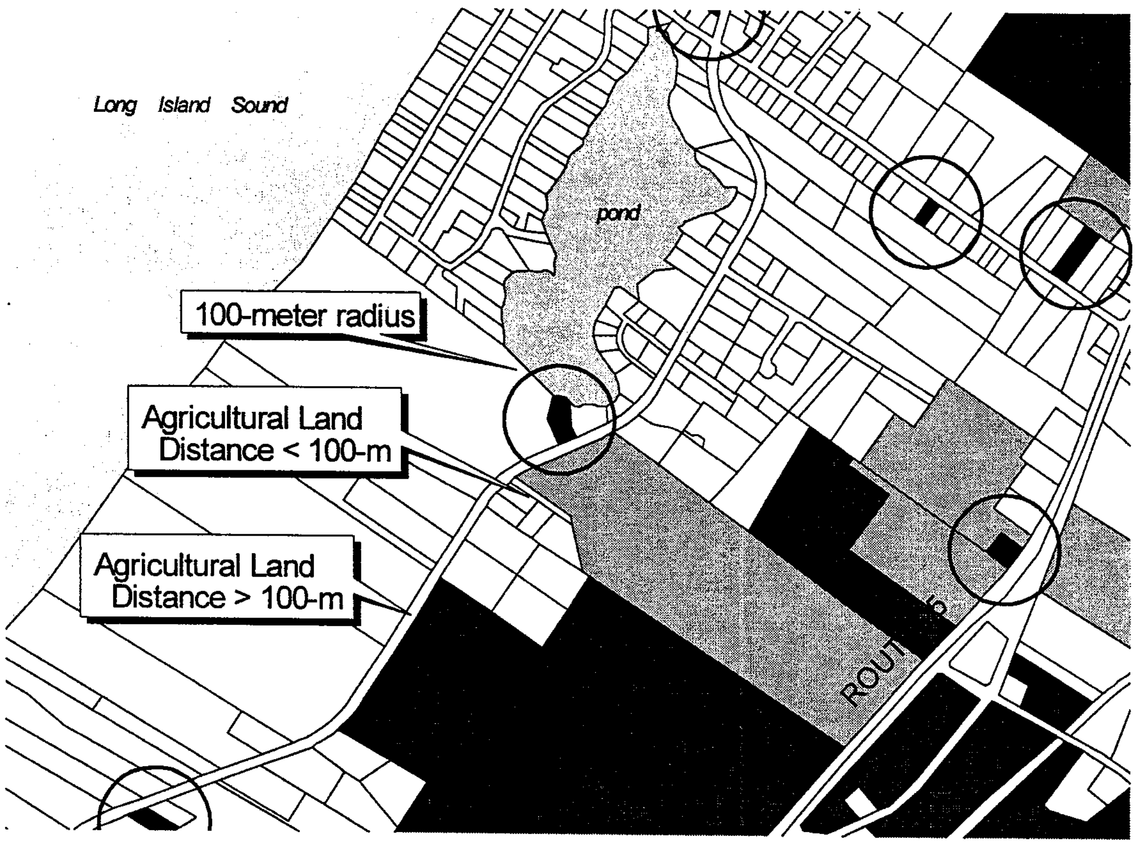
Mean values of variables included in the analysis, for the 374 observations in the database, are illustrated below.

Table B.1 Mean Values of Model Variables

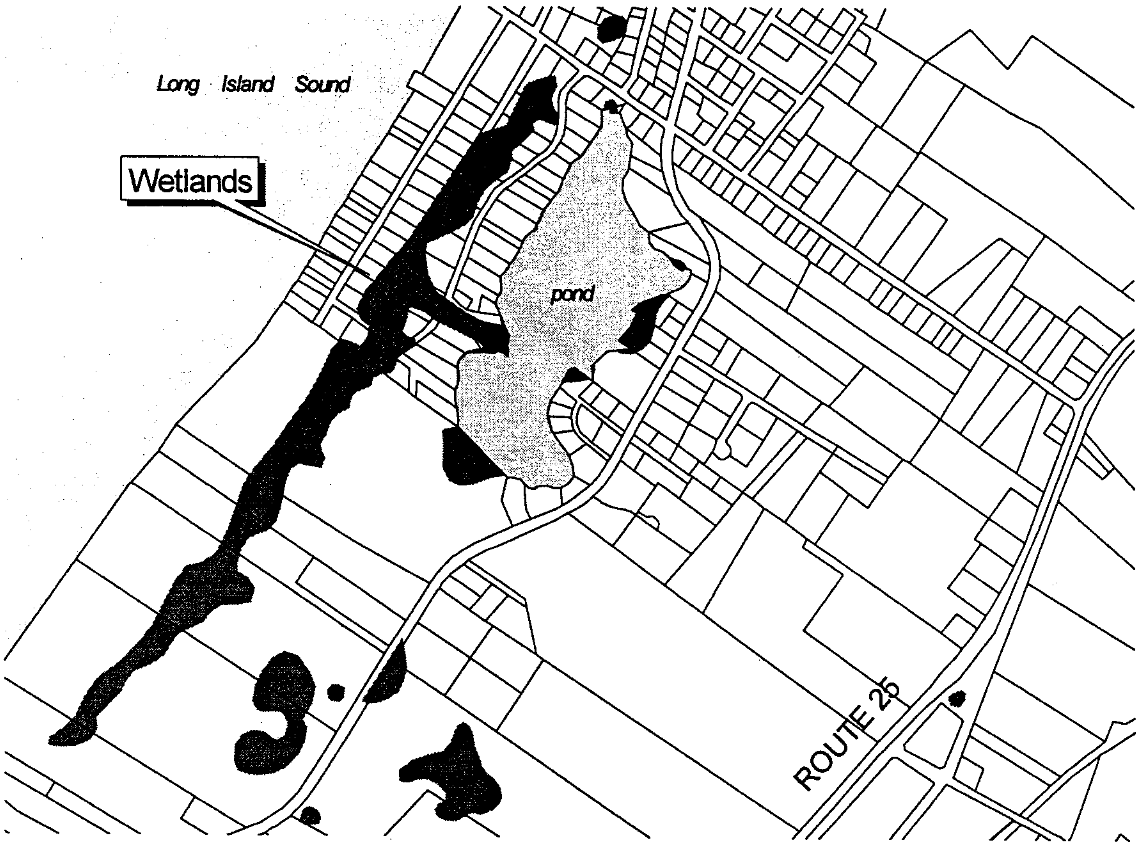
Variable	Mean Value
LVALACRE	12.8362
LNACRE	-0.7521
WATFRONT	0.2340
BULKHEAD	0.0718
PORCH	0.5266
YEAR	16.7500
GARSQFT	265.1861
PATIO	0.4734
BATHS	1.6303
NOHEAT	0.1197
FIRE	0.5372
SQFT	1270.3200
SPECIAL	0.1064
PECON100	0.0053
SOUND100	0.0848
ONROAD	0.0585
ONFARM	0.0452
DFARM	2395.1400
OPENSPACE	0.050398
WETLAND	2.4548
LARGEZONE	0.1011

GIS Maps Used to Define Model Variables: Examples

Many of the variables in the analysis were derived from GIS parcel coverages of Southold. The following GIS map illustrates the type of analysis applied. In this case, the map illustrates the process used to determine the existence of agricultural land within 100 meters of each parcel in the sales database.



The following GIS map covers the same area of Southold, yet illustrates the distribution of wetlands, used to assess the percentage of each sales parcel covered by freshwater wetlands.



APPENDIX B. The Statistical Model

To establish the functional (mathematical) relationship between model variables and assessed land values, the analysis on the findings of prior research. In particular, the analysis follows Wichelns and Kline (1996), Chicoine (1981), Shonkwiler and Reynolds (1986), and Garrod and Willis (1992) applying a transcendental or translog functional form to the property price – characteristics equation

$$Vi = \beta_0 X_{i1}^{\beta 1} \exp[\sum_{j=2...n} \beta_j X_{ij}]$$

where V_i is the 1996 selling price of the *ith* parcel, in dollars per-acre, X_{i1} is parcel size in acres, and X_{ij} are measures of the $j = 2...n$ other characteristics that affect land value. The β's are parameters to be estimated, and represent the effects of each of the characteristics on per-acre land price. Estimated parameters are used to calculate the effects of different open space characteristics on the value of land in Southold. The transcendental form is chosen for its ability to capture realistic relationships between parcel characteristics and land values (Chicoine 1981). For example, the transcendental form permits a positive or negative marginal relationship between value and parcel size (acres), requires value to be zero when parcel size is zero, can detect proportional value-size relationships, and allows for increasing or decreasing returns to scale for land parcel characteristics (Chicoine 1981; Wichelns and Kline 1993). Moreover, functional forms such as the semi-log or transcendental are preferred (to the more flexible functional forms) when there is potential omitted variable bias (Garrod and Willis 1992).

The empirical version of the translog model is as follows:

$$\ln(V) = \ln\beta_0 + \beta_1 \ln(X_1) + \beta_2 X_2 + ... + \beta_n X_n + \varepsilon$$

where the variables are as defined above, and $\ln(\cdot)$ represents the natural log. This is the form used for statistical analysis in the Southold property value study.

The estimated trans-log model appears to fit the data well. Overall model statistics and individual variable significance levels indicate good model fit, and trials with alternate functional forms (e.g., linear, semi-log) indicate that these alternate forms result in lower significance levels and explanatory power. A White test for heteroskedasticity (White 1980) fails to reject the null hypothesis of homoskedasticity at the 5% level. Although multicollinearity is ubiquitous in hedonic models, tests for multicollinearity indicate that it does not have severe impacts on model results in the present application. As the data is cross-sectional and data order has been randomized, tests for autocorrelation are unnecessary.

APPENDIX C. OLS Model Results

Dependent Variable: LVALACRE

Source	DF	Sum of Squares	Mean Square	F Value Prob>F
Model	20	152.03723	7.60186	89.930
Error	355	30.00860	0.08453	
C Total	375	182.04583		

Root MSE	0.29074	R-square	0.8352
Dep Mean	12.83621	Adj R-sq	0.8259
C.V.	2.26502		

Parameter Estimates

Variable	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	11.409748	0.08174613	139.575	0.0001
LNACRE	-0.905956	0.02606823	-34.753	0.0001
WATFRONT	0.333735	0.04497479	7.420	0.0001
BULKHEAD	0.200245	0.06780928	2.953	0.0034
YEARSQ	0.000302	0.00011945	2.528	0.0119
YEAR	-0.012017	0.00484814	-2.479	0.0136
GARSQFT	0.000165	0.00006797	2.428	0.0157
PATIO	0.103269	0.03166099	3.262	0.0012
BATHS	0.109587	0.02678655	4.091	0.0001
NOHEAT	-0.099710	0.04189498	-2.380	0.0178
FIRE	0.117428	0.03516537	3.339	0.0009
SQFT	0.000264	0.00004262	6.193	0.0001
SPECIAL	0.123980	0.05349404	2.318	0.0210
SOUND100	0.294474	0.07076478	4.161	0.0001
PECON100	0.671739	0.30810728	2.180	0.0299
ONROAD	-0.176308	0.06582347	-2.678	0.0077
FARMDISTANCE	0.000017320	0.00000374	4.625	0.0001
ONFARM	-0.142932	0.07661228	-1.866	0.0629
WETLAND	0.002729	0.00181653	1.502	0.1339
LARGEZONE	0.154045	0.06636055	2.321	0.0208
OPENSPACE	0.120691	0.07154488	1.687	0.0925

IV. OUTDOOR RECREATIONAL USES AND USE VALUES IN THE PES

IV.A. INTRODUCTION

This chapter presents results of EAI's study of outdoor recreational uses and use values for the Peconic Estuary System ("PES"). The information presented includes: (1) a review of participation and location choice for key recreational uses, and (2) estimates of the economic value of those uses. Also presented is a summary of expenditures at PES farm stands, wineries, and rental housing, data that was identified as a gap in EAI's Phase I study and is of interest to decision makers.

The main tool for providing information for this analysis is a recreational use survey carried out in August, 1995. The recreational survey was designed to:

- identify key outdoor recreational activities and locations in the PES
- estimate the level of participation in key recreational activities
- identify key characteristics and preferences of users
- estimate the value of recreational uses of the PES
- fill data gaps identified in the Phase I study.

Key recreational uses and locations. More than 15 recreational uses of the PES were identified through focus groups and discussions with local citizens and officials. One key component of the recreational use survey is to assess where these recreational uses take place throughout the PES.

Participation in key recreational uses. EAI's Phase I study (Diamantides and Grigalunas, 1996) estimated participation in only a few key recreational uses, using "off-the-shelf" information. Phase I also identified many data gaps concerning participation rates and values for outdoor recreation in the PES. The Phase II recreational survey is designed to fill these data gaps.

Characteristics and preferences of users. Prior to the recreational use survey, only anecdotal information existed concerning recreational users of the PES. Information, such as residency, accommodations, recreational preferences, etc., are provided by EAI's Phase II recreational survey.

Recreational use values. Data from the Phase II recreational survey is used to estimate the economic value of key recreational activities in the PES and, when possible, to estimate the change in recreational value resulting from changes in water quality.

Phase I economic impact data gaps. Key data gaps identified in the Phase I study include the economic impact of specialized sectors of the local economy. These sectors include: summer rentals, winery tours and sales, and farm stand sales. Each of these sectors was identified by local citizens and officials as playing an important, but unquantified role, in the local economy. Economic data for these sectors--sales-- is presented in this report.

IV.B. IDENTIFICATION OF RECREATIONAL USES AND LOCATIONS

Outdoor recreation is a major activity in the PES. Based on recreational uses identified during the survey development process (see Sec. C, Survey Development), the survey questionnaire included 16 major natural resource-based recreational uses. Of these, eight key recreational activities were identified:

- Fishing
- Boating
- Swimming
- Shell fishing
- Beach Use
- Bird Watching
- Wildlife Viewing
- Hunting

Data were collected for these eight key recreational uses, including annual participation during the past year. Detailed information also was obtained on these activities for the respondent's most recent recreational outing to the East End.

Annual participation data on key recreational activities include the number of times the respondent had done each activity at specific East End locations during that year (1995). The survey instrument identified eight water bodies as potential locations for fishing, boating, swimming, and Shell fishing. The eight locations identified by water body are:

- Flanders Bay
- Great Peconic Bay
- Little Peconic Bay
- Shelter Island Sound
- Gardiners Bay
- Block Island Sound
- Long Island Sound
- Atlantic Ocean.

Locations for the remaining key recreational activities (beach use, bird watching, wildlife viewing, and hunting) were categorized by the town in which the activity took place. Five East End towns were identified by the survey instrument. The five recreation locations identified by town are:

- East Hampton
- Riverhead
- Shelter Island
- Southampton.
- Southold.

Single-day data on key recreational activities include information on activities the respondent participated in during their *most recent* recreation day at the East End. This question was followed by occasion-specific, write-in questions concerning the: (1) location of the activity, (2) perceived water quality, (3) number of people in the recreation party, (4) travel time, and (5) time on site. Other activity-specific data collected included fishing catch, shellfish harvest, choice of marina or ramp, perception of beach facility quality, and number of birds or type of wildlife sighted[7].

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[7]Hunting was not included in the occasion-specific questioning, due to the time of year and anticipated low participation.

IV.C. SURVEY DEVELOPMENT AND IMPLEMENTATION

The development and implementation of the recreational use survey parallels the development and implementation of the resource survey. Meetings, interviews, and focus groups were instrumental in the development of both surveys. Similarly, implementation of the two surveys occured at the same time and places using the same survey staff. Only significant aspects of the development of the recreational survey that differ from the resource survey will be discussed here. For a full discussion of the resource survey development and implementation including similarities with the recreational survey (see Chapter VI, Resource Value Survey).

A major challenge in the development of the recreational use survey was the creation of a question format. A single instrument was selected to cover all the major recreational uses and locations of the PES. The single-instrument format allowed collection of data for multiple current and past uses and was a much easier, and less costly, method for acquiring data, an important issue given realistic limits on budgets for this project.

Questionnaire development began with meetings with the Management Committee, the Citizen's advisory group, and "expert informants" from major stakeholder groups, such as marina operators and Baymen. Based on issues raised by the three groups, questionnaire development then proceeded with informal interviews with the public, focus groups, and pretests in order to determine the most relevant questions, wording of questions, and survey presentation.

Informal interviews with the public were a critical component of questionnaire development. From these interviews we gained insight into who the users are and their perspective on recreation in the PES. For example, during these interviews, it became apparent that many recreational users did not think in terms of the PES as an estuary system. Instead individuals more easily identified the East End or individual bays within the PES as geographic entities. The questionnaire, therefore, asks about recreational uses at locations at the East End with which individuals could easily identify.

Focus groups and pretests were used to hone the questionnaire down to an efficient presentation that would allow us to collect all the required data. For example, one issue we used focus groups to refine was the questionnaire's approach to eliciting water quality perceptions. Originally we had hoped to use the questionnaire to ask very specific water quality questions, such as clarity, smell, debris, etc., so that we might be able to estimate the contribution of these different attributes to an individual's overall perception of water quality. However, during focus groups we found that recreational users can have very complex and inconsistent ways of assessing water quality, which include numerous additional attributes such as beach condition, signs, and plant abundance. Eliciting information on all of these attributes became too cumbersome, and a more simplified approach was eventually used. The simplified approach asks the respondent to rank water quality at the site on a four point scale from "excellent" to "poor". As is described below, this approach worked satisfactorily in that we found a statistical association between respondents' subjective estimates of water quality and objective measures of water quality based on field sampling undertaken by the County.

A key objective in the survey development phase was to keep the questioning simple and consistent across uses. Many versions of the recreational use survey were pretested, to assess the ease with which respondents could understand and answer the questions. The survey pretests were instrumental in reducing the size of the questionnaire. One of our concerns was that if the questionnaire was too long, only the first few questions would be answered, or respondents would only answer selected questions. Another important concern was that the survey be clear and relatively brief in order to allow us to use an intercept-survey, self-administration approach, to economize on scarce research funds. The final version of the recreational use survey questionnaire is available from the authors.

The recreational use survey and the resource use survey were implemented simultaneously during the week of August 22-29, 1995, in pre-selected, public places in each of the five East End towns. Interviewers solicited potential respondents by simply approaching them and asking if they would be willing to spend 10-15 minutes filling out a survey to be used to help develop a plan to protect and manage the bays. Survey locations included beaches, shopping areas, libraries, Post Offices, and miscellaneous public places throughout the study area.

Other natural resource-based recreational activities were identified in the survey development process. These activities include: walking/hiking, biking, sightseeing, jet skiing, jogging, windsurfing, art work, and photography. Questions on these activities were retained in the questionnaire for comprehensiveness. However, these activities are considered less significant than the key activities identified above, and data collected on these "non-key" activities are limited to a single question on participation.

IV.D. DESCRIPTION OF THE RECREATIONAL USE SURVEY QUESTIONNAIRE

The survey booklet cover provides a map of the East End to orient respondents. The first set of questions asks whether the respondent is an East End resident, owns a second home in the East End, or is a visitor. Visitors are also asked the mode of transportation they used to travel to the East End and the type of accommodations used, if any.

Subsequent questions address the issue of Brown Tide ("BT"). BT refers to the discoloration of the waters in and around the PES due to an algae that sporadically grows in enormous numbers. Recent incidents of BT may have contributed to a significant decline in ecologically productive eelgrass beds and caused major disruptions in the formerly valuable scallop industry. BT also was a significant concern to recreationists, as described in some detail later.

Throughout the survey development process, the issue of BT repeatedly surfaced. Questions concerning the BT were placed in the beginning of the questionnaire in part to diffuse this issue early on, allowing respondents to focus on the questions that follow. We asked respondents whether they were aware of BT and which, if any, of their recreational activities were affected by BT.

The next set of questions asked respondents to indicate their annual participation in key recreational activities by filling out two brief charts. One chart identified recreation locations by *water body*. The other chart identified recreation locations by *town*. Respondents indicated the number of times that they did each activity in each location during the past year (1995).

The annual participation questions were followed by single-day recreation activity questions. Respondents were asked to identify their *most recent* recreation day at the east End. They then were asked to identify all the recreational activities participated during that day. Shell fishing, swimming and beach use, boat use, fishing, bird watching, and wildlife viewing were selected as key activities. For each of these recreational pursuits, a separate page of questions asked for activity-specific information. Activity-specific questions included: location, travel distance, time on site, number of people in the party, catch or harvest, and water quality and site quality ratings.

After the participation questions, respondents were asked about selected expenditures made at the East End during the past twelve months. As noted, these questions were designed to fill data gaps in the Phase I study for farm stands, wineries, and housing rentals. Residents and second home owners were also asked a referendum-type question about their willingness to support selected water quality initiatives (see section on water quality initiative referendum). Finally, a. set of questions was asked in order to obtain socio-demographic data, such as residency, household status, income, age, education, and employment status.

IV.E. DESCRIPTIVE RESULTS: DEMOGRAPHICS

A total of 1,354 respondents provided usable survey questionnaires, although not every respondent answered all questions. Selected, major demographic results of the survey are summarized as follows:

- Residents and second homeowners from all East End towns were represented in the sample
- A majority (59 %) of respondents were visitors to the East End
- Most visitors (76%) came from either Long Island or New York City
- Most visitors (60 %) stayed at the East End overnight
- The most common overnight accommodation was with friends or relatives (39%)
- Compared to 1990 Census data, the sample has a slightly higher share of women and people in the middle age groups; is better educated; and is wealthier than the resident population.

