

Fire Island Inlet to Montauk Point, NY

Final General Reevaluation Report



APPENDIX D1

RECREATION

**U.S. Army Corps of Engineers
New York District**



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FIRE ISLAND TO MONTAUK POINT REFORMULATION STUDY – FINAL GRR
Appendix D1
Recreation

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I. PURPOSE AND OVERVIEW

This sub-appendix summarizes the recreational benefit analysis for the Fire Island to Montauk Point CSRM Reformulation. The summary is organized in two portions, to describe the methodology applied, and subsequent updates to reflect changes in the project features recommended in the final alternative.

The initial recreation analysis was conducted during pre-Sandy plan formulation. This sub-appendix describes the derivation of a simulated demand curve for the with and without-project conditions and the survey and interpretation steps necessary to extract the applicable willingness to pay (WTP) values.

The second portion of the appendix describes the necessary adjustments to the initial analysis to adjust the benefit estimates to reflect a reduced footprint and renourishment period for Recommended Plan (see Figure D1-1) beachfill, and to reflect the necessary updates of price level and visitor usage to reflect the passage of time since the original analysis.

The initial analysis evaluated WTP for a with project condition as compared to the 1998 beach profile as the without project condition. Given the dynamic nature of beach profiles and the history of sediment placement in the study area, the without project condition applied in the initial analysis the recreation analysis is determined to be representative of the beach condition in the current condition absent any federal action.

1. Purpose of the analysis

The purpose of this recreation use study is to develop estimates of National Economic Development (NED) recreational benefits produced by a beach improvement project that covers the beaches from Fire Island to Montauk, New York. Benefits were initially estimated for the following beaches: Fire Island (town beaches, Sailors Haven, Watch Hill), Smith Point County Park, Shinnecock County Park, Sagg Town Park (Southampton) and Main Town Park (East Hampton).

Implementation of the project will widen the beaches within the study area. Increasing the width of existing beaches will create the potential for an enhanced recreation experience which may be reflected in an increase in willingness to pay (WTP) for the recreation experience, an increase in visitation, or both.

Since the development of the initial recreation analysis approach and the completion of the recreation use surveys, the plan formulation process has identified that design beach fill is only justified for coastal storm damage reduction at the communities on Fire Island and for continuation at the beaches restored at the west Hampton Interim Project. In addition to documenting the initial recreation use results, this report also provides a description and updated results reflecting current price levels, recreation use and the adjustments for areas excluded from the placement and maintenance of design beach nourishment.

2. Statement of the 'without' and 'with-project' condition

The "without project" condition for the recreation use survey is to maintain the beaches at widths present in 1998. The project proposal is to widen and maintain the beaches in the study area against erosion to a width of approximately 400 feet, which is similar in size to the beach at Robert Moses State Park in 1998.

3. Description of the study area.

The impact of beach nourishment relates to the geographic recreation "market". The market is defined by the location of the potential user population. The potential user population is delineated as people now using the Fire Island, Smith Point, East Hampton and Southhampton beaches.

Some potential users are excluded from the study. Non-users of the beach are excluded. The study does not consider the potential demand for beach recreation of individuals whose maximum WTP for beach recreation currently falls below their travel costs or below the existing entry fee. Non-users of the beach might have a WTP for the improved beaches due to a perception that a wider beach provides an improved recreation experience. Potential "switchers" from other adjacent beaches who might be willing to switch some or all of their visitations to the project beaches once the projects are implemented are also excluded.

4. Introduction to Methodology

A) Simulated Demand Curve

The procedure for estimating the use value of a recreation site is to develop a Simulated Demand Curve. These demand curves are referred to as "simulated" since they are not based on actual market behavior, but on behavior in the hypothetical market. The concept of demand, in the instance of a beach visitor using a daily pass to enter the beach, describes the relationship between the number of annual visits (Quantity Demanded) people are willing to make at each WTP bid (Price). The use value is estimated as the area under the demand curve.

B) Contingent Valuation Method

The information necessary to develop a simulated demand curve was obtained from a survey conducted during August-September, 1998. Respondents were asked about their WTP for the 'with-project' condition, and about their 'without' and 'with-project' beach visitation. The methodology described above is referred to as the contingent valuation method (CVM). The CVM questionnaires are displayed in Appendix 'A'.

Two CVM questionnaires were used since beachfill is proposed for areas accessible through different transportation means and require different valuation. The first obtained information from respondents using the Fire Island beaches (questionnaires were distributed on the Fire Island Ferries). The second obtained information from respondents using the beaches at Smith Point, East Hampton and Southhampton. None of the beaches in the study area charge a beach use fee. Transportation costs and parking fees are associated with access to the beaches in the study area.

Respondents completed the questionnaire. Interviewers were not used to collect the CV information. Given the complexity of a CV questionnaire, respondents did have a degree of difficulty interpreting and responding to the 'with-project' visitation and willingness-to-pay (WTP) questions. Many respondents had the identical 'without-project' and 'with-project' visits, suggesting difficulty in interpreting the question (if that was the case 'with-project' visits should be zero). Extensive data editing was necessary on the 'with-project' visitation question, resulting in a likely understatement of visits and benefits.

The WTP responses has bids that are high (\$25, \$20, \$15) for a daily admission pass to the beach. These high bids, in some cases, are associated with large annual visitation. An interviewer process would probe the respondent to ensure understanding and consistent answers. Carefully editing of questionnaires and responses reduced some of the outlier responses.

The quality of the data from the respondent completed methodology is a limitation of the study.

C) Incremental WTP

Normally, the WTP question for the 'with-project' condition elicits a respondent's incremental or additional WTP, above what they bid for the 'without project' condition. In this instance the WTP question only elicited the respondent's 'without-project' bid.

It is not feasible to estimate directly the incremental 'with-project' WTP. This is a limitation of the study and which may overstate the NED benefits.

D) Sampling Distribution

The sampling distribution method was used to derive the simulated demand curves. This approach uses the distribution of WTP bids and corresponding quantity demanded at each bid from the CVM survey. The bids are arranged in ascending order. Visits or number of people willing to pay each bid are cumulated on a greater than basis. The sample proportion of respondents or visits willing to pay each bid or greater represents an estimate of the proportion of the population at each bid. The sample distribution of WTP bids and the population willing to pay each bid or greater is the price and quantity demanded in the simulated demand curve.

II. SAMPLE DESIGN AND EVALUATION

The sample design specifies the location and number of questionnaires completed, and how respondents are selected. Questionnaires were distributed to and collected from respondents on three Table II- 1 Fire Island ferries and at beach locations in Smith Point, East Hampton and South Hampton. On the ferries, questionnaires were distributed to all passengers riding the ferry. On the beaches, questionnaires were distributed to respondents using random numbers. The number of questionnaires completed and dates are displayed in Table 1 for the Fire Island Ferries.

The small sample sizes is a limitation of the study.

Table 1: Completion Rate: The Number of Questionnaires by Ferry Location and Date

Location	Total Number of Questionnaires Completed	
	September 4	September 5
Ferry to Ocean Beach	76	0
Ferry to Seaview & Ocean Bay Park	46	29
Ferry to Cherry Grove	0	56
Total	122	85

Table 2: Completion Rate: The Number of Questionnaires by Beach Location and Date

Location	Total # of Interviews Completed	
	Weekday	Weekend
Shinnecock County Park, South Hampton	15	39
Smith Point County Park	15	21
Sagg Town Park, South Hampton	0	21
Main Town Park, East Hampton	32	25
Total	62	106

The number of questionnaires completed can be evaluated to determine the limits of error between the sample mean willingness to pay (WTP) and the true population mean WTP. The error is a measure of precision when using the sample distribution method for estimating NED benefits.

The tolerated error (using the sampling distribution approach) is expressed as the deviation between the sample mean and the population mean as a percentage of the population mean.

