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CONSUMER INVESTMENT IN SHORE PROTECTION

by

Patricia L. Braden

and

Susan R. Rideout

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CONSUMER INVESTMENT IN
SHORE PROTECTION

A Survey of Michigan Shoreline Property Owners

by

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INTRODUCTION

Each year Michigan shoreline property owners experience substantial losses stemming from the effects of shoreline erosion. Inadequate shore protection certainly contributes to this mounting problem, but providing adequate shore protection is a complex process. For example, one person's shore protection can adversely affect another person's property, and some protective actions stimulate erosion of the very property they are meant to protect.¹ Considerable progress has been made in evaluating shoreline protection in terms of cost and performance.² However, little time or effort has been devoted to examining the behavior of shoreline property owners when faced by erosion damage to their land.

A previous proposal, "Private Investment in Shoreland Protection Systems" (Braden, 1977), was designed to examine some preliminary yet crucial factors in decisions involving shoreline protection. With plans to use data collected by the Coastal Zone Laboratory³ this study was charged with the following goals:

- to determine the amount of investment and type of shore protection system most likely to be installed by residential, commercial, and industrial landowners under varying conditions of recession,
- to estimate total private funds available for investment in shoreline protection and the shortfall when compared to total investment requirements,

¹Coastal Zone Laboratory, The University of Michigan, Great Lakes Shoreline Damage Survey: Muskegon, Manistee, Schoolcraft, Chippewa, Alcona, and Huron Counties, Michigan. Prepared for the U.S. Army Corps of Engineers, North Central Division, 1975.

²John M. Armstrong and R. Bruce Denuyl, "An Investment Decision Model For Shoreland Protection and Management," Coastal Zone Management Journal, V. 3, No. 3 (1977), pp. 237-53.

³Coastal Zone Laboratory, Great Lakes Shoreline Damage Survey.

- to identify areas where cooperative regional investment would be feasible,
- to establish a basis for estimating the economic feasibility of State-sponsored, non-structural shoreline protection regionally,
- to identify the information needs of residential, commercial, and industrial landowners so that appropriate technical assistance can be given prior to investment decisions.

The study found that data were unavailable for commercial and industrial landowners, precluding a comparative analysis between various types of land uses. More importantly, however, the data on residential investment in shore protection were found to be inadequate for studying decision behavior of the bulk of shoreline property owners. The current study attempts to bridge gaps in knowledge of the investment behavior of residential shore property owners.

As specified in the proposal entitled "Shoreline Protection Investment Behavior of Residential Property Owners" (Braden, UMSG, 1979, R/CE-1), this study investigates the following:

- the demographic characteristics of shoreline property owners, the physical aspects of their shore property, and factors involved in the acquisition of this land,
- the behavior of shoreline owners when faced with varying degrees of erosion damage,
- the level of formal or informal organization of shoreline property owners and the extent of cooperative shore protective efforts,
- the availability and usefulness of information on shore protection,
- the use of marine contractors in the planning and construction of shore protection devices,
- the costs of various types of shore protection and average investment in protection,
- an assessment of the rationality of investment in shore protection in relation to land value and other considerations.

This study was conceived primarily as exploratory research. Much of the analysis is descriptive in nature to characterize the residential shoreline property owner population and explore shore protective behavior. Some statistical tests are performed to examine relationships among variables and further delineate investment behavior.

Sample Design

Because limited funds were available for conducting the study, it was necessary to restrict coverage to a few selected regions. Both the Coastal Zone Laboratory (CZL) data⁴ and the damage risk assessments made by the Department of Natural Resources⁵ were used to make final selections. Data from CZL studies revealed that there are differences along the coastline of Michigan with respect to both property damage and shore protection undertaken by property owners. Because complete censuses were taken in the 1975 six-county study conducted by CZL, these counties were deleted from the sample to avoid respondent bias. The sampling problem was one of selecting regions of the state which adequately reflected the differences in channel development, damage risk, and probable investment in shore protection systems.

Using damage risk assessment and residential development information, cluster analyses of shoreline counties were conducted, and several revealing relationships emerged. After removing the original six counties used in the 1975 CZL study from consideration (Alcona, Chippewa, Huron, Manistee, Muskegon, and Schoolcraft), as well as five additional counties (Antrim, Benzie, Luce, Ontonagon, and Tuscola) because of sparseness of population and administrative

⁴Coastal Zone Laboratory, Great Lakes Shoreline Damage Survey.

⁵Marty Jannareth, 1974 Erosion Statistics (Lansing, Michigan: Department of Natural Resources, 1974).

problems encountered in identifying property ownerships, four regions emerged from the clustering procedures. These regions are:

- Region One - the southwestern shore of the state facing Lake Michigan,
- Region Two - the northern half of the lower peninsula with shores on both Lake Michigan and Lake Huron,
- Region Three - the southeast shoreline of the state,
- Region Four - the upper peninsula with shores on Lake Michigan, Huron, and Superior.

These regions represent differing levels of both risk of damage and residential development. Since marketing channel development is somewhat dependent upon population density, it is expected that such channels in each region also differ.

Given that the regions represent a reasonable segmentation of the Michigan coastline for purposes of studying shoreline protection, the next step was to decide how many counties--and particularly, which ones--should constitute the second stage sampling frame. Because it is expected that more shore protection activity will occur in areas with adequate channel development and with a definite need for protection, it was decided that primary emphasis should be placed on obtaining accurate information in those regions. If they do not reveal extensive market exchange between channel members and property owners, it is doubtful that other areas lacking residential development and damage risk will engage in extensive private shore protection. Therefore, resources were heavily allocated to study Regions One, Two, and Three. Counties in Region Four have low damage risk ratings and are sparsely populated, with few moderate-size cities located in the vicinity.

Region One can be divided into two sub-areas: those counties located to the north of Muskegon (Oceana and Mason) and those located to the south of Muskegon (Allegan, Berrien, Ottawa, and Van Buren). The four lower southwest Michigan counties were selected to represent the high-risk, high-population

density segment. Muskegon (a medium-sized shoreline city) borders the northern edge of this area, and Holland and the twin cities of Benton Harbor and St. Joseph are located along the coastline to the south. Grand Rapids is a potential inland source for contractor services in this area. The number of sizeable cities in this vicinity and the high-risk environment suggest that a developed market structure may exist here.

Region Three is similar to Region One in terms of its likelihood for channel development. Southeast Michigan comprises approximately fifty percent of the entire state population, and the shoreline regions are densely settled in this area. The five potential counties seem to fall into two groups: those facing Lake Huron and those facing either the Detroit River, Lake St. Clair, or Lake Erie. Wayne and Macomb counties were excluded from further consideration since many of the shoreline properties in these counties are used for commercial or industrial, rather than residential, purposes. Monroe County, the only one facing Lake Erie, was also excluded from the sample frame because of the low risk of erosion damage. This county often experiences heavy damage, but it is usually a result of flooding, which is not the primary concern of this study. Of the two remaining counties, Sanilac was chosen for examination because its entire shoreline borders Lake Huron, making it more susceptible to storm damage, and like St. Clair County its shoreline is heavily developed. Sanilac County is also located near major markets offering construction and engineering services.

Leelanau County was chosen to represent Region Two for several reasons. It is similar to the other counties in the region in terms of damage risk characteristics, even though Region Three faces both Lake Huron and Lake Michigan. It is unique, however, because of its dual facing. Approximately one-half of the shoreline properties directly face Lake Michigan; the remaining

shoreline is located on Grand Traverse Bay. These two areas are believed to have different degrees of susceptibility to damage and to have actually incurred different levels of damage. The areas are similar, however, in market characteristics. Traverse City is the only major city in the region, and both shores are equally accessible to construction intermediaries. For these reasons, Leelanau County provides a natural experimental setting to test the effects of damage risk on the level of shore protection activity.

Region Four is characterized by sparsely populated land areas and relatively low damage risks. Since the counties in this region did not appear to be large enough for meaningful examination, the decision was made to restrict the study to those regions located in the lower peninsula of Michigan. Data from the Coastal Zone Laboratory study indicate that the amounts of erosion damage and protective activity in these counties were relatively small, thus their exclusion should not influence the results of the study. If damage-prone regions do not report substantial channel activity, it is unlikely that Region Four would have an established network for shore protection. In summary, three regions were examined using the following six counties:

Region 1 - Allegan, Berrien, Ottawa, Van Buren

Region 2 - Leelanau

Region 3 - Sanilac

The remaining discussions in this report are restricted to these six counties.

After segmenting the shoreline areas according to damage risk and population density and selecting the counties within these areas to represent the regions included in the study, individual property owners were randomly chosen to participate. This probability sampling procedure allows aggregate

statements to be made about the counties studied. These estimates cannot be extended to include the entire Michigan shoreline since the counties were selected judgmentally. However, they do represent a conservative test of market channel development for shore protection.

The lists of shoreline property addresses supplied by the Coastal Zone Laboratory (with the permission of the U.S. Army Corps of Engineers, North Central Division) were used for dividing each county's shoreline into sequential units to facilitate sampling. Each list contained approximately 80 percent of the property lots in that area. These lots were ones not sampled by the Coastal Zone Laboratory in their ongoing damage assessment project sponsored by the U.S. Army Corps of Engineers, North Central Division. Since the Coastal Zone Laboratory used a random sampling procedure to select its participants, randomly sampling from the reduced lists (net of the CZL participants) also approximates a random sample of the whole.⁶ Therefore, the data can be extrapolated for individual counties and for the sampled counties as a group.

The primary sampling units were defined as property lots. Individuals owning several adjacent lots had a higher probability of selection, but their responses were directed toward their entire property holding. This procedure was necessary for examining the extent of shoreline protection investment in the entire sample and in its subgroupings, since the total investment should vary according to the size of the respective property.

⁶ Leslie Kish, Survey Sampling (New York: John Wiley and Sons, 1965); William G. Cochran, Sampling Techniques (New York: John Wiley and Sons, 1977). 3rd Ed.

The Tax Assessors' offices for the selected counties were contacted to determine home addresses of property owners living outside of the county. Changes in ownership and in addresses of property owners residing in the county were also obtained. After allowing for a ten percent rate of incomplete and incorrect addresses, a random sample was taken using a sampling fraction of one-fourth. Approximately 17.5 percent of the property owners in the six counties were included in the final sample.

Instrument Design and Administration

Several groups of property owners and associations were interviewed to gain insight into important issues not identified when the study plan was formulated. Not only did these unstructured interviews provide new insight into the nature of predicted relationships, they also provided assistance with the design and construction of the questionnaire. Although many key issues were identified when the preliminary hypotheses were formulated, the appropriate means of measuring them had not been decided. Some of these measurement voids were overcome by informally interviewing property owners.

A pretest was conducted to solicit comments regarding questionnaire design and wording. A sample of 50 randomly-selected shoreline residents received the questionnaire prior to full-scale implementation. Their comments and suggestions were incorporated into the final printed questionnaire.

The self-administered questionnaire used in this survey contains seven sections.⁷ Section One solicits personal information from the respondent.