Residency Status. Of the 1,267 respondents who provided this information, over half of those responding (59%) were visitors from outside the East End (Table IV.1). Of the remainder, 28% indicated that their primary residence was at one of the five East End towns, and 13% owned a second home at the East End, but had a primary residence somewhere else. Some Brookhaven residents considered themselves East End residents but were not counted as such in this study.

Residents and Second Home Owners - Place of Residency. Residents and second home owners from each of the five East End towns were represented in the survey sample. Southampton (30%) and Southold (28%) had the largest percentages of resident respondents. The remainder was closely distributed among Shelter Island (16%), East Hampton (14%), and Riverhead (12%). The relatively high proportion of Shelter Island resident respondents is not expected to have a significant effect on survey results.

Table IV.1 - Residency Status of Survey Respondents

Residency	Number of Respondents	Percentage of all Respondents
East End Residents	358	28%
Second Home Owners	159	13%
Visitors	750	59%
Total	1267	100%

For second home owners, New York City was the dominant primary place of residence (45 % of second home owners surveyed), followed by Nassau (19 %) and Suffolk counties (14 %). Other locations, largely distributed across Westchester and Rockland counties in New York and northeastern New Jersey, were the primary residences of the remaining 22%.

Visitors -Place of Residency. Visitors to the East End predominately came from Long Island and New York City. 40% of visitors came from Suffolk county, 20% came from New York City, and 16% from Nassau county. Only 8% came from other locations in New York State and New Jersey, and just 5% came from Connecticut and Massachusetts. Other locations, such as Florida, California, and several foreign countries accounted for the primary residences of the remaining 11%.

Visitor Classification and Accommodations. Most visitors in our sample (60%) were overnight visitors. Day trippers (those who returned to a home outside the East End at the end of the day) accounted for 39% of visitors surveyed.

Of the 700 overnight visitors who provided accommodation information, the most common (39%) type of accommodation was with friends or relatives. Rental (24%) and hotel or motel (22%) accommodations were closely matched. Surprisingly, 15% of overnight visitors to the East End reported that they stayed at accommodations other than friends or relatives, hotels or motels, or rental properties. Presumably these other accommodations are predominately boats and camp sites.

Sample characteristics: comparison with resident census data. Gender, age, education, and income characteristics of survey respondents can be compared to the characteristics of the resident population as identified by the most recent (1990) census. Only comparisons to the resident population are possible, since characteristics of the second homeowner and visitor populations are unknown.

For all residency and visitor categories, the share of female respondents was only slightly more than in the resident population. The age distribution of the sample reflects the survey implementation practice of not including individuals less than 18 years of age.

Our survey sample is much more educated than the resident population. For example, census data indicates that 49% of the resident population had some level of post-secondary education. The same level of education was achieved by 80% of the resident sample, 95% of second homeowners, 91% of overnight visitors, and 82% of day trippers.

The survey sample also has higher household incomes than the resident population. According to the census, 34% of the resident population has a household income of $50,000 or more. However, nearly half (48%) the residents in the survey sample have household incomes of $50,000 or more, as do 80% of second homeowners, 64% of overnight visitors, and 59% of day trippers.

Sample characteristics: comparison among resident and visitor categories. The distribution among female and male respondents slightly favored females in all categories. Day trippers have the most respondents under 24 years of age (10%), and overnight visitors have the most respondents in the 25-44 age group (60%). Second homeowners have the largest percentage of 45-74 year olds (62%). Second homeowners are also the most highly educated (95% post-secondary schooling) and have the highest incomes (80% above $50,000 household income).

Sample characteristics: East End Town of Residence. Residents and second home owners from Shelter Island and Southold were-over represented in the survey sample, based on comparisons to year-round and seasonal population statistics. Residents were under represented in Riverhead and Southampton. Second home owners were under represented slightly in East Hampton and also in Southampton. This disproportionate distribution of the sample most likely has little, if any, effect on survey results since the type and frequency of recreational activity is not strongly related to the East End town the respondent lives in.

Table IV.2 - Population Demographics vs. Survey Respondent Demographics

	1990 Population	Resident Sample	Second Homewner Sample	Overnight Visitor Sample	Day tripper Sample
Gender					
Female	51.83%	53.57%	54.67%	53.63%	55.34%
Male	48.17%	46.43%	45.33%	46.37%	44.66%
Age					
up to 20	23.89%	3.83%	3.36%	1.49%	2.76%
21-24	4.53%	1.91%	1.34%	4.95%	7.09%
25-34	16.23%	14.48%	8.72%	25.50%	22.83%
35-44	12.84%	21.86%	19.46%	34.65%	24.02%
45-54	11.01%	18.85%	30.87%	21.29%	20.87%
55-64	11.04%	13.39%	18.79%	8.42%	12.20%
65-74	11.17%	21.31%	12.08%	2.97%	7.87%
75-84	7.25%	3.83%	4.70%	0.50%	1.97%
85 and up	2.04%	0.55%	0.67%	0.25%	0.39%

Table IV.2 - Population Demographics vs. Survey Respondent Demographics, cont.

	1990 Population	Resident Sample	Second Homewner Sample	Overnight Visitor Sample	Day tripper Sample
Education					
<High School	7.44%	1.27%	0.00%	0.28%	0.46%
Some HS	11.55%	2.55%	0.77%	0.84%	2.78%
HS Grad.	31.77%	16.56%	4.62%	7.58%	14.35%
Some Coll.	18.35%	21.66%	13.85%	17.42%	26.39%
Assoc. Deg.	6.66%	12.74%	4.62%	7.30%	12.04%
Bachelor's Deg.	13.51%	21.97%	23.85%	29.78%	19.44%
Advanced Deg.	10.72%	23.25%	52.31%	36.80%	24.54%
Income					
<$15,000	19.17%	9.42%	1.57%	5.16%	3.70%
$15,000 - $24,999	14.60%	12.01%	3.15%	4.01%	8.80%
$25,000 - $34,999	14.40%	13.31%	5.51%	10.32%	8.33%
$35,000 - $49,999	17.52%	17.53%	10.24%	16.62%	20.37%
$50,000 - $74,999	18.90%	23.38%	13.39%	19.48%	26.85%
$75,000 - $99,999	7.04%	11.36%	14.96%	11.75%	17.59%
$100,000 - $149,999	4.93%	6.82%	18.11%	17.19%	9.26%
$150,000 and up	3.41%	6.17%	33.07%	15.47%	5.09%

IV.F. DESCRIPTIVE RESULTS: KEY RECREATION ACTIVITY PROFILE

Respondents were asked the number of times that they performed each of the following outdoor recreational activities at various East End locations (Bays and towns) this year (1995):

- *Activities*: Fishing, Boating, Swimming, Shell fishing
  Locations: Flanders Bay, Great Peconic Bay, Little Peconic Bay, Shelter Island Sound, Gardiners Bay, Block Island Sound, Long Island Sound, and Atlantic Ocean

- *Activities*: Beach Use, Bird Watching, Wildlife Viewing, and Hunting
  Locations: East Hampton, Riverhead, Shelter Island, Southampton, and Southold.

The water bodies of the Peconic Estuary System are identified as Flanders Bay, Great Peconic Bay, Little Peconic Bay, Shelter Island Sound, and Gardiners Bay. Substitute water bodies included in the survey were Long Island Sound, Block Island Sound, and the Atlantic Ocean.

Swimming and beach use were treated as separate activities in the questionnaire in order to identify swimming locations by body of water and identify the number of beach goers by town. Since each of the five towns has multiple water body options for swimming, it was necessary to ask for location by both water body and town.

Figures for swimming and beach use should not be summed. This is because the activities are not mutually exclusive, and it is expected that most respondents gave a positive answer to both categories even though they may be referring to a single outing.

Major characteristics of respondents' annual recreational activity during the year are:

- Most (83%) engaged in at least one key recreational activity, half in more than one activity.
- Most residents (95 %) participated in key recreational activities
- Swimming was the most popular activity
- The PES was the most popular swimming location (42% of all swimming trips)
- Boating, fishing, and Shell fishing were predominantly done in the PES.

Sample Participation Overall. Most respondents (83%) engaged in at least one outdoor recreational activity at the East End and during the past year averaged 38 recreational experiences per respondent. In total, respondents engaged in more than 48,400 outdoor recreational experiences during the past year. Of this number, more than 26,000 were *water-based* outdoor recreational experiences, and the majority of these (15,506) were in the PES. Land-based outdoor recreational experiences the five East End towns amounted to 22,300.

Sample Participation By Activity. Among all respondents, swimming and beach use were the most popular activities. Swimming was done on more than 15,000 occasions by respondents. The most popular area for swimming was the PES, which accounted for 42% of all swimming trips.

More than 12,000 beach visits at the five East End towns were reported.

Shell fishing was the least frequent water- based activity (1,304 trips). More than half (59%) of these Shell fishing trips took place in the PES. Hunting was the least popular land-based activity (255 occasions). Note that bird watching and wildlife viewing responses given in Table IV.3 were adjusted to include only trips for viewing, i.e., activity less than one mile from home was not included.

Table IV.3 - Participation in Key Recreation Activities - By Residency Status

	Residents (n=358)	SHO (n=159)	Overnight (n=427)	Day trippers (n=273)	Total (n=1217)
Fishing	88 (25%)	41 (26%)	62 (15%)	13 (5%)	204 (17%)
Boating	132 (37%)	63 (40%)	88 (21%)	39 (14%)	322 (26%)
Swimming	186 (52%)	80 (50%)	153 (36%)	28 (10%)	447 (37%)
Shell fishing	49 (14%)	19 (12%)	14 (3%)	6 (2%)	88 (7%)
Beach use	282 (79%)	103 (65%)	235 (55%)	74 (27%)	694 (57%)
Bird watching	36 (10%)	13 (8%)	23 (5%)	32 (12%)	104 (9%)
Wildlife viewing	73 (20%)	39 (17%)	45 (11%)	40 (15%)	185 (15%)
Hunting	10 (3%)	3 (2%)	6 (1%)	2 (1%)	21 (2%)
Any key activity*	342 (96%)	132 (83%)	287 (67%)	117 (43%)	878 (72%)
Multiple key activities	262 (73%)	103 (65%)	182 (43%)	65 (24%)	612 (50%)

*May include bird watching and wildlife viewing trips less than one mile from home.

Participation Rate Overall By Residency Status. East End residents are more likely to participate in outdoor recreation than any other group. Fully 95% of the residents surveyed engaged in at least one, key water-based activity in the PES or one key land-based activity in one of the East End towns. By comparison, 83% of second homeowners and 67% of overnight visitors also participated in outdoor recreation. Day trippers have the lowest rate of participation (43%).

A direct comparison between the number of people engaging in land-based and water-based activities cannot be made. This is due to the inability to tell the difference between beach use in the

PES and beach use on the Atlantic Ocean or Long Island Sound shoreline at the East End. However, the majority of residents (73%) and second home owners (65%)--and 50% of all survey respondents-- engaged in more than one key recreational activity during the past year.

Participation Rate in Key Recreational Activities-By Residency Status. Proportionately more residents (70%) and second homeowners (65%) swim, boat, fish, and shellfish than overnight visitors (45%) and day trippers (22%). Among these activities, the highest participation rates across all residency status categories are for swimming (37%) followed by boating (26%) and fishing (17%). Shell fishing is more popular with residents (14%) and second home owners (12%) as compared with the overall sample (only 7 %).

Residents and second homeowners are more likely to go to the beach, watch birds, view wildlife, and hunt in the East End than other groups. Proportionately more residents (85%) and second homeowners (70%) engage in these activities than overnight visitors (59%) and day trippers (37%). Among these activities, the highest participation rates across all groups are for beach use (57%) followed by wildlife viewing (21%) and bird watching (19%). Only 2% of survey respondents hunt.

Location of Key Recreational Activities. Respondents used the PES more times (15,506 occasions) for all key outdoor recreation activities--swimming, boating, fishing, and Shell fishing--than any other water body at the East End (Table IV.4).

Table IV.4 - Water Body Selection by Activity - (n=1267)

	Fishing	Shell fishing	Boating	Swimming	Totals
Block Island Sd.	320 (6%)	71 (5%)	467 (5%)	380 (2%)	1238 (5%)
Long Island Sd.	1422 (25%)	266 (20%)	1760 (20%)	2801 (18%)	6249 (24%)
Atlantic Ocean	1125 (20%)	201 (15%)	1056 (12%)	5685 (37%)	7116 (27%)
PES	2732 (49%)	766 (59%)	5470 (62%)	6538 (42%)	15506 (60%)
Totals	5599 (100%)	1304 (100%)	8753 (100%)	15404 (100%)	26060 (100%)

* Percentages may not sum precisely due to rounding

No single town is the dominant site for all categories of recreation by respondents. For example, beach use occurs most often at Southampton (3334 occasions) and East Hampton (3139). Shelter

Island was the most used for bird watching (567) and hunting (92), and East Hampton had the most (1123) wildlife viewing experiences. On the other hand, Riverhead was the least used town for beach use (1075), bird watching (68), and wildlife viewing (220). Southampton had the least number of hunting occasions (26).

Table IV.5 - Town Selection by Activity - (n=1267)

	Beach Use	Bird Watching	Wildlife Viewing	Hunting	Total Trips
East Hampton	3139 (26%)	300 (20%)	1123 (29%)	50 (20%)	4612 (25%)
Riverhead	1075 (9%)	68 (5%)	220 (6%)	56 (22%)	1419 (7%)
Shelter Island	2461 (20%)	567 (37%)	1030 (27%)	92 (36%)	4150 (25%)
Southampton	3334 (27%)	386 (25%)	690 (18%)	26 (10%)	4436 (24%)
Southold	2239 (18%)	215 (14%)	764 (20%)	31 (12%)	3249 (18%)
Totals	12248 (100%)	1536 (100%)	3827 (100%)	255 (100%)	17866 (100)

*Percentages may not sum precisely due to rounding

Location of PES Water-Based Activities. Great Peconic Bay is the most popular water body in the PES for recreational activity, with 28% of recreational trips in the PES, while Flanders Bay is the least frequently used, with 8%. Great Peconic Bay is also the most popular location in the PES for swimming (30%), fishing (29%), and boating (25%). Gardiners Bay is the most popular PES location for Shell fishing, accounting for 33% of all PES Shell fishing trips.

Table IV. 6 - PES Key Recreational Activity Outings - (n=1267)

	Fishing	Shell fishing	Boating	Swimming	Totals
Flanders Bay	288 (11%)	45 (6%)	562 (10%)	366 (6%)	1261 (8%)
Gt. Peconic Bay	793 (29%)	199 (26%)	1362 (25%)	1991 (30%)	4345 (28%)
Ltl. Peconic Bay	486 (18%)	109 (14%)	1021 (19%)	1298 (20%)	2914 (19%)
Shelter Isl. Sound	511 (19%)	158 (21%)	1321 (24%)	1410 (22%)	3400 (22%)
Gardiners Bay	654 (24%)	255 (33%)	1204 (22%)	1473 (23%)	3586 (23%)
Totals	2732 (100%)	766 (100%)	5470 (100%)	6538 (100%)	15506 (100%)

* Percentages may not sum precisely due to rounding

PES Key Recreational Activities by Residency Status. Swimming is the most popular water-based activity in the PES for all residency groups and overall accounts for 42% of all water-based recreation trips (Table IV.7). Boating is nearly as popular (36% of all PES trips).

Overnight visitors fish more (22% of their outdoor recreation activity) than any other group. Day trippers allocate a larger percentage of their PES trips to Shell fishing (16%) than to fishing (9%), although Shell fishing overall is a modest activity (5% of PES all trips).

Table IV.7 - PES Key Recreational Activity Outings by Residency Status - (n=1217)

	Residents	SHO	Overnight	Day tripper	Total
Fishing	1114 (17%)	401 (11%)	947 (22%)	30 (9%)	2492 (17%)
Boating	2354 (37%)	1275 (36%)	1450 (34%)	110 (34%)	5189 (36%)
Swimming	2520 (39%)	1676 (48%)	1839 (43%)	132 (41%)	6167 (42%)
Shell fishing	396 (6%)	154 (4%)	92 (2%)	52 (16%)	694 (5%)
Totals	6384 (100%)	3506 (100%)	4328 (100%)	324 (100%)	14542 (100%)

* Percentages may not sum precisely due to rounding

Locations of PES Activities - By Residency Status. For residents, Shelter Island Sound (27%) is the most popular location in the PES, followed closely by Great Peconic Bay (25%) (Table V.8). Gardiners Bay (31%) is the most frequented destination for second home owners, with Great Peconic Bay (30%) again nearly as popular. Over night visitors and day trippers prefer Great Peconic Bay (30% and 34%, respectively) over all other locations.

Flanders Bay is by far the least often visited location for residents (7%), second home owners (3%), and overnight visitors (10%). The least visited location by day trippers is Gardiners Bay (13%), presumably because it is the furthest of the bays from their homes. Flanders Bay is more popular with day trippers (17%) than with any other group.

Table IV. 8 - PES Key Recreational Activity Locations by Residency Status (n=1217)

	Residents	SHO	Overnight	Day tripper	Total
Flanders Bay	451 (7%)	114 (3%)	446 (10%)	54 (17%)	1065 (7%)
Gt. Peconic Bay	1589 (25%)	1048 (30%)	1304 (30%)	110 (34%)	4051 (28%)
Ltl. Peconic Bay	1260 (20%)	740 (21%)	736 (17%)	60 (19%)	2796 (19%)
Shelter Isl. Sound	1752 (27%)	525 (15%)	1031 (24%)	58 (18%)	3366 (23%)
Gardiners Bay	1332 (21%)	1079 (31%)	811 (19%)	42 (13%)	3264 (22%)
Total	6384 (100%)	3506 (100%)	4328 (100%)	324 (100%)	14542 (100%)

* Percentages may not sum precisely due to rounding

IV.G. DESCRIPTIVE RESULTS: PARTICIPATION AND TRIP ESTIMATES

Introduction The total number of trips (or "outings") for outdoor recreation is the product of three factors: (1) The *potential number* of participants, (2) the *proportion* who actually participate, and (3) the *number* of times those who participate engage in an recreation activity. Thus, we have:

Trips = No. of Potential Participants x Percent Participating x No. of Times Participate

For example, assume that there are 2 million potential participants (i.e., residents, second home owners, over night visitors, and day trippers) for swimming, that 20 % of these actually swim, and that of these participants, each swims an average of 10 times per year. In this case, the number of swimming trips or outings is 4 million:

$$= 2 \text{ million} \times 20\,\% \times 10$$

$$= 400{,}000 \times 10 = 4 \text{ million trips}$$

The data and assumptions used to estimate trips for each PES recreation activity is explained below.

Estimation of Total Number of Trips. The *population of potential participants* include all East End residents, second homeowners, overnight visitors, and day trippers. To estimate this population, we used 1990 census data from the Long Island Regional Planning Board ("LIRPB"). The LIRPB analysis provides estimates of the year-round resident population; the seasonal population, including second homeowners and guests; year-round resident guests; and hotel, motel, and campsite capacities. The number of participants in each recreational activity was estimated separately for each of these residency category. The resident population over age 15 is estimated by the LIRPB to be 84,871.

Data are not available for the age breakdown of the seasonal population. Lacking authoritative data, we assume that the *seasonal* population has the same percentage over the age of 15 (80%) as the *resident* population. This implies an estimated seasonal population over age 15 of 135,620.

The seasonal population is split into two groups, based on EAI's recreational use survey results: Second Home Owners (27%) and Overnight Visitors (73%). Our survey results indicate that the two components of the seasonal population have different participation rates and therefore should be considered separately, when possible. Note that many overnight visitors stay with second homeowners and residents as renters or guests.

Population data is not available for day trippers; therefore this group is excluded from our participation estimates. The absence of this information will slightly understate outdoor recreation participation.

Information concerning the *percent* of potential participants that participates in one or more recreational activity was presented earlier. The *trips per participant* are given in Table IV.9.

The major results of estimated annual participation in PES outdoor recreation (excluding day trippers[8]) for 1995 can be summarized as follows:

[8]Day tripper are excluded because we have no reliable way of estimating the total number in this group. This omission slightly understates total participation in PES recreation (see text).

- 127,762 people participate in either swimming, boating, fishing, or Shell fishing in the PES, taking 3.3 million outings.

- 156,184 people participated in either beach use, bird watching, wildlife viewing, or hunting in the East End towns, engaging in 5.2 million trips.

Table IV.9 - Average Annual Outings per Participant by Activity and Residence*

	Residents	SHO	Overnight	Day trippers
Fishing	12.66	9.78	15.27	2.31
Boating	17.83	20.24	16.48	2.82
Swimming	13.55	20.95	12.02	4.71
Shell fishing	8.08	8.11	6.57	8.67
Beach Use	22.50	25.85	9.20	6.11
Bird Watching	37.55	23.49	8.83	3.28
Wildlife Viewing	34.36	25.39	9.99	3.80
Hunting	13.20	16.33	7.00	5.50

*Includes activities at the five East End towns and PES water bodies only

The total number of trips by each group, for each activity, is estimated by multiplying the estimated number of trips per participant (Table IV.9) for each group (i.e., residents, second homeowners, etc.) by the estimated total number of participants by group. The results are shown in Table IV.10.