The formula is:

$$r = \sqrt{t^2 v^2 / n}$$

- Where
- r is the tolerated error
 - t is the tolerated risk expressed as a t-statistic specifying the confidence level of using the sample mean to estimate the population mean
 - v is the coefficient of variation or the standard deviation divided by the mean
 - n is the sample size

The above formula is solved using ten percent tolerated risk (t=1.282), substituting the actual sample size on the WTP bids, and the calculated coefficient of variation for the WTP bids. The results are displayed in Table 3.

Table 3: Tolerated Error for WTP Bids (Ten Percent Confidence Level)

	FIRE ISLAND BEACHES	SMITH POINT	SHINN. COUNTY	SAGG & MAIN TOWN PARKS
Sample Size*	144	30	37	59
Coefficient of Variation	1.5697	1.3867	.97743	.82492
Tolerated Error	17%	32%	21%	14%

*Valid WTP Bids

There are two reasons for the high tolerated error reported and the variability in the tolerated errors (range from a low of 14 percent to a high of 32 percent) across the four survey locations. The structure of the WTP question results in relatively high tolerated error. In this study respondents were asked about their incremental WTP for improvements to the beach using a payment card. The incremental WTP approach will have a relatively large number of zero bids (the percentage of valid zero bids ranged from a high of 40 percent to a low of 8 percent) as respondents may not be willing to pay for any beach improvements. A large number of zero bids reduces the mean WTP relative to the standard deviation, thus increasing the coefficient of variation and the tolerated error. Another reason for the high tolerated error is the relatively small sample size. A larger sample size will reduce the term inside the square root sign thereby reducing the tolerated error. A smaller sample size also tends to magnify outlier responses causing variability across the four survey locations.

III. DESCRIPTIVE STATISTICS

1. Trip Bias and Weighting Corrections

The sample distribution of visits does not correspond to the population distribution of visits, more so with the sample size being very small. Persons going to the beach more often are more likely to be selected as respondents. The information on visitation from the CV survey is subject to "trip bias".

The correction for the trip bias was to estimate the population average visitation from the sample data. The procedure is to divide the sample size by the sum of the inverse of visits for each case across all respondents in the sample.

The formula is :

$$Avg = [n / \sum(1/v_i)]$$

Where Avg is the average number of visits corrected for trip bias
 n is the sample size
 v_i is the number of visits for respondent i.

The correction for trip bias is presented in Table 4. The adjustment for trip bias was performed based on a respondent's summer visitation to the survey beach and for the Fire Island questionnaire the number of summer round trips on the ferry. The sample mean visitation, as expected due to trip bias, is substantially larger than the mean visitation corrected for trip bias (the estimate of the population mean visits).

Table 4: Mean Visitation to Survey Beaches (Summer of 1998)

	FIRE ISLAND BEACHES*	SMITH POINT	SHINNECOCK	SAGG & MAIN TOWN PARKS
Actual From Survey	14.05	7.03	14.92	19.12
Corrected for Trip Bias	4.33	2.69	5.73	3.98

*Number of Round Trips on Fire Island Ferry

The existence of trip bias required that the survey information be adjusted for overrepresentation of respondents that visit frequently. The correction was to weight the data items from each respondent by the inverse of visitation [1/v_i]: Where v_i is the summer visitation to the survey beach for each respondent (ferry trips for the Fire Island survey). The weighting by the inverse of the summer visitation to the survey beach corrects the sample data for over representation of respondents that visit the beach frequently.

2. Descriptive Statistics

Descriptive statistics, sample means, standard deviations for the respondents at each survey location are displayed in Table 5.

With respect to beach valuation the average incremental WTP to maintain the beach against erosion ranged from \$3.03 for Fire Island to \$8.57 at Shinnecock County Beach. The substantially higher average beach valuation at Tianna Beach is due to the sample size, outliers and the trip bias correction. An outlier or a high WTP bid from a single respondent (given the small sample size) that did not have a large number of visits takes on added importance after the trip bias correction. The average incremental WTP from this study is greater and the number of valid zero bids is less than in other studies using similar methodology. Explanations for these differences are the questionnaire completion methodology (in the current study respondents completed the questionnaire without an interviewer resulting in a higher percentage of uncertain and inconsistent responses), the relatively high income and education levels of respondents in this study resulting in higher WTP, the small sample sizes that magnify outlier responses, and that no beach user fee is currently charged on Fire Island or at the survey beaches.

Note the number of "valid" zero bids. This is consistent with the incremental WTP approach. To identify protest WTP responses on the beach valuation questions, respondents were asked to indicate the reason why they stated a maximum WTP of zero dollars. These questions were asked immediately after respondents had answered the "without" and "with" project valuation questions. A series of fixed response categories were presented along with an open ended category if a respondents reason did not fit one of the specified categories. A zero bid response was classified as "valid" if the respondent stated "that is (zero bid amount) what it ("without" and/or "with" project condition) is worth to me", or "worth more, but all can afford", or "beach fees already too high". Other responses ("not enough information", "did not want to place a dollar value", and "objected to way question was asked") were classified as protest bids. More respondents than usual wrote an explanation of their bid in the "other" category on the questionnaire (25 percent on the Fire Island survey). These were carefully analyzed individually to determine if the bid was valid or a protest.

Demographic characteristics and type of beach visit were different across the four survey locations. Smith Point visitors tended to be day visitors with the lowest percent employed full-time and the lowest income level compared with the other survey locations. Sagg & Main Town Parks had the highest percentage of vacation visitors at the beach and the highest income. Fire Island and Sagg & Main Town Parks had the highest percentage of summer residence (both with about 12 percent of beach visitors).

Table 5: Descriptive Statistics (Standard Deviation in Parenthesis)

TYPE OF QUESTION	FIRE ISLAND BEACHES	SMITH POINT	SHINNECOCK	SAGG & MAIN TOWN PARKS
<u>Beach Valuation & Visitation</u>				
Incremental WTP to Maintain Beach Against Erosion	\$3.03 [3.96]	\$3.23 [4.06]	\$8.57 [9.88]	\$4.47 [3.06]
% Valid Zero Bids	27.6%	40.1%	26%	8.3%
% Certain of Answers	61.2%	58.9%	65.1%	72.9%

TYPE OF QUESTION	FIRE ISLAND BEACHES	SMITH POINT	SHINNECOCK	SAGG & MAIN TOWN PARKS
# Round Trips on Fire Island Ferry	4.33 [6.56]	--	--	--
# Visits to Interview Beaches	8.21 [15.87]	2.69 [3.64]	5.73 [8.76]	3.98 [8.05]
% Day Visit	34.3%	75.3%	43.4%	19.3%
% Weekend Trip	21.6%	0.6%	17.9%	10.9%
% Vacation	9.6%	3.2%	11.9%	51.9%
% Visit to Family/Friends	19.0%	19.9%	15.9%	2.1%
% Summer Residence	11.9%	1.0%	7.7%	12.7%
% Drove a Car/Passenger in Car	63.0%	89.4%	96%	58.3%
<u>DEMOGRAPHIC CHARACTERISTICS</u>				
% Female	57.5%	66.7%	60.7%	56.3%
% Completed College	40.1%	23.2%	23.3%	40.4%
% Some Graduate/Completed Graduate	38.7%	38.7%	30.3%	46.4%
% Employed Full Time	69.2%	50.4%	65.9%	65.9%
% Income GT \$100,000	25.4%	20.3%	44%	46.5%
Age	36 [12.09]	43 [11.89]	41 [7.47]	40 [8.26]
Sample Size	207	36	54	78

*Observations are weighted by the inverse of visitation (ferry trips for Fire Island) to correct for trip bias.