⁷ See Appendix C for sample questionnaire.

For example, demographic information, participation in property associations, and the extent of knowledge of the surrounding area are included in this section. The property acquisition decision is outlined in Section Two. Such factors as the nature of the acquisition, the attributes deemed important in the decision, and the general property condition at the time of acquisition are addressed. Section Three covers the buildings located on the property as well as the decisions to improve the property holding. Characteristics of the property, such as bluff, beach, and vegetation features are solicited in Section Four. Financial characteristics of the property constitute Section Five. Section Six addresses the nature, extent, and perceived causes of damage. The final section is devoted entirely to the dynamics of the shore protection decision and its outcome. The questionnaire was designed to cover the full range of shore-related issues thought to be important to property owners.

The administration of the questionnaire was divided into four phases. Three weeks before the first wave of questionnaire mailings, postcards were sent to the individuals selected to participate, informing them of the nature and purpose of the study and that a questionnaire would be forthcoming. The questionnaire mailing in January, 1979 included (in addition to a copy of the instrument) a cover letter reiterating points made in the postcard message and informing the property owners that they would receive highlights of the results of the study. A second copy of the questionnaire was mailed to the entire sample after several weeks. A follow-up cover letter was included thanking the participants for cooperating. The property owner was encouraged to retain a copy of the questionnaire for use as a guide when considering future shore protection.

A good response to the questionnaire was obtained; Table 1 shows the return rate by county and region.

Table 1

QUESTIONNAIRE RETURN RATE
SIX COUNTY SAMPLE, 1979

County	Number of Questionnaires Sent	Number of Questionnaires Returned	Effective Return Rate
Region One			
Allegan	66	34	51.5
Berrien	164	65	39.6
Ottawa	203	107	52.7
Van Buren	44	27	61.4
Entire Region	477	233	48.8
Region Two (Leelanau)	422	206	48.8
Region Three (Sanilac)	315	130	41.3
Returned without Specifying County		4	
Entire Sample	1,214	573	47.2

The return rate of 47.2 percent much surpassed the expected rate of approximately 25 percent. The number of actual respondents in the final sample represents about 7 percent of the total number of shoreline property owners in the counties involved. In Region One 7.3 percent of total property owners are included, in Region Two 7.6 percent, and in Region Three 5.7 percent.

Analysis

Returned questionnaires were checked for accuracy, the data recorded, coded, keypunched, and verified. The data were then subjected to wild code checks to detect keypunching and respondent-generated errors. Analysis was performed primarily using the Michigan Interactive Data Analysis System

(MIDAS) software. Descriptive statistics (e.g., means, standard errors, and frequency distributions) were computed to establish general trends and relationships. For continuous variables, mean tests, tests of differences between means and analysis of variance were employed to examine for differences among groups. The Chi-square test was used extensively with discrete variables. Various attributes were tested for differences among geographic areas, between users and non-users of protective devices, and among other groups where appropriate.

A special problem arose with respect to the financial variables. Since the properties were purchased and the protective devices installed at various points over a long period of time, cost data reported by respondents were not comparable. To obviate this problem caused by the general inflationary trend, nominal dollar amounts reported by property owners were indexed to 1978 dollars prior to mathematical or statistical manipulation. Since respondents were requested to record the date of property purchase and installation of shore protective devices, it was possible to express each dollar amount in comparable terms using the housing purchase and maintenance and repair commodities and services components of the Consumer Price Index. See Appendix A for a more complete explanation of the indexing process.

Chapter II examines demographic characteristics of the property owners and their shoreline property, and influences on the acquisition decision. Perceptions of erosion damage and general consumer behavior in reaction are studied in Chapter III while the fourth chapter treats in more detail one aspect of consumer behavior: the investment in shore protection. Chapter V examines the rationality of the amounts invested in shore protection with respect to property value. The last chapter notes study highlights and policy suggestions.

II

CONSUMER AND PROPERTY CHARACTERISTICS ALONG THE MICHIGAN SHORELINE

Background knowledge of some of the demographic characteristics of shoreland property owners as well as the physical features of their shoreline property are important in understanding and evaluating the reaction of consumers to erosion damage of their land. Income and age may influence consumers' reaction to erosion and their ability to cope with it. Value of the dwelling and intensity of use are among other factors which may affect the willingness to take action and the extent of investment in shoreline protection. Exposure to the elements, natural protection, character of the shoreline, setback of the dwelling, and other physical features will determine the type of damage incurred and may influence the counter measures taken by property owners.

This chapter surveys some of the factors expected to influence the behavior of consumers in dealing with shoreline erosion damage. Characteristics such as age, income, education level, and residency are examined for the total sample and stratified by county and region. Factors influencing the decision of sample respondents to acquire the property, intensity of use, dwelling and property improvements as well as physical aspects of the property are also noted as background to the study of consumer behavior.

Shoreland Property Owners

Demographic characteristics of sample respondents are presented here for the sample as a whole and grouped by county and region in the following tables. Some characteristics show no significant differences among groups while for others real variations may be noted among counties. Table 2 displays data relating to age, residency, education, and income.

Table 2

DEMOGRAPHIC CHARACTERISTICS OF MICHIGAN SHORELAND
PROPERTY OWNERS, SIX COUNTY SAMPLE, 1979

County	Median Age ^a	Permanent Shoreline Residents (Percent)	Michigan Residents (Percent)	With High School or Less Education (Percent)	Median Income ^a (Dollars)
Region One					
Allegan	64	23.5	47.1	6.8	30,000
Berrien	60	57.8	64.6	11.0	28,600
Ottawa	59	28.0	86.0	14.3	30,700
Van Buren	60	29.6	74.1	11.1	30,000
Entire Region	60	35.7	73.0	11.7	29,800
Region Two (Leelanau)					
	57	24.3	76.2	14.7	30,200
Region Three (Sanilac)					
	59	20.0	96.1	39.4	20,800
Entire Sample	59	28.0	79.4	18.7	27,700

^a Approximated by interpolation within the median range of grouped data.

Age and Residency

With a median age of approximately 59 years, sample shoreline property owners are older than the general population of homeowners. For the majority of the respondents (some 72 percent) the shoreline property represents a second or vacation home, very likely acquired after establishment of the primary home. Although there is no notable difference in property-owner age among the counties studied, there are significant differences in the distribution of those who are permanent residents. As shown in Table 2, about 28 percent of the total respondents are permanent residents of their shoreline properties, ranging from 20 percent in Sanilac County on Lake Huron to nearly 58 percent in the more populous Berrien County on Lake Michigan. The location of the cities of Benton Harbor and St. Joseph on Lake Michigan in Berrien County probably accounts for the higher-than-average percentage of permanent residents there. On the other hand, Sanilac is a more remote county with no large centers of population.

Sample percentages of property owners who are Michigan residents are also shown in Table 2. For the sample as a whole, 79.4 percent of the respondent property owners are residents of the State of Michigan. However, there is a wide range in the proportions among counties; less than half (47.1 percent) of the property owners surveyed in Allegan County are Michigan residents while nearly all (96.1 percent) of those in Sanilac County reside permanently somewhere in Michigan.

Education and Income

Shoreline property owners as represented in this sample are rather well educated. Of the 561 who responded to the question on education, 13 had completed primary school only while 173 had completed an advanced

degree. Table 2 shows the percentage of shore property owners who have a high school or less education--18.7 percent for the sample as a whole. This percentage was 39.4 in Sanilac County, however, and only 6.8 in Allegan County where half of the respondents had done graduate work beyond the bachelor's degree.

The estimated median income for the sample as a whole is approximately \$27,700. Again Sanilac County stands out with a lower median income of approximately \$20,800; the other counties all cluster around a median income of \$29,000 to \$30,000. When respondents are grouped by retirement status, those retired show a median income of approximately \$16,200 while those who are still working have a median income of about \$34,600. This difference may be a partial reason for the relatively low median income in Sanilac County which has the largest proportion of residents who are retired, as will be noted in the next section.

Occupation

Table 3 shows the present occupation of sample respondents by county. Of the entire sample over half (52.3 percent) are in white collar occupations including medicine, law, engineering, teaching, management, finance and other careers; 11.9 percent are self-employed or housewives, 3.2 percent are in blue collar occupations, and 32.6 percent are retired. Berrien, Ottawa, Van Buren and Leelanau Counties show the largest percentages of white collar workers, slightly above the sample average. The largest percentage of self-employed (21.4) is found in Allegan County, while Sanilac shows the largest proportion of both blue collar and retired persons.

Table 3
 PRESENT OCCUPATION OF MICHIGAN SHORELINE
 RESIDENTS, SIX COUNTY SAMPLE, 1979

County	Percentage				Total ^a	Sample Size
	Blue Collar	White Collar	Self-employed or Housewife	Retired		
Region One						
Allegan	0.0	42.9	21.4	35.7	100.0	28
Berrien	0.0	57.1	17.5	25.4	100.0	63
Ottawa	4.0	58.0	9.0	29.0	100.0	100
Van Buren	0.0	56.0	12.0	32.0	100.0	25
Entire Region	1.9	55.6	13.4	29.2	100.0	216
Region Two (Leelanau)	2.1	57.2	12.4	28.4	100.0	194
Region Three (Sanilac)	7.6	38.1	8.5	45.8	100.0	118
Entire Sample	3.2	52.3	11.9	32.6	100.0	528

^a Rows may not sum to totals because of rounding.

Shoreland Property Acquisition

Factors involved in the acquisition of shoreland property may affect later decisions about property improvements and measures considered for shoreline protection. This section presents data relating to the property acquisition such as original value, means of acquisition, intended use, and factors affecting the decision to acquire shoreland property.

Property Value

The amount of funds which a property owner has invested in purchasing his shoreland property may affect his willingness to invest additional resources in protecting against erosion. Table 4 shows the average purchase price of respondents' shore property and the mean number of years the property has been held.

Table 4
PROPERTY ACQUISITION VALUE AND YEARS HELD
SIX COUNTY SAMPLE, 1979

	Mean Market Value at Acquisition	Number at Acquisition	Mean Years Held	Mean Acquisition Value 1978 Dollars	Number at 1978 Dollar Value
Region One	\$23,080	205	19.1	\$35,060	163
Region Two	19,540	181	14.2	25,235	162
Region Three	16,295	144	17.1	31,549	86
Entire Sample	20,251	500	16.8	30,452	411

The first column of Table 4 shows the mean property value at acquisition in nominal dollars (that is, in dollars at the time of each purchase). The averages in this column are not very meaningful because dollars of different values are added together in computing the means. As can be noted in the third column, the properties have been held for differing periods of time, and the purchase values in nominal dollars are not comparable.

To alleviate this problem, the housing purchase component of the Consumer Price Index was used to inflate all purchase prices to 1978 dollars; the resultant inflated values are shown in the fourth column of Table 4.⁸ In

⁸For a more detailed explanation of the inflating process, see the Appendix.

the inflating process all cases in which the property was purchased before 1953 had to be eliminated because comparable index figures were not available before that time. The reduction in the data set can be noted by comparing the "Number" columns following each value column.