Overall, there are 5.15 million beach use, bird watching, wildlife viewing, and hunting outings taken in East End towns and 3.35 million swimming fishing, boating, and Shell fishing outings taken in the PES in 1995 (Table IV.10). Most outdoor recreational activity is accounted for by residents, who engaged in 3.3 million land-based and 1.5 million water-based occasions locally. Second homeowners took 1.1 million land-based trips and more than 800 thousand water-based trips. Overnight visitors engaged in more than 780 thousand land-based, and 1 million water-based, trips.

Total trip estimates slightly understate actual recreation trips because day tripper trip estimates are not included due to the lack of population data for this group, as noted earlier. According to EAI's recreational use survey, day trippers account for 3% of land-based and 2% of water-based recreational trips taken by the sample.

Comparison with Phase I Total Outdoor Recreational Trip Estimates: Introduction. The Phase I study (Grigalunas and Diamantides, 1996) gave estimates of total recreation trips to the area for selected activities based on available "off the shelf" data and were comprised of a variety of sources. No original data was collected during Phase I. In Phase II original data was assembled and it is important to note and to explain the major differences between the two sets of results (Table IV.11).

Table IV.10 - Estimated Annual Key Recreation Activity Outings*

	Residents	SHO	Overnight	Totals
Fishing	268,617	93,110	226,766	588,493
Boating	559,902	296,451	342,630	1,198,983
Swimming	598,001	383,563	428,406	1,409,970
Shell fishing	96,006	35,636	19,513	151,155
Beach Use	1,508,582	615,257	500,955	2,624,794
Bird Watching	219,008	32,139	41,699	292,846
Wildlife Viewing	174,861	39,218	40,392	254,471
Hunting	33,609	11,959	6,930	52,498
Totals	3,458,586	1,507,333	1,607,291	6,573,210

*Includes activities at the five East End towns and PES water bodies only

In general, we found major that the Phase I estimates of recreational activity were understated--in some cases, greatly understated-- as compared to the Phase II results. The major reason for the large differences in estimates between the Phase I and II reports can be explained as follows. Our survey-based estimates find much high participation rates and trips per participant than the Phase I report, which used a state-wide average for New York. For example, in Phase II for bird watching and wildlife viewing we found a high participation rate (19% for bird watching and 21% for wildlife viewing) for respondents and a large number of trips per participant (37.55 bird watching trips and 34.36 wildlife viewing trips for residents). The Phase I survey, in contrast, was based on NFWS statewide estimates for New York. These statewide participation rates (9.4%) and number of trips per participant (8.3) are very much lower than those found in the PES survey sample.

This major difference between the Phase I and Phase II results is not surprising (at least in retrospect). Residents and seasonal visitors to the PES are attracted to the area precisely because they are interested in estuary-related outdoor recreation. We thus would expect this group to be much more interested in outdoor recreation than the general population of the state. Similar large differences between the Phase I and II results were found for other activities (see Table IV.11 and also see Appendix for details) and the same explanation seems relevant.

Table IV.11 - Comparison of Participation Estimates Phase I Versus Phase II

	PES - Phase II	PES - Phase I*
Beach Use	2,624,794	NA**
Non-Consumptive	547,317	91,713
Hunting	52,498	77,300
Fishing	588,493	113,589
Boating	1,198,983	NA
Swimming	1,409,970	714,600

* Grigalunas and Diamantides (1996).
** NA = Not available

IV.H. DESCRIPTIVE RESULTS: SELECTED EXPENDITURE ESTIMATES

Introduction. During the early survey development phase of our work, members of the Citizens Advisory Committee and officials at the Suffolk County Dept. of Health Services expressed interest in our collecting information on sectors of the PES economy for which data are difficult to find using standard economic sources. Specific sectors of the economy targeted for special consideration were Farm Stands, Wineries, and Rental Lodging.

The survey questionnaire asked respondents to estimate the amount that their household spent at Farm stands and Wineries at the East End over the past year. Visitors also were asked whether they rented a house, condo, apartment, etc., at the East End over the past twelve months. Respondents who answered "yes" to this question were asked the length of the rental agreement and the amount they spent. Responses to these questions were given in 1995 dollars, summarized in Table IV.12 and explained briefly below.

Population of Potential Participants. Expenditure data on Farm stands, Wineries, and

Rental Lodging collected in this survey are household (not per person) expenditures. The number of East End resident households (44,241) and seasonal households (29,183) are based on 1995 Long Island Lighting Company estimates.

The number of overnight visitor households cannot be adequately estimated with available data. LIRPB seasonal population estimates account for occupancy of some rental lodgings, such as hotels, motels, and campsites. However, this component of the population estimate does not account for turnover, i.e., the same rental lodgings will be used by an unknown number of overnight visitors over the course of a season. Estimating the number of overnight visitor households is further complicated by the large percentage of overnight visitors (39%) who indicated that they stayed with friends or relatives, which implies that some amount of their expenditures may be included in resident and seasonal household estimates. For these reasons, expenditures of overnight visitors are not estimated in this analysis. Still, the average annual expenditure for rental accommodations per household from our survey --$5,400--make it evident that seasonal rentals are a major source of income for PES rental property owners and owners of hotels, motels, and inns.

Estimated Total Participation and Expenditures. Table IV.13: Estimated Farm Stand and Winery Expenditures presents estimates (in 1995 dollars) of participation and expenditures in these sectors for resident and seasonal households. Table IV.13 also presents estimates of PES-related expenditures in these sectors. PES-related expenditures were estimated using the same seasonal adjustment (45 %) used in the Phase I Report to estimate the PES-related impacts of tourism and recreation sectors. Total rental lodging expenditures could not be estimated due to incomplete information on the number of participants.

Table IV.12 - Survey Farm Stand, Winery, and Rental Lodging Expenditures (1995 dollars)*

	Farm stand	Winery	Rentals
Residents			
Participation	316 (88%)	114 (32%)	---
Total Expenditures	$86,400	$20,871	---
Average Expenditures	$273	$183	---
Second Home Owners			
Participation	131 (82%)	67 (42%)	---
Total Expenditures	$48,122	$15,350	---
Average Expenditures	$367	$229	---
Overnight Visitors			
Participation	225 (53%)	114 (27%)	103 (26%)
Total Expenditures	$41,228	$18,360	$556,000
Average Expenditures	$183	$161	$5,398
Day Trippers			
Participation	153 (56%)	94 (34%)	---
Total Expenditures	$12,755	$9,121	---
Average Expenditures	$83	$97	---
Totals			
Participation	825 (68%)	389 (32%)	103 (9%)
Total Expenditures	$188,505	$63,702	$556,000
Average Expenditures	$228	$164	$5,398

* Figures in parentheses indicate the percent who made such expenditures

Table IV.13 - Estimated PES Farm Stand and Winery Expenditures

	Farm stand	Winery
Residents		
Estimated Participating Households	38,932	14,157
Estimated Total Expenditures	$10,628,436	$2,590,731
Estimated PES-Related Expenditures	$4,782,796	$1,165,829
Second Home Owners		
Estimated Participating Households	23,929	12,256
Estimated Total Expenditures	$8,781,943	$2,806,624
Estimated PES-Related Expenditures	$3,951,874	$1,262,981
Totals		
Estimated Participating Households	62,861	26,413
Estimated Total Expenditures	$19,410,379	$5,397,355
Estimated PES-Related Expenditures	$8,734,671	$2,428810

An interesting finding is that PES-related Farm stand expenditures are greater than earlier estimates for several other food-related sectors presented in the Phase I Report. For example, PES-related farm stand expenditures are greater than expenditures (in 1995 dollars) in Meat and Fish Markets ($6.5 million), Fruit and Vegetable Markets ($3.8 million), Retail Bakeries ($2.9 million), and Drinking Establishments ($6.0 million) (Grigalunas and Diamantides, 1996).

IV.I. DESCRIPTIVE RESULTS: REFERENDA AND BROWN TIDE RESULTS

IV.I.1. Hypothetical Referenda

Introduction. One section of the recreational use survey posed referendum-type policy questions to East End residents and second home owners. These questions were added to "test the waters" on selected policy issues and were not designed as a basis for resource valuation, which would have required considerably more effort and data than was possible for this project.

Referenda Questions. The referenda questions focus on four policy actions:

(1) reseeding scallops following Brown Tide,

(2) planting hard clams,

(3) upgrading the Riverhead sewage treatment plant, and

(4) reducing road runoff.

Respondents were presented with one of these programs and were asked whether they support the program, if they had to pay a given annual cost. Annual costs were varied for each of the proposed policy actions as described in Table IV.14.

Referenda Results. Respondents overwhelmingly supported the policy actions and indicated a willingness to pay the annual costs. Support ranged from a high of 100% for reseeding scallops following Brown Tide at an annual cost of $10, to a low of 75% for upgrading the Riverhead sewage treatment plant at an annual cost of $100. This high level of support for PES management programs was consistent across residents and second home owners. Overall, 87% of respondents indicated they support the policy actions at the given costs (Table IV.14).

IV.I.2. Descriptive Results: Effects of Brown Tide

Respondents were asked whether they had heard of Brown Tide ("BT"). Those who had heard of BT were asked about their level of concern and about any activities that may have been affected by BT. Overall, most respondents (83%) had heard of BT, and of those, most (71%) were also very concerned (Table IV.15).

BT had the biggest effect on swimming. Fifty-eight percent of those who had heard of BT indicated that it had affected their swimming. Recreational fishing (34 percent) and shell fishing (33 percent) also were affected by BT.

Residents and second home owners had the most knowledge of and the highest concern for BT. Overnight visitors had the least knowledge and indicated that their activities were affected the least.

Table IV.14. Management Action Referenda Results

Proposal; Annual Cost	Residents Y/N	SHO Y/N	Totals Y/N	Total %Yes
Reseed Scallops Following Brown Tide; $5	21/2	6/0	27/2	93%
Reseed Scallops Following Brown Tide; $10	14/0	10/0	24/0	100%
Reseed Scallops Following Brown Tide; $25	17/2	5/1	22/3	88%
Plant Hard Clams; $5	21/4	12/0	33/4	89%
Plant Hard Clams; $10	18/3	5/0	23/3	88%
Plant Hard Clams; $25	14/2	2/2	16/4	80%
Upgrade Riverhead Sewage Treatment Plant;$5	16/2	6/0	22/2	92%
Upgrade Riverhead Sewage Treatment Plant;$25	18/3	9/1	27/4	87%
Upgrade Riverhead Sewage Treatment Plant;$50	15/4	6/0	21/4	84%
Upgrade Riverhead Sewage Treatment Plant;$100	73/28	30/6	103/34	75%
Reduce Road Run Off; $10	19/1	11/0	30/1	97%
Reduce Road Run Off; $25	22/1	15/1	37/2	95%
Reduce Road Run Off; $50	22/1	6/0	28/1	97%
Totals	290/53	123/11	413/64	87%

Table IV.15 Awareness of Brown Tide

	Residents	Second Home Owners	Overnight Visitors	Day Trippers	Total
Heard of Brown	370	159	279	202	1010
	97.11%	91.91%	67.72%	78.29%	82.52%
Have NOT Heard of Brown Tide	11	14	133	56	214
	2.89%	8.09%	32.28%	21.71%	17.48%
Very Concerned about Brown Tide*	295	113	174	131	713
	80.16%	71.52%	62.37%	65.17%	70.87%
A Little Concerned about Brown Tide*	70	44	100	64	278
	19.02%	27.85%	35.84%	31.84%	27.63%
NOT Concerned about Brown Tide*	3	1	5	6	15
	0.82%	0.63%	1.79%	2.99%	1.49%

* Includes only respondents who have heard of Brown Tide

Table IV.16. Activities Affected By Brown Tide

	Residents	Second Home Owners	Overnght Visitors	Day Trippers	Total
Swimming	224	98	151	118	591
	60.54%	61.64%	54.12%	58.42%	58.51%
Fishing	148	49	82	69	348
	40.00%	30.82%	29.39%	34.16%	34.46%
Shell fishing	168	52	62	58	340
	45.41%	32.70%	22.22%	28.71%	33.66%
Boating	72	30	43	37	182
	19.46%	18.87%	15.41%	18.32%	18.02%
Other	32	13	20	10	75
	8.65%	8.18%	7.17%	4.95%	7.43%

* Includes only respondents who have heard of Brown Tide

IV.J. ESTIMATES OF THE ECONOMIC VALUE OF RECREATION

IV.J.1. Introduction

Our intention was to use data from the recreational survey to assess the use value for many water-based and shore-based recreational activities. The survey collected activity-specific data on fishing, Shell fishing, boating, and swimming in the PES and surrounding waters. Information also was collected on beach use, birdwatching, wildlife viewing, and hunting in the five PES towns.

Unfortunately, the total number of surveys was limited to 1,354 completed responses due to budgetary reasons. The number of completed responses for each activity was the limiting factor in assessing which activities could be valued. Values were estimated for primary activities of interest: swimming, fishing, boating, and for birdwatching and wildlife viewing (the last two of which were combined into one activity). However, the number of responses was insufficient to estimate the value of Shell fishing and hunting. Beach use was not valued separately from swimming.

Swimming is the most popular activity, and swimming and recreational fishing are the activities most directly affected by water quality and hence by management actions aimed at enhancing water quality (e.g., Table IV.15) For this reason, swimming is a focus of our efforts to estimates the benefits of management actions in terms of changes in swimming values. We recognize that participation in, and the economic value of, all activities depends upon the quality of the experience. For example, substantial research on recreational fishing, including the results of this study, shows the importance of the quality of the experience--the catch rate--on the number of trips and their economic value (e.g., Freeman, 1995; McConnell and Strand, 1994). However, establishing the necessary cause-and-effect scientific links between policies to preserve or restore habitat, for example, with changes in salt water recreational catch rates appears to be beyond the state of the art[9]. Nevertheless, we can simulate how benefits to recreation fishing would change if the catch rate increased by, say, 10 percent.

Individual recreation trip value estimates and annual aggregate value estimates are given for three cases. First, we present the existing ("baseline") conditions for swimming, fishing, boating, and for birdwatching and wildlife viewing. For the baseline, we show consumer surplus per trip, total estimated number of trips in 1995, and total benefits for the year for the four key recreation activities studied.

Second, we show how economic value for *swimming* changes for illustrative, hypothetical policies affecting water quality. One such policy is assumed to increase water quality by 10 percent in each of the five PES bays. We also simulate a 20 percent uniform improvement in water quality for comparative purposes. Finally, a 10 percent improvement in the recreational fishing catch rate is simulated.

IV.J.2. Methodology

Value estimates for each activity are derived using the Travel Cost method of valuation (see, for example, Freeman, 1993). The rationale behind this methodology is that, although there is no market price that reveals the value of a recreational activity, an implicit price can be observed through the cost of traveling to the activity's location. Included in this implicit price is the cost of transportation, such as gas, wear and tear on the automobile, etc., and the value of the individual's travel time. In theory, an individual's opportunity cost is valued as his or her next best use of their time. However, a fraction of the individual's wage is generally used, in practice, to represent income foregone in favor of recreation.

In the travel cost model, the number of trips a person takes for recreation at a specific site depends on the costs of getting to that site, the comparative costs of getting to substitute sites, and the quality of the recreational experience at the sites. In other words, the cheaper it is to get to a site, the cheaper travel to that site is relative to other sites, and the better the quality of the recreational experience at that site, the more times the individual will visit that site, all else equal. Thus, observed recreation choices reveal tradeoffs between cost of participation, as measured by travel

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[9]This contrasts with policy actions to replant shellfish or to stock fish, the latter of which is often done in fresh water to enhance recreational fishing. In these cases, it may be easier to link a policy to a change in catch rate and hence to benefits.

cost, and participation rates. In addition, participants might reveal values for site quality by participating more at sites of higher quality, and less at sites of lower quality, all else being the same.

Carrying out the travel cost analysis requires data on participation rates, cost of travel to sites, and site quality. Data on participation rates is collected in the recreational survey. Data on travel costs to the target and substitute sites, including the opportunity cost of travel time, are collected from the survey and augmented, as necessary, with distance information from road maps. Data on water quality comes from two sources. First, we use field measurements of various water quality parameters from the SCDHS PES water sampling program, including nitrogen, coliform counts, water clarity (Secchi disk measurements) and Brown Tide cell counts. These are objective measures of quality. Second, we use data from the recreation survey which asked respondents their subjective evaluation of water quality (excellent, good, fair or poor). These evaluations of course are subjective.

For swimming, our analysis combines the subjective assessments by individuals and the objective field measurements of water quality. Ultimately, we are interested in whether we can provide sequential linkages between:

(1) management *actions* that effect water quality parameters,
(2) the resultant *perceptions* of water quality, and
(3) *participation* in specific recreation activities.

If we can establish such a linkage we can evaluate water quality policy alternatives.[10]

To attempt to do so, we relate participation to subjective ratings of water quality, as indicated in the recreational survey, and in turn, we relate these subjective water quality ratings to field measurements of water quality. These are: water clarity, nitrogen concentration, coliform counts, and Brown Tide cell counts for each location and time period. This allows us to estimate the recreational benefits associated with water quality improvements resulting from management options.

The annual benefits of a policy improving water quality has two parts. One is that individuals will enjoy the swimming experience more; the other is that they will make more trips. This is the basis of our approach for estimating the economic benefits of water quality improvements in the PES for swimming.

For example, consider an assessment of proposed improvements in the Riverhead sewage treatment plant. Upgrading the sewage treatment plant will result in improvements in water clarity, reductions in coliform counts, etc., with the largest effect in Flanders Bay and progressively small changes in

[10]We note that a water quality model developed by Tetra Tech of Fairfax, VA for the PES Program will estimate water quality changes in each of the bays due to proposed program policies.

bays to the east. Our model allows us to predict how these changes in water quality parameters effect the subjective assessment of water quality by recreational users, and the resultant changes in participation rates and in recreational values at various sites. Thus, we can identify benefits to recreational swimming that result from management options that improve water quality.

In order to implement this methodology, we will coordinate our assessments with ongoing water quality modeling efforts in the PES. Thus, we anticipate that water quality modeling will be used to project changes in quality parameters from prospective management policies. Our recreational modeling will then be used to estimate recreational benefits resulting from these changes in quality.

Similarly for recreational fishing, quality of the experience depends upon catch rates, which in turn depend upon fish populations. Our recreational fishing model includes catch rates as a predictor of participation rates and recreational values. Thus, if predictions can be made concerning the effect of management actions on fish populations, we could use our recreational model to estimate resultant benefits to recreational anglers. However, it may not be feasible for natural scientists to predict changes if salt water fish populations that would likely result from management actions. Nevertheless, the opportunity exists for estimating recreational fishing benefits from management actions, if resultant changes in populations can be estimated. Even in cases where precise predictions are not possible, it may be possible to provide possible ranges of population changes, which will enable us to provide order-of-magnitude estimates of possible benefits.

The economic benefits from improving (or maintaining) water quality could be long-run benefits, if the policy is sustained. To recognize the long-run benefits, we sum the annual benefits over time, discounting them as appropriate to get an equivalent value today--the asset value of the resource in providing services supporting that activity.

IV.K. ESTIMATES OF ECONOMIC VALUE: RESULTS

IV.K.1. Value (Consumer Surplus) Per Trip

The methodology described above yields a consumer surplus estimate per person, per trip ranging from \$8.59 for swimming to \$49.83 for non-residential bird watching and wildlife viewing (Table IV.17). Fishing and boating values per trip fall within that range at \$40.25 and \$19.23, respectively. These estimates of consumer surplus are the average value individuals receive per trip over and above the cost of their recreational trip. Looked at another way, it is the *unpaid for* benefit that individuals receive, on average, from a recreational trip. The relative sizes of these values are consistent with the literature (e.g. Walsh et al., 1988; Freeman, 1995).

IV.K.2. Total Annual Economic Value for All Trips

Total annual benefits from each of the four recreational activities studied are given in Table IV.17. The total benefits are estimated by multiplying the average consumer surplus for an activity by the estimated total number of trips to engage in that activity during the year (1995). Viewing of Birds and Wildlife is the most valued of the activities studied ($27.3 million). Of the water-based activities, recreational fishing is the most highly valued ($23.7 million).

We emphasize that total values rarely are useful for policy analyses since most policies involve *small changes* in an activity or its quality and are not "all or nothing" choices. Nevertheless, we recognize that information on total values, such as that given in Table IV.17 helps put the scale of these activities in some perspective.

Table IV.17 Total Annual Value of Recreational Activities at the PES (Baseline Water Quality)

	Swimming	Boating*	Recreatonal Fishing	Bird Watching& Wildlife Viewing
Total Trips/Year	1,409,970	937,387	588,493	547,317
Consumer Surplus Per Trip	$8.59	$19.23	$40.25	$49.83
Total Annual Consumer Surplus	$12,113,216	$18,025,952	$23,685,985	$27,272,806

* Excludes boating trips taken primarily for fishing

IV.K.3. Asset Value of PES for Key Recreation Activities

Using the results given above, the asset value of the PES for providing each of the recreational activities ("services") can be estimated. We use a discount rate of 7 percent and time horizon of 25 years and assume that the estimated values remain the same over the 25 year period. Using these assumptions, and our annual estimates from the above table, the asset values range from $318 million for Bird Watching and Wildlife Viewing to$141 million for Swimming. The PES has an asset value of $276 million for Recreational Fishing and $210 million for Boating.