IV. BEACH ATTENDANCE

1. Estimated Beach Usage

Beach attendance is estimated from the beach parking pass data furnished by East and Southampton, parking statistics from Smith Point and Shinnecock Suffolk County beaches, the number of round trip Fire Island ferry crossings, and information from the CV survey. The beach parking pass data used is: the number of daily and seasonal parking passes sold in the Town of East Hampton; the number of non-resident daily, non-resident full season, resident and resident senior citizen parking passes sold in the Town of Southampton; and the number of annual-resident, annual tourist, daily-resident, daily-tourist parking passes sold for Smith Point and Shinnecock beaches by the Suffolk County Department of Parks.

The beach parking pass data understates the actual beach visitation. Beach visitors can arrive by transportation other than car (walk, bike or take mass transit). The information from the CV survey suggested that in East and Southampton (beaches close to residential and commercial areas) a significant percentage of sample respondents did not use a parking pass (an adjustment was made to attendance data to account for these visitors). Beach parking passes may not be required when there is threatening weather or late in the afternoon. While expected WTP for these visits might be low with the less than optimal weather, a significant visitation does accumulate in periods when parking passes are not taken.

Given the parking pass data and information from the CV survey (adjusted for trip bias), the algorithm for calculating summer beach attendance at East Hampton, Southampton, Smith Point and Shinnecock is:

$$\text{Beach Attendance} = ([\# \text{daily passes sold} * \text{average \# of passengers in a car}] + [\# \text{season passes sold} * \text{average \# of passengers in a car} * \text{average \# of visits}]).$$

The algorithm used to calculate the 'with-project' increase in beach visits is:

$$\text{With-project increase in beach visits} = [\% \text{ of respondents (daily \& season) showing an increase} * \text{total beach visits} * \text{average increase}].$$

The estimated summer beach attendance is displayed in Table 6.

Table 6: Summer 1998 Beach Attendance

BEACH LOCATION	# DAILY PASSES SOLD	# SEASON PASSES SOLD	SUMMER 1998 BEACH ATTENDANCE	INCREASE IN VISITS WITH PROJECT
Smith Point	436	4,643	130,061	12,811
Shinnecock	47	822	16,096	6,684
East Hampton _{1,2}	7,300	3,000	194,837	-0-
South Hampton ₁	19,898	18,317	831,209	27,695

¹ At East Hampton and Southampton an adjustment was made for beach visitors not using a parking pass. At East Hampton, the CV survey indicated 30 percent of visitors and at Southampton, 10 percent of visitors did not use a parking pass.

² No respondents indicated a willingness to increase visitation under the with-project condition.

The CV survey distribution of respondents across daily/season parking passes was not consistent with the actual number of passes sold furnished by Suffolk county at Smith Point and Shinnecock, even after correcting for trip bias. Many more daily pass visitors are present in the survey than would be suggested by the number of passes sold. Further, the small number of completed questionnaires and the trip bias adjustment based on the small sample size may impact the attendance estimates. For example, the number of beach visits by respondents entering with a season parking pass (after adjusting for trip bias) is low compared with results from other beaches. The above factors serve to underestimate actual beach attendance.

At Fire Island the algorithm for beach attendance used the number of summer ferry (round-trip) passengers to Fire Island from the Navigation Data Center, Army Corps of Engineers (2,227,472), and information from the CV survey. The algorithm is:

Fire Island Beach Visits by Visit Type = [Average summer beach visits at Fire Island per round trips on the ferry * percentage of total sample ferry trips * Total Round Trip Ferry Passengers].

The algorithm to calculate the with-project visitation is:

Fire Island With Project Increase in Visits by Visit Type = [average with-project increase in visits per round trips on the ferry * percentage of total sample ferry trips with an increase * total round trip ferry passengers].

Table 7: Fire Island Beach Visits by Type of Visitor, Summer 1998

TYPE OF VISITOR	VISIT TO FIRE ISLAND BEACHES	% OF TOTAL VISITS	INCREASE IN VISITS WITH PROJECT	% OF TOTAL VISIT INCREASE
Day Visit	1,014,390	26.7	198,467	40.8
Weekend Trip	673,587	17.7	79,520	16.4
Vacation	454,404	12.0	153,695	31.6
Visit to Family Friends	499,399	13.1	8,464	1.7
Work	118,501	3.1	0	0.0
Summer Residence	1,042,456	27.4	46,331	9.5
TOTAL	3,802,737	100%	486,477	100%

V. BENEFITS FROM EXISTING BEACH USERS

Simulated Demand Curves

1. Fire Island Beaches

The procedure for estimating the use value of the improvements to the Fire Island beaches is to develop "simulated" demand curves. These demand curves are referred to as "simulated" since they are not based on actual market behavior, but on behavior in the hypothetical contingent valuation market. The concept of demand, in the instance of a visitor using a day pass to enter the beach, describes the relationship between the number of yearly visits (quantity demanded) people are willing to make at each WTP bid (price). The approach used to obtain the WTP bids in the simulated demand curve was the sampling distribution. The sampling distribution uses the actual WTP bids from the CV survey.

A) Without Project Use Value - Value for Maintaining Existing Beaches

i) Description of the with project condition

Respondents were asked how often they use the beaches at the survey site (in this case, Fire Island). They are then asked how often they used any other beaches. Next the respondents are asked what is the maximum amount they would be willing to pay in addition to any fee they now paid to **maintain the beaches in their existing state**.

The without project condition is wider Long Island beaches which are nourished to maintain the beaches them against erosion. The following statement was presented in a box to respondents. "As you know beaches are subject to erosion. Several projects for restoring and maintaining beach areas on Long Island against erosion are being studied. The improvements and maintenance against erosion will only take place if you and others are willing to pay for it. One way to collecting the needed funds is through user fees."

The WTP question is ..."Which of the following amounts is the maximum amount, in addition to any current fee, you would be willing to pay for a DAILY admission pass to maintain Fire Island beaches against erosion? Please circle the amount."

ii) Without Project Recreation (Use) Value, WTP Bids Based On The Sampling Distribution

The information necessary to calculate the simulated demand curve is: an estimate of the number of annual visits to the beaches at Fire Island under the "without project" condition, and the percentage of the visits by the respondents at each WTP bid or greater.

The number of annual visits to the beaches at Fire Island, 3,802,737, is estimated from the information on the CV questionnaire and the number of ferry round-trip passengers. The simulated "without project" demand curve, using the sampling distribution, is shown in Table 8.

Column '1' shows the actual (sample) WTP bids displayed in descending order. They range from a maximum of \$20 per visit to a minimum of \$0.00. A zero bid means that the

respondents were not willing to pay any additional amount over what they currently pay to maintain the beaches.

Column '2' is the average number of visits by respondents at each bid. This figure was adjusted for trip bias by weighting the number of visits by respondents at each bid by the inverse of the summer ferry trips to Fire Island. Column '3' is the number of respondents at each sample bid. This figure was also adjusted for trip bias by weighting the number of respondents at each bid by the inverse of the summer ferry trips to Fire Island. The multiplication of column '2' with column '3' yields the with project visits from the sample at each bid, which is shown in column '4'. There were, for example, 26 respondents in the sample willing to pay an additional \$2.00 for a daily admission pass, to maintain the beaches at their existing condition. These respondents were willing to make an average of 4.66 visits at the additional \$2.00 fee. The number of visits to the maintained beaches at Fire Island, from the respondents in the sample, at an additional \$2.00, is 122.4.

The percentage of total visits to the maintained beaches at Fire Island at each bid, cumulated on a greater than basis, is presented in column '5'. For example at the \$5.00 bid, sample visits account for 24.4 percent of total visits. As the sample bid (price) declines, visits increase. At the \$2.00 bid, for example, 56 percent of the visitation will take place. Total population visits, displayed in column '6', at each sample bid were calculated by multiplying the cumulative percentages in column '5' times the estimation of total visitation from the population, 3,802,737.

The simulated demand curve is represented by column '1' (the sample distribution of WTP bids or "price") and column '6' (quantity demanded at each sample bid). The area under the simulated demand curve is displayed at the bottom of column '7'. This figure of \$14,390,027 (1998 PL) is an estimate of the annual with project use value from visitors to the beaches at Fire Island. The use value is to maintain the beaches at their existing conditions. For each WTP increment the area under the demand curve is calculated by multiplying the average number of visits (column 6) for the increment by the difference in price (column 1) for the increment.