The effect of making different nominal values comparable through indexing can be noted by comparing the relative positions of Regions 2 and 3 in the two value columns. Although Region 1 shows the highest acquisition value in both nominal and 1978 dollar terms, Region 2 is second highest in nominal dollars but third in 1978 dollars. The reason for the change in position is related to the relative number of years the properties have been held. Region 2 is the newest and latest developed of the three areas; hence, the nominal average purchase price is higher than that in the older Region 3. However, when acquisition values are all inflated to 1978 dollars, Region 3 shows a higher mean purchase price.

In 1978 dollars, the mean acquisition value for all shore properties in the sample was \$30,452, representing some \$12.5 million investment for the 411 properties in the sample which were purchased after 1952. Region 1 properties averaged \$35,060 in 1978 dollars, Region 2--\$25,235, and Region 3--\$30,452.

Means of Acquisition

Table 5 shows the means by which respondents acquired their shoreland properties. In general, nearly half purchased the property directly from the original owner without the use of a realtor. This direct approach to acquisition was more common in Region 1, particularly Allegan County, than in the other regions. For the sample as a whole, about 30 percent of the property owners acquired their land through a realtor although this method of acquisition was much more common in Sanilac County where 45.7 percent of the respondents used the services of a realtor. Developers were of notable importance only in Ottawa and Leelanau Counties where approximately 10 percent of the properties were acquired as part of a development. Inheritance as a means of acquisition was more prevalent in Region 1 than in the other regions.

Approximately one-third (32.7 percent) of the shoreline property owners obtained a loan to acquire their properties. However, in Van Buren County 55.6 percent of the respondents reported borrowing funds to obtain their properties and 42.9 percent in Berrien County did so. Of the 169 property owners who financed their purchases, half were granted funds by banks, 16.5 percent by savings and loan companies or credit unions, 18.9 percent obtained land contracts, and 14.2 percent used personal loans or other means.

Factors in the Property Decision

Respondents to the questionnaire were asked to assign percentage weights to purposes for which the shoreline property was originally intended. The average weights assigned for the whole sample are as follows: recreational use--54 percent, permanent residence--32 percent, long term investment--10 percent, source of annual income--2 percent, and other purposes--2 percent.

Table 5
 MEANS OF ACQUIRING SHORELAND PROPERTY
 SIX COUNTY SAMPLE, 1979

County	Percentage							Sample Size
	Individual Owner	Realtor	Developer	Gift	Inheritance	Other	Total ^a	
Region One								
Allegan	58.8	20.6	0.0	2.9	14.7	2.9	100.0	34
Berrien	41.5	30.8	3.1	3.1	21.5	0.0	100.0	65
Ottawa	54.2	23.4	10.3	1.9	10.3	0.0	100.0	107
Van Buren	51.9	22.2	7.4	0.0	11.1	7.4	100.0	27
Entire Region	51.1	24.9	6.4	2.1	14.2	1.3	100.0	233
Region Two (Leelanau)	47.1	26.7	9.7	5.3	8.3	2.9	100.0	206
Region Three (Sanilac)	44.2	45.7	1.6	1.6	5.4	1.6	100.0	129
Entire Sample	48.1	30.3	6.5	3.2	10.0	1.9	100.0	568

^aRows may not sum to totals because of rounding.

Property owners were further requested to rate a list of factors on an importance scale of 1 to 7 in which 1 was labeled "not important," 4 "somewhat important," and 7 "very important." Table 6 shows the mean ratings given to the factors by respondents. The factor given by far the highest mean rating by the entire sample was scenic view; this attribute received a uniformly high rating in all regions. Other factors given mean ratings with a value above 4 (in descending order) were: condition of property, quality of neighborhood, feasibility of location for eventual permanent residence, quality of neighbors, condition of dwelling, accessibility to permanent residence, and features of dwelling.

Analysis of variance tests were performed among subsamples to detect any regional differences in the way in which respondents rated the importance of the attributes. However, probability levels suggest real differences exist in the mean ratings for only four factors, and of these only one, accessibility to permanent residence, was assigned a mean rating above the midpoint of the scale by any subsample. Property owners in Region 3 gave a mean rating of 5.58 to accessibility to permanent residence and those in Region 1 assigned a mean rating of 4.84 to this factor; respondents in Region 2 gave only a 3.97 to this attribute. The proximity of the Detroit area to Region 3 and of the Chicago and southwest Michigan centers of population to Region 1 probably generated these higher mean ratings. Region 2 is relatively more remote from large centers of population. Otherwise, respondents from the entire sample concurred in rating highly factors relating to the neighborhood and to the property itself and found less important accessibility to sports and entertainment. This relatively stronger emphasis in selecting the property on factors relating to the property and its condition may tend to dispose the shoreline property owners to take protective action when shoreline erosion occurs.

Table 6

MEAN IMPORTANCE RATINGS OF SELECTED ATTRIBUTES WHEN ACQUIRING PROPERTY
SIX COUNTY SAMPLE, 1979

Attribute	Mean Rating ^a			Probability Level ^b	
	Entire Sample	Region 1	Region 2		Region 3
Scenic View	6.53	6.52	6.56	6.51	.87
Condition of Property	5.78	5.66	5.87	5.83	.50
Quality of Neighborhood	5.51	5.53	5.64	5.26	.24
Feasibility of Location for Eventual Permanent Residence	5.25	5.27	5.19	5.30	.89
Quality of Neighbors	4.99	5.07	5.04	4.77	.45
Condition of Dwelling	4.89	4.91	4.85	4.91	.97
Accessibility to Permanent Residence	4.72	4.84	3.97	5.58	.00
Features of Dwelling	4.32	4.51	4.28	4.01	.26
Accessibility to Wilderness Areas	3.37	3.30	3.83	2.67	.00
Accessibility to Preferred Fishing Spots	2.89	2.27	3.30	3.26	.00
Accessibility to Dining	1.82	1.81	1.85	1.79	.93
Accessibility to Preferred Hunting Spots	1.69	1.21	2.06	1.88	.00
Accessibility to Night Life	1.43	1.35	1.50	1.48	.46

^a Attributes rated on a 7 point scale: 1 = not important, 7 = very important.

^b In an analysis of variance test among regions, the probability that a difference as large as that displayed could occur by chance.

Property Usage

Intensity of use of shoreline property may affect the propensity of the owners to take protective action against erosion damage. The proportion of property owners who are permanent shoreline residents was noted in Table 2. For the entire sample, approximately 30 percent of the non-permanent residents reported using the property during all four seasons. In only three counties, all in Region 1, was there any notable deviation from this percentage. Some 53.8 percent of the non-permanent resident property owners in Allegan County and 47.4 percent in Van Buren County reported year-round use; on the other hand, only 18.4 percent use the property during all four seasons in Ottawa County.

Non-permanent residents were asked to estimate the number of times per year they used their shoreline property and the total number of days per year it was used. Respondents in Regions 1 and 3 reported an average number of uses per year of approximately 21 times while those in Region 2 estimated that they used their properties about nine times per year. Over the entire sample, respondents reported using their properties for an average 96 days per year; there were no significant regional differences in the number of days of use per year. Apparently non-permanent residents in Regions 1 and 3 make more frequent, shorter trips than those in Region 2. This is consistent with the closer proximity of these regions to large population centers. Respondents also estimated that their properties were used an average 18.5 days per year by persons outside of the family.

Shoreland Property Characteristics

Physical Characteristics

Topographic features of shoreland property help to determine the degree and type of erosion damage to which the land is susceptible and the type of

protective action which is appropriate. Table 7 indicates some of the physical characteristics of the sample respondents' shore property.

Table 7
TYPE OF SHORELAND PROPERTY
SIX COUNTY SAMPLE, 1979

County	Percentage of Properties				Total ^a
	Bluff	Dune	Bluff and Dune	Marsh	
Region One					
Allegan	91.2	8.8	0.0	0.0	100.0
Berrien	61.9	27.0	9.5	1.6	100.0
Ottawa	54.3	43.8	1.9	0.0	100.0
Van Buren	62.0	33.6	3.9	0.4	100.0
Region Two (Leelanau)	60.4	28.4	1.2	10.0	100.0
Region Three (Sanilac)	95.2	4.8	0.0	0.0	100.0
Entire Sample	69.4	25.0	2.1	3.4	100.0

^aRows may not sum to totals because of rounding.

The majority of the properties in the entire sample are bluff in nature, but two of the counties, Sanilac and Allegan, stand out as being made up primarily of bluff land. The highest proportion of dune land is found in Ottawa and Van Buren Counties. Marshy properties are notable only in Leelanau County.

Average dune and bluff heights for those types of properties and average lot dimensions are shown in Table 8 by region. The greatest elevation, both in dunes and bluffs, is shown in Region 1, along southern Lake Michigan. Lower elevations are more common along Lake Huron in Region 3.

Shorefronts tend to be the longest in Region 2 where beaches average about 172 feet in length. Average beach depth is the greatest in Region 1 at about 91 feet. There are no significant regional differences in the total depth of lot which averages approximately 545 feet for the sample as a whole.

Table 8

PROPERTY CHARACTERISTICS
SIX COUNTY SAMPLE, 1979

	Average (in feet)				
	Length of Shorefront	Depth of Beach	Depth of Lot	Height of Dune	Height of Bluff
Region One	147.9	90.7	592.8	55.1	54.1
Region Two	171.8	40.8	463.7	12.6	40.2
Region Three	104.5	52.7	586.5	10.3	26.4
Entire Sample	146.7	65.2	544.9	37.9	41.3

About 77 percent of the properties owned by respondents have exposure to the open body of one of the Great Lakes; however, this proportion varies from nearly 100 percent in Regions 1 and 3 to only 36 percent in Region 2 where nearly two-thirds of the properties face on Grand Traverse Bay. Nineteen percent of the respondents reported that natural barriers protected their properties from full wave action. In Region 3 only nine percent of the properties enjoyed such natural protection. The most common type of natural protection reported in all regions was the presence of sandbars.

Vegetation can offer a deterrent to erosion. Various types of vegetation were described by respondents, some natural and some planted. Grass

grows on about 38 percent of the beaches and shrubs on about 30 percent. Twenty-eight percent of respondents reported small trees on their beaches and 22 percent reported large trees there. More vegetation was described on the dunes, bluff or marsh sections of the properties where 82 percent reported grass, 77 percent shrubs, 74 percent small trees, and 55 percent large trees.

Bare ground is much more susceptible to erosion than that covered with vegetation. Table 9 shows the proportions of various property sectors not covered by vegetation.