IV.K.4. Change in Swimming Trips and Benefits Due to Hypothetical Water Quality Changes

To illustrate how the economic benefits estimated in this report can be used to contribute to estuary management policy, consider a hypothetical policy or set of policies that improves all water quality measures by *10 percent* in all five PES Bays. That is, the policy reduces field measurements of Nitrogen, Total Coli, Brown Tide cell counts by 10 percent and increases Secchi depth by 10 percent throughout the PES. Note that since water quality measures differ among individual bays (and indeed within Bays), the *absolute* water quality changes due to a 10 percent improvement will

Table IV.18 Benefits to Swimmers of 10% Improvements in Each Water Quality Indicator at Each PES Water Body

PES Water Body	Total Kjeldahl Nitrogen	Total Colifrm	Brown Tide Cell Counts	Secchi Disk Depth	Water Body Total
Flanders Bay	$65,278 *7,598*	$71,310 *8,300*	$14,424 *1,679*	$125,753 *14,637*	$276,766 *32,215*
Great Peconic Bay	$24,801 *2,887*	$3,522 *410*	$48,095 *5,598*	$126,362 *14,708*	$202,779 *23,603*
Little Peconic Bay	$20,584 *2,396*	$1,140 *133*	$70,207 *8,172*	$139,929 *16,288*	$231,860 *26,988*
Shelter Is. Sd.	$22,598 *2,630*	$4,553 *530*	$109,790 *12,779*	$175,093 *20,381*	$312,033 *36,320*
Gardiners Bay	$14,138 *1,646*	$129 *15*	$76,863 *8,947*	$185,286 *21,567*	$276,416 *32,174*
PES Total	$147,399 *17,156*	$80,653 *9,387*	$319,378 *37,175*	$752,423 *87,581*	$1,299,854 *151,299*

Italics indicate number of trips

A hypothetical uniform 20 % improvement in water quality increases the number of trips by 169 thousand and annual swimming benefits by $2.6 million (Table IV.19 Again most of the increase in benefits ($1.46 million) is attributable to greater water clarity. However, benefits due to reduced Brown Tide cell count (about $652 thousand) also are important.

In policy analyses, it is important to examine the incremental benefits of policies in order to know what the public gets from stricter policies and the higher costs that they entail. The annual, incremental swimming benefits of going from an initial 10 percent improvement in water quality ($1.299 million) are somewhat larger than the added benefits ($1.264 million)of the second 10 percent water quality improvement (i.e. going from 10 percent to 20 improvement). The issue of incremental benefits from alternative management actions that affect different PES bays differently will be addressed more comprehensively in Phase III economic studies.

Table IV.19. Benefits of 20% Improvements in Each Water Quality Indicator at Each PES Water Body

PES Water Body	Total Kjeldahl Nitrogen	Total Colifrm	Brown Tide Cell Counts	Secchi Disk Depth	Water Body Total
Flanders Bay	$130,030 *15,135*	$141,908 *16,518*	$28,888 *3,362*	$253,807 *29,543*	$554,633 *64,558*
Great Peconic Bay	$48,869 *5,688*	$6,200 *722*	$95,937 *11,1678*	$249,204 *29,152*	$400,201 *46,729*
Little Peconic Bay	$41,319 *4,809*	$2,510 *292*	$139,892 *16,283*	$279,957 *32,262*	$463,678 *53,647*
Shelter Is. Sd.	$44,207 *5,145*	$7,907 *920*	$235,633 *27,427*	$315,939 *36,775*	$603,685 *70,268*
Gardiners Bay	$28,555 *3,324*	$5567 *648*	$151,556 *17,641*	$356,181 *41,459*	$541,859 *63,071*
PES Total	$292,979 *34,102*	$164,653 *19,100*	$651,905 *75,881*	$1,455,088 *169,191*	$2,564,065 *298,273*

Italics indicate number of trips

IV.K.5. Change in Fishing Trips and Benefits Due to Hypothetical 10 Percent Change in Catch Rate

We also simulate the effects of an assumed policy that leads to a 10 percent increase in the recreational fishing catch rate. The 10 percent increase in catch rates raises the benefit (Consumer Surplus) per trip by $0.80, increases the number of recreation trips by 11,249, and boosts total annual benefits by $472,359. The present value of this increase in catch rates--the increase in the asset value of the PES in providing this service-- is $5.5 million, using the 7 percent discount rate and time horizon of 25 years used for all cases.

Table IV.20. Benefits of Improving Expected Recreational Catch Rate by 10 Percent

	Baseline	10 Percent Increase in Expected Catch Rate	Incremental Benefits
Number of Fishing Trips	588,493	599,742	11,249
Consumer Surplus/Trip	$40.25	$41.05	$0.80
Total Consumer Surplus	$23,685,985	$24,158,344	$472,359

We re-emphasize that the results presented here are for benefits only; the *cost* of water quality improvements, or of improvements that might increase recreational fishing catch rates, have not been considered. Thus, we do not know the *net benefits* of potential management actions. Later Benefit-Cost analyses to be done by EAI of proposed program actions will address these issues.

IV.L. REFERENCES

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Supplementary Tables and Appendices

Supplementary Tables

Table S.1

East End Resident Respondent Distribution by Town			
Town	Number of Respondents	Percentage of All Respondents	Percentage of Year-round Population-a
East Hampton	50	14%	15%
Riverhead	42	12%	22%
Shelter Island	57	16%	2%
Southampton	107	30%	43%
Southold	102	28%	19%
Totals	358	100%	100%*

*adjusted to account for rounding
a- Source: Long Island Regional Planning Board

Table S.2

Second Home Owner Primary Residence		
Area	Number of Respondents	Percentage of All SHO Respondents
New York City	72	45%
Nassau County	30	19%
Suffolk County	22	14%
Other Areas[1]	35	22%
Totals	159	100%

[1]Includes Westchester and Rockland Counties in New York and parts of Northeastern New Jersey.

Table S.3

Second Home Owner Distribution by Town			
	Number of Respondents	Percentage of all Respondents	Percentage of Seasonal Home Population-a
East Hampton	29	22%	29%
Riverhead	6	5%	5%
Shelter Island	17	13%	3%
Southampton	39	29%	49%
Southold	42	32%	14%
Totals	133	100%*	100%*

*adjusted for rounding
a- Source: Long Island Regional Planning Board

Table S.4

Primary Residency of Visitors to the East End		
Area	**Number of Respondents**	**Percentage of All Respondents**
New York City	146	19%
Nassau County	118	16%
Suffolk County	300	40%
Other New York State and New Jersey	63	8%
Connecticut and Massachusetts	39	5%
Other	84	11%
Totals	750	100%*

*adjusted for rounding

Table S.5

Accommodations for Overnight Visitors		
Accommodation	**Number of Respondents**	**Percentage of All Overnight Visitor Respondents**
Hotel or Motel	95	22%
Rental	101	24%
Friends or Relatives	168	39%
Other	63	15%
Totals	427	100%*

* Adjusted for rounding

Table S.6

Overall Participation[a] in Key Recreation Activities - All Respondents (n=1354)		
	Number of Participants	**Percentage of all Respondents**
Any Activity*	944	70%
Multiple Activities	648	48%
Water Based Activities	820	61%
Land Based Activities	644	48%

*Any of the eight activities listed in the survey questionnaire. Water Based Activities: Swimming, Boating, Fishing, Shell fishing; Land Based Activities: Beach Use, Bird Watching, Wildlife Viewing, Hunting.

[a] Includes water-based recreation at PES, BIS, LIS, and Atlantic Ocean.

Table S.7

Participation in PES Water Based Recreation - All Respondents (n=1354)				
Activity	**Number of Participants**	**Percentage of Total Participation**	**Number of Experiences**	**Average Experiences Per Participant**
Fishing	224	35%	2732	12
Boating	338	52%	5470	16
Swimming	470	73%	6538	14
Shell fishing	92	14%	766	8
Totals	644	100%	15506	24 *

* Includes more than one activity.

Table S.8

Participation in Land Based Recreation - All Respondents (n=1354)				
Activity	**Number of Participants**	**Percentage of Total Participation**	**Number of Experiences**	**Average Experiences Per Participant**
Beach Use	736	90%	12248	17
Bird Watching	243	30%	5371	22
Wildlife Viewing	275	34%	5628	20
Hunting	23	3%	255	11
Totals	820	100%	23502	29 *

* Includes more than one activity.

S.9 - Estimated Trips for Key Recreation Activities for Sample*

	Residents	SHO	Overnight	Totals
Fishing	21,218	9,520	14,850	45,588
Boating	31,402	14,647	20,791	66,840
Swimming	44,133	18,309	35,641	98,083
Shell fishing	11,882	4,394	2,970	19,246
Beach Use	67,048	23,801	54,452	145,301
Bird Watching	8,555	3,032	5,346	16,933
Wildlife Viewing	17,313	6,225	10,098	33,636
Hunting	2,546	732	990	4,268

*Includes activities at the five East End towns and PES water bodies only

Appendix B - Technical Appendix: Swimming Trips and Value Estimation

Overview

A "count data" model is used to estimate the demand for recreational activities in the PES. Count data models are appropriate for estimating recreational demand because the number of recreational trips taken by an individual must take on an integer value. The Poisson distribution is used to estimate the number of trips to each site in the PES and to estimate the economic value (consumer surplus) of those trips.

For swimming, the number of trips to each site is modeled as a function of the travel cost to the site, costs of travel to substitute sites, the number of boating occasions at the same site, and a subjective measure of water quality at the site. The measure of water quality is the probability that water quality at the site will be ranked either good or excellent by survey respondents who recreate at that site.

This model can be used to estimate the effect of management actions to improve water quality on the number of recreational trips to each site, and to the value of a recreational trip to a site. In order to do so, we need to link management actions to changes in water quality, and to link objective field measures of water quality to subjective perceptions of water quality by recreational users.

Predictions of changes in water quality due to management actions is done as part of ongoing water quality modeling work, carried out as part of the Peconic Estuary Program (Tetra Tech, 1998). The relationship between objective water quality measures and subjective perceived water quality is estimated by linking data collected in the recreational survey with field measure of water quality. Specifically, for those respondents who indicate that they went swimming on their most recent recreation day, the survey asked where they went swimming and how highly they rated water quality (excellent, good, fair or poor) at that site. We also obtained data on measures of key water quality variables, including brown tide cell counts, total coliform bacteria, total Kjeldahl nitrogen, and Secchi disk depth readings from sampling locations distributed across the PES. The data was grouped into ten sites - north fork and south fork sites for Flanders, Great Peconic, Little Peconic, Shelter Island Sound and Gardners bay.

An ordered LOGIT model was used to estimate the probability that an individual would rate water quality high (good or excellent), fair or poor as a function of the objective field measures of water quality, discussed above. We then include these *predicted* probabilities into the travel cost estimation, so that the number of trips to a site is related to the cost of traveling to the site, the cost of traveling to key substitute sites, and the predicted probabilities of the subjective rankings of water quality. These steps are described in detail below.

Water Quality Model

The water quality model links individuals' perception of water quality - expressed in a ranking of poor, fair, good, and excellent - to physical measures of water quality collected at sampling stations by the SCDHS. An ordered logit model is used to estimate the probabilities for each rank based on physical measures of water quality and on the effects of Brown Tide on the individual's swimming that year. The purpose of the water quality model is to provide input into the travel cost model i.e., the probability that the water quality of a site would be ranked good or excellent.

Data for the water quality model consists of site readings during August 1995 for the following water quality indicators:

1. Brown Tide, *Aureococcus anophagefferens*, in cells per milliliter.
2. Total Kjeldahl nitrogen in milligrams per liter.
3. Total coliform bacteria in MPN per 100 milliliters.
4. Secchi disk depth measured in feet.

These water quality indicators were selected for their relevance to potential management actions and for their modeling compatibility. Also included in the water quality model data set are responses to the Recreational Use Survey Questionnaire administered during August 1995. Three questions from the questionnaire are included. One question asks individuals if their swimming was affected by Brown Tide. Another question asks respondents to rank the water quality - poor, fair, good, excellent - at their last swimming outing in the PES. The third question asks respondents to identify the swimming location of their last swimming outing in the PES.

The data is grouped into ten sites: Flanders bay north and south, Great Peconic bay north and south, Little Peconic bay north and south, Shelter Island sound north and south, and Gardiners bay north and south. Swimming locations were allocated to the ten sites according to locations indicated by the survey respondent. Only observations that indicate an identifiable swimming location for trips taken during August 1995 were included in the data set. Water quality sampling stations were allocated to the ten sites according to SCDHS sampling station maps, as described in Table A1. The number of samples recorded from each sampling station varies. An average of the data recorded at each station during August 1995 (the period during which our survey was administered) was taken. Sampling stations with a central position, as opposed to north or south, were included in the averages of both north and south sites.

Data for Brown Tide, total Kjeldahl nitrogen, and total coliform bacteria were used to construct indices of water quality relative to threshold values for each parameter to make the measures more comparable.

The average Brown Tide cell count for each of the ten sites was divided by 250,000cells/ml - the visibility threshold for Brown Tide. The resulting value was then multiplied by 1 if the respondent indicated that their swimming was affected by Brown Tide, or by 0 if not. In this way, the Brown Tide cell count is modeled to affect the water quality ranking of only those respondents who indicated they had knowledge of and were affected by Brown Tide.

The average total Kjeldahl nitrogen reading for each of the ten sites was divided by .5mg/l, the nitrogen guideline established by the SCDHS. The average total coliform bacteria reading for each of the ten sites was divided by 400MPN/100 ml, a threshold for bathing water quality. The total Kjeldahl nitrogen index and the total coliform bacteria index were added together to form a joint nitrogen-bacteria index. This joint index was used in the ordered logit model instead of the individual indices because high colinearity in field measurements of nitrogen and coliform bacteria precluded separate estimation of the effects of these two water quality variables. All indices were multiplied by 100 to preclude the use of fractions. Average input values for each site are presented in table A2.

The modeling procedure uses an ordered logit model that predicts water quality rank based on the Brown Tide Index, Nitrogen-Bacteria Index, and Secchi Disk depth readings. The ordered logit model is based on the logistical distribution,

$$\Pr ob(Y=1) = \frac{e^{\beta' x}}{1+e^{\beta' x}}.$$

where β represents parameters to be estimated and x represents water quality field measures (e.g., water clarity) that contribute to the subjective water quality rankings. Given that the rankings are discrete and finite (excellent, good, fair and poor), it is reasonable to talk about the probability that any ranking would be chosen based on the levels of the water quality indicators encountered by an individual. Since the individual is faced with a predetermined ranking order - poor, fair, good, excellent - the choice made reflects the rank order that is most similar to the individual's own perception. In other words, the individual may feel that water quality at their swimming location that day was somewhere between good and excellent, but because of the ranking order presented by the questionnaire, the individual will choose either good or excellent as the best choice. This selection process is modeled as a multinomial logit model where

$$y^* = \beta' x + \epsilon.$$

Y* is a continuous measure of site quality, not constrained by the discrete ranking, β is the vector of coefficients estimated by the ordered logit model, x is the vector of field measures of water quality, and ϵ is a vector of unknown factors that might affect the individual's rank order choice (e.g., the individual's mood or the prevailing weather conditions). The unknown factors are assumed to be logistically distributed across individuals with a mean of zero and a variance of one.

Although y* is unobserved, the rank order selections indicated in the survey questionnaire are observed. These selections can be modeled as

$$\begin{array}{ll} y = 0 \text{ (poor)} & \text{if } y^* \leq 0, \\ y = 1 \text{ (fair)} & \text{if } 0 < y^* \leq \mu 1, \\ y = 2 \text{ (good)} & \text{if } \mu 1 < y^* \leq \mu 2, \\ y = 3 \text{ (excellent)} & \text{if } \mu 2 \leq y^*. \end{array}$$

where the μi are threshold values that determine when water quality ranking would change for a "representative" individual. The ordered logit model estimates the μ threshold parameters along with the vector of β coefficients.

The results of the ordered logit model are presented in Table A3. The estimated coefficients indicate that a reduction in Brown Tide cell counts or a reduction in the nitrogen-bacteria index would result in higher water quality rankings. Similarly, an increase in Secchi disk depth (increased water clarity) would raise the subjective water quality ranking by survey respondents.

The probabilities that water quality would be ranked poor, fair, good, or excellent are calculated from the ordered logit model results. These probabilities are:

$$\begin{array}{ll} \text{Prob } (y = 0; \text{ poor}) & = \Lambda\,(-\beta' x), \\ \text{Prob } (y = 1; \text{ fair}) & = \Lambda\,(\mu 1 - \beta' x) - \Lambda\,(-\beta' x), \\ \text{Prob } (y = 2; \text{ good}) & = \Lambda\,(\mu 2 - \beta' x) - \Lambda\,(\mu 1 - \beta' x), \\ \text{Prob } (y=3; \text{ excellent}) & = 1 - \Lambda\,(\mu 2 - \beta' x), \end{array}$$

where Λ indicates the logistic cumulative distribution function.

The rank order probabilities are given for nine sites only, as no survey respondents reported swimming at Flanders Bay south. These probabilities are generated by substituting the site-specific water quality indicator values for the mean values of the entire sample. An average of each probability weighted by the number of observations for each site is calculated for the five PES water bodies. For example, the probability that water quality at Gardiners bay will be ranked good is based on the weighted average of the probability for good at Gardiners bay north and Gardiners bay south. The probabilities for the nine sites are presented in table A4. The probabilities for the five PES water bodies are presented in table A5.

The effects of management actions on the rank order probability at any or all of the nine sites can be simulated by changing the water quality measures for the sample station readings. Changes in these values will in turn change the value of the water quality indices and/or Secchi Disk readings used as input into the ordered logit model. These simulated values for objective water quality field measures are used to provide at a new set of probabilities for subjective ratings of water quality for the sites, which in turn affect predicted participation rates for swimming in each of the PES water bodies.

Tables A6-A9 contain estimated water quality ranking probabilities i.e., the probability that water quality will be ranked poor, fair, good, or excellent, for each of nine PES sites at a 10% improvement in an objective water quality parameter. The objective water quality parameters used in the 10% improvement model are Brown Tide cell counts, Total Kjeldahl Nitrogen readings, Total Coliform readings, and Secchi Disk depth.

For example, under baseline water quality levels in 1995, Great Peconic Bay (Table A5) is predicted to obtain a "poor" rating for water quality by 8% of sample respondents, a "fair" rating by 37% of sample respondents, a "good" rating by 45% of sample respondents and an "excellent" rating by 10% of sample respondents. These probabilities are the weighted averages of the ranking probabilities for Great Peconic Bay North and Great Peconic Bay South (Table A4). If, continuing our example, Brown Tide Cell counts were to improve (decrease) by 10% at sampling stations in Great Peconic Bay North and Great Peconic Bay South, the model predicts that Great Peconic Bay overall (Table A10) would obtain a "poor" rating by 7% of sample respondents, a "fair" rating by 36% of sample respondents, a "good" rating by 46% of sample respondents and an "excellent" rating by 10% of sample respondents.

Travel Cost Model

The travel cost model predicts the annual number of swimming trips to each of the five water bodies in the PES based on the cost of travel to the swimming location, the cost of travel to substitute swimming locations, the number of times the individual went to the same location that year, and the probability that the water quality at that location would be ranked good or excellent. The predicted number of trips and the estimated coefficient on the travel cost variable are used to calculate the value of swimming trips to each PES water body.

The travel cost model is also used to estimate the increased number of trips and increased value per trip that results due to management actions that increase water quality. This is done in three steps. First, the changes in water quality resulting from specific management actions (e.g. upgrading the Riverhead sewage treatment plant) are to be simulated using the water quality modeling results (Tetra Tech, 1998). Next, changes in subjective probabilities are predicted using the methods discussed above. Finally, predicted perceptions of water quality by users are substituted into the Travel cost model, to calculated the estimated number of trips and value per trip under the new level of water quality.

Data for the travel cost model comes from the Recreational Use Survey and from the results of the water quality model. The survey questionnaire asks respondents to indicate the number of times they went swimming this year at a variety of water bodies on the East End. These water bodies include Flanders Bay, Great Peconic Bay, Little Peconic Bay, Shelter Island Sound, Gardiners Bay, Long Island Sound, Block Island Sound, and the Atlantic Ocean.

The price, or marginal cost, of swimming in the PES is not identified in any existing market. Since there is no readily available market data on the price of swimming in the PES, a proxy for price is used. In the travel cost model, the cost of getting to and from a swimming location is considered the implicit price of swimming at that location. Travel costs to swimming locations are based on distance traveled, travel time, and the household income according to the formula:

Travel Cost = Round Trip Distance * $0.32 + {Round Trip Distance/40mph * 40% hourly wage}.

The round trip distance traveled is double the one-way highway distance between the respondent's point of origin and each swimming location. This distance was determined on a case by case basis using a road atlas and assessing the most direct travel route. Verification of distance traveled was made possible when respondents answered the question concerning distance traveled on their most recent swimming occasion. Travel time was estimated by dividing the round trip distance by 40 miles per hour. This speed was used as a reasonable compromise between highway speeds of 55 mph and more and local speeds between 25 and 40 mph. The opportunity cost of travel time was estimated at 40% of the wage rate, a common practice in benefit estimation. For respondents who did not indicate household income, income was estimated using a simple OLS regression that modeled income as a function of a constant value and education.