Table 8: Sampling Distribution (Fire Island) – Use Value from Restoring and Maintaining Beaches

Number of annual visits estimated to be 3,802,737, survey price level August 1998

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
\$20.00	100	0.139	13.90	0.015985215	60,787.6	
\$15.00	11.37	2.36	26.87	0.046883037	178,283.9	597,678.6
\$10.00	4.52	8.76	39.58	0.092402534	351,382.5	1,324,166.0
\$9.00	60.00	0.28	16.68	0.111584792	424,327.6	387,855.1
\$7.00	10.80	1.53	16.51	0.130575227	496,543.2	920,870.9
\$5.00	5.62	17.65	99.21	0.244668100	930,408.4	1,426,951.7
\$4.00	3.33	4.45	14.81	0.261701945	995,183.7	962,796.1
\$3.00	5.75	23.91	137.47	0.419795720	1,596,372.7	1,295,778.2
\$2.00	4.66	26.27	122.42	0.560583901	2,131,753.1	1,864,062.9
\$1.00	7.93	14.73	116.84	0.694952420	2,642,721.3	2,387,237.2
\$0.00	6.84	38.78	265.26	1.000000000	3,802,737.0	3,222,729.1
		138.860	869.55	Annual Use Value =		14,390,126

A 95 percent confidence interval was constructed for the area under the simulated demand curve. The procedure is to estimate the confidence interval for the proportion (percentage) of visits by respondents at bid or greater(column '5' in Table V-A).

The formula is:

$$\text{Confidence Interval} = \sqrt{u \pm ts_p}$$

where

- u Estimated visits
- sp $p(1-p) / n(1-n/N)$ where sp is the standard deviation of sample proportion
- p sample proportion from column '5' Table 8
- n sample size
- t t-statistic at 95 percent, 1.645

The confidence intervals for the simulated demand curve (Table 8) presented in Table 9 indicate that the 95% confidence in WTP for restoring and maintaining the beaches is plus or minus 9% of the mean value.

Table 9: Sampling Distribution (Fire Island) – Use Value from Restoring and Maintaining Beaches, 95% Confidence Interval

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
20.00	0.008989	0.0159851	0.0229807	0	0	0
20.00	0.008989	0.0159851	0.0229807	34,185	60,787	87,390
15.00	0.035092	0.0468827	0.0586735	133,445	178,282	223,120
10.00	0.076249	0.0924018	0.1085548	289,954	351,380	412,805
9.00	0.094022	0.1115839	0.1291460	357,540	424,324	491,108
7.00	0.111781	0.1305742	0.1493679	425,072	496,539	568,007
5.00	0.220688	0.2446662	0.2686447	839,217	930,401	1,021,585
4.00	0.237182	0.2616999	0.2862179	901,940	995,176	1,088,411
3.00	0.392264	0.4197924	0.4473205	1,491,678	1,596,360	1,701,042
2.00	0.532896	0.5605795	0.5882633	2,026,462	2,131,736	2,237,010
1.00	0.669265	0.6949470	0.7206290	2,545,038	2,642,700	2,740,363
0.00	1.000000	1.0000000	1.0000000	3,802,737	3,802,737	3,802,737
				13,134,317	14,390,027	15,645,738

B) With Project Use Value

The recreational value for improvements to the beaches on Fire Island is derived from the beach visitation with the described improvements to the beaches and the responses to the ‘without project’ WTP (from only respondents having a change in visitation). The ‘with project’ condition was presented to respondents with the following statement in a box. “Public beaches from Fire Island to Montauk Point have experienced erosion. Under a proposal being considered, the public beaches in this area that have experienced erosion would be restored and maintained against further erosion at a width of about 400 feet; which is similar in size to Robert Moses State Park beaches. We are interested in how your use of beaches from Robert Moses State Park to Montauk Point might change if the

improvements just described are made.” The visit question is “How may more days per summer would you use the below beaches after the improvements are made?”

The simulated demand curve and confidence intervals are presented in Table 10 and Table 11. Table 11 indicates that the 95% confidence in WTP for improving the beaches is plus or minus 21% of the mean value.

Table 10: Sampling Distribution (Fire Island) – Use Value from Increase in Visits with Restoring and Maintaining Beaches

Number of annual visits estimated to be 486,477

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
\$20.00	20	0.088	1.76	0.032662260	15,889	
\$15.00	4.00	0.594	2.38	0.076756311	37,340	133,074
\$10.00	2.46	4.928	12.12	0.301733958	146,787	460,317
\$9.00	15.00	0.264	3.96	0.375224043	182,538	164,662
\$5.00	1.60	7.282	11.65	0.591448204	287,726	940,528
\$4.00	1.00	2.926	2.93	0.645749211	314,142	300,934
\$3.00	2.88	0.836	2.41	0.690431183	335,879	325,011
\$2.00	3.43	3.322	11.39	0.901890737	438,749	387,314
\$0.00	2.97	1.780	5.29	1.000000000	486,477	925,226
		22.020	53.88		Annual Use Value =	3,637,066

Table 11: Sampling Distribution (Fire Island) – Use Value from Increased Visits with Restoring and Maintaining Beaches, 95% Confidence Interval

Sample WTP Bid	Visits at WTP bid or greater					
	Lower Limit	Sample	Upper Limit	Lower limit	Sample	Upper Limit
20.00	-0.00716799	0.03265866	0.07248531	0	0	0
20.00	-0.00716799	0.03265866	0.07248531	-3,487	15,888	35,262
15.00	0.01710231	0.07674785	0.13639339	8,320	37,336	66,352
10.00	0.19885322	0.30170070	0.40454818	96,738	146,770	196,803
9.00	0.26669446	0.37518268	0.48367091	129,741	182,518	235,295
5.00	0.48123483	0.59138301	0.70153119	234,110	287,694	341,279
4.00	0.53850347	0.64567803	0.75285260	261,970	314,108	366,245
3.00	0.58675671	0.69035508	0.79395345	285,444	335,842	386,240
2.00	0.83510871	0.90179133	0.96847395	406,261	438,701	471,140
0.00	1.00000000	1.00000000	1.00000000	486,477	486,477	486,477
				2,876,002	3,636,718	4,397,434

2. Smith Point County Beach

A) Without Project Use Value

i) Description of the without project condition

The without project description is identical to that used in the Fire Island questionnaire and measures the value of maintaining the beaches in their existing condition.

ii) Without Project Recreation (Use) Value, WTP Bids Based On The Sampling Distribution

The information necessary to calculate the simulated demand curve is: an estimate of the number of annual visits to the beaches at Smith Point under the "without project" condition, and the percentage of the visits by the respondents at each WTP bid or greater.

The number of annual visits to the beach at Smith Point, 130,061, is estimated from the information on the CV questionnaire and the number of parking passes sold. The simulated "without project" demand curve, using the sampling distribution, is shown in Table 12.

Column '1' shows the actual (sample) WTP bids displayed in descending order. They range from a maximum of \$25 per visit to a minimum of \$0.00. A zero bid means that the respondents were not willing to pay any additional amount over what they currently pay to maintain the beaches.

Column '2' is the average number of visits by respondents at each bid. This figure was adjusted for trip bias by weighting the number of visits by respondents at each bid by the inverse of the summer visits to Smith Point. Column '3' is the number of respondents at each sample bid. This figure was also adjusted for trip bias by weighting the number of respondents at each bid by the inverse of the summer visits to Smith Point. The multiplication of column '2' with column '3' yields the with project visits from the sample at each bid, which is shown in column '4'. There were, for example, 3.857 respondents in the sample willing to pay an additional \$2.00 for a daily admission pass, to maintain the beaches at their existing condition. These respondents were willing to make an average of 1.96 visits at the additional \$2.00 fee. The number of visits to the maintained beaches at Smith Point, from the respondents in the sample, at an additional \$2.00, is 7.56.