Table 9

PRESENCE OF BARE GROUND
SIX COUNTY SAMPLE, 1979

<u>Percentage of Property Sectors with Bare Ground</u>			
<u>County</u>	<u>Beach</u>	<u>Bluff, Dune or Marsh</u>	<u>Inland Property</u>
Region One			
Allegan	96.6	76.2	27.8
Berrien	85.2	43.6	20.6
Ottawa	93.2	30.6	21.2
Van Buren	94.1	57.1	26.7
Entire Region	91.5	43.2	22.6
Region Two (Leelanau)	87.6	37.3	26.5
Region Three (Sanilac)	88.3	29.3	5.5
Entire Sample	89.3	38.1	20.1

As might be expected, the great majority of beach lands have no vegetative cover, and there were no significant county or regional differences in the distribution. However, 38 percent of the respondents reported areas of

bare ground in their bluff, dune, or marsh property sectors, ranging from about 30 percent in Sanilac County to over three-quarters in Allegan County. About 20 percent of the inland properties contained sections of bare ground.

Structures

The presence and condition of dwellings on shoreland property affects the value of the property to the owners and will likely influence their willingness to take protective action in the face of erosion damage. Table 10 shows the proportion of shore properties with dwellings and indicates whether the structure was built by the present owner or acquired with the property.

Table 10

DWELLINGS ON SHORELAND PROPERTIES
SIX COUNTY SAMPLE, 1979

County	Percentage			Total ^a
	Dwelling on Property at Acquisition	Dwelling Built After Acquiring Property	No Dwelling on Property	
Region One				
Allegan	58.1	41.9	0.0	100.0
Berrien	44.8	37.9	17.2	100.0
Ottawa	44.4	41.4	14.1	100.0
Van Buren	44.0	44.0	12.0	100.0
Entire Region	49.7	43.7	13.6	100.0
Region Two (Leelanau)	31.3	46.9	21.9	100.0
Region Three (Sanilac)	52.1	37.8	10.1	100.0
Entire Sample	42.2	42.4	15.5	100.0

^a Rows may not sum to totals because of rounding.

There are dwellings on about 85 percent of the sample shoreland properties; all of the properties in Allegan County (Region 1) contain a dwelling while about 22 percent of the lots in Leelanau County (Region 2) are vacant. Of the dwellings now in place, about half were built by the present owners and half were already on the property at acquisition. Nearly 60 percent of the housing structures in Leelanau County were built by the present owners.

About half of the owners of vacant lots plan to construct a permanent housing structure on the land sometime in the future. Some 61.0 percent of such respondents in Region 2 and 58.3 percent in Region 3 reported construction plans; however, only 24 percent of the owners of shoreland property with no existing dwelling in Region 1 plan eventually to put up housing.

Table 11 shows the average age of the dwellings, the setback from the bluff or dune edge, and a rating of the condition of the dwelling as seen by respondents.

Table 11
AVERAGE DWELLING AGE, SETBACK, AND CONDITION
SIX COUNTY SAMPLE, 1979

	Average Age of Dwelling (in years)	Average Setback (in feet)	Average Rating of Condition ^a
Region One	31.1	132.0	4.25
Region Two	23.5	112.5	4.52
Region Three	27.6	124.0	4.12
Entire Sample	27.7	123.8	4.31

^aRated by respondents on a five point scale; 1 = poor, 5 = excellent.

Sample dwellings averaged about 28 years of age; those in Region 1 showed the oldest mean age--31.1 years. Dwellings in Region 2, the most northerly region, averaged only 23.5 years of age. The average setback from the edge of the bluff or dune was 123.8 feet; there were no statistically significant regional differences in setback.

On the average respondents across the entire sample perceived their houses as being in very good condition, 4.31 on a five point scale. As might be expected, considering the respective ages of the dwellings, respondents in Region 2 on the average rated the condition of their houses the highest of any region. About two-thirds of the property owners reported that they had undertaken major improvements on their dwellings in the past, and 46.4 percent plan to invest in major improvements in the future. The highest proportion--70.8 percent--of respondents planning future improvements occurred in Van Buren County (Region 1).

Erosion Damage at Acquisition

Some of the shoreland property owners were aware of the possibility of future erosion damage at the time of acquisition because of the presence of visible erosion damage and the existence of shore protection devices on the property and on neighboring land, as shown in Table 12. About 24 percent of the respondents noticed visible erosion damage to their properties at the time of acquisition, and about 11 percent of the properties already had shore protection devices in operation. Chi square tests performed on the distributions indicate that there were no statistically significant differences at the .05 level in the distribution of the presence of erosion damage at acquisition among counties. However, there are real differences among counties in the likelihood of shore protection

Table 12

EROSION DAMAGE AND SHORE PROTECTION DEVICES AT ACQUISITION
SIX COUNTY SAMPLE, 1979

County	Percentage at Acquisition		
	Visible Erosion Damage	Shore Protection Device	Neighbor With Shore Protection Device
Region One			
Allegan	14.7	21.2	17.6
Berrien	21.5	7.7	14.1
Ottawa	26.2	10.7	13.5
Van Buren	30.8	7.4	14.8
Entire Region	23.7	11.0	14.4
Region Two (Leelanau)	20.8	6.5	14.5
Region Three (Sanilac)	28.3	18.1	25.6
Entire Sample	23.7	11.0	17.0

devices in operation at the time of acquisition. The probability of such devices was the greatest in Allegan and Sanilac Counties and the least in Leelanau County. Seventeen percent of the respondents noted that at the time of acquisition of their properties, shoreline neighbors had protection devices in operation, but there were no significant county differences in the frequencies.

III

CONSUMER BEHAVIOR OF MICHIGAN INVESTORS IN SHORE PROTECTION

Owners of shoreland property react in a variety of ways to perceived erosion damage or threat of damage. They may erect individual protective devices, join in collective action with their neighbors, attempt to influence governmental policy, sell their property, or do nothing at all. This chapter is concerned with respondents' perceptions of damage incurred and their reactions in terms of general type of actions taken.

Perceived Damage

The antecedent to a consumer's undertaking protective shoreline action is erosion damage, either perceived or threatened. The degree and type of damage, its rate of change, its severity relative to that occurring on neighbors' lands, and perceived causes, as judged by the property owners, are all probable influences on consumer reaction in the form of protective measures they may (or may not) take. Respondents were questioned on their perceptions of the erosion damage to their shoreline properties.

Table 13 shows the percentages of respondents, by county and region, who have experienced erosion damage to their properties since acquisition. Over 91 percent of the shoreline property owners in Allegan County have perceived erosion damage, and Region 1 appears to be the most heavily damaged. The counties of Region 1 may be treated as a single unit in terms of erosion damage; chi square tests performed on the distributions indicated real differences among the six counties and among the three regions but no significant differences (at the .05 level) among counties within Region 1. Altogether approximately two-thirds of the property owners

experienced erosion damage; the least affected area is Region 2 where only 43.6 percent reported damage. In terms of numbers affected, 380 reported erosion damage, including 196 in Region 1, 88 in Region 2, and 96 in Region 3.

Table 13

EROSION DAMAGE PERCEPTION
SIX COUNTY SAMPLE, 1979

County	Experienced Erosion Damage	
	Percent	Number
Region One		
Allegan	91.2	31
Berrien	80.6	50
Ottawa	88.8	95
Van Buren	76.9	20
Entire Region	85.6	196
Region Two (Leelanau)	43.6	88
Region Three (Sanilac)	73.8	96
Entire Sample	67.7	380

Types of Damage

Beach erosion. As shown in Table 14, 92.3 percent of property owners with erosion damage reported beach erosion, including over 98 percent in Region 1. The smallest proportion (83.5 percent) experiencing beach erosion occurred in Region 3. Nearly 70 percent of those with beach erosion felt that the severity had increased since acquisition of the property.

Only in Leelanau County was the proportion experiencing increased beach erosion notably below the sample average. Since the respondents acquired their properties at varying times, their ranges of estimation are different; however, the data indicate that a majority of those with beach erosion do see a problem increasing in severity with time.

Table 14

BEACH EROSION
SIX COUNTY SAMPLE, 1979

County	Respondents With Erosion Percent with Beach Erosion	Respondents With Beach Erosion Percent			All Respondents Mean Change in Beach Depth (feet) Summer Conditions
		Increasing	Decreasing	Same	
Region One					
Allegan	100.0	75.9	6.9	17.2	
Berrien	97.9	82.6	2.2	15.2	
Ottawa	97.9	70.9	18.6	10.5	
Van Buren	100.0	73.7	10.5	15.8	
Entire Region	98.4	75.0	11.7	13.3	-48.3
Region Two (Leelanau)	87.2	52.8	16.7	30.6	- 7.8
Region Three (Sanilac)	83.5	71.4	14.3	25.7	-13.9
Entire Sample	92.3	69.3	13.4	17.4	-26.8

One measure of the severity of beach erosion is shown in the last column of Table 14, the average change in beach depth⁹ from the time of acquisition to the present. Shoreline property owners in Region 1 have lost an average 48.3 feet, those in Region 2 some 7.8 feet, and those in Region 3 an average 13.9 feet. One caution should be observed in interpreting this

⁹Distance between the water's edge and the foot of the bluff.

data. The respondents acquired their properties at different times and thus are using different ranges of time to measure change in beach depth. This variation may affect the average because of the cyclic rise and fall of the Great Lakes. Those property owners who reported having experienced erosion damage showed an average 38 foot loss in depth of beach while those who reported no erosion damage averaged a 1.5 foot gain.

Bluff erosion. Table 15 presents data pertaining to bluff erosion.

Table 15

BLUFF EROSION
SIX COUNTY SAMPLE, 1979

County	Percent of Respondents with Bluffs and Erosion Damage				Percent of Respondents with Bluff Erosion		
	Bluff Erosion	Change in Bluff Angle			Increasing	Decreasing	Same
		Steeper	Less Steep	Same			
Region One							
Allegan	89.7				84.6	3.8	11.5
Berrien	97.1				80.0	0.0	20.0
Ottawa	84.6				68.7	16.4	14.9
Van Buren	84.6				78.9	5.3	15.8
Entire Region	89.1	49.2	6.9	43.8	75.7	8.6	15.8
Region Two (Leelanau)							
	81.8	17.0	14.9	68.1	47.6	4.8	47.6
Region Three (Sanilac)							
	92.7	31.8	20.0	48.2	66.7	13.3	20.0
Entire Sample	88.6	37.8	12.6	49.6	68.8	9.3	21.9

Over the entire sample, 88.6 percent of bluff properties described by owners as having sustained some type of erosion damage, suffered bluff erosion. As measured by change in bluff angle, the damage appears to have been the most severe in Region 1 where nearly half of the respondents reported that

the angle of the bluff is steeper now than it was at the time of acquisition. Erosion can make a bluff angle steeper by eating away at the foot of the bluff, thus increasing the angle. A larger proportion (over three-quarters) of respondents in Region 1 also believe that their bluff erosion problem has become increasingly severe since they acquired their properties.

Damage to Dwelling and Vegetation. Some property owners have suffered damage to their dwelling structures and loss of yard vegetation caused by erosion. Table 16 presents data on this type of loss.