In the case of substitute swimming locations, the same travel cost formulation used for the PES locations was applied to the substitute swimming locations. The average of travel costs to Long Island Sound, Block Island Sound, and the Atlantic Ocean, for each respondent, was used as the cost of travel to substitute sites and input into the travel cost model. Data on the number of trips to the PES swimming location comes directly from the survey questionnaire. The water quality variable used in the travel cost model is the sum of the probabilities that the PES swimming location would be ranked good and excellent. These probabilities are generated by the water quality model.

Overall, 199 respondents provided sufficient information to be included in the travel cost model. Given that there are five PES swimming locations, 995 observations were used in the travel cost model estimation.

The travel cost modeling procedure is based on a Poisson regression model. The Poisson regression model is often used when the dependent variable is discrete and includes zero as a viable choice. In this case, many individuals took no trips to one or more of the PES swimming locations. This type of data is referred to as count data, meaning that the data indicates the number of times some phenomenon occurs, such as swimming trips to Flanders Bay.

The Poisson regression model is based on the assumption that each observation is drawn from a Poisson distribution. The probability that the actual number of trips taken is equivalent to the estimated number of trips is formulated as:

$$\text{Prob}\ (Y_i = y_i) = e^{\lambda i}\ \lambda_i^{yi} / y_i\ !$$

Where $y_i = 0,1,2,3,\ldots$; $\ln \lambda_i = \beta' x_i$; β is the vector of estimated coefficients; and x is the vector of independent variables.

The results of the Poisson estimation are consistent with prior expectations, as presented in Table A14. The estimated coefficients indicate that the number of trips to a site decreases as the cost of travel to the site increases; increases when the cost of travel to a substitute site increases; increases the more times the individual participates in swimming at the same location; and increases as water quality at the site increases.

The value of swimming trips to PES locations is estimated from the results of the travel cost model according to the formula:

Consumer Surplus = -(Predicted number of trips)/(coefficient on travel costs).

Consumer surplus is the net value of swimming at a PES location above and beyond the costs of participating. Consumer surplus is affected by the same variables that influence the number of trips to a swimming location. Therefore, the value of a swimming trip varies among the five PES swimming locations due to differences in water quality.

The value of a swimming trip to a PES location will be affected by management actions to improve water quality. The results of the travel cost model can be used to estimate the changes in consumer surplus due to water quality improvements. The recreational swimming benefits of improving water quality are estimated by applying new probabilities of water quality ratings to the results of the travel cost model. This can be calculated using the following formula:

$$\text{New CS} = \frac{\{T + \Delta T * \Delta P\}}{-(C)}$$

Where T represents the number of trips taken prior to the quality change, ΔT represents the change in the number of trips that occurs due to a 1% change in the probability of obtaining a "good" or "excellent" water quality rating, ΔP represents the change in the probability of obtaining a "good" or "excellent" rating that results from the management action, and C represents the coefficient on the travel cost variable.

Increases in the number of swimming days to PES locations and increases in consumer surplus due to a hypothetical 10% improvement in water quality measures are presented in Table A15.

Aggregate benefits are based on the estimated baseline number of swimming trips to the PES. This number of trips - 1,409,970 - was estimated by extrapolating the number of trips respondents identified in the Recreational Use Survey to the population of residents, second home owners, and overnight visitors. The population of overnight visitors was estimated based on the proportion of overnight visitors in the survey sample (see section on Participation). The aggregate value of swimming in the PES under baseline conditions is presented in table A16.

Table A1. PES Sampling Station Locations

Location	Sampling Station
Flanders Bay North	170 (Central), 220, 240
Flanders Bay South	170 (Central)
Great Peconic Bay North	101, 130 (Central)
Great Peconic Bay South	130 (Central)
Little Peconic Bay North	102, 103, 105, 113 (Central)
Little Peconic Bay South	113 (Central)
Shelter Island Sound North	106,107,108,109,111,112,114, 115,119,122
Shelter Island Sound South	118,121,126,127,131
Gardiners Bay North	116
Gardiners Bay South	132,133,134

Table A2. Average Input Value for the Water Quality Model (Ordered Logit)

Site	Brown Tide Index	Nitrogen - Bacteria Index	Secchi Disk Depth (Feet)
Flanders Bay North	5.57	818.09	3.2
Great Peconic Bay North	18.33	169.85	3.13
Great Peconic Bay South	14.81	117.75	3.5
Little Peconic Bay North	28.04	126.39	3.5
Little Peconic Bay South	16.21	126.76	3.5
Shelter Is. Sd. North	39.51	136.44	4.35
Shelter Is. Sd. South	47.5	256.26	4.37
Gardiners Bay North	32.41	94.21	5.75
Gardiners Bay South	33.37	124.7	5.08

Table A3. Results of the Water Quality Model (Ordered Logit)

Observations	199		Chi-Squared	27.50	
Log Likelihood	-225.26		D. Frdm.	3	
Res. L. Likelihood	-239.00		Sig. Level	.000005	
Variable	Coefficient	Std. Err.	T Stat.	Sig. Level	Mean of X
Constant	2.0679	1.1136	1.857	0.06332	
Brown Tide Index	-0.02297	0.00499	-4.605	0.00000	33.83
Nitro. - Bact. Index	-0.00147	0.00089	-1.652	0.09860	173.4
Secchi Disk	0.34515	0.23232	1.486	0.13737	4.397
μ 1	2.2812	0.25915	---	---	
μ 2	4.6968	0.3522	---	---	

Table A4. Baseline Probabilities for Nine Sites

Site	Prob. Poor	Prob. Fair	Prob.Good	Prob. Excellent
Flanders Bay North	0.14	0.47	0.34	0.05
Great Peconic Bay North	0.08	0.37	0.45	0.10
Great Peconic Bay South	0.06	0.32	0.49	0.13
Little Peconic Bay North	0.08	0.38	0.45	0.10
Little Peconic Bay South	0.06	0.33	0.49	0.12
Shelter Is. Sd. North	0.08	0.38	0.45	0.10
Shelter Is. Sd. South	0.11	0.43	0.39	0.07
Gardiners Bay North	0.04	0.25	0.53	0.18
Gardiners Bay South	0.05	0.30	0.50	0.14

*Probabilities may not sum to one due to rounding

Table A5. Baseline Probabilities for PES Water Bodies

PES Water Body	Prob. Poor	Prob. Fair	Prob. Good	Prob. Excellent
Flanders Bay	0.14	0.47	0.34	0.05
Great Peconic Bay	0.08	0.37	0.45	0.10
Little Peconic Bay	0.08	0.37	0.45	0.10
Shelter Is. Sd.	0.08	0.39	0.44	0.09
Gardiners Bay	0.05	0.28	0.52	0.16

Table A6. Probabilities at Nine Sites for 10% Improvements in Brown Tide Cell Count

Site	Prob. Poor	Prob. Fair	Prob.Good	Prob. Excellent
Flanders Bay North	0.14	0.47	0.34	0.05
Great Peconic Bay North	0.07	0.37	0.46	0.10
Great Peconic Bay South	0.06	0.32	0.50	0.13
Little Peconic Bay North	0.08	0.37	0.46	0.10
Little Peconic Bay South	0.06	0.32	0.49	0.13
Shelter Is. Sd. North	0.07	0.36	0.46	0.10
Shelter Is. Sd. South	0.10	0.42	0.41	0.08
Gardiners Bay North	0.04	0.24	0.53	0.19
Gardiners Bay South	0.05	0.29	0.51	0.15

Table A7. Probabilities at Nine Sites for 10% Improvements in Total Kjeldahl Nitrogen Readings

Site	Prob. Poor	Prob. Fair	Prob.Good	Prob. Excellent
Flanders Bay North	0.13	0.46	0.35	0.06
Great Peconic Bay North	0.08	0.37	0.45	0.10
Great Peconic Bay South	0.06	0.32	0.49	0.13
Little Peconic Bay North	0.08	0.38	0.45	0.10
Little Peconic Bay South	0.06	0.33	0.49	0.12
Shelter Is. Sd. North	0.08	0.37	0.45	0.10
Shelter Is. Sd. South	0.11	0.43	0.39	0.07
Gardiners Bay North	0.04	0.25	0.53	0.18
Gardiners Bay South	0.05	0.30	0.51	0.14

Table A8. Probabilities at Nine Sites for 10% Improvements in Total Coliform Readings

Site	Prob. Poor	Prob. Fair	Prob.Good	Prob. Excellent
Flanders Bay North	0.13	0.46	0.35	0.06
Great Peconic Bay North	0.08	0.37	0.45	0.10
Great Peconic Bay South	0.06	0.32	0.49	0.13
Little Peconic Bay North	0.08	0.38	0.45	0.10
Little Peconic Bay South	0.06	0.33	0.49	0.12
Shelter Is. Sd. North	0.08	0.38	0.45	0.10
Shelter Is. Sd. South	0.11	0.43	0.39	0.07
Gardiners Bay North	0.04	0.25	0.53	0.18
Gardiners Bay South	0.05	0.30	0.50	0.14

Table A9. Probabilities at Nine Sites for 10% Improvements in Secchi Disk Depth

Site	Prob. Poor	Prob. Fair	Prob.Good	Prob. Excellent
Flanders Bay North	0.12	0.46	0.36	0.06
Great Peconic Bay North	0.07	0.35	0.47	0.11
Great Peconic Bay South	0.05	0.30	0.51	0.14
Little Peconic Bay North	0.07	0.36	0.46	0.11
Little Peconic Bay South	0.06	0.31	0.50	0.13
Shelter Is. Sd. North	0.07	0.35	0.47	0.11
Shelter Is. Sd. South	0.09	0.41	0.41	0.08
Gardiners Bay North	0.03	0.22	0.54	0.21
Gardiners Bay South	0.05	0.27	0.52	0.16

Table A10. Probabilities at PES Water Bodies for a 10% Improvement in Brown Tide Cell Counts

PES Water Body	Prob. Poor	Prob. Fair	Prob. Good	Prob. Excellent
Flanders Bay	0.14	0.47	0.34	0.05
Great Peconic Bay	0.07	0.36	0.46	0.10
Little Peconic Bay	0.07	0.36	0.46	0.10
Shelter Is. Sd.	0.08	0.37	0.45	0.10
Gardiners Bay	0.04	0.26	0.52	0.17

Table A11. Probabilities at PES Water Bodies for a 10% Improvement in Total Kjeldahl Nitrogen Readings

PES Water Body	Prob. Poor	Prob. Fair	Prob. Good	Prob. Excellent
Flanders Bay	0.13	0.46	0.35	0.06
Great Peconic Bay	0.07	0.37	0.46	0.10
Little Peconic Bay	0.08	0.37	0.45	0.10
Shelter Is. Sd.	0.08	0.38	0.44	0.09
Gardiners Bay	0.05	0.27	0.52	0.16

Table A12. Probabilities at PES Water Bodies for a 10% Improvement in Total Coliform Readings

PES Water Body	Prob. Poor	Prob. Fair	Prob. Good	Prob. Excellent
Flanders Bay	0.13	0.46	0.35	0.06
Great Peconic Bay	0.08	0.37	0.46	0.10
Little Peconic Bay	0.08	0.37	0.45	0.10
Shelter Is. Sd.	0.08	0.39	0.44	0.09
Gardiners Bay	0.05	0.28	0.52	0.16

Table A13. Probabilities at PES Water Bodies for a 10% Improvement in Secchi Disk Depth

PES Water Body	P(Poor)	P(Fair)	P(Good)	P(Excellent)
Flanders Bay	0.12	0.46	0.36	0.06
Great Peconic Bay	0.07	0.35	0.47	0.11
Little Peconic Bay	0.07	0.35	0.47	0.11
Shelter Is. Sd.	0.07	0.36	0.46	0.11
Gardiners Bay	0.04	0.25	0.53	0.19

Table A14. Results of the Travel Cost Model (Poisson Regression)

Observations	995		Chi-Squared	1846.693	
Log Likelihood	-3707.225		D. Frdm.	4	
Res. L. Likelihood	-4630.572		Sig. Level	.000000	
Variable	Coefficient	Std. Err.	T Stat.	Sig. Level	Mean of X
Constant	-0.76984	0.16607	-4.636	0.00000	
Travel Cost	-0.028321	0.00210	-13.494	0.00000	23.29
Boating	0.0781	0.00157	49.757	0.00000	0.9246
Travel Cost to Substitute Locations	0.00978	0.00119	5.282	0.00000	31.74
Water Quality Rank	2.688	0.28209	9.529	0.00000	0.5404
Scale Factor	1.5002				
Marginal Effect for Water Quality Rank	4.0325				

Appendix C. Comparison of Recreation Activity Estimates: Phase I and Phase II Reports

Comparison with Phase I Total Outdoor Recreational Trip Estimates: Beach Use. Beach use, in this report, refers to any beach in the five East End towns, including Long Island Sound and Atlantic Ocean beaches, as well use of PES beaches. The Phase I report did not estimate beach use on Long Island Sound or the Atlantic Ocean and therefore is not presented for comparison.

Comparison with Phase I Total Outdoor Recreational Trip Estimates: Non-Consumptive Wildlife Use. Bird watching and wildlife viewing estimates in this Phase II report are combined to create a "non-consumptive wildlife use" estimate of 547 thousand trips (Table V.11). This estimate greatly exceeds the PES Phase I estimate of non-consumptive wildlife use (92 thousand trips).

The major reason for the large differences in estimates between the Phase I and II reports is explained as follows. Our survey-based estimate finds a high participation rate (19% for bird watching and 21% for wildlife viewing) for respondents and a large number of trips per participant

(37.55 bird watching trips and 34.36 wildlife viewing trips for residents). The Phase I survey, in contrast, was based on NFWS statewide estimates for New York. These statewide participation rates (9.4%) and number of trips per participant (8.3) are very much lower than those found in the PES sample. This major difference is not surprising since residents and seasonal visitors to the PES would be expected to be more interested in outdoor recreation than the general population of the state.

Comparison with Phase I Total Outdoor Recreational Trip Estimates: Recreational Fishing. Not surprisingly the recreational use survey data yields a much larger estimate (588 thousand trips) of recreational fishing trips in the PES than the Phase I study (114 thousand). The Phase I estimate is based on the NFWS survey covering all of New York State. In the NFWS study, the average estimates of participation rate (9%) and trips per participant (8 for residents, 4.3 for visitors) is much lower than found in the PES survey. This estimated participation rate is 17% and trips per participant range from 15.27 for overnight visitors to 9.78 for second homeowners. Again, we would expect PES residents and visitors to be more avid recreational fishers than the New York population at large.

Comparison with Phase I Total Outdoor Recreational Trip Estimates: Swimming. The Phase I swimming estimate (715 thousand) is simply the sum of all available beach attendance data for the PES. The Phase II survey-based estimate (1.4 million) includes participation not only at official beaches but also at the many unadministrated beaches throughout the PES, and in addition includes the Atlantic Ocean and Long Island Sound, as well as the PES.

Comparison with Phase I Total Outdoor Recreational Trip Estimates: Hunting. The discrepancy between the Phase I (77 thousand trips) and Phase II (52 thousand trips) hunting estimates also is based on differences in participation rate and number of hunting days per participant, as estimated by the two surveys. The NFWS estimates that 11% of the New York State population over 16 hunts, and that participants average 18.6 hunting trips per year. On the other hand, the PES survey indicates that only 2% of residents and visitors to the PES hunt in the PES. These participants also hunt less than the state average, ranging from 16.33 trips per second homeowner participant to 5.5 trips per participating day tripper. The Phase I hunting estimate was based only on residents and did not attempt to account for participation by seasonal residents and visitors since such data are unavailable.

V. WETLAND PRODUCTIVITY VALUES IN THE PES

V.A. INTRODUCTION

Eelgrass, saltmarsh, and intertidal mud bottom ("wetlands") provide many services to the public. These services include contributing to the production of commercial and recreational harvests of fin fish and shell fish, and of birds and other wildlife used for viewing and for hunting. Other services include protection of shoreline property from storm damage and erosion.

Wetland services may occur on site or off site and may or may not be valued in markets. For example, some wetland services, such as scallop harvests, occur on site, while others are realized offsite, for example, when fin fish or birds "produced" by an eelgrass bed of intertidal salt marsh are harvested or viewed many miles away. Some wetland services are valued in the market place (e.g., commercially harvested fish or shellfish), while others are not (e.g., bird species used for viewing and waterfowl that are hunted).

Understanding the economic value of the various natural services provided by ecosystems can provide useful information for policy analyses about preservation and restoration decisions. For this purpose, the most useful information is the value of a small change in wetlands, that is, the *marginal value* of wetlands. Marginal values rather than the total value of all wetlands are important because most policies address relatively small changes in wetlands--not whether or not to preserve all wetlands.

This chapter adapts[13] estimates by French and Schuttenberg (1998) of the marginal value of PES eel grass beds, salt marshes, and intertidal mud flats. Two types of wetland productivity (biological) gains are considered:

(1) The increase in *food* produced by the habitat which is utilized by higher trophic levels (such as fish and shellfish) in the PES, and

(2) The increase in production of higher trophic levels brought about by the increased availability of *habitat*.

The biological gains from restoring or protecting increments of each wetland type (eelgrass, saltmarsh, and intertidal mud flats) are assigned an economic value. This value is based on the (1) commercial value of the fin fish and shell fish, (2) the viewing value of birds, and (3) the hunting

[13]Two major changes are noted. French and Schuttenberg valued PES wetlands over a 100-year period and used a 3 % discount rate. We use a 7 % discount rate and a 25-year time period for consistency with results given elsewhere in this report. The higher discount rate and shorter time horizon means that our results for estimated economic values will be lower than in French and Schuttenberg.

value of waterfowl ultimately "produced" by wetlands. *Other direct and indirect services and values wetlands may provide are not considered.*

Two assumptions are critical to the analysis that follows. One is that food and habitat are biologically limiting factors for the species considered; that is, fish, shell fish and birds depend upon the availability of wetlands, so that small changes in wetlands will causes changes in the populations of these species. If wetlands are not limiting for these species, then an increment of wetlands would have no productivity value for the species concerned, although it may have other values (e.g., shoreline erosion protection, esthetics, or existence value)

The second critical assumption concerns effort and its cost. Fishing, viewing or hunting require the use of labor, capital and other inputs used for harvesting, viewing or hunting; the net gain from these activities is the benefit (e.g., value of fish landings) minus the costs of the effort required. However, very small changes in the abundance of fish, shellfish or birds due to a small change in wetland areas will lead to only a very slight increase in harvests per unit of effort. Slight increases in catch per unit effort will have a negligible effect on the level of effort itself. The changes in the availability of each wetland category due to preservation or restoration actions are presumed to be small enough so that fishing, hunting, or viewing effort remains the same. This assumption implies that we do not need to net out the cost of any change in effort due to small changes in abundance of fish, or birds arising from marginal changes in wetlands. Under these assumptions, the value of additional harvests, viewing or hunting is the gross value.

V.B. METHODOLOGY AND DATA

V.B.1. Introduction

Several studies estimate the economic values provided by natural ecosystems[14]. For example, Lynne *et al.* (1981) estimated the relationship between mangrove area, fishing effort, and landings of a single species, blue crab in Florida. They estimated a marginal value for blue crab of several dollars. Bell (1989) also used a time series of data on mangrove area, effort, and catch to evaluate the marginal productivity of Florida mangroves in the production of principal Florida commercial and recreational fish. He estimated a marginal value of several thousand dollars per acre of mangrove over all commercial and recreational species. Kahn and Kemp (1985) estimated the incremental value of subtidal vegetation in contributing to striped bass populations in the Chesapeake Bay and their subsequent harvest by recreational fishermen. Costanza and Farber (1986) assessed the per acre services of Louisiana wetlands for recreation and as a buffer for storm protection, in addition to contributing to the production of commercial fisheries. Finally, Pornpinatepong (1997) used the results in the Natural Resource Damage Assessment Model (French, *et al*, 1996) to estimate the asset value of coastal wetland services in the Northeast.

[14]A summary of the productivity approach and examples for coastal areas is given in Grigalunas and Congar (1995).

The approach used in this chapter derives estimates of wetland productivity using data specific to the PES. The virtue of this approach is that it captures the underlying biological structure and productivity of PES wetlands, and it uses biological information and economic values specific to the PES. The method--in effect a "simulation"-- side steps some of the data and other problems faced in statistical studies, such as that by Lynne et al., by Bell, and by Costanza and Farber. On the other hand, the method used does not allow for statistical tests of significance and hence heavily relies upon professional judgement.

The methodology used is described next. First, we explain how the food web estimates were made. Then, the methodology and data used for habitat values is presented. A detailed statement of the methodology, data and assumptions is given in French and Scuttenberg (1998).

V.B.2. Food Web Estimates

Saltmarsh and eelgrass beds benefit the entire food web by primary (plant) production. Similarly, the net gain in lower trophic level, animal production is passed up the food web. Ultimately this production via the food web results in the production of species of economic value to people.