The percentage of total visits to the maintained beaches at Smith Point at each bid, cumulated on a greater than basis, is presented in column '5'. For example at the \$5.00 bid, sample visits account for 41.3 percent of total visits. As the sample bid (price) declines, visits increase. At the \$2.00 bid, for example, 59 percent of the visitation will take place. Total population visits, displayed in column '6', at each sample bid were calculated by multiplying the cumulative percentages in column '5' times the estimation of total visitation from the population, 130,061.

The simulated demand curve is represented by column '1' (the sample distribution of WTP bids or "price") and column '6' (quantity demanded at each sample bid). The area under the simulated demand curve is displayed at the bottom of column '7'. This figure of \$659,064 is an estimate of the annual with project use value from visitors to the beach at Smith Point. The use value is to maintain the beach at its existing condition.

Table 12: Sampling Distribution (Smith Point County Park) – Use Value from Restoring and Maintaining Beaches

Number of annual visits estimated to be 130,061

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
\$25.00	12	0.203	2.44	0.033463979	4,352.36	
\$15.00	10.00	0.261	2.61	0.069318243	9,015.60	66,839.79
\$10.00	1.88	2.668	5.02	0.138222170	17,977.31	67,482.28
\$8.00	2.00	1.247	2.49	0.172482910	22,433.30	40,410.61
\$5.00	2.51	6.989	17.54	0.413467383	53,775.98	114,313.92
\$3.00	3.33	1.508	5.02	0.482450986	62,748.06	116,524.04
\$2.00	1.96	3.857	7.56	0.586300869	76,254.88	69,501.47
\$1.00	4.00	0.638	2.55	0.621358371	80,814.49	78,534.68
\$0.00	2.37	11.630	27.56	1.000000000	130,061.00	105,437.75
		29.001	72.79		Annual Use Value =	659,044.55

A 95 percent confidence interval was constructed for the area under the simulated demand curve. The procedure is to estimate the confidence interval for the proportion (percentage) of visits by respondents at bid or greater (column '5' in Table 12). The results displayed in Table 13 indicate that the 95% confidence in WTP for restoring and maintaining the beaches is plus or minus 30% of the mean value.

Table 13: Sampling Distribution (Smith Point County Park) – Use Value from Restoring and Maintaining Beaches, 95% Confidence Intervals

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
25.00	-0.001201	0.0334651	0.0681313	0	0	0
25.00	-0.001201	0.0334651	0.0681313	-156	4,353	8,861
15.00	0.020362	0.0693205	0.1182795	2,648	9,016	15,384
10.00	0.071700	0.1382267	0.2047531	9,325	17,978	26,630
8.00	0.099666	0.1724885	0.2453115	12,963	22,434	31,905
5.00	0.318558	0.4134808	0.5084036	41,432	53,778	66,123
3.00	0.386149	0.4824667	0.5787840	50,223	62,750	75,277
2.00	0.491390	0.5863200	0.6812495	63,911	76,257	88,604
1.00	0.527885	0.6213786	0.7148723	68,657	80,817	92,977
0.00	1.000000	1.0000000	1.0000000	130,061	130,061	130,061
				460,639	659,064	857,489

B) With Project Use Value

The recreational value for improvements to the beach at Smith Point is derived from the beach visitation with the described improvements to the beach (12,811) and the responses to the 'without project' WTP (from only respondents having a change in visitation). The 'with project' condition statement is identical to that used at Fire Island.

The simulated demand curve and confidence intervals are presented in Table 14 and Table 15. Table 15 indicates that the 95% confidence in WTP for improving the beaches is plus or minus 24% of the mean value.

Table 14: Sampling Distribution (Smith Point County Park) – Use Value from Increase in Visits with Restoring and Maintaining Beaches

Number of annual visits estimated to be 12,811

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
\$15.00	40.00	0.315	12.60	0.372881125	4,776.98	
\$5.00	3.11	1.998	6.21	0.556770116	7,132.78	59,548.81
\$3.00	2.00	1.575	3.15	0.649990397	8,327.03	15,459.81
\$2.00	1.45	3.267	4.74	0.790180383	10,123.00	9,225.01
\$1.00	1.00	0.790	0.79	0.813559437	10,422.51	10,272.76
\$0.00	6.00	1.050	6.30	1.000000000	12,811.00	11,616.75
		8.995	33.79		Annual Use Value =	106,123.14

Table 15: Sampling Distribution (Smith Point County Park) – Use Value from Increase in Visits with Restoring and Maintaining Beaches, 95% Confidence Intervals

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
15.00	0.23605401	0.37266056	0.50926710	0	0	0
15.00	0.23605401	0.37266056	0.50926710	3,024	4,774	6,524
5.00	0.41607902	0.55644077	0.69680252	5,330	7,129	8,927
3.00	0.51481306	0.64960591	0.78439876	6,595	8,322	10,049
2.00	0.67457877	0.78971297	0.90484718	8,642	10,117	11,592
1.00	0.70300708	0.81313735	0.92326762	9,006	10,417	11,828
0.00	1.00000000	1.00000000	1.00000000	12,811	12,811	12,811
				81,049	106,065	131,080

3. Shinnecock County Beach

A) Without Project Use Value

i) Description of the without project condition

Respondents were asked how often they use the beaches at the survey site (in this case, Fire Island). They are then asked how often they used any other beaches. Next the respondents are asked what is the maximum amount they would be willing to pay in addition to any fee they now paid to maintain the beaches in their existing state.

The without project condition is wider Long Island beaches which are nourished to maintain the beaches them against erosion. The following statement was presented in a box to respondents. "As you know beaches are subject to erosion. Several projects for restoring and maintaining beach areas on Long Island against erosion are being studied. The improvements and maintenance against erosion will only take place if you and others are willing to pay for it. One way to collecting the needed funds is through user fees."

The WTP question is ..."Which of the following amounts is the maximum amount, in addition to any current fee, you would be willing to pay for a DAILY admission pass to maintain Shinnecock County Beach against erosion? Please circle the amount."

ii) Without Project Recreation (Use) Value, WTP Bids Based On The Sampling Distribution

The information necessary to calculate the simulated demand curve is: an estimate of the number of annual visits to the Shinnecock County beach under the "without project" condition, and the percentage of the visits by the respondents at each WTP bid or greater.

The number of annual visits to the beach at Shinnecock county, 16,096, is estimated from the information on the CV questionnaire and the number of parking passes sold. The simulated "without project" demand curve, using the sampling distribution, is shown in Table 16. The confidence intervals shown in Table 17 indicate that the 95% confidence in WTP for restoring and maintaining the beaches is plus or minus 30% of the mean value.