Table 16

DAMAGE TO DWELLING AND YARD VEGETATION
SIX COUNTY SAMPLE, 1979

County	Respondents With Erosion Damage	
	Percent with Damage to Dwelling	Percent with Loss of Yard Vegetation
Region One		
Allegan	13.8	32.1
Berrien	26.2	43.9
Ottawa	14.3	18.3
Van Buren	11.8	43.8
Entire Region	16.9	29.3
Region Two (Leelanau)	3.0	17.6
Region Three (Sanilac)	4.0	32.5
Entire Sample	10.8	27.6

Some 10.8 percent of the dwelling structures suffered erosion-related damage, and 27.6 percent of the property owners with erosion damage reported some loss of yard vegetation. Dwelling structures were most likely to be

damaged in Region 1, particularly in Berrien County. A very small percentage of those in Regions 2 and 3 sustained structural damage. With respect to yard vegetation, properties in Berrien and Van Buren Counties suffered the greatest losses.

Comparative Damage

Respondents were asked to assess the relative damage to their properties with respect to that suffered by other shoreline properties in the county on a seven point scale with 1 labeled as "much less," 4, the midpoint, labeled as "about the same," and 7 as "much more." The mean rating for the entire sample was 3.40; that is, on the average, respondents believed that their properties were less damaged by erosion than those of other property owners in their counties. In no region was the mean rating greater than 4.0--"about the same." The respondents in Region 2 gave the lowest mean damage rating, 2.99, or "somewhat less" than other property owners. Sample property owners also rated their damage on the same scale with respect to that incurred by upcurrent and downcurrent neighbors. The results were very similar; in all cases respondents, on the average, believed that their damage was slightly less than that of their neighbors.

Natural barriers such as sandbars, reefs, and islands apparently give some comparative protection from erosion damage. Approximately 56 percent of the properties which are afforded some protection by natural barriers suffered erosion damage as compared with about 71 percent of those with no such protection. The experience of property owners in Leelanau County where some properties face Lake Michigan and others face Grand Traverse offers some evidence of the comparative protection given by a large bay. Some 52.9 percent of those facing Lake Michigan have suffered erosion damage as compared to only 36.5 percent of those facing Grand Traverse Bay.

Perceived Causes of Damage

The property owner's perception of the cause of erosion damage may influence the degree and type of protective action taken. Accordingly, respondents who reported erosion damage were queried as to the perceived causes of the damage. Table 17 shows the distribution of the responses. A large majority of respondents in all regions cited the first three causes, wave action, water levels, and wind action. Ground seepage was the most prevalent in Region 3 where half of the respondents noted it as a problem. About 38 percent of all respondents with damage perceived ice formations and the spring thaw as causes; however, ice formations were more commonly cited in Regions 2 and 3 and the spring thaw in Region 3. About 22 percent of the respondents felt that upcurrent neighbors' shore protection devices partially caused their erosion damage, and 10 percent thought that down-current neighbors' devices were at fault.

Table 17

PERCEIVED CAUSES OF EROSION DAMAGE
SIX COUNTY SAMPLE, 1979

Perceived Cause	Percentage of Respondents with Damage Citing Cause			
	Region 1	Region 2	Region 3	Entire Sample
Wave Action	96.7	89.8	94.4	94.4
Water Levels	98.9	90.9	89.5	94.7
Wind Action	87.1	72.8	78.2	81.5
Ground Seepage	31.5	12.3	50.0	31.4
Ice Formations	30.5	44.0	44.9	37.9
Spring Thaw	39.7	24.3	48.5	37.8
Upcurrent Neighbors' Shore Protection	25.0	7.5	29.2	21.6
Downcurrent Neighbors' Shore Protection	13.6	3.0	9.7	10.0
Absent or Inadequate Shore Protection	61.2	38.5	74.3	59.1

The last cause listed is interesting in that it is not a natural cause but the lack of human action. Fifty-nine percent of the respondents with damage felt that absent or inadequate shore protection was a partial cause of their problem; nearly three-quarters of those in Region 3 held this opinion. Seeing the lack of shore protection as a contributing factor implies that these respondents view shore protection devices as at least a partial solution to their erosion problems. There is uncertainty, however: a larger percentage of respondents checked "don't know" to this cause than to any other. A need for more complete information may be indicated here.

Reactions to Damage

Consumers, having realized damage to their properties, react in a number of ways ranging from doing nothing at all through taking various degrees of protective action to sale of property. This section is concerned with the general form of reaction of property owners who have perceived erosion damage to their shoreline properties. Factors influencing these reactions will be examined.

Trips to Check Damage and Insurance

Prompt repair of erosion damage caused by storms can often limit the severity of the loss and reduce the probability of cumulative damage. Year-round residents are in a position to observe damage and make repairs, but others must make special trips from their permanent homes to check for damage and arrange for repairs. About 43 percent of the non-permanent residents who had sustained some erosion damage to their properties in the past reported making special trips to their shoreline properties to check for possible storm damage. Over 58 percent of those in Region 3 made such trips compared to only 33 percent in Region 2. The smaller proportion

of property owners making inspection trips in Region 2 may be influenced partially by lesser degree of erosion damage as noted earlier and partially by the greater distance of Leelanau County from heavy concentrations of population. Conversely, the proximity of Sanilac County (Region 3) to the Detroit area may account in part for the larger proportion of non-permanent residents making trips to check for damage.

Another way in which shoreline property owners can reduce the risk of financial loss from erosion damage is through insurance. Property owners may purchase policies from private insurance firms although premiums may be quite high if the danger of erosion damage is great. Only five respondents, however, reported having been refused insurance because their property was located on the shoreline. Another possibility open to shoreline residents is federal Flood Insurance for damage caused by high waters. Table 18 indicates the insurance status of properties included in the sample.

About 80 percent of all respondents hold insurance of some type; policies issued by private firms are by far the most common. Leelanau County shows the highest proportion of uninsured properties (31.7 percent) while in Allegan County nearly 90 percent of the respondents hold some type of insurance on their properties. It is evident that property owners who have experienced erosion damage do attempt to avoid some of the risk of financial loss through insurance. With respect to both private and flood insurance, the frequency of those insuring their properties is significantly greater among those who reported erosion damage than among those who did not. Some 78.1 percent of respondents with erosion damage hold private insurance as compared with 64.3 percent of those who had perceived no damage.

Table 18

INSURANCE STATUS OF SHORELINE PROPERTIES
SIX COUNTY SAMPLE, 1979

County	Respondents with Erosion Damage Type of Insurance Held - Percentage				Total ^a
	Private and Flood	Private Only	Flood Only	No Insurance	
Region 1					
Allegan	21.4	64.3	3.6	10.7	100.0
Berrien	18.4	57.1	4.1	20.4	100.0
Ottawa	9.1	72.7	3.4	14.8	100.0
Van Buren	10.5	73.7	0.0	15.8	100.0
Entire Region	13.6	67.4	3.3	15.8	100.0
Region 2 (Leelanau)	2.4	65.9	0.0	31.7	100.0
Region 3 (Sanilac)	1.1	79.5	0.0	19.3	100.0
Entire Sample	7.9	70.1	1.7	20.3	100.0

^aRows may not sum to totals because of rounding.

Political Remedies

Attempts to influence legislation and to obtain redress through the court system are other methods by which property owners may seek to reduce their losses from erosion. Only four sample respondents had been involved in a court erosion damage claim; however, 146 or 26.4 percent of the respondents reported having attended public hearings pertaining to their shoreline properties. Those who have experienced erosion damage are more likely than others to participate in the hearings. Over 30 percent of respondents with erosion damage had attended public hearings pertaining to their properties compared with 17 percent of those who had perceived no damage.

On a geographic basis, 36.6 percent of respondents with erosion damage from Region 1 had attended public hearings as compared to 29.9 percent in Region 2 and 20.2 percent in Region 3. Table 19 shows the distribution of the substantive issues of the hearings by region.

Table 19

SUBSTANTIVE ISSUES OF PUBLIC HEARINGS
SIX COUNTY SAMPLE, 1979

	<u>Respondents with Erosion Damage - Percentage of Mentions</u>				
	Conservation	Shore Protection	Zoning	Other	Total ^a
Region 1	16.5	38.0	41.8	3.8	100.0
Region 2	4.3	13.0	56.5	26.1	100.0
Region 3	5.3	47.4	36.8	10.5	100.0
Entire Sample	12.4	34.7	43.8	9.1	100.0

^a Rows may not sum to totals because of rounding.

Shore protection appears to be a more common issue of public hearings in Regions 1 and 3 than in Region 2 where issues concerning land use are more often discussed.

Sale of Property

Another possible reaction to erosion damage is sale of the shoreline property to avoid further loss. This was the apparent response of some of the property owners in the sample; of those who had experienced erosion damage, 26.3 percent have considered selling their property as compared to 16.1 percent of those who have not had erosion damage. Likewise, 56.7 percent of those with damage reported that a neighbor had tried to sell his property as opposed to 44.1 percent of those with no damage. Although sale of property is a reasonable reaction to damage, the presence of

erosion damage may reduce the marketability of the shoreline property. Some 13.4 percent of those with erosion damage believed that their property was not currently marketable at a reasonable rate of return, while only 2.8 percent of those without damage felt that their property was unmarketable.

Table 20 shows by county the proportion of shoreline property owners with damage who have considered selling their property and the distribution of sample respondents' opinions about the current marketability of their properties.

Table 20
PROPERTY SALE AND MARKETABILITY CONSIDERATIONS
SIX COUNTY SAMPLE, 1979

County	Consider Selling Property (Percent)	Respondents with Erosion Damage Consider Property (Percent)		
		Marketable	Not Marketable	Don't Know
Region 1				
Allegan	38.7	73.3	20.0	6.7
Berrien	40.0	44.9	30.6	24.5
Ottawa	13.3	82.6	7.6	9.8
Van Buren	30.0	80.0	20.0	0.0
Entire Region	26.2	71.2	16.8	12.0
Region 2 (Leelanau)	26.1	81.6	11.5	6.9
Region 3 (Sanilac)	28.3	76.3	8.6	15.1
Entire Sample	26.7	71.2	13.5	11.6

About 26.7 percent of property owners with damage have considered selling their property with little variation in the regional proportions. However, among counties within Region 1 there is considerable variation. Forty percent of those in Berrien County and 38.7 percent in Allegan County have deliberated about selling their property. These two counties showed the highest frequency of bluff erosion as indicated in Table 15, and 26.2 percent of respondents in Berrien County (by far the highest proportion) reported damage to their dwelling structures (Table 16). As might be expected, respondents from Berrien County also showed the highest proportion of uncertain and negative feelings about the marketability of their properties. On the whole, about 71 percent of the shoreline property owners feel that their holdings are currently marketable at a reasonable rate of return.

Respondents who believed that their properties were not currently marketable at a reasonable rate of return were asked what they thought were the reasons for this problem. Table 21 shows the distribution of these reasons by region.