To estimate the economic value of these food-web effects, several pieces of information are needed. First, it is necessary to quantify the amount of food produced by a habitat. To do this, primary (plant) and bottom (amphipods, worms, etc., in and on the sediments) production rates were estimated for PES wetland categories, using results in the literature. Then, the fraction of the additional production passed up the food web was estimated. Next, this additional production is translated into commercial fin fish and shell fish production and landings using average relationships estimated across many estuaries by Nixon (1982). Finally, the estimated fish and shell fish landings are valued using species-specific fishery values for PES landings.

Thus, lower trophic levels are translated into equivalent upper trophic level fish and shellfish production harvested and valued by people. Specifically, fishery production is estimated to be 0.16 percent of primary production and 4 % percent of bottom (benthic macrofaunal) production. Details of these calculations are given in French and Schuttenberg (1998).

V.B.3. Habitat Estimates

Habitat values are estimated for species (bay scallops, blue crab, softshell clams, and birds) having human use values. Habitat values are based on (1) the expected yield of fish or shellfish dependent upon the habitat, and (2) the abundances of wildlife (birds) that utilize the habitat. Fish and shellfish values are commercial values; wildlife values are for hunting (waterfowl) and viewing (waders).

Bay scallops depend upon eelgrass as nursery habitat for juveniles. The grass provides a refuge from predators for juvenile scallops. It is assumed that eelgrass is a limiting factor for scallops, so that the entire PES scallop fishery depends upon eelgrass beds. Blue crab use saltmarsh and eelgrass habitats preferentially. Again, it is assumed that the entire blue crab fishery depends upon the saltmarsh and eelgrass beds of the estuary. Softshell clams prefer intertidal mud flats and sand flats. Softshell clams are assumed to all have been produced in intertidal mudflats and shoals in the PES.

Abundance of birds depends upon habitat type. An average abundance per unit area of habitat is assumed, based on the results for the coastal area including the PES, as given in the Natural Resource Damage Assessment Model (Version 2.4, April, 1996) developed by the authors for the US Department of the Interior (French, et al, 1996a,b,c). Birds that are specifically benefitted by saltmarsh, eelgrass or mud flats were selected and included in the present analysis. These species are waders (herons, egrets, and ibis), shorebirds, brant and black ducks. Waders use all three of the habitat types, while shorebirds use marsh and mud flats. Brants specifically feed on eelgrass. Black ducks are know to require structured habitat, marsh and eelgrass.

The value of bird species usage of the habitat is based on the benefits human receive from viewing or hunting (waterfowl) birds. The values are marginal values, that is, the additional value people obtain by seeing additional birds per day. The values per animal per year are proportional to the number of viewing trips and the rareness of the species in the local area (see French et al. (1996a,b,c) for a full description of the development of these values.

V.C. RESULTS

V.C.1. Introduction

Results are provided for the (1) Marginal value of existing wetlands, and (2) the marginal value for restored wetlands. Restored wetlands have a lower value than existing wetlands since it may take years for an existing wetland to become fully functional.

V.C.2. Results

Table V.1 shows the marginal value for existing and restored wetlands. The value for existing wetlands would be used for policy issues dealing with preservation decisions; results for restoration are critical for assessing policies to restore wetlands.

Two values are calculated: An annual value and an asset value. The annual value is the sum of the food web values and the habitat values. Asset values were calculated by discounting the annual value over a 25 period using a discount rate of 7 percent, the same time frame and discount rate used elsewhere in this report[15]. Eelgrass has a 20 % higher marginal value per acre than that for saltmarsh. Intertidal mud flats have the lowest marginal value.

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[15]Use of lower discount rate and longer time horizon would lead to a larger value. Use of the 7 % discount rate reflects the opportunity cost of resources used in restoration/preservation. That is, resources used in these activities to some extent will be drawn away from private and public investments.

Estimated marginal values for restoring wetlands are much lower than the value of existing wetlands of the same category. This is because it takes several years before a restored wetland becomes fully functional. Thus, in the table it is noted that eelgrass, saltmarsh, and intertidal mud flats take 15, 10, and 3 years, respectively, to become fully functional.

The marginal asset values of PES wetlands appear to be substantial, especially in light of the fact that other services wetlands may provide, such as protection from erosion and storms, aesthetics and existence value, are not considered.

Table V.1. Marginal Values of PES Wetlands

	Existing Habitats		Created Habitats		
Wetland Type	**Annual Value per Acre [a]**	**Asset Value per Acre [b]**	**Years to Become Fully Functional [a]**	**Asset Value per Acre [b]**	**Estimated Number of Acres in PES (millions)**
Eelgrass	$1,065	$12,412	10	$9,996	6.04
Saltmarsh	$338	$4,291	15	$3454	13.51
Intertidal Mud Flat	$67	$786	3	$626	14.05

a French and Schuttenberg (1998) estimate habitat values using a discount rate of 3 % and time horizon of 25 years. Our use of 7 % and 25 years reduces the estimated wetland values by almost one half.

b Using a discount rate of 7 percent and a time horizon of 25 years. Assumes linear recovery to full (99%) restoration over the period estimated by French and Schuttenberg (1998). French and Schuttenberg used a sigmoid function to approximate the time path or recovery.

V.D. SUMMARY AND CONCLUSIONS

This chapter presents estimates of the marginal economic value of the productivity services provided eelgrass, salt marsh, and intertidal mud flats in the PES. The productivity services covered are food web and habitat services. Economic values estimated are for commercial fishing value for crab, scallop, and clams; viewing values for birds; and hunting values for waterfowl. Other possible values provided by PES wetland services, such as erosion and storm protection, aesthetics, and existence value are not considered.

V.E. REFERENCES

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VI. NATURAL RESOURCE PRIORITIES AND VALUES

VI. G. INTRODUCTION

This section describes a study of natural resource values for the Peconic Estuary System (PES). In August 1995, we surveyed 968 year-round and seasonal residents of the area surrounding the Peconic Estuary. Respondents to the survey were asked about their priorities and values for protecting and restoring important natural resources of the PES. The results include:

(1) an analysis of values and priorities for a set of important natural resources of the area—farmland, undeveloped land, wetlands, safe shellfishing areas, and eelgrass;

(2) estimates of economic benefits that would result from protecting or restoring these resources; and

(3) public opinions related to the Estuary.

The survey was designed to complement scientific and technical studies, using data available at the time, to provide information that will be useful in the final policy analysis. This information will be used in a cost-benefit analysis of policy alternatives (Phase III of the Comprehensive Economic Valuation Study), that will help policy makers prioritize alternative management actions.

The remainder of this section is organized as follows: Part B describes the survey development and implementation, and the questionnaire design; Part C gives descriptive results of the survey; Part D presents the estimates of economic values; and Part E is a summary and conclusions.

VI. B. THE NATURAL RESOURCE SURVEY

VI.B.1. Survey Development and Implementation

We developed the survey over a six-month period, from February to August 1995, in an extensive process that included individual interviews, focus groups, and pretests. The primary goal of the survey was to learn about the public's preferences, priorities and values for natural resources of the Peconic Estuary that might be affected by preservation and restoration actions.[16]

[16] Other important goals were to create a survey that would minimize some of the problems often associated with valuation surveys; would be easily understandable to members of the public; could be answered in a reasonable amount of time; and could be administered in a variety of public places.

VI.B.1.a. Initial Meetings, Interviews, and Information Gathering

We began the survey development process in February, 1995 by meeting with members of the Management Committee. Shortly afterwards, we met with representatives of different interests, including the head of the Local Government Committee; the Chairman of the Citizen's Advisory Group, who is also president of a local environmental group; a representative of the Nature Conservancy; a biologist from the NY State Department of Environmental Conservation; a marina owner who was head of the local Marine Trades Association; a commercial fisherman who represented the Long Island Inshore Trawlermen's Association; and a bank president. These meetings, and a meeting with the Citizen's Advisory Group, helped us to learn about the area and about the concerns of various interest groups.

VI.B.1.b. Informal Interviews With the Public

Next, we conducted a set of informal interviews with members of the public, where we asked about their uses of and concerns about the Estuary. A total of sixteen randomly selected people were interviewed in Montauk, Springs, Sag Harbor, Shelter Island and Greenport. They included business owners, store clerks, a police officer, visitors, and residents.

These interviews provided information on some of the most important natural resources and related concerns, and how people think and talk about the bays. Most people interviewed were very concerned about water quality, declines in fish populations over the years, and impacts on business if water quality continues to decline. We also learned that many people were not familiar with the word "estuary;" and most people in Montauk did not consider themselves to be located on the Peconic. Consequently, in the final survey, the Peconic Estuary System was referred to as the Peconic Bays System, and was defined by a map at the beginning of the survey.

VI.B.1.c. Focus Groups and Preliminary Survey

The next step was a series of focus groups, and a short preliminary survey. Table VI.1 lists the dates of the focus groups and pretests, their locations, and the number of participants. In the first three focus groups, we asked the participants general questions about how they define the study area; their familiarity with the Peconic Estuary Program; the characteristics of the area that are most and least important to them; their uses of the local waters; the attributes they look for in choosing recreational sites; their perceptions of water quality; and their concerns about the natural environment and natural resources of the Estuary.

A short preliminary survey was carried out in Montauk on March 19, before the St. Patrick's Day parade, an event that draws a large number of visitors and residents. This survey included both closed- and open-ended questions, including questions about:

(1) participation in recreational activities around the water;
(2) concerns related to the Estuary; and

(3) positive and negative aspects of the East End in general.

Table VI.1 - Focus Groups and Pretests

Date	Location		Number of Participants
March 18	Montauk	Focus Group 1	6
March 19	Montauk	Preliminary Survey	35
March 22	Jamesport	Focus Group 2	10
March 31	Riverhead	Focus Group 3	7
April 19	Shelter Island	Focus Group 4	3
April 20	Southampton	Focus Group 5	9
April 29	East Hampton	Focus Group 6	6
May 2	Springs	Focus Group 7	7
May 11	Rhode Island	Focus Group 8	5
May 18	Springs	Pretest 1	10
June 21	Rhode Island	Pretest 2	5
June 27	Rhode Island	Pretest 3	5
July 9	Jamesport	Pretest 4	13
July 9	Mattituck	Pretest 5	17

The thirty-five usable responses gave some preliminary information about important attributes of the area and its recreational sites; and about people's greatest concerns for the Estuary. Respondents were asked to rank a list of concerns on a scale of 1 to 10, where 1 indicates the highest level of concern. Table V.2 lists these concerns, in order of importance to respondents. The most important were declining stocks of shellfish and finfish, water quality, trash on beaches, and areas closed to shellfishing. The least important were crowding in boating harbors, public access to the water and availability of wildlife for viewing.

In the next several focus groups, we asked participants general questions about their concerns, their perceptions of water quality, and actions they would like to see. We also tested preliminary survey questions and question formats, which were revised between groups. Several of these questions were primarily intended to stimulate discussion. For example, one question asked about participation in recreational activities, and was used to generate a discussion of these activities and related concerns. Other questions asked participants which of a list of human impacts on the Bays were most important to them; which of a list of environmental problems they believed were most serious; and which potential actions should be given highest priority.

The questions asking participants to prioritize impacts, concerns, and actions were difficult for people to answer, for two important reasons. First, many people in the focus groups believed that almost everything was important, and therefore resisted ranking their priorities. Instead, they wanted to rate *everything* as most important. Second, many participants stated that they did not know enough to rank the causes of environmental problems and the effects of potential actions, but believed that priorities should be decided by experts. Nonetheless, these questions provided a good focus for the discussion of people's concerns.

Table VI.2 - Concerns of Preliminary Survey Respondents, Montauk, March 19, 1995

Concern	Mean Rank[a]
Declining stocks of shellfish	3.09
Declining stocks of finfish	3.34
Water quality	3.43
Trash on beaches	3.59
Areas closed to shellfishing	3.66
Overcrowding of recreational sites	4.23
Declining open space	4.57
Crowding in boating harbors	4.74
Too little public access to the water	4.88
Need to improve public access points	4.90
Less wildlife available for viewing	5.21

a - Ranked from 1 to 10, with 1 denoting the most important.

Other questions in these focus groups asked about priorities related to natural resources, and tested possible question formats for the survey, including standard contingent valuation questions and contingent choice questions. Contingent valuation asks people directly to state their willingness to pay to preserve or improve a natural resource. Contingent choice asks people to make tradeoffs between alternative actions with results specified in terms of the natural resources that would be protected or restored and the cost.[17] Contingent choice questions are similar to marketing surveys

[17] Several additional questions were also tested in these focus groups. One question asked respondents to indicate their three most important reasons for living on the East End, from a list of fifteen reasons given by participants in earlier focus groups. This question was later dropped because it did not provide enough information to justify the space and time it took in the survey. A set of environmental attitude questions was also tested, with the intention of correlating respondents' attitudes with their values for natural resources. The attitude questions generated quite a bit of controversy, as they were designed to elicit strong opinions, and were dropped from the final survey for several reasons. First, they tended to draw respondents' focus from the more important questions in the survey; second, they took too long to answer; and finally, it was feared that the controversial nature of the questions might result in a

often done by businesses to allow them to understand tradeoffs that customers are willing to make among product characteristics under diffrent programs and costs.

As discussed in more detail below, the contingent choice method appeared to be the most promising format, and thus we developed this method further in the next focus groups. As the contingent choice questions were refined through the focus group process, the survey became less complicated and less wordy, with fewer attributes included in each comparison; and graphics were added to the questions.

VI.B.1.d. Survey Pretests and Implementation

In May and June, we conducted several pretests of preliminary survey instruments.[18] This series of pretests helped to refine the question wording and layout of the survey, resulting in large improvements in respondents' ability to easily make the comparisons. In July, a fifth draft of the survey was pretested on Long Island, with a group of people at the First Parish Church in Jamesport, and with randomly selected people on the beach in Mattituck. In these pretests, people were able to easily comprehend and answer the survey questions. In early August, after meeting with members of the Management Committee, we made final modifications to the survey, and conducted final pretesting. An example of the final survey is included in Appendix A[19].

We implemented the survey during the week of Aug. 22-29, 1995 in a variety of pre-selected public locations around the East End, using convenience intercept sampling. We selected this method over a mail survey with probability sampling primarily because budget limitations made it necessary to administer both the natural resource survey and the recreation survey together, and because names and addresses of visitors were not available. Thus, we designed the surveys to be administered in public places where visitors to the area could be intercepted. We selected a wide variety of locations, in order to intercept a representative sample in terms of demographic characteristics and location of residence. The survey locations, and the number of surveys collected at each, are listed in Table 3. A total of 968 resource surveys were collected from year-round and seasonal residents of the East End.

In implementing the survey, interviewers were instructed to approach people and say:

> Hi, my name is __________, and I'm working for Suffolk County. We're doing a survey of the public to help develop a plan to protect and manage the bays. Would you be willing to fill out a survey, which will take about 5-10 minutes?

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negative reaction to the entire survey.

[18] Several of these pretests were conducted in Rhode Island, in order to save time and money. Because the objective at this point was to refine the format, layout and wording, rather than the content, it was not necessary to conduct all tests on the East End.

[19] Note that the example shown in the Appendix is only one of 12 different survey booklets, each of which contains five different contingent choice questions.

The interviewer then asked those who agreed to fill out the survey if they were visitors, year-round residents, or seasonal residents of the East End. Only year-round and seasonal residents were asked to fill out the resource survey. All visitors, and every third resident, were given the recreational use survey. When the survey was handed to the person, they were told that there are no right or wrong answers, and that all answers would be confidential. Interviewers were instructed to give brief and neutral answers to any questions.

VI.B.2. Questionnaire Design

VI.B.2. a. Selection of Survey Format

As mentioned above, we considered two methods for asking the public about their values for protecting and restoring natural resources—contingent valuation and contingent choice. We selected the contingent choice format for several reasons. At the time the survey was developed and implemented, the Management Committee had not yet determined specific actions that might be taken to protect and restore natural resources of the Estuary, and their results. Therefore, the survey needed to ask the public about their preferences for important natural resources that would most likely be affected by restoration and preservation programs. The contingent choice format allows for comparisons and valuation of many different combinations of improvements in resources that might be obtained by management actions. This will allow for assessment of programs that would affect any combination of the natural resources evaluated in the survey, either by ranking alternative programs or valuing benefits of specific programs.

Contingent choice may also minimize some of the problems associated with contingent valuation. For example, people often have trouble putting dollar values on specific natural resources. Contingent choice does not require that values be expressed in monetary terms, but elicits choices among alternative outcomes of actions. Therefore, responses are focused on tradeoffs among resources, and respondents are not asked to directly express monetary values, although these can be inferred from the analysis. Focus group participants found this type of question to be easier to answer.

An additional issue, which may be a factor in both contingent valuation and contingent choice surveys is the expression of "symbolic" values. This might be related to expressions of approval or disapproval of the actions to be taken to protect natural resources, or expressions of the importance of improving or protecting the environment in general, versus values for specific levels of natural resources. For example, a survey might ask respondents to state how much they would be willing to pay to protect a particular species of birds from oil spills. A person answering the survey may not care about those specific birds, but may state a positive willingness to pay because they think that oil spills should be prevented. Thus, their response may not reveal the value of the birds, *per se*.

Table V1.3 - Survey Locations and Number Collected

	Location	Number Collected
Beaches:	Orient State Beach, Southold	3
	Southold Town Beach	10
	Cedar Point County Beach, Southold	3
	New Suffolk Beach, Southold	4
	East Creek Marina Beach, Southold	2
	Alberts Landing Town Beach, East Hampton	16
	Fresh Pond Town Beach, East Hampton	9
	Maidstone Beach, East Hampton	7
	Indian Wells Town Beach, East Hampton	16
	Hither Hills Beach, East Hampton	4
	Montauk Point State Park, East Hampton	4
	Wades and Cascade Beaches, Shelter Island	4
Shopping Areas:	Greenport Corner	70
	Greenport IGA	44
	Genovese Shopping Center, Southold	71
	King Kullen Shopping Center, Mattituck, Southold	11
	K-Mart Shopping Center, Riverhead	72
	Downtown Southampton	33
	IGA Southampton	16
	King Kullen and Caldor Shopping Centers, Bridgehampton	107
	IGA Shopping Center, Shelter Island	27
Libraries and Post Offices:	Southold Library	4
	Cutchogue Library, Southold	10
	Riverhead Free Library	16
	East Hampton Post Office	87
	Sag Harbor Post Office	37
	Shelter Island Heights Post Office	34
	Shelter Island Center Post Office	60
Miscellaneous:	New London-Orient Point Ferry	19
	Goose Creek, Southold	3
	County Center Cafeteria, Riverhead	23
	Okeanos Aquarium, Riverhead	71
	Department of Motor Vehicles, Riverhead	39
	Pindar Winery, Southold	19
	John Drew Theatre, East Hampton	8
	Location unidentified	5

Because the survey used in this study presents only outcomes of actions, respondents are not given the opportunity to focus on the means of achieving results. Thus, responses are less likely to be expressions of approval or disapproval for actions, and more likely to focus on the specific natural resources. However, people may still express symbolic values for protecting the environment, beyond their values for the natural resource improvements. This is more easily detected and corrected for in contingent choice than contingent valuation, as discussed below.

Finally, it has been pointed out that "survey methods are better at estimating relative demand than absolute demand," even for market goods, and "absolute willingness to pay is hard to pin down" (National Oceanic and Atmospheric Administration 1993, p. 4609). Thus, the relative values or priorities for natural resources elicited by a contingent choice survey may be valid, even if the absolute dollar values of specific resource changes are not. For a policy analysis that focuses on prioritizing actions, information on relative values and priorities for resources is more important than the estimation of total dollar values. Hence, contingent choice, rather than contingent valuation, may be more effective in obtaining the information needed to compare alternative policies.

Based on the results of focus groups and past research (Mazzotta and Opaluch 1995), each comparison was designed to include only three attributes: Two of the five natural resources included in the survey, and the cost. This simplifies the choice, so that it is more likely that choices will be based on considering and balancing all of the attributes.

In the final survey, respondents were asked to select from a set of three hypothetical choices: no new action or one of two restoration/protection programs. Each option was described by different levels of resulting natural resources, and the annual cost to each household. In early focus groups, only the two programs were presented, but focus groups participants indicated that a "no new action" option should be added, for two reasons. First, it allowed people to express a preference for no action if they did not support either program. Second, it provided a baseline from which to judge the benefits of each of the programs.

VI.B.2.b. Selection of Natural Resources and Levels

VI.B.2.i. Natural Resources Included in the Survey

Based on concerns expressed by participants in focus groups and natural resources identified as important by the Technical Advisory Committee, we selected five natural resources to be included in the survey:

- farmland
- undeveloped land
- wetlands
- safe shellfishing areas
- eelgrass

We included farmland and undeveloped land because most people in preliminary interviews and focus groups expressed concern about the rate of development in the area and resulting loss of farmland and open space. Both farmland and open space are important components of the quality of life, or "sense of place," (Sagoff 1992; Kellert 1995) for many residents of the East End, who enjoy the rural quality of the area and shopping at numerous local farm stands. The amount of development also affects environmental quality of the Estuary. Thus, it is important to consider uses of the surrounding land as well as resources more directly associated with the Estuary.

Many people were aware of the importance of wetlands to water quality and as wildlife habitat, and expressed concern for declines in the quantity of wetlands in the area. People also expressed concern for reopening closed shellfishing areas. This is due to the historical significance of shellfishing to the local economy, and its importance as a recreational activity, combined with the declines in shellfish caused by brown tide[20] and the recent large increases in areas closed to shellfishing.