Table 16: Sampling Distribution (Shinnecock County Beach) - Use Value from Restoring and Maintaining Beaches

Number of annual visits estimated to be 16,096

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
\$25.00	1	4.83	4.83	0.033340512	536.65	
\$20.00	2	2.4	4.80	0.066473941	1,069.96	4,016.53
\$15.00	5	0.96	4.80	0.099607369	1,603.28	6,683.11
\$10.00	13.07	2.22	29.02	0.299894801	4,827.11	16,075.97
\$7.00	60	0.09	5.40	0.337169908	5,427.09	15,381.29
\$5.00	3.65	9.24	33.73	0.569973659	9,174.30	14,601.38
\$4.00	10.00	0.48	4.80	0.603107087	9,707.61	9,440.95
\$3.00	30.00	0.15	4.50	0.634169676	10,207.60	9,957.60
\$2.00	22.22	0.87	19.33	0.767610417	12,355.46	11,281.53
\$1.00	15.00	0.96	14.40	0.867010702	13,955.40	13,155.43
\$0.00	2.47	7.80	19.27	1.000000000	16,096.00	15,025.70
		30.000	144.87	Annual Use Value =		115,619.50

Table 17: Sampling Distribution (Form 3) location 3.1 (Shinnecock County Beach – Use Value from Restoring and Maintaining Beaches, 95% Confidence Intervals

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
25.00	0.008915	0.0333405	0.0577657	0	0	0
25.00	0.008915	0.0333405	0.0577657	144	537	930
20.00	0.032581	0.0664739	0.1003665	524	1,070	1,615
15.00	0.058862	0.0996074	0.1403526	947	1,603	2,259
10.00	0.237553	0.2998948	0.3622369	3,824	4,827	5,831
7.00	0.272851	0.3371699	0.4014891	4,392	5,427	6,462
5.00	0.502616	0.5699737	0.6373318	8,090	9,174	10,258
4.00	0.536542	0.6031071	0.6696726	8,636	9,708	10,779
3.00	0.568637	0.6341697	0.6997023	9,153	10,208	11,262
2.00	0.710147	0.7676104	0.8250742	11,431	12,355	13,280
1.00	0.820811	0.8670107	0.9132100	13,212	13,955	14,699
0.00	1.000000	1.0000000	1.0000000	16,096	16,096	16,096
				96,607	115,620	134,632

B) With Project Use Value – Value of Increasing Beach Width

The recreational value for improvements to the Shinnecock county beach is derived from the beach visitation with the described improvements to the beach (6,684) and the responses to the ‘without project’ WTP (from only respondents having a change in visitation). The ‘with project’ condition statement is identical to that used at Fire Island.

The simulated demand curve and confidence intervals are presented in Table 18 and Table 19. Table 19 indicates that the 95% confidence in WTP for improving the beaches is plus or minus 9% of the mean value.

Table 18: Sampling Distribution (Shinnecock County Beach) –Use Value from Increase in Visits with Restoring and Maintaining Beaches

Number of annual visits estimated to be 6,684

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
25					-	
25	15	2.4	36	0.744361462	4,975.31	124,383
20	2	1.2	2.4	0.793985559	5,307.00	7,463
15	5	0.48	2.4	0.843609657	5,638.69	5,805
5	1.43	2.52	3.6036	0.918120239	6,136.72	4,980
3	15	0.08	1.2	0.942932288	6,302.56	663
2	3	0.12	0.36	0.950375903	6,352.31	124
0	2	1.2	2.4	1	6,684.00	332
		8	48.36		Annual Use Value =	143,750

Table 19: Sampling Distribution (Shinnecock County Beach) - Use Value from Increased Visits with Restoring and Maintaining Beaches, 95% Confidence Interval

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
25.00	0.64155160	0.74436146	0.84717132	0	0	0
25.00	0.64155160	0.74436146	0.84717132	4,288	4,975	5,662
20.00	0.69866539	0.79398556	0.88930573	4,670	5,307	5,944
15.00	0.75800342	0.84360966	0.92921589	5,066	5,639	6,211
5.00	0.85350012	0.91812024	0.98274035	5,705	6,137	6,569
3.00	0.88826026	0.94293229	0.99760431	5,937	6,303	6,668
2.00	0.89919315	0.95037590	1.00155866	6,010	6,352	6,694
0.00	1.00000000	1.00000000	1.00000000	6,684	6,684	6,684
				130,902	143,750	156,598

4. East & Southampton Town Beaches

A) Without Project Use Value

i) Description of the without project condition

Respondents were asked how often they use the beaches at the survey site (in this case, Fire Island). They are then asked how often they used any other beaches. Next the respondents are asked what is the maximum amount they would be willing to pay in addition to any fee they now paid to maintain the beaches in their existing state.

The without project condition is wider Long Island beaches which are nourished to maintain the beaches them against erosion. The following statement was presented in a box to respondents. "As you know beaches are subject to erosion. Several projects for restoring and maintaining beach areas on Long Island against erosion are being studied. The improvements and maintenance against erosion will only take place if you and others are willing to pay for it. One way to collecting the needed funds is through user fees."

The WTP question is ..."Which of the following amounts is the maximum amount, in addition to any current fee, you would be willing to pay for a DAILY admission pass to maintain East and Southampton Town beaches against erosion? Please circle the amount."

ii) Without Project Recreation (Use) Value, WTP Bids Based On The Sampling Distribution

The information necessary to calculate the simulated demand curve is: an estimate of the number of annual visits to the town beaches in East and Southampton under the "without project" condition, and the percentage of the visits by the respondents at each WTP bid or greater. The East and Southampton town beaches are aggregated due to the small sample size of respondents with a valid WTP bid.

The number of annual visits to the town beaches in East and Southampton, 1,026,046, is estimated from the information on the CV questionnaire and the number of parking passes sold. The simulated "without project" demand curve, using the sampling distribution, is shown in Table 20 and the 95 percent confidence interval in Table 21 indicates that the 95% confidence in WTP for restoring and maintaining the beaches is plus or minus 10% of the mean value.

Table 20: Sampling Distribution East and Southampton – Use Value from Restoring and Maintaining Beaches

Number of annual visits estimated to be 1,026,046

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
10					-	
10	1.67	9.512	15.88504	0.069931034	71,752	717,525
7	8	0.522	4.176	0.088315124	90,615	160,335
6	5.58	1.45	8.091	0.123934297	127,162	237,555
5	3.76	20.126	75.67376	0.457074427	468,979	1,879,994
4	6	0.638	3.828	0.47392651	486,270	77,810
3	2.48	9.628	23.87744	0.579042649	594,124	377,489
2	2.85	8.352	23.8032	0.683831959	701,643	268,797
1	8.07	2.958	23.87106	0.788920011	809,468	161,738
0	9.96	4.814	47.94744	1	1,026,046	108,289
		58	227.15		Annual Use Value =	3,989,530

Table 21: Sampling Distribution East and Southampton – Use Value from Restoring and Maintaining Beaches, 95% Confidence Interval

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
10.00	0.042099	0.0699310	0.0977635	0	0	0
10.00	0.042099	0.0699310	0.0977635	43,195	71,752	100,310
7.00	0.057348	0.0883151	0.1192821	58,842	90,615	122,389
6.00	0.087974	0.1239343	0.1598946	90,265	127,162	164,059
5.00	0.402709	0.4570744	0.5114398	413,198	468,979	524,761
4.00	0.419434	0.4739265	0.5284191	430,359	486,270	542,182
3.00	0.525162	0.5790426	0.6329233	538,840	594,124	649,408
2.00	0.633087	0.6838320	0.7345769	649,576	701,643	753,710
1.00	0.744385	0.7889200	0.8334547	763,774	809,468	855,163
0.00	1.000000	1.0000000	1.0000000	1,026,046	1,026,046	1,026,046
				3,581,512	3,989,530	4,397,549

B) With Project Use Value

The recreational value for improvements to the East and Southampton town beaches is derived from the beach visitation with the described improvements to the beach (27,695) and the responses to the ‘without project’ WTP (from only respondents having a change in visitation). The ‘with project’ condition statement is identical to that used at Fire Island.

The simulated demand curve and confidence intervals are presented in Table 22 and Table 23. Table 23 indicates that the 95% confidence in WTP for improving the beaches is plus or minus 10% of the mean value.