Table 21

REASONS PROPERTY NOT MARKETABLE
SIX COUNTY SAMPLE, 1979

	<u>Percentage of Mentions - Respondents With Damage</u>						
	<u>Damage-Related Reasons</u>				<u>Price</u>		
	High Water	Erosion	Poor Setback	Total	Too High	Other	Total
Region 1	6.3	62.5	21.9	90.6	0.0	9.4	100.0
Region 2	10.0	10.0	20.0	40.0	20.0	40.0	100.0
Region 3	0.0	50.0	12.5	62.5	25.0	12.5	100.0
Entire Sample	6.0	50.0	20.0	76.0	8.0	16.0	100.0

Over three-quarters of the reasons mentioned for non-marketability of their properties were related to erosion damage. This type of explanation was most prominent in Region 1 and least often offered in Region 2.

Investment in Shoreline Protection

Investment in shoreline protection, the strategy of major interest in this study, is another typical reaction to erosion damage. As Table 22 shows, the majority of sample respondents who perceived erosion damage invested in some type of shoreline protection.

Table 22

INVESTMENT IN SHORE PROTECTION
SIX COUNTY SAMPLE, 1979

	<u>Have Taken</u> <u>Protective Action</u>		<u>Have Not Taken</u> <u>Protective Action</u>		<u>Total</u>	
	(Number)	(Percent)	(Number)	(Percent)	(Number)	(Percent)
Have Experienced Erosion Damage	203	53.0	180	47.0	383	100.0
Have Not Experienced Erosion Damage	23	12.6	159	87.4	182	100.0

Chi Square = 83.76; degrees of freedom = 1; probability = 0.0

Of the 383 respondents who experienced erosion damage to their shoreline properties, 203 or 53 percent have taken some type of shore protective action while 47 percent have not. As might be expected, most respondents with no erosion damage had not taken any shoreline protective action; however, note that 23 respondents who had experienced no damage, nonetheless, had undertaken some action to prevent erosion, probably as a preventive measure.

Table 23 shows by region the proportion of respondents with erosion damage who have taken some type of shoreline protective action.

Table 23

INVESTMENT IN SHORE PROTECTION, BY COUNTY
SIX COUNTY SAMPLE, 1979

County	Respondents with Erosion Damage Who Have Taken Protective Action	
	(Number)	(Percent)
Region 1		
Allegan	11	35.5
Berrien	24	48.0
Ottawa	69	72.6
Van Buren	14	70.0
Entire Region	196	60.2
Region 2 (Leelanau)	37	42.0
Region 3 (Sanilac)	46	47.9
Entire Sample	201	52.9

The region with the largest proportion of property owners with damage who have taken protective action is Region 1; however, this region also contains the county with the smallest proportion, 35.5 percent in Allegan County. In Region 2 only 42 percent of those with damage have taken action, possibly because of the apparent lesser severity of erosion damage in that region.

Given that the occurrence of erosion damage is a good predictor of the undertaking of shore protective action, what other factors may influence the property owner to employ this strategy? Several other variables were analyzed to detect relationships with investment in shoreline protection. For example, age, income level, residency status, or the existence of

permanent dwellings may influence the property owner in his decision. Twelve factors were examined for influence on shore protective behavior in a manner similar to the analysis of the effect of erosion damage (as shown in Table 22. Chi square tests were performed on the distributions, and the results are presented in summary in Table 24. Factors will be discussed individually.

Table 24

RELATIONSHIP OF VARIOUS FACTORS TO SHORE PROTECTIVE ACTION
RESULTS OF CHI SQUARE TESTS

Variable	Value of Chi Square	Degrees of Freedom	Probability
Age	1.48	4	.8302
Education Level	9.69	7	.2066
Occupation	4.78	9	.8531
Retirement status	.03	1	.8579
Income level	2.98	6	.8116
Residency (permanent vs. part-time)	2.63	1	.1037
Membership in property owners' association	.72	1	.3951
Presence of permanent dwelling	7.09	1	.0077
Presence of major improvements	.22	1	.6353
Rate of change of damage	2.16	1	.1413
Presence of shore protection at acquisition	5.69	1	.0171
Presence of neighbors' shore pro- tection at acquisition	3.57	1	.0588

To adjust for the strong relationship evident between erosion damage and investment in shore protection and to study the influence of the factors in the face of damage, only those respondents who had perceived erosion damage to their properties were included in the distributions. The value in the last column indicates the probability that the deviation of the sample distribution from that distribution which would be expected if the factor in question had no relationship with shore protective behavior could have occurred through sampling error. A very low value (e.g., less than .05) suggests that there are real differences in shore protective behavior with respect to the variable under study.

None of the personal demographic (the first seven) variables showed a strong significant relationship (at the .05 level) with investment in shore protection. There was no discernible relation between age categories, as structured in the questionnaire, and shore protection. Of course, the fact that age was questioned at a particular point in time while investment in shore protection could have taken place over a period of time (since acquisition of property) may have blurred any existing association between the variables.

Likewise, no strong relationship can be noted between investment in shore protection and educational level achieved or occupation, although blue collar workers and housewives appear less likely to invest than the other categories. Retirement status, too, seemed to have no effect. Surprisingly, no association at all could be discerned between income, as categorized in the questionnaire, and investment in shore protection. Even within the lowest income class (\$6,000 or less) about half of the respondents with damage had invested in shore protection.

About 59 percent of the permanent residents have taken shore protective action as compared to approximately 50 percent of the non-permanent residents; however, there is a probability of about 10 percent that a variation of this size could have occurred because of sampling. Membership in a property owners' association appears to exert little or no influence on the decision to invest in shore protection.

The presence of a permanent dwelling on the property does appear to be related to investment in shore protection. Shore protection had been given to 56.1 percent of the properties on which permanent dwellings were located as compared to 34.1 percent of the properties without permanent dwelling structures. Property owners apparently attempt to protect their investment in dwelling structures by further investment in shore protection. However, investment in major improvements by the property owner appeared to have no association with investment in shore protection.

It was originally hypothesized that the perceived rate of change of erosion would influence the property owner's propensity to invest in shore protection; that is, the property owner who saw erosion damage increasing with time would be more likely to install some type of shore protection. Respondents with erosion damage were classified into two groups: those who perceived the erosion of their property as increasing with time and those who saw it as decreasing or remaining the same. About 57 percent of those who saw erosion as increasing have invested in shoreline protection as compared to 48 percent of those who did not. However, there is a 14 percent probability that a difference of this size is due to sampling variation.

The second factor which showed a strong relationship with investment in shore protection was the presence of some type of shoreline protection at acquisition of the property. Of those respondents with erosion damage, 70.5 percent of those who purchased property with some type of shore protection device in operation added to the shore protection in some way. Only 51.4 percent of those without protection at acquisition later installed a safeguard. There is also likely a relationship, though not as strong, between investment in shoreline protection and the presence of some type of shore protection on a neighbor's land at acquisition.

One other relationship with investment in shore protection was tested. It was hypothesized that the perceived value of properties with shore protection installations in operation might be higher than those with none for two reasons: (1) property owners with the higher valued lands might be more inclined to protect their investments with shore protection; (2) the presence of shore protection devices might increase the value of the land. The mean perceived value of properties with shore protection was slightly larger than the mean value of those with none but a Student's two-sample t-test indicated that the difference was not significant (probability: .3596).

Reasons for Not Investing in Shoreline Protection

Shoreline property owners who have experienced erosion damage may fail to invest in protection for a variety of reasons. One of the strongest influences may be a lack of confidence in the ability of the protective devices to reduce erosion damage. One measure of this influence was examined in the sample questionnaire. Respondents who reported specific types of damage were asked if they believed that adequate shoreline protection could have reduced the damage. The percentage of property owners responding negatively to this query is shown in Table 25.

Table 25

LACK OF CONFIDENCE IN SHORE PROTECTION
SIX COUNTY SAMPLE, 1979

County	Percentage of Respondents with Specific Type of Erosion Damage "Shore Protection Could Not Reduce Damage"			
	Beach Erosion	Bluff Erosion	Loss of Beach Vegetation	Loss of Bluff Vegetation
Region One				
Allegan	32.3	19.2	24.0	22.2
Berrien	17.4	12.2	17.1	5.5
Ottawa	19.8	15.9	19.0	20.0
Van Buren	23.5	17.6	20.0	16.7
Entire Region	21.7	15.6	19.5	14.6
Region Two (Leelanau)	34.7	30.0	25.6	35.7
Region Three (Sanilac)	12.9	9.7	12.5	12.5
Entire Sample	22.7	16.2	19.4	17.4

On the whole, about 20 percent of the respondents with erosion damage believe that their losses could not be reduced by shore protection. Those in Region 2 appear to have the least confidence; depending on the type of damage, from 25.6 to 35.7 percent believe that shore protection is ineffective. A much smaller proportion of respondents in Region 3 doubt the efficiency of this strategy.

Of the respondents with erosion damage who have not invested in shore protection, 53.6 percent have considered doing so. This group was asked their reasons for not investing in shore protection. About 15 percent had not made up their minds; another 15 percent felt that nothing would help; 35.5 percent said that shore protection would be too expensive. The

balance gave a variety of reasons including the unavailability of labor, materials, financing, and professional help.

Summary

About two-thirds of the sample shoreline property owners have experienced some type of erosion damage, beach erosion being the most common. On almost all measures, Region 1--southern Lake Michigan--shorelines are the most severely damaged. The least damaged area is Region 2--northern Lake Michigan. Shorelines in Region 3--southern Lake Huron--take a middle position.

Reactions to the perceived damage studied include insurance, political action, sale of property and shoreline protection. Most respondents hold some type of insurance; the frequency of uninsured properties is the greatest in Region 2. Nearly a third of the respondents with damage have attended public hearings concerning shoreline properties; attendance was the most common in Region 1. A little over one-quarter of respondents with damage have considered selling their properties. Of those who feel their properties are not marketable, over three-quarters gave damage-related reasons.

Slightly over half of respondents with damage invested in shore protection. Region 1 shows the greatest proportion and Region 2 the smallest. Presence of a permanent dwelling and presence of a shore protection device at acquisition appear to be the factors most strongly related (of those studied) to investment in shore protection. None of the personal demographic factors showed a strong relationship. Among reasons given for not investing in shore protection, the high expense was the most common, followed by the belief that nothing would help. The strongest confidence in the efficacy of shore protection is shown in Region 3 and the weakest in Region 2.

IV

SHORE PROTECTIVE ACTIVITIES OF MICHIGAN
LAKE PROPERTY OWNERS

Shoreline property owners who choose to invest in shore protection must select from numerous alternative devices and methods of attaining their goals. This chapter is concerned with their decisions regarding amounts invested, specific types of protection, action taken individually or collectively, and use of contractors. The sources of information which are used, satisfaction with shore protection, and expectations about future protective actions are also examined.

About one-third or 184 of the shoreline property owners in the sample had taken some type of individual protective action since acquisition of their land, as shown in Table 26.