Finally, we included eelgrass for two reasons. First, much of the Estuary's eelgrass was destroyed by the brown tide, and one proposed action is restoring eelgrass areas. Second, eelgrass serves as a proxy for fish and shellfish populations. Many participants in the preliminary interviews and focus groups expressed great concern over declines in fish over the years. However, the technical consultants could not easily determine potential changes in these populations resulting from proposed actions. Therefore, we hoped that by including eelgrass, which serves as fish and shellfish habitat, the survey would capture some of these concerns.

VI.B.2. ii. Levels of Natural Resources in the Survey

The objective of the survey was to determine respondents' values for improvements in natural resources above a baseline level. We defined the baseline as the level that would exist in the year 2020, if no action is taken to preserve or restore the resource. We determined the baseline in consultation with the Technical Advisory Committee, based on historical declines and the judgment of experts, for each resource.

[20] Brown Tide is an algal bloom of the species *Aureococcus anophagefferens*, which first occurred in 1985-1988, and has subsequently recurred for shorter periods. The major brown tide episodes severely affected scallops, eelgrass, and other shellfish in the estuary (see Suffolk County Department of Health Services 1992).

First, we determined the level of each resource in 1981 and the current level.[21] Next, we projected the levels in 2020 based on information and judgments provided by members of the Technical Advisory Committee regarding the anticipated change in the resource if no new actions were to be taken. In cases where no technical projections were available, we based the projection on extrapolation of past trends.

In the survey, respondents were presented with two pages of background information, which described the level of each resource in 1981, the current level, and projections of levels in 2020 if no new actions are taken. These levels are shown in Table 4, and the survey pages are shown in Appendix A. Respondents were told that "trends indicate approximate conditions in 2020," in order to make it clear that these are not precise, scientifically-based projections.

When the survey was created, the Technical Advisory Committee had not completed their scientific studies of how potential actions might affect specific natural resources. To get around this lack of information, we chose the levels of each natural resource to be included in the survey in order to bracket a reasonable range of changes under various policy actions, including the "no new action" option. The Technical Advisory Committee assisted us in determining the largest realistic and feasible change for each resource. Although, in some cases, anticipated results of restoration and preservation programs are likely to be smaller than those presented in the survey, this approach is conservative because it brackets the full range of feasible resource changes. This allows for interpolation when valuing resource changes, rather than extrapolating results beyond the range included in the survey.

In the contingent choice questions, each resource was included at three different levels: The projected level for 2020 (the "no new action," or baseline, scenario), and two levels associated with hypothetical programs that would preserve or restore the resource. In order to make the hypothetical context clear, survey respondents were told:

> "The following programs are hypothetical. We are trying to learn which resources are most important to you and how much you would pay to protect them."

The levels for each resource and for cost are shown in Table IV.5.

If no action is taken, farmland is projected to decrease by twenty-five percent. The results of different hypothetical preservation programs were projected to reduce the loss of farmland to fifteen

[21] We compiled this information from the recent brown tide study (Suffolk County Department of Health Services 1992); a 1981 land use report (Long Island Regional Planning Board 1981); and information provided by the New York State Department of Environmental Conservation and other members of the Technical Advisory Committee. The acres of farmland and undeveloped land in the Long Island Regional Planning Board's land use report were presented for the entire East End. Therefore, to calculate the number of acres within the Peconic Estuary Program study area, we assumed that the fraction of farmland and undeveloped land within the study area is proportional to the amount of total land on the East End that is within the study area.

percent or maintain it at the current level. Undeveloped land was also projected to decrease by twenty-five percent if no new action is taken. Because it did not seem realistic to preserve undeveloped land at the current level, hypothetical preservation programs were projected to reduce the loss of undeveloped land to ten percent or five percent.

Table VI.4 - Past, Present and Projected Natural Resource Levels

Natural Resource	1981 Level	1995 Level	Projected 2020 Level
Farmland[a]	13,500 acres	12,000 acres	9,000 acres
Undeveloped Land[a]	74,000 acres	66,000 acres	50,000 acres
Wetlands[b]	18,000 acres	16,000 acres	12,000 acres
Safe Shellfishing Areas[b]	28,000 acres	26,000 acres	25,000 acres
Eelgrass[b]	10,000 acres	9,000 acres	8,000 acres

a - Calculated based on Long Island Regional Planning Board 1981, and Suffolk County Department of Health Services 1992.

b - Calculated based on Suffolk County Department of Health Services 1992 and information provided by NY State DEC.

Wetlands were projected to degrade by twenty-five percent if no new action is taken; or they might be preserved at the current level or restored to ten percent above the current level. The baseline for safe shellfishing areas is a twenty-five percent decrease, and hypothetical programs might maintain the current level or increase safe areas by ten percent. The baseline for eelgrass is a ten percent decrease, and it might be preserved at the current level or increased by twenty-five percent.

The costs of the hypothetical programs were designed to learn how much people would pay for the resource changes presented above, and to bracket a range of costs that seemed feasible to members of the Management Committee. However, they are not intended to reflect actual costs of some particular set of programs. The no new action option was always presented at no additional cost to each household. The other levels of annual household cost included were $50, $100, $200, $300, and $500.

Table VI.5 - Levels of Natural Resources and Cost in the Survey

	No Action, Baseline Level (% Change)		Level with Moderate Preservation or Restoration (% Change)		Level with High Preservation or Restoration (% Change)	
Farmland	9,000 acres (-25%)		10,000 acres (-15%)		12,000 acres (current)	
Undeveloped Land	50,000 acres (-25%)		59,000 acres (-10%)		63,000 acres (-5%)	
Wetlands	12,000 acres (-25%)		16,000 acres (current)		17,500 acres (+10%)	
Safe Shellfishing Areas	25,000 acres (-5%)		26,000 acres (current)		29,000 acres (+10%)	
Eelgrass	8,000 acres (-10%)		9,000 acres (current)		11,000 acres (+25%)	
Cost Levels	$0	$50	$100	$200	$300	$500

In order to statistically estimate values for each resource, we chose a statistical design that required sixty different comparisons.[22] However, we wanted to make sure that the survey could be answered in a reasonable amount of time (10-15 minutes). Thus, we included five comparisons in each of twelve different survey booklets.

VI.B.2. iii. Description of The Survey Questionnaire

The first page of the full survey booklet described the goal of the survey and showed a map of the relevant area. The first three questions asked about participation in recreational activities in the area; support for different possible actions; and opinions about brown tide.

Next the background information for the contingent choice questions were presented, followed by a page of instructions and the five comparison questions. The survey ended with a set of demographic questions about the respondent, in order to obtain information that could be used to adjust the results to reflect the values of a representative member of the public.

[22] The combinations of attributes and levels were selected using a method based on Addelman's fractional factorial design, which produces orthogonal arrays of attributes (Addelman 1962a, 1962b; Addelman and Kempthorne, 1961). This allows for statistical independence among the attributes so that the model estimation will be statistically efficient.

VI. C. DESCRIPTIVE RESULTS

VI. C.1. Who Responded to the Survey?

Table VI.6 reports demographic information for all respondents, and Table VI. 7 compares the sample demographics to actual population demographics for gender, age, education, and income. Table VI. 8 gives the number of respondents by town.

The major characteristics of our sample can be summed up as follows:

- Most are year-round residents (73%).
- Most are homeowners (85%).
- A majority live closer to the Peconic Estuary than to Long Island Sound or the Atlantic Ocean (58%).
- 15% live on the waterfront and a majority live ½ mile or less from the water (51%).
- A majority have lived in the area for more than 10 years (63%).
- The average household size is just under 3 members, and 46% have no children under age 18 in their household.
- Most are employed (67%), and 21% are retired.
- Compared to 1990 population figures, the sample contains a slightly higher percent of women and people in the middle age groups, and the sample population is better educated and more wealthy than the general population.[23]

[23] Note that census data are only available for year-round residents, so these results are for year-round residents in the sample.

Table VI.6 - Respondent Demographics, Full Sample

Question	Category	Number	Percent of Sample
9: Type of residence	Primary Home	673	73.1%
	Second Home	248	26.9%
	Did Not Answer	47	4.86%
10: Own or rent	Own	773	84.7%
	Rent	140	15.3%
	Did Not Answer	55	5.7%
12: Closest water body	Peconic Bays	564	58.3%
	Long Island Sound	216	22.3%
	Atlantic Ocean	219	22.6%
12: Distance from any water body	Waterfront	143	14.8%
	≤1/2 Mile From Water	347	35.8%
	>1/2 Mile From Water	382	39.5%
	Did Not Answer	96	9.9%
12: Dist. from Peconic Bays	Waterfront	116	12.0%
	≤1/2 Mile From Water	234	24.2%
	>1/2 Mile From Water	618	63.8%
13: Length of residence	0-10 Years	297	30.7%
	11-20 Years	245	25.3%
	21-30 Years	176	18.2%
	>30 Years	185	19.1%
	Did Not Answer	65	6.7%
14: Gender	Female	540	57.8%
	Male	394	42.2%
	Did Not Answer	34	3.5%
15: Size of household	1-2 Household Members	481	49.7%
	3-6 Household Members	430	44.4%
	>6 Household Members	24	2.5%
	Did Not Answer	33	3.4%
	Average hh size	2.94	
16: Number of children	No Children	440	45.5%
	1-2 Children	254	26.2%
	>2 Children	66	6.8%
	Did Not Answer	208	21.5%

Table VI.6 (Continued)

Question	Category	Number	Percent of Sample
17: Age	up to 20	23	2.5%
	21-24	36	3.9%
	25-34	121	13.1%
	35-44	207	22.5%
	45-54	194	21%
	55-64	162	17.6%
	65-74	144	15.6%
	75-84	33	3.6%
	85 and older	2	.2%
	Did Not Answer	46	4.8%
18: Education	Less Than High School	5	.5%
	Some High School	16	1.7%
	High School Graduate	126	13.6%
	Some College	167	18.1%
	Associate's Degree	90	9.7%
	Bachelor's Degree	236	25.5%
	Advanced Degree	284	30.7%
	Did Not Answer	44	4.6%
19: Employment	Employed Full Time	497	53.9%
	Employed Part Time	123	13.3%
	Full Time Homemaker	66	7.2%
	Full Time Student	28	3%
	Retired	197	21.4%
	Unemployed	11	1.2%
	Did Not Answer	46	4.8%
20: Income	<$15,000	43	5.1%
	$15,000-$24,999	77	9.1%
	$25,000-$34,999	102	12.1%
	$35,000-$49,999	111	13.2%
	$50,000-$74,999	201	23.8%
	$75,000-$99,999	113	13.4%
	$100,000-$149,999	86	10.2%
	$150,000 or more	111	13.2%
	Did Not Answer	124	12.8%

Table V.7 - Population Demographics vs. Survey Respondent Demographics

		1990 Population[a]	Year Round Resident Sample[b]	Seasonal Resident Sample[b]
Gender	**Female**	51.83%	60.85%	51.36%
	Male	48.17%	39.15%	48.64%
Age	**up to 20**	23.89%	3.17%	0.45%
	21-24	4.53%	4.76%	3.62%
	25-44	29.07%	40.39%	26.24%
	45-54	11.01%	19.05%	24.89%
	55-64	11.04%	14.99%	22.62%
	65-74	11.17%	14.11%	19.00%
	75-84	7.25%	3.17%	3.17%
	85 up	2.04%	0.35%	0.00%
Education (over age 24)	**< High School**	7.44%	0.00%	0.00%
	Some H.S.	11.55%	1.53%	0.94%
	H.S. Graduate	31.77%	15.33%	2.83%
	Ed. categories 1-3	50.76%	16.86%	3.77%
	Some College (Ed. cat. 4)	18.35%	21.26%	8.49%
	Assoc. Degree	6.66%	11.30%	7.08%
	Bachelor's Deg.	13.51%	23.18%	31.60%
	Advanced Deg.	10.72%	27.39%	49.06%
	Ed. categories 5-7	30.90%	61.88%	87.74%
Income	**< $15,000**	19.17%	5.45%	1.81%
	$15,000-$24,999	14.60%	11.60%	1.81%
	Inc. categories 1&2	33.77%	17.05%	3.62%
	$25,000-$34,999	14.40%	14.94%	4.98%
	$35,000-$49,999	17.52%	15.99%	5.88%
	Inc. categories 3&4	31.93%	30.93%	10.86%
	$50,000-$74,999	18.90%	27.94%	14.48%
	$75,000-$99,999	7.04%	11.07%	18.55%
	$100,000-$149,999	4.93%	7.38%	18.10%
	Inc. categories 5-7	30.86%	46.40%	51.13%
	$150,000 and up (Inc. cat. 8)	3.41%	5.62%	34.39%

a - The 1990 population figures are for year-round residents only; sources of data are Long Island Lighting Company 1995 and Suffolk County Department of Planning 1991, based on 1990 census data and projections. No demographic data are available for seasonal residents.

b - Sample percents refer to percentages of those who answered the question.

Table VI.8 - Numbers of Respondents by Town

Town	Number of Respondents	Percent of Sample
Brookhaven	19	1.9%
Riverhead	110	11.4%
Southold	247	25.5%
Shelter Island	136	14.1%
East Hampton	182	18.8%
Sag Harbor	66	6.8%
Southampton	139	14.4%
Other	25	2.6%
Did not Answer	44	4.5%

VI.C. 2. Participation in Recreational Activities

The responses to Question 1, which asked about participation in recreational activities, are shown in Table VI.9. Almost all of the respondents (97%) participate in at least one of the listed activities, and 81% participate in at least one activity in the Peconic Estuary. Swimming is the most popular activity, with 86 percent participating. Swimming is followed by walking and hiking (71%), boating (54%), fishing (53%), other beach use (34%), shellfishing (32%), artwork (26%) and other activities (11%).

More people participate in activities on or around the Peconic Estuary than any other water body. This result is consistent with results of a telephone survey of residents conducted in the fall of 1993 by the Center for Community Research of Suffolk Community College (the SCC survey), which also found that the Peconic Estuary System was used more frequently than any other water body (Suffolk Community College 1994).

VI. C.3. Support for Management Actions

Table VI.10 summarizes the responses to Question 2, which asked about support for specific management actions. We included this question in order to allow respondents to express their opinions about proposed actions, and to give them an idea of the types of actions that might be taken to obtain the natural resource changes described in the contingent choice questions.

Table VI.9 - Participation in Recreational Activities

Activity	Peconic Bays	Atlantic Ocean	L.I. Sound	Other	All Locations
Fishing	391 (40.4%)	167 (17.3%)	216 (22.3%)	74 (7.6%)	516 (53.3%)
Shellfishing	261 (27.0%)	18 (1.9%)	55 (5.7%)	39 (4.0%)	311 (32.1%)
Walking/ Hiking	518 (53.5%)	339 (35.0%)	306 (31.6%)	69 (7.1%)	684 (70.7%)
Swimming	610 (63.0%)	468 (48.3%)	362 (37.4%)	79 (8.2%)	833 (86.1%)
Other Beach Use	201 (20.8%)	169 (17.5%)	131 (13.5%)	44 (4.5%)	324 (33.5%)
Boating	432 (44.6%)	144 (14.9%)	224 (23.1%)	67 (6.9%)	520 (53.7%)
Artwork	204 (21.1%)	120 (12.4%)	129 (13.3%)	40 (4.1%)	252 (26.0%)
Other	68 (7.0%)	46 (4.8%)	51 (5.3%)	24 (2.5%)	103 (10.6%)
All Activities	779 (80.5%)	586 (60.5%)	534 (55.2%)	205 (21.2%)	936 (96.7%)

As expected, all of the actions are supported by a majority of respondents. The actions with the greatest level of support are building more pumpout stations so that boat discharge can be prohibited; improving sewage treatment plants; public education; and more research on water quality issues. The actions with the least support are required pumpouts of septic systems, and restrictions on the use of lawn chemicals.

The Suffolk Community College survey also asked about support for actions. Although their questions were more general and not perfectly comparable to those presented here, their results are similar. For example, 83 percent of their sample support stronger building regulations, which is comparable to the 76.3 percent of our sample who support zoning regulations, the 78.7 percent who support waterfront restrictions, and the 76.7 percent who support restrictions on vegetation. The SCC survey found that 71 percent of respondents were willing to change fertilizers, which is consistent with the 68.2 percent of this sample who support restrictions on fertilizers and lawn

Table VI.10 - Support for Actions

Action	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	No Opinion	Average Rank
Prohibit sewage discharge from boats. (requires building more pumpout stations)	79.0%	10.5%	1.0%	1.2%	1.4%	6.7%	1
Improving sewage treatment plants.	78.0%	11.8%	1.5%	0.3%	0.6%	7.7%	2
Public education to teach people how to reduce their impacts on the environment.	70.0%	17.4%	4.6%	0.7%	1.0%	6.2%	3
More research on water quality issues.	64.9%	19.4%	6.9%	0.7%	1.1%	6.9%	4
Better enforcement of existing regulations.	66.3%	17.0%	3.2%	0.4%	0.9%	12.1%	5
Restrictions on waterfront property, including requiring buffer zones (areas left untouched) between development and the water, drywells for roof runoff, etc.	61.9%	16.8%	8.5%	2.5%	2.5%	7.9%	6
Zoning to limit future development.	62.3%	14.0%	11.1%	2.4%	2.2%	8.1%	7
Limiting removal of vegetation on newly developed land.	58.5%	18.2%	9.9%	2.8%	2.6%	8.1%	8
Requiring repair or upgrade of septic systems when property is sold or improved.	51.4%	21.8%	12.4%	2.5%	2.6%	9.3%	9
Controlling stormwater runoff with diversion, catch basins, etc.	47.6%	26.1%	12.9%	1.7%	0.9%	10.7%	10
Restricting use of fertilizer and lawn chemicals for residential property.	43.4%	24.8%	16.7%	5.4%	2.2%	7.5%	11
Requiring pumpouts of existing septic systems every 4 years.	32.7%	21.3%	20.9%	6.7%	4.2%	14.2%	12

chemicals. While 75 percent of the SCC sample stated that they were willing to improve their own septic system, 73.2 percent of our sample support required upgrades when property is sold or improved. However, only 54 percent support required pumpouts every four years.

It was hypothesized that certain groups of people would be more likely to support or oppose specific actions. For example, boaters, who would be most inconvenienced by discharge prohibitions, were expected to show less support for this action. However, 90.4 percent of boaters, versus 88.2 percent of non-boaters support no-discharge regulations (although, based on a test of equality of the means, the difference in the mean strength of support for discharge prohibitions between boaters and non-boaters is not statistically significant). Thus, boaters appear to be willing to undergo some inconvenience in exchange for cleaner water. This is consistent with the SCC survey finding that 63 percent of boaters are willing to change their boating habits to improve water quality.

Based on similar reasoning, waterfront residents were expected to be less likely to support restrictions on waterfront property. There is some support for this hypothesis, with 76.2 percent of waterfront residents, 79.8 percent of residents who live up to ½ mile from the water, and 82.5 percent of people who live more than ½ mile from the water supporting restrictions on waterfront property. However, there was no statistically significant difference in the mean strength of support across these groups.

Finally, the strength of support for all actions was compared for members of environmental groups versus those who are not members.[24] Although the average level of support was slightly greater for members of environmental groups, the means were not statistically significantly different.

From these results, it can be concluded that the majority of respondents are in favor of environmental actions, with slightly lower support for some actions that are personally inconvenient. However, as expected, the results appear to be primarily symbolic of a general desire for action. That is, people seem to support most actions. Thus, these results do not provide adequate information with which to make policy decisions.

VI.C.4. Opinions About Brown Tide

Question 3 asked respondents whether they have heard of brown tide, and if they have, about their level of concern, whether their activities have been affected, and whether they support funding for further study. The results are reported in Table V.1.

Most people (90%) had heard of brown tide, and 75 percent said that at least one activity was affected by the brown tide. The most commonly affected activity was swimming, with 59 percent

[24] A total score for all actions was calculated by summing the level of support for all actions, where 1 indicates strong support and 5 indicates strong opposition. The mean score for members of environmental groups was 19.51, and that of non-members was 25.1, with a lower score indicating greater strength of support.

of those who had heard of brown tide affected, followed by shellfishing (40%) and fishing (37%). A small number of people said that boating or other activities were affected. The most commonly mentioned "other" activity affected was eating seafood. The majority (97%) of those who had heard of brown tide are concerned (21%) or very concerned (76%) about it. Most of those who had heard of brown tide (86%) also support more funding to study brown tide and possible remedies for it.

Table V.11 - Responses to Brown Tide Questions

	Heard of Brown Tide 872 (90.1%)	**Heard of and Affected by Brown Tide** 725 (74.9%)
Q. 3B - How concerned are you about brown tide?		
No Opinion	22 (2.5%)	8 (1.1%)
Not Concerned	5 (0.6%)	1 (0.1%)
A Little Concerned	183 (21.0%)	120 (16.6%)
Very Concerned	662 (75.9%)	596 (82.2%)
Q. 3D - Do you support or oppose more funding to study the causes of brown tide and how to end it?		
No Opinion	26 (3.0%)	14 (1.9%)
Opposed	17 (1.9%)	13 (1.8%)
Neutral	79 (9.1%)	61 (8.4%)
Support	750 (86.0%)	637 (87.9%)
Q. 3C - Activities Affected by Brown Tide		
	Swimming	512 (58.7%)
	Boating	121 (13.9%)
	Fishing	319 (36.6%)
	Shellfishing	349 (40.0%)
	Other	89 (10.2%)

VI.C.5. Membership in Organizations

Question 21 asked respondents whether they are members of different types of organizations. The choices listed are sports, community service, environmental, political, business-related, farm or agricultural, religious, and civic organizations. The purpose of this question was to supplement the standard demographic questions by providing information about respondents' interests and level of commitment to different causes. Table VI.12 shows the statistics for membership in organizations.