Table 22: Sampling Distribution East and Southampton – Use Value from Increase in Visits with Restoring and Maintaining Beaches

Number of annual visits estimated to be 27,695

Sample WTP Bids	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
5					-	
5	4	0.992	3.968	0.201462226	5,579.50	27,897
3	10	1.156	11.56	0.788383428	21,834.28	65,019
2	3	0.464	1.392	0.859057677	23,791.60	4,893
0	2	1.388	2.776	1	27,695.00	3,903
		4	19.7		Annual Use Value =	101,713

Table 23: Sampling Distribution East and Southampton – Use Value from Increased Visits with Restoring and Maintaining Beaches, 95% Confidence Intervals

Sample WTP Bid	Lower Limit	Sample	Upper Limit	Visits at WTP bid or greater		
				Lower limit	Sample	Upper Limit
5.00	0.05284575	0.20146223	0.35007870	0	0	0
5.00	0.05284575	0.20146223	0.35007870	1,464	5,579	9,695
3.00	0.63703916	0.78838343	0.93972770	17,643	21,834	26,026
2.00	0.73012759	0.85905768	0.98798776	20,221	23,792	27,362
0.00	1.00000000	1.00000000	1.00000000	27,695	27,695	27,695
				85,954	101,713	117,473

VI. SUMMARY OF ANNUAL BENEFITS, BASELINE SUMMER 1998

The summary of benefits are presented in Table 24.

Table 24: Baseline 1998 Summary of Annual Benefits

	Maintain Existing Beaches (Without Project)	Widen Beaches (With Project)
Fire Island	\$14,390,000	\$3,637,000
Smith Point	659,000	106,000
Shinnecock	115,000	144,000
East & Southampton	3,989,000	102,000
TOTAL	\$19,153,000	\$3,989,000

VII. UPDATE FOR 2018 CONDITIONS

The summary of benefits presented in Table 25 represents the recreation use value if a beach nourishment project were completed for the entire study area. In order to achieve a mutually agreeable plan and to be consistent with the Project Vision Statement, the proposed areas for beachfill were revised, and the duration of renourishment reduced from the formulated alternative at the time of the original recreation analysis. The formulation identified that a maintained beach nourishment plan should be implemented within the communities of Fire Island and Smith Point County Park with a maintenance period of 30 years. The plan would also extend the re-nourishment period for the existing Westhampton Interim Project and would provide a feeder beach to be located at Downtown Montauk. This is a significant reduction in the spatial and temporal project extent and requires adjustments to the potential recreation benefits. In general these adjustments are:

- Updating the price level of the demand curves to FY19 conditions (October 2018 price level and FY 2019 interest rate). This is accomplished by applying the Consumer Price Index (CPI) to each of the WTP amounts on the demand curves;
- Revising the spatial extent of the project. This is accomplished by eliminating the the use and benefit data for the Shinnecock, and Southampton areas and by reducing the estimated usage at Fire Island to exclude users of the National Park Service Beaches that will not receive beach nourishment;
- Evaluating the impact of of the feeder beach at Downtown Montauk in maintaining recreation use and value;
- Calculating the total present value of the recreation benefits for the 30 year re-nourishment period. In order to express this value as an equivalent annual benefit over the 50 year period of analysis, the total present value of recreation benefits is multiplied by the 50 year capital recovery factor.

Updated ferry usage data and park attendance data were collected and evaluated. The most recent ferry data from the Bureau of Transportation Statistics (BTS) was found to be inconsistent and the BTS confirmed that the information had errors and would need to be adjusted. Accordingly the ferry usage is based on a compilation of data from 2006 - 2014. This evaluation indicated that the number of roundtrip ferry transits is approximately

2,421,753, which is 109% of the 2,227,472 roundtrips reported in 1998. Accordingly the 1998 attendance estimate of 3,802,737 and increased visitation estimate of 486,477 have been increased by 109%) to provide a current attendance of 4,134,413. Additionally, information provided by the NPS cites a typical attendance to the Park Service beaches of 650,000 per year. To adjust the usage numbers to exclude the areas not proposed for beachfill, a conservative assumption that 84% of the visitors to Fire Island beaches arriving via ferry use the community beaches and would benefit from the project. Overall beach visitation by ferry passengers is estimated to be 3,484,413 per year and the increase in visitation for these users is estimated to be 445,754 per year.

The updated demand curves reflecting current price levels and use data for visitors reaching Fire Island by Ferry are provided in Table 25 and Table 26. The benefit associated with increased value for existing (without project) beach visits is estimated to be \$24,219,000, an average of about \$5.86 per visit. The benefit associated with increased beach visitation with the project is estimated to be \$6,121,000, an average of about \$11.57 per visit.

As described earlier, beach usage at Smith Point County Park was based on a combination of the reported number of parking passes sold and the visitation information from the surveys. At this time current estimates of beach usage have not been obtained for Smith Point County Park. Since the benefits at this location represent a small proportion of the total project benefits the prior usage estimates have been retained and incorporated into the updated demand curves presented in Table 27 and Table 28. The benefit associated with increased value for existing (without project) beach visits at Smith Point County Park is estimated to be \$1,020,000, an average of about \$7.85 per visit. The benefit associated with increased beach visitation at Smith Point County Park with the project is estimated to be \$164,000, an average of about \$12.62 per visit.

Table 25: Sampling Distribution Fire Island - Use Value from Restoring and Maintaining Beaches

Updated as of 1/11/2016, CPI updated from August/September 1998 – October 2018
 Number of annual visits estimated to be 4,134,413

Original Sample WTP Bids (August to September 1998)	Sample WTP Bids Updated by CPI	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Calcs
\$20.00							
\$20.00	\$30.96	100	0.139	13.90	0.01599	66,089	
\$15.00	\$23.22	11.37	2.36	26.87	0.04688	193,834	1,005,903
\$10.00	\$15.48	4.52	8.76	39.58	0.09240	382,030	2,228,594
\$9.00	\$13.93	60.00	0.28	16.68	0.11158	461,338	652,767
\$7.00	\$10.84	10.80	1.53	16.51	0.13058	539,852	1,549,841
\$5.00	\$7.74	5.62	17.65	99.21	0.24467	1,011,559	2,401,584
\$4.00	\$6.19	3.33	4.45	14.81	0.26170	1,081,984	1,620,402
\$3.00	\$4.64	5.75	23.91	137.47	0.41980	1,735,609	2,180,817
\$2.00	\$3.10	4.66	26.27	122.42	0.56058	2,317,686	3,137,250
\$1.00	\$1.55	7.93	14.73	116.84	0.69495	2,873,220	4,017,761
\$0.00	\$0.00	6.84	38.78	265.26	1.00000	4,134,413	5,423,909
			138.86	869.55		Annual Use Value =	\$24,218,829

Table 26: Sampling Distribution Fire Island - Use Value from Increase in Visits with Restoring and Maintaining Beaches

Updated as of 1/11/2016, CPI updated from August/September 1998 – October 2018
 Number of annual visits estimated to be 528,908

Original Sample WTP Bids (August to September 1998)	Sample WTP Bids Updated by CPI	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Calcs
\$20.00							
\$20.00	\$30.96	20	0.088	1.76	0.03266	17,275	
\$15.00	\$23.22	4.00	0.594	2.38	0.07676	40,597	223,966
\$10.00	\$15.48	2.46	4.928	12.12	0.30173	159,589	774,721
\$9.00	\$13.93	15.00	0.264	3.96	0.37522	198,459	277,129
\$5.00	\$7.74	1.60	7.282	11.65	0.59145	312,822	1,582,924
\$4.00	\$6.19	1.00	2.926	2.93	0.64575	341,542	506,477
\$3.00	\$4.64	2.88	0.836	2.41	0.69043	365,174	546,998
\$2.00	\$3.10	3.43	3.322	11.39	0.90189	477,017	651,856
\$0.00	\$0.00	2.97	1.780	5.29	1.00000	528,908	1,557,171
			22.02	53.88		Annual Use Value =	\$ 5,742,000

Table 27: Sampling Distribution Smith Point County Park - Use Value from Restoring and Maintaining Beaches

Updated as of 1/11/2016, CPI updated from August/September 1998 - October 2018
 Number of annual visits estimated to be 130,061