Table 26

SHORE PROTECTIVE ACTIONS
SIX COUNTY SAMPLE, 1979

	All Respondents				
	Have Taken Collective Action		Have Taken Individual Action		Individual Actions (Number)
	(Number)	(Percent)	(Number)	(Percent)	
Region One	55	23.6	90	39.3	214
Region Two	3	1.5	43	21.5	72
Region Three	5	3.8	51	39.8	96
Entire Sample	63	11.1	184	33.0	382

Approximately 40 percent of respondents in both Regions 1 and 3 have taken individual action as compared to 21.5 percent in Region 2. In total, individual actions number 382, an average 2.1 per property owner who has individually invested in shoreline protection.

In collective action, 63 respondents have invested in shoreline protection. Collective protection has occurred by far the most frequently in Region 1 where nearly 24 percent of the property owners have acted in conjunction with their neighbors. These two categories (individual and collective action) overlap; some respondents have taken both individual and collective action. Table 27 shows shoreline protective action in exclusive categories, including consideration about investment.

Clearly, shore protective behavior is the most active in Region 1 where 62.4 percent of respondents have invested in individual and/or collective protection or have discussed collective action with neighbors. On the other hand, nearly three-quarters of those in Region 2 have neither taken any type of action nor considered collective action. In a middle position, almost half of Region 3 property owners have invested in shore protection or have talked about collective efforts with neighbors.

Amount of Investment

Sample property owners who reported financial data have invested a total of \$1,332,683 in shore protection. This amount includes \$1,023,460 in 277 individual actions and \$309,223 in the individual shares of collective action. The total investment in 38 collective efforts in which respondents participated was \$2,025,818. Actually the investment by sample property owners was greater than that shown here because some respondents did not report financial data. If those who did not report financial data invested proportionately the same amounts as those respondents who did, the total investment in shoreline protection by sample property owners would reach approximately \$1,791,000.

Table 27

SHORE PROTECTIVE BEHAVIOR
SIX COUNTY SAMPLE, 1979

	Percentage of All Respondents							Total ^a
	Collective and Individual Action Only	Collective Action Only	Individual Action and Talk About Collective	Individual Action Only	Talk About Collective Only	No Action, No Talk About Collective		
Region One	8.3	15.7	14.4	16.6	7.4	37.6	100.0	
Region Two	0.5	1.0	2.5	18.5	3.0	74.5	100.0	
Region Three	1.6	2.3	9.4	28.9	6.3	51.6	100.0	
Entire Sample	3.9	7.4	9.0	20.1	5.6	54.0	100.0	

^aRows may not sum to totals because of rounding.

Table 28 shows the mean investment by region of respondents who undertook shore protective action. The investment is shown in 1978 dollars; the data reported by property owners were inflated, using the maintenance and repair components of the consumer price index, to allow comparison and arithmetic manipulation.¹⁰ Because the data have been weighted by the index, no statistical tests have been performed; data are presented for descriptive purposes only.

Table 28

INVESTMENT IN SHORE PROTECTION
SIX COUNTY SAMPLE, 1979

Mean Investment--Respondents Taking Protective Action In 1978 Dollars				
	Region One	Region Two	Region Three	Total Sample
Individual Action:				
Per Action	\$4,808.50	\$1,546.30	\$2,755.90	\$3,694.80
Per Respondent	8,781.00	2,306.80	5,431.40	6,603.00
Collective Action:				
Per Respondent	6,072.00	3,638.50	4,140.50	5,834.40
Total Investment (Individual and Collective)				
Per Foot of Shore Front	82.84	11.91	79.65	68.61

¹⁰See Appendix A for more detailed explanation of indexing.

For the sample as a whole those property owners who took individual action invested an average \$6,603 in shore protection, ranging from \$2,307 in Region 2 to \$8,781 in Region 1. These figures include all individual actions taken by respondents; the average investment per action is \$3,695. In collective action the average share was \$5,834. As with individual action, the highest mean investment was made in Region 1 and the lowest in Region 2.

The last row of Table 28 shows the average total investment, both individual and collective, per foot of shore front. The much more substantial investments per front foot in Regions 1 and 3 as compared to Region 2 probably reflect the more severe erosion problems occurring in these two areas.

Information Sources

The availability of reliable information is critical both to the decision to invest in shoreline protection and to the choice of protective devices. Without sources of good information the property owner may fail to act when action is needed or may waste his resources by investing in inappropriate or unnecessary devices. Good channels of information are vital both in the purchase and marketing of shoreline protection.

Table 29 shows the use of selected sources of information by sample property owners.

Table 29

USE OF SELECTED INFORMATION SOURCES
SIX COUNTY SAMPLE, 1979

Source	Percentage of Respondents Who Have Obtained Information from Source			
	Region One	Region Two	Region Three	Entire Sample
County Extension Agent	7.5	7.5	4.7	6.8
Department of Natural Resources	21.8	13.3	12.5	16.5
Private Consulting Engineers	25.7	8.5	11.9	16.3
Private Marine Contractors	36.9	5.4	22.1	22.3
U.S. Army Corps of Engineers	33.6	8.5	29.7	23.9
Property Associations	20.1	6.2	2.4	10.9
Shoreline Neighbors	65.6	27.5	46.5	47.9
Friends	56.2	36.1	41.2	45.6

Property owners most frequently used an informal, personal source of information--friends and shoreline neighbors. Nearly half of the respondents reported having solicited information from this source. The next most commonly used sources were private marine contractors and the U.S. Army Corps of Engineers. Both of these groups would be assumed to be professionals in the area of water resources. About 16 percent of the property owners also solicited information on shore protection from the Michigan Department of Natural Resources and private consulting engineers. Less commonly consulted were shoreline property associations and county extension agents.

Respondents from Region 1 most frequently sought information from all sources studied; those from Region 2 least commonly solicited advice about shore protection. This difference is probably related to differences in erosion damage and use of shoreline protection in the two areas. As expected, respondents who had taken some type of protective action much more frequently reported having sought information from the various sources than those who had not.

Property owners were asked to rate each source with which they were familiar on a scale of one to seven with respect to helpfulness and reliability. The rating 1 was labeled "not helpful/reliable," 7 "very helpful/reliable," and the midpoint 4 "somewhat helpful/reliable." The mean ratings are shown in Table 30 for the entire sample and grouped as those who have invested in shoreline protection and those who have not.

The information source given the highest "helpfulness" rating (4.65) by the entire sample was shoreline neighbors, followed by friends, private consulting engineers, and private marine contractors. All of the other information sources received mean ratings lower than the midpoint (that is, less than "somewhat helpful"). Respondents gave the county extension agents

Table 30

HELPFULNESS AND RELIABILITY OF SELECTED INFORMATION SOURCES
SIX COUNTY SAMPLE, 1979

	Mean Rating ^a			Prob- ability ^b
	Have Taken Protective Action	Have Not Taken Protective Action	Entire Sample	
<u>Helpfulness</u>				
County Extension Agent	2.55	3.62	3.07	.01
Department of Natural Resources	3.71	4.21	3.95	.14
Private Consulting Engineers	4.34	4.16	4.26	.88
Private Marine Contractors	4.64	3.75	4.33	.02
U.S. Army Corps of Engineers	3.58	3.92	3.70	.33
Property Associa- tions	3.33	3.94	3.65	.08
Shoreline Neighbors Friends	4.74	4.54	4.65	.34
	4.25	4.28	4.27	.88
<u>Reliability</u>				
County Extension Agent	3.07	4.11	3.56	.05
Department of Natural Resources	4.19	4.84	4.48	.10
Private Consulting Engineers	4.61	4.63	4.62	.96
Private Marine Contractors	4.70	4.20	4.56	.21
U.S. Army Corps of Engineers	4.26	4.58	4.38	.43
Property Associa- tions	3.59	4.30	3.93	.06
Shoreline Neighbors Friends	4.50	4.60	4.54	.68
	3.94	4.06	4.00	.61

^aRated on a seven-point scale ranging from 1 (not helpful/reliable) to 7 (very helpful/reliable).

^bProbability in a two-sample Student's t-test that a difference between sample means as large as that shown could have occurred because of sampling variability.

an average rating of 3.07, the lowest rating of all.

The property owners assigned higher ratings to reliability than to helpfulness to all but two sources, friends and shoreline neighbors. Friends and neighbors are apparently more helpful than reliable. The highest reliability rating was given to private consulting engineers, followed by private marine engineers, and shoreline neighbors. Only county extension agents and property associations received mean ratings below the midpoint of the scale.

Property owners who have actually invested in shoreline protection likely have more actual experience on which to base their evaluations than those who have not. Consequently, the mean ratings of the two groups were compared. The last column of Table 30 shows the probability that the difference between the two means could have occurred because of sampling variability.

With respect to helpfulness, there were significant differences (at the .05 level) in the mean ratings of only two information sources. Respondents who have taken a protective action rated the helpfulness of county extension agents considerably lower than those who have not. On the other hand, private marine contractors received a higher rating by those who had experience with shore protection. On reliability, only county extension agents received a significantly lower rating from respondents who had invested in shore protection. Other differences may be noted in Table 30; significance may be evaluated through the probability column.

There were also regional differences in the helpfulness and reliability ratings. In general respondents in Region 2 rated all information sources on helpfulness and reliability higher than did respondents in the other

regions. All ratings of Region 2 property owners averaged higher than 4.0, the midpoint. The most striking differences were in the considerably higher Region 2 ratings of county extension agents and the Department of Natural Resources. Respondents in Region 3 also showed significantly less confidence in the helpfulness and reliability of their shoreline neighbors as information sources than did respondents in the other regions.

Property owners may also obtain information about shoreline protection from various available brochures. Respondents were asked about their use of three of these publications; results are presented in Table 31.

Table 31

FAMILIARITY WITH SELECTED PUBLICATIONS
SIX COUNTY SAMPLE, 1979

County	Percentage of Respondents Familiar with Publications		
	"Help Yourself: a Discussion of the Critical Erosion Problems on the Great Lakes and Alternative Methods of Shore Protection"	"Shoreline Erosion: Questions and Answers"	"The Role of Vegetation in Shoreline Management"
Region One			
Allegan	15.6	18.8	12.5
Berrien	31.1	18.6	25.9
Ottawa	13.8	13.5	8.4
Van Buren	19.2	8.0	12.0
Entire Region	19.7	15.1	14.3
Region Two (Leelanau)	4.8	2.2	3.3
Region Three (Sanilac)	9.4	8.7	5.9
Entire Sample	12.1	9.0	8.5

Respondents in Region 1 were more familiar with all three of the selected publications than those in other regions. Property owners in Region 2 were least likely to have read the brochures. A larger percentage of respondents who were members of property owners' associations had read the publications than those who were not members. Likewise, those who had invested in shoreline protection more frequently were familiar with the brochures than non-investors.

Sample respondents who reported that they were familiar with the publications were requested to rate the helpfulness of the brochures on a scale of one to seven similar to that used for rating the sources of information; they were also asked whether they had recommended the publications to a friend. Results are shown in Table 32. On the whole sample respondents found the publications helpful; all three received mean ratings above the midpoint on the scale. Property owners in Region 3 tended to be more impressed by the brochures than those in other regions.