Sixty-five percent of respondents belong to at least one organization, and 31 percent belong to an environmental organization. This is comparable to the results of the SCC survey, which found that 57 percent of respondents had donated to environmental organizations, and 21 percent had been active in an environmental group.

Table VI.12 - Membership in Organizations

Organization	Number (%)
Sports	171 (17.7%)
Community Service	182 (18.8%)
Environmental	300 (31.0%)
Political	146 (15.1%)
Business	94 (9.7%)
Agricultural	24 (2.5%)
Religious	275 (28.4%)
Civic	152 (15.7%)
Other	91 (9.4%)
Any Organization	628 (64.9%)

VI.D. ESTIMATES OF ECONOMIC VALUE

VI.D.1. Responses to Contingent Choice Questions

As discussed above, there were 60 different choice questions, with five included in each booklet, to create twelve different booklets. There were between 73 and 85 responses to each of the twelve booklets. The demographic groups—year-round vs. seasonal residence, gender, age, education, employment, and income—were fairly evenly distributed across booklets.

Table VI.13 shows how many of the contingent choice questions were answered by respondents. Of the 968 people who completed the survey, 897 (92.7%) answered at least one of the five contingent choice questions in their survey booklet, and 790 (81.6%) answered all of the choice questions. Of the 4,840 total choice questions, 4,307 (89%) were answered. Seventy-one respondents (7.3% of the sample) did not answer any of the choice questions.

Table VI.13 - Number of Choice Questions Answered

Number Answered	Number of Respondents	Percent of Total Sample
0	71	7.3%
1	8	.8%
2	8	.8%
3	31	3.2%
4	60	6.2%
5	790	81.6%

Older respondents, and those with lower education and income levels, were slightly less likely to answer all of the choice questions. Of those who answered at least one choice question, almost all (91.6%) chose an action, rather than no action, for more than half of their answers. Only 27 people (3.0%) chose no action for all of the choice questions answered. These results demonstrate the strong environmental concern expressed by survey respondents, but also may suggest some symbolic bias, if respondents voted to "take action," irrespective of the associated levels of resource protection and cost. Below we discuss some methods that we employed to identify and control for this possible bias.

Of those who chose either Program A or Program B, more people chose Program A than Program B.[25] This may indicate a tendency to select the option placed in the center, or may simply indicate that the options presented as Program A were preferred more often. This is discussed further in the Technical Appendix.

VI.D.2. Results and Discussion

The statistical models used to estimate the results are described in detail in the Technical Appendix. These methods calculate the relative weights, or values, for an additional acre of each natural resource, and for an additional dollar of cost to each household. These weights are measured by the estimated coefficients for each resource and cost. From these coefficients, relative values for the

[25] Of respondents who answered more than one question, 434 (48%) chose Program A for more than half of the questions they answered, and 76 (8.5%) chose Program A for all of the questions they answered. This compares to 287 (32%), who chose Program B for more than half of the questions they answered, and 15 (2%) who chose Program B for all of the questions they answered.

different resources, and dollar values for protecting an additional acre of each resource, can be calculated.[26]

The results for two different models are reported in Table VI.14.[27] The model results indicate that the order of priorities for protection or restoration of resources is as follows: farmland, eelgrass, wetlands, shellfish, and undeveloped land.

Table VI.14 - Estimation Results

	Coefficient	Value /Acre/hh/ year	95% Confidence Interval[a]		Avg. Value /Acre/Year[b]
Model 1:[c]					
Farmland	0.000511	$0.136	$0.122	$0.150	$ 9,979
Undeveloped Land	0.000107	$0.028	$0.025	$0.032	$ 2,080
Wetlands	0.000336	$0.089	$0.079	$0.100	$ 6,560
Shellfish Areas	0.000233	$0.062	$0.053	$0.071	$ 4,555
Eelgrass	0.000419	$0.111	$0.098	$0.125	$ 8,186
Cost	-0.003765				
Model 2:[d]					
Program B	-.1586				
Farmland	.000300	$0.087	$0.073	$0.101	$6,398
Undeveloped Land	.000056	$0.016	$0.013	$0.019	$ 1,203
Wetlands	.000228	$0.066	$0.056	$0.077	$ 4,863
Shellfish Areas	.000128	$0.037	$0.031	$0.044	$ 2,724
Eelgrass	.000281	$0.082	$0.069	$0.094	$6,003
Cost	-.003441				

a - The 95% confidence interval indicates the range within which the "true" value is likely to fall, with a 95% probability.
b - Calculated based on 73,423 households.
c - Conditional Logit model.
d - Nested Logit model.

[26] These calculations are described in detail the Technical Appendix.
[27] Model 1 is the standard conditional logit model, and Model 2 is the nested logit model.

As discussed above, symbolic values are often an issue for both contingent valuation and contingent choice methods. The estimation results show that this is an issue in this survey, and that respondents to the survey are more likely to choose to take action, independent of the specific results of the action. Thus, these respondents may be expressing a symbolic willingness to pay to take action, as opposed to revealing values for the specific natural resources of concern. The higher probability of choosing to take action is not surprising, given the level of concern among residents of the area for the environment of the Estuary.

However, Model 2 provides a correction for such values, by separating the probability of taking action vs. no action, from the probability of selecting either Program A or Program B. Thus, the estimated dollar values for Model 2 are approximately half to two-thirds as large as those estimated from Model 1. The estimated dollar values range from around $2.1 thousand per acre per year for undeveloped land, to around $10 thousand for farmland for Model 1; and around $1.2 thousand to $6.4 thousand for Model 2. The values from Model 2 might be interpreted as the portion of respondents' willingness to pay to take action which can be attributed to the described changes in natural resource levels. This is smaller than the estimated value in Model 1, which includes a "symbolic" effect.

Although the estimated dollar values differ, both models result in the same ordering of priorities and relative values for the natural resources. These results indicate that priorities and relative values are robust with respect to different model specifications, and are independent of symbolic effects, but that the estimated dollar values vary somewhat, although they are close in magnitude. Therefore, it may be concluded that the model is relatively robust to different specifications, and that the proportion of value that is "symbolic" is not great.

3. Discounted Present Values

Discounting is a means of aggregating dollar values over time, and is based on the idea that natural resources are assets that provide a flow of services over time. Thus, "[t]he economic value of a resource-environment system as an asset can be defined as the sum of the discounted present values of the flows of all of the services. The benefit of any public policy that increases the flow of one type of service is the increase in the present value of that service" (Freeman 1993, p. 5).

The discounted present values for two discount rates are presented in Table IV.15. The 7 percent rate is used to approximate a "typical" interest rate for public planning. For example, 7.625 percent was the official water resources planning discount rate for fiscal year 1996 (U.S. Department of the Interior 1995).[28] The 3 percent rate is included for comparison, because it is often argued that the social discount rate should be lower. The 25 year time horizon was chosen to match the time period

[28] This is the rate required by the government for Federal water and related land resources planning, and is based on the average yield during the preceding fiscal year on interest-bearing marketable securities of the United States with 15 years or more remaining to maturity (U.S. Department of the Interior 1995).

presented in the survey. The 100 year time horizon was used to identify values associated with a longer time horizon.

Table IV.15 - Comparison of Discounted Present Values

	PV/Acre r=.03, t=100*	PV/Acre r=.03, t=25*	PV/Acre r=.07, t=100*	PV/Acre r=.07, t=25*
Model 1:				
Farmland	$315,314	$173,759	$142,387	$116,286
Undeveloped Land	$65,728	$36,221	$29,681	$24,240
Wetlands	$207,286	$114,228	$93,605	$76,446
Shellfish Areas	$143,945	$79,323	$65,001	$53,086
Eelgrass	$258,675	$142,547	$116,811	$95,398
Model 2:				
Farmland	$202,175	$111,412	$91,297	$74,562
Undeveloped Land	$38,028	$20,956	$17,172	$14,024
Wetlands	$153,659	$84,676	$69,388	$56,669
Shellfish Areas	$86,070	$47,430	$38,867	$31,742
Eelgrass	$189,703	$104,539	$85,665	$69,962

* r is the discount rate; t is the time horizon in years.

VII.E. CONCLUSIONS AND SUMMARY

This section described the development, implementation, and results of a survey of public values for important natural resources of the Peconic Estuary System. We developed the survey through an extensive six-month process of interviews, focus groups, and pretests. We selected the contingent choice method to elicit values for five important resources: farmland, undeveloped land, wetlands, safe shellfishing areas, and eelgrass. The survey was implemented in August, 1995, to 968 year-round and seasonal residents of the East End of Long Island.

In summary, residents of the East End are very concerned about protecting of the area's natural resources, and are willing to pay a significant amount to do so. Our statistical results indicate that respondents are so concerned about protecting the East End's environment that they would be willing to pay to take action, independent of specific results of the action. We corrected for this "symbolic" value in our estimation models, and present the results of both the standard and "corrected" model.

Overall priorities for the five natural resources included in this survey are for farmland, followed by wetlands, eelgrass, shellfish areas, and undeveloped land. Discounted present values for the most conservative model range from around $14 thousand to preserve an acre of undeveloped land, to around $75 thousand to preserve an acre of farmland. The results of this survey will be combined with those of several other studies to evaluate benefits of a set of proposed management actions for the Estuary.

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Appendix A - Example Survey *

* Readers who would like to obtain a copy of the survey should contact the authors.

Appendix B - Technical Appendix

Based on the random utility model, relative values and priorities for the natural resources were estimated using the standard conditional logit method (Greene 1993; Maddala 1983), where

$$P_{ij} = \frac{\exp(\beta' \mathbf{z}_j + \alpha' \mathbf{z}_j \mathbf{w}_i)}{\sum_k \exp(\beta' \mathbf{z}_j + \alpha' \mathbf{z}_j \mathbf{w}_i)}. \tag{1}$$

P_{ij} is the probability that individual i will select option j; $\mathbf{z}_j$ is a vector of attributes of the choice (e.g., the levels of natural resources and the cost), which may also vary across individuals; $\mathbf{w}_i$ is a vector of characteristics of the individual; and β and α are vectors of parameters of the model, estimated using maximum likelihood techniques. Box-Cox tests were carried out to select an appropriate functional form and, based on these tests, the linear form was chosen for all subsequent estimation.

The second alternative specification is the nested logit model, which allows for correlations between the two action alternatives. The nested logit model was structured so that respondents are assumed to first choose whether to take action or not, and then to choose a specific program conditional on taking action. In the nested logit model, the probability that an individual chooses alternative k is

$$P_{kj} = P(k|j)P(j). \tag{2}$$

The choice probability for each of the three lowest level alternatives is conditional on the choice to take action or not. In this case, if the person chooses not to take action, then the probability of selecting the "No New Action" alternative is 1, since it is the sole alternative on that branch of the nested model. If they choose to take action, the probability of selecting "Program A" or "Program B" is

$$P(k|j) = \frac{\exp(V_{k|j})}{\sum_{n|j} \exp(V_{n|j})} = \frac{\exp(\beta' \mathbf{x}_{k|j})}{\sum_{n|j} \exp(\beta' \mathbf{x}_{n|j})} = \frac{\exp(\beta' \mathbf{x}_{k|j})}{\exp(\mathbf{J}_j)}, \tag{3}$$

where k is one of the two alternatives, Program A or Program B; j is the choice to take action; n is the number of alternatives in choice j, which would be 2; and Jj is the inclusive value for choice j, which represents the expected maximum utility from the choice of an alternative that sub-branch.

This is defined as

$$J_j = \log(\sum_{n|j} \exp(\beta' \mathbf{x}_{n|j})). \tag{4}$$

The probability of choosing to take action or not is

$$P(j) = \frac{\exp(\alpha' Y_j + \tau_j J_j)}{\sum_m \exp(\alpha' Y_m + \tau_m J_m)}, \tag{5}$$

where m is the number of branches, which in this case is two.

The parameter J is the inclusive value coefficient, which is related to the correlation between alternatives within a branch. A value of τ between 0 and 1 indicates that there is greater substitutability within, rather than across, groups of alternatives. In terms of this study, this would indicate that Program A and Program B are closer substitutes than either program and the "No New Action" alternative. If τ is equal to 1, then all alternatives are equally substitutable, and the model becomes identical to the standard conditional logit model (McFadden 1981; Kling and Herriges 1995; Kling and Thomson 1996).

The results of the conditional logit model were compared to two alternative specifications. These results are presented in Table B-1. The first is the conditional logit model with two alternative-specific constants, one for the choice of an action versus no action, and one for Program B. Thus, the coefficient on the first constant term reflects factors other than the levels of attributes that affect the choice of an action versus the choice of no action.[14] For example, respondents may be expressing a symbolic willingness to pay to take action, as opposed to revealing values for the specific natural resources of concern. The coefficient on the second constant term reflects any difference in preference for Program B versus Program A that is unrelated to the levels of attributes of A and B, such as an order effect.

The results of both of these models indicate that there may be effects on choices unrelated to the described attributes. In the alternative-specific constant model, both constant terms are statistically significant, indicating that there is an effect on choices unrelated to the quantities of the individual attributes, but is instead related to the choices themselves. The positive and significant coefficient

[14] Note that, alternatively, this could also suggest use of the incorrect functional form, although the Box Cox test shows that the linear form is the most appropriate of the commonly used functional forms.

for "Action" indicates that people are more likely to choose an action rather than "No New Action," independent of the action's specific effects on natural resources. Similarly, the negative and significant coefficient for "Program B" indicates that, even if Program A and Program B produced the same results in terms of preservation of natural resources, respondents are more likely to choose Program A. The coefficient on Action indicates that there is an 87 percent probability that the average respondent would select action over no action, if that action cost nothing and provided zero resource protection. Similarly, conditional on taking action, there is a 55 percent probability that the representative respondent would choose Program A over Program B if their costs and levels of resource protection were identical.

Table B-1 - Comparison of Model Results

	Coefficient	Value /Acre	95% Confidence Interval		Avg. Value /Acre/Year*
Conditional Logit Model:					
Farmland	0.000511	\$0.136	\$0.122	\$0.150	\$ 9,979
Undeveloped Land	0.000107	\$0.028	\$0.025	\$0.032	\$ 2,080
Wetlands	0.000336	\$0.089	\$0.079	\$0.100	\$ 6,560
Shellfish Areas	0.000233	\$0.062	\$0.053	\$0.071	\$ 4,555
Eelgrass	0.000419	\$0.111	\$0.098	\$0.125	\$ 8,186
Cost	-0.003765				
ρ^2=1-(L (β)/L (0))	.138				
Model with Alternative-Specific Constants:					
Action	1.2866				
Program B	-0.1799				
Farmland	.000300	\$0.094	\$0.078	\$0.109	\$ 6,872
Undeveloped Land	.000057	\$0.018	\$0.014	\$0.022	\$ 1,304
Wetlands	.000179	\$0.056	\$0.045	\$0.066	\$ 4,090
Shellfish Areas	.000108	\$0.034	\$0.023	\$0.044	\$ 2,467
Eelgrass	.000214	\$0.067	\$0.052	\$0.081	\$ 4,909
Cost	-.003207				
ρ^2	.171				
Nested Logit Model:					
Program B	-.1586				
Farmland	.000300	\$0.087	\$0.073	\$0.101	\$6,398
Undeveloped Land	.000056	\$0.016	\$0.013	\$0.019	\$ 1,203
Wetlands	.000228	\$0.066	\$0.056	\$0.077	\$ 4,863
Shellfish Areas	.000128	\$0.037	\$0.031	\$0.044	\$ 2,724
Eelgrass	.000281	\$0.082	\$0.069	\$0.094	\$6,003
Cost	-.003441				
τ	.3397				
ρ^2	.309				

* - Calculated based on 73,423 households.

These constant terms for taking action and for differences in probability of selecting A and B may be interpreted as representing a qualitative or symbolic dimension of respondents' preferences, while the coefficients on the natural resources represent the quantitative dimension that can be attributed to the stated levels of resource protection. Thus, if respondents exhibit a tendency to a resource protection action, rather than "No New Action," beyond that which can be associated with the stated levels of resource protection and the cost, they may be expressing a symbolic willingness to pay to take action to protect the environment of the East End. Similarly, the coefficient on the constant term for Program B indicates that there is some qualitative reason that people choose Program A, and measures the degree of preference for A over B which cannot be explained by the described attributes of the two programs. Note that this constant term is statistically significant, but quantitatively small.

The higher probability of choosing to take action is not surprising, given the level of concern among residents of the area for the environment of the Estuary. However, the preference of one program over another beyond the described effects is not expected, and could occur for a variety of reasons. For example, the effect could be related to the ordering of the two programs, their placement on the page, or could possibly indicate that respondents infer some preference from the labels (e.g., an A is better than a B).

The constant for the choice of action versus no action accounts for qualitative aspects of the decision to choose an action rather than no new action. However, it is estimated as a constant term and thus assumes a fixed effect, where the constant represents a mean "bias" towards action versus no action, beyond that which can be explained by the described levels of resource protection and cost. An alternative approach to modeling is to use a random effects model, where the random components of preferences for the two action programs are correlated. This implies that an action/no action bias might exist, but that the bias is randomly distributed across choices. For example, some individuals might exhibit a bias towards taking action, while others might exhibit a bias against taking action.

The random effects model can be implemented using the nested logit approach, which captures the correlation of the random components of utility associated with the two action alternatives. Tests of the inclusive value parameter in the nested logit model indicate that there is greater substitutability between Program A and Program B than between taking action or not, and that there is significant correlation between the Program options. The constant term for Program B is similar in magnitude to that estimated in the previous model.

Economic values for the conditional logit model were estimated based on Hanemann (1984), and are measured by the cost, C, that would make a person indifferent between the choice selected and the baseline, no action, which has zero cost. Thus, for the conditional logit model,

$$U(R_{ij}, M_i) = U(R_{ik}, M_i - C_k) \text{ for all } k \neq j, \tag{6}$$

where j represents the "No New Action" alternative, or the baseline levels of the resources, so that C_j=0; k is the option selected; and C_k is the maximum willingness to pay for option k. For the linear approximation of the utility function presented above, this can be solved for C_k as follows:

$$\beta R_{ij} + \gamma(M_i) = \beta R_{ik} + \gamma(M_i - C_k) \text{ and } C_k = -\frac{\beta}{\gamma}(R_{ik} - R_{ij}). \tag{7}$$

Thus, for the conditional logit model, the dollar value to the average respondent for a unit change in each of the natural resources is calculated as the ratio of the coefficient on the resource, β, to the coefficient on cost, γ.

The calculation of dollar values for the nested logit model must account for the nested structure and the inclusive value parameter, τ. The formula for the compensating variation associated with a change in one of the attributes of the choice is (Kling and Thomson 1996; Hanemann 1982):

$$CV = -\frac{1}{\gamma}\left\{\ln\left[\sum_{j=1}^{J}\left(\sum_{k=1}^{K_j}\exp(V_{jk}^2/\tau_j)\right)^{\tau_j}\right] - \ln\left[\sum_{j=1}^{J}\left(\sum_{k=1}^{K_j}\exp(V_{jk}^1/\tau_j)\right)^{\tau_j}\right]\right\} \tag{8}$$

where V is the utility function, the superscripts on V indicate whether the attributes are set at the new level or the old level, and γ is the coefficient on cost.

The estimated dollar values and relative values, calculated as ratios between the coefficients on each pair of resources, were compared for each model using Friedman's test for more than two related samples (Neave and Worthington, 1988). Based on this test, the hypothesis of equality of the estimated dollar values for the three models is rejected. However, a comparison of the estimated dollar values for the nested logit model and the alternative-specific constants model using the Wilcoxon signed rank test does not reject the hypothesis of equality of values for these two models.

The Friedman test does not reject the hypothesis that the relative values for natural resources are equal for all three models. Additionally, the ordinal priorities for all three models are the same, with farmland most important, followed by eelgrass, wetlands, shellfishing areas and undeveloped land. These results indicate that priorities and relative values are robust with respect to different model specifications, and are independent of symbolic effects, but that the estimated dollar values vary somewhat between the base model and the two alternative specifications. However, the estimated dollar values for the three models are close in magnitude. Therefore, it may be concluded that the model is relatively robust to different specifications, and that the proportion of value that is "symbolic" is not great.

These results indicate, however, that there may be a statistically significant symbolic component to choices, which is comprised of an effect that is unrelated to the described levels of resource protection provided by the hypothetical programs and the associated cost. The similarity of results from the nested logit and conditional logit with constants models, and the fact that the results are not statistically different, indicate that these biases are likely overwhelmingly in one direction—towards taking action rather than no action. Thus, both of these models appear to account for a "symbolic" aspect of values, and to separate that from estimated values for specific natural resource improvements. Note, however, the Nested Logit model provides considerable improvement in fit, as measured by the ρ^2 statistic.