Original Sample WTP Bids (August to September 1998)	Sample WTP Bids Updated by CPI	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Calcs
\$25.00							
\$25.00	\$38.70	12	0.203	2.44	0.03346	4,352	
\$15.00	\$23.22	10.00	0.261	2.61	0.06932	9,016	103,468
\$10.00	\$15.48	1.88	2.668	5.02	0.13822	17,977	104,463
\$8.00	\$12.38	2.00	1.247	2.49	0.17248	22,433	62,556
\$5.00	\$7.74	2.51	6.989	17.54	0.41347	53,776	176,958
\$3.00	\$4.64	3.33	1.508	5.02	0.48245	62,748	180,379
\$2.00	\$3.10	1.96	3.857	7.56	0.58630	76,255	107,588
\$1.00	\$1.55	4.00	0.638	2.55	0.62136	80,814	121,572
\$0.00	\$0.00	2.37	11.630	27.56	1.00000	130,061	163,218
			29.00	72.79		Annual Use Value =	\$1,020,201

Table 28: Sampling Distribution Smith Point County Park - Use Value from Increase in Visits with Restoring and Maintaining Beaches

Updated as of 1/11/2016, CPI updated from August/September 1998 – October 2018
 Number of annual visits estimated to be 12,811

Original Sample WTP Bids (August to September 1998)	Sample WTP Bids Updated by CPI	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Calcs
\$15.00							
\$15.00	\$23.22	40.00	0.315	12.60	0.37288	4,777	
\$5.00	\$7.74	3.11	1.998	6.21	0.55677	7,133	92,182
\$3.00	\$4.64	2.00	1.575	3.15	0.64999	8,327	23,932
\$2.00	\$3.10	1.45	3.267	4.74	0.79018	10,123	14,280
\$1.00	\$1.55	1.00	0.790	0.79	0.81356	10,423	15,902
\$0.00	\$0.00	6.00	1.050	6.30	1.00000	12,811	17,983
			9.00	33.79		Annual Use Value =	\$164,279

The demand curves for the Shinnecock County Park area were not included in the updates because the project will not construct a nourished beach in the area. The incremental analysis of beachfill measures indicated that traditional beach nourishment at the Shinnecock Reach would not be cost effective and would not be evaluated further.

Initially, the Ponds and Montauk Reaches were excluded from the recreation updates since the plan for both reaches was a small (120,000 cy) feeder scheduled every 4 years. Based on comments on the Draft GRR the feeder beach at Potato Road in the Ponds reach was eliminated and the volume of the feeder beach at Downtown Montauk was re-evaluated to consider the survivability of the fill between 4 year nourishment cycles. Considering the increase in costs associated with the increased feeder beach volume and the importance of a recreation beach to the Downtown Montauk commercial base, the decision was made to incorporate recreation benefits into the updated assessment. Table 29 provides the updated demand curve for the Downtown Montauk area. The annual beach usage of 342,746 was based on data provided by the community and considered hotel occupancy (807 rooms Downtown Montauk and 759 rooms nearby in Montauk), and the 784 spaces available for daily beach parking. The usage is approximately 50% of the communities maximum use estimate and reflects conditions considered more representative of conditions with a feeder beach, rather than a cesigned beachfill including advance fill.

Table 29: Sampling Distribution Downtown Montauk - Use Value from Maintaining Beaches

Updated as of 1/24/2019, CPI updated from August/September 1998 - October 2019

Sample WTP Bids	Sample WTP Bids Updated by CPI	Average Visits by X Respondents	Number of Respondents Willing to Pay Bid	Number of Visits by Respondents at Bid	Percentage of Visits by Respondents at Bid or Greater	Estimated Number of Visits at WTP Bid or Greater	Area Under Demand Curve
10						-	
10	\$15.48	1.67	9.512	15.89	0.06993	23968	
7	\$10.84	8	0.522	4.18	0.08832	30269	125,938
6	\$9.29	5.58	1.45	8.09	0.12393	42477	56,305
5	\$7.74	3.76	20.126	75.67	0.45707	156656	154,129
4	\$6.19	6	0.638	3.83	0.47393	162432	246,974
3	\$4.64	2.48	9.628	23.88	0.57904	198459	279,329
2	\$3.10	2.85	8.352	23.80	0.68383	234374	335,012
1	\$1.55	8.07	2.958	23.87	0.78892	270391	390,688
0	\$0.00	9.96	4.814	47.95	1.00000	342736	474,561
						Annual Use Value =	\$2,062,935

Because the feeder beach in the Recommended Plan does not provide the full beach width assumed in the recreation survey, the recreation value of the beach in each year was estimated as a percentage of the width available compared to the widths revered in the usage survey. The was calculated based on a 6000 foot length of beach at Downtown Montauk and a berm with of 90 feet (about 540,000 sf of berm area) to achieve the benefits estimated in the demand curve. The Recommended feeder beach will add approximately 50 feet of width in addition to a 20 ft existing width. The maximum benefit after nourishment would be 78% of the benefit calculated in the demand curve (420,000 sf / 540,000 sf). With an erosion rate estimated at about 15 feet per year, the recreation benefits in subsequent years were estimated to be, 61%, 45% and 28% of the benefits estimated from the demand curve. This pattern is repeated every 4 years as the feeder beach is renourished. The benefits in each year based on the percentage of a design beach width available are multiplied by the present worth factor and summed to calculate the present value of recreation benefits.

Table 30 provides an estimate of the annual beach use benefits for the 30 yr renourishment and for equivalent annual benefits for the 50 year period of analysis. A total present value of \$648,863000 was calculated using a present worth factor of 19.92. This present worth factor was calculated for 30 years at an interest rate of 2.875% using the following equation:

$$\frac{(1+i)^n - 1}{i(1+i)^n}$$

Where i is the interest rate per interest period
 n is the number of interest periods (years)

Total equivalent annual benefits of \$22,695,000 were calculated using a capital recovery factor of 0.03795. This capital recovery factor was calculated for 50 years at an interest rate of 2.875% using the following equation:

$$\frac{i(1+i)^n}{(1+i)^n - 1}$$

Where i is the interest rate per interest period
 n is the number of interest periods (years)

Table 30: Annual Beach Use Benefits for 30-yr Renourishment and for Equivalent Annual Benefits for the 50-yr Period of Analysis

	Fire Island	Smith Point	Downtown Montauk	Total
Existing Usage	4,134,000	130,000	342,736	4,606,736
Annual Benefits for Existing Users (30-yr Period)	\$24,219,000	\$1,020,000	\$1,048,000	\$26,287,000
Increase in Usage	529,000	13,000	NA	542,000
Annual Benefits, Increased Usage (30-yr Period)	\$6,121,000	\$164,000	\$0	\$6,285,000
Total Benefits	\$30,340,000	\$1,184,000	\$1,048,000	\$32,572,000
Present Value (30-yr Period)	\$604,402,000	\$23,586,000	\$20,875,000	\$648,863,000
Equivalent Annual Benefits	\$22,936,000	\$895,000	\$792,000	\$24,623,000

VIII. BENEFIT UNCERTAINTY

As described in Section V of this report, the use of statistical sampling to develop recreation demand curves allows an estimate of the uncertainty in the benefit estimates. The 95% confidence bands of the benefits for each category are considered a reasonable representation of this uncertainty. Table 31 provides a summary of the upper and lower bounds of the benefit recreation estimates.

Table 31: Uncertainty in Equivalent Annual Recreation Benefits
95% Confidence Intervals

Location	Benefit type	Lower limit	Sample	Upper Limit
Fire Island	Existing Usage	\$ 16,711,000.00	\$ 18,308,660.03	\$ 19,906,000.00
Fire Island	Increase in Usage	\$ 3,659,000.00	\$ 4,627,247.54	\$ 5,595,000.00
Smith Point	Existing Usage	\$ 539,000.00	\$ 771,081.93	\$ 1,003,000.00
Smith Point	Increase in Usage	\$ 95,000.00	\$ 123,977.88	\$ 153,000.00
Downtown Montauk	Existing Usage	\$ 711,000.00	\$ 792,248.88	\$ 873,000.00
	Total	\$ 21,715,000.00	\$ 24,623,216.26	\$ 27,530,000.00