About a third of the respondents familiar with the publications have recommended "Help Yourself" and "The Role of Vegetation in Shoreline Management" to a friend. Those who are investors in shoreline protection and those who are members of property owners' associations have more frequently recommended these two publications to a friend than the respondents who are not. Although distribution of these representative publications appears to be quite limited, those property owners who are familiar with the brochures on the average rate them as helpful and often recommend them to others. Wider distribution of printed matter on shoreline protection may indeed be a viable way of broadening property owners' information sources.

Table 32

HELPFULNESS OF SELECTED PUBLICATIONS
AND FREQUENCY OF RECOMMENDATION
SIX COUNTY SAMPLE, 1979

	Mean Helpfulness Rating ^a		
	"Help Yourself"	"Shoreline Erosion"	"The Role of Vegetation"
Region One	4.08	3.85	4.82
Region Two	4.55	5.00	4.50
Region Three	5.73	5.33	6.43
Entire Sample	4.46	4.31	5.05
Probability ^b	.05	.07	.11

	Percentage of Respondents Who Have Recommended Publication to a Friend		
Region One	31.0	16.1	36.4
Region Two	23.1	11.1	14.3
Region Three	35.3	42.9	41.7
Entire Sample	30.6	22.2	34.6
Have Taken Protec- tive Action	43.2	23.1	41.7
Have Not Taken Protective Action	17.1	21.4	28.6
Member Property Owners Association	45.5	33.3	56.3
Not a Member	22.9	17.9	25.0

^a Rated on a seven-point scale ranging from 1 (not helpful) to 7 (very helpful).

^b Probability in an analysis of variance test that differences as large as those shown could have occurred because of sampling variability.

Individual Shore Protective Action

Individually, 184 sample property owners have undertaken 382 shore protective actions. Individual action has been much more common than collective efforts. In this section concerned with individual actions, much of the analysis is based on the number of actions rather than the number of respondents. For example, a percentage refers to the proportion of total actions rather than to total property owners.

Types of Action

Table 33 shows the types of action taken by region. The most common type of shore protective action taken has been the installation of seawalls. These structures, separating land and water areas to reduce the effects of wave action and erosion, make up 27.5 percent of total sample individual actions. The next most popular type of protection has been the building of groins perpendicular to the beach to trap beach material propelled by currents. Nearly 20 percent of all individual actions have been the construction of groins; in Region 2, groins have been installed even more frequently than seawalls. The following efforts each make up about ten percent of the individual actions taken by respondents: construction of revetments (a facing of heavy materials to protect a bluff or embankment from the effects of wave action); the planting of trees, grass, and/or shrubs on exposed bluff or beach areas for the purpose of retarding erosion damage; and the installation of gabions and fences to build up sand on beaches. Among other protective efforts reported by respondents were the replacement of beach materials, repair and maintenance on existing shore protection structures, construction of breakwaters, and relocation of dwellings.

Table 33
 TYPES OF SHORE PROTECTIVE ACTION
 SIX COUNTY SAMPLE, 1979

Type of Action	Percentage of Total Actions			
	Region 1	Region 2	Region 3	Total Sample
Seawall	31.8	19.4	24.0	27.5
Groin	16.8	26.4	20.8	19.6
Revetment	11.2	11.1	9.4	10.7
Restorative Vegetation Management	10.7	9.7	11.5	10.7
Gabion	8.9	13.9	9.4	9.9
Replacement of Beach Materials	4.7	12.5	14.6	8.6
Repair/Maintenance on Existing Structure	8.4	5.6	7.3	7.6
Other	7.4	1.4	3.1	5.2
Total ^a	100.0	100.0	100.0	100.0

^a Columns may not sum to totals because of rounding

For the sample as a whole, the years 1973 through 1975 have been the time of heaviest activity in installation of shore protection by present property owners, as can be seen in Table 34. This period coincides with a peak in Great Lakes water levels. Construction activity peaked a year earlier--1972 through 1974--in Region 1, while in Region 3 the most concentrated recent activity has taken place in 1975, 1976, and 1978.

Table 34

YEAR OF INSTALLATION -- INDIVIDUAL SHORE PROTECTIVE ACTIONS
SIX COUNTY SAMPLE, 1979

Year	Percentage of Total Actions			
	Region 1	Region 2	Region 3	Total Sample
1945-1959	9.2	3.0	10.8	8.5
1960-1969	8.7	13.6	16.1	8.7
1970	3.9	10.6	2.2	4.6
1971	3.4	9.1	5.4	4.9
1972	10.6	3.0	5.4	7.9
1973	15.9	15.2	8.6	13.9
1974	19.8	10.6	8.6	15.3
1975	8.7	18.2	15.1	12.0
1976	9.7	7.6	10.8	9.6
1977	6.3	4.5	6.5	6.0
1978	3.9	4.5	10.8	5.7
Total ^a	100.0	100.0	100.0	100.0

^a Columns may not sum to totals because of rounding.

Although the protective actions examined here are efforts made by individual property owners, an adjacent neighbor's shore protection structure can affect the timing, the type of device, and even the need for protection. Some 54.2 percent of the protective actions taken by respondents in Region 1, 11.9 percent in Region 2, and 26.3 percent in Region 3 were made in conjunction with the action of an adjacent neighbor. Forty-two of the shore protective actions, including 11 seawalls, six groins and one breakwater, were undertaken as a result of damage caused by adjacent neighbors' protective structures.

Costs of Individual Actions

Respondents were asked to provide cost data on their shore protective installations which is presented in Table 35. Caution should be observed in interpreting this data because many property owners gave only total costs without breaking down the materials and labor components as requested. The "number" column gives the number of cases which were averaged for a particular type of installation. As can be noted, the number of cases is much greater for the total cost than for materials and labor. The number of cases for the labor component is smaller than the others for another reason. Respondents who did their own work were instructed to place a zero in the labor column; these cases were not included in computing the average labor cost in order to provide a meaningful estimate for those cases in which labor was purchased. Because the cases included in the averages differ for materials, labor, and total costs, the components do not sum to the total. The means for total costs should probably be considered the most representative both because of the larger number of cases included and because respondents are more likely to have reliable figures for total costs than for the components.

The costs reported by property owners are presented in 1978 dollars in Table 35. After 1963 the maintenance and repair commodities component of the Consumer Price Index was employed to inflate the materials costs reported, and the maintenance and repair services component was used for the labor costs. From 1953 to 1963 the price index for exterior house paint was used for materials and the index for reshingling roofs was used for labor costs. Financial data for actions prior to 1953 were not used.

The average cost for all actions was \$3,694.80; seawalls were the most costly projects with a mean total cost of \$6,155.60 followed by repair on existing structures at \$4,857.60 and revetments at \$3,989.20. For the

Table 35

SHORE PROTECTION COSTS - INDIVIDUAL ACTIONS
SIX COUNTY SAMPLE, 1979

Type of Action	In 1978 Dollars						
	Materials		Labor		Total		
	Mean Cost	Number ^a	Mean Cost	Number ^a	Mean Cost	Number ^a	
						Mean Total Cost Per Foot of Shore Front	
Seawall	\$2,251.30	32	\$4,736.90	14	\$6,155.60	75	\$59.31
Groin	716.12	25	1,206.30	8	2,697.50	53	38.80
Revetment	1,081.30	15	1,301.70	6	3,989.20	19	21.45
Restorative Vegetation Management	789.92	25	1,092.60	5	1,366.40	29	14.73
Gabion	608.95	21	1,905.20	5	2,347.40	34	23.90
Replacement of Beach Materials	614.76	17	580.50	8	2,326.20	29	18.79
Repair Maintenance on Existing Structure	6,852.20	12	633.00	1	4,857.60	26	25.74
Other	752.14	7	2,706.75	4	2,486.90	12	19.54
All Actions	1,536.60	154	2,249.70	51	3,694.80	277	34.77

^aNumber of cases for which financial data is available.

cases with materials costs broken out, these costs were the greatest for repair, followed by seawalls and revetments. The average materials cost over all actions was \$1,536.50. For most types of action the average labor costs for the cases reported were greater than the materials costs. Seawall construction entailed the greatest labor costs with an average \$4,736.90 per job. Average labor costs for all types of action were \$2,249.70.

The mean cost per foot of shore front was calculated for each type of action and is shown in the last column of Table 35. The highest average per foot cost, \$59.31, was incurred in the construction of seawall, followed by groins at \$38.80 per foot. On the average across all types of structures, property owners paid \$34.77 per front foot for each individually installed protective device.

Assessments of Shore Protection

Sample property owners' expectations with respect to the useful life of the various protective actions taken are shown in Table 36. About a third of the installations are expected to last ten or more years but not permanently and another 18 percent are expected to be permanent. Relatively short lives (nine years or less) are predicted for about 24.4 percent of the devices, and respondents are unsure about the lifespan of another 23 percent. The protective action most frequently thought to be permanent was restorative vegetation management, followed by repair maintenance on existing structures. The most uncertainty about expected life was expressed concerning the replacement of beach materials. About 39 percent of seawalls and 38 percent of groins are expected to last ten years or more but not permanently.

Since 82.8 percent of the shore protective actions were taken in this decade and nearly half within the past five years, it is impossible to know at this time whether the property owners' expectations about the useful lives of their installations have proved correct. Eighty percent of the individual shore protective devices installed by sample respondents are still in operation. There have been some disappointments, however; of the 25 protective actions which only lasted one year, 19 had longer expected lives, and of the 17 which became inoperative after two years, 15 had been expected to last longer including two which had been installed as permanent operations.

Property owners were asked to rate the effects of their shore protective actions on a seven point scale ranging from "very negative" to "very positive." Table 37 shows the mean ratings given to selected types of actions. Overall, shore protection installations were given a mean rating of 5.6 (between "somewhat positive" and "positive"). An analysis of variance test showed that there were no statistically significant differences

Table 36

EXPECTED LIFE OF SHORE PROTECTIVE ACTIONS
SIX COUNTY SAMPLE, 1979

Type of Action	Expected Life in Years - Percentage of Total Individual Actions						Don't Know	Total ^a
	1	2	3-9	10 and Over, Not Permanent	Permanent			
Seawall	1.1	5.7	12.6	39.1	18.4	23.0	100.0	
Groin	5.0	10.0	11.7	38.3	10.0	25.0	100.0	
Revetment	3.6	3.6	14.3	32.1	21.4	25.0	100.0	
Restorative Vegetation Management	2.9	11.8	8.8	29.4	32.4	14.7	100.0	
Gabion	6.1	6.1	18.2	30.3	15.2	24.2	100.0	
Replacement of Beach Materials	0.0	18.5	18.5	14.8	7.4	40.7	100.0	
Repair Maintenance on Existing Structures	16.7	0.0	0.0	50.0	29.2	4.2	100.0	
Other	0.0	0.0	28.6	14.3	28.6	28.6	100.0	
Total--All Types	4.0	7.7	12.7	34.3	18.3	23.0	100.0	

^aRows may not sum to totals because of rounding.

at the .05 level among the mean ratings given to the various types of action. The effect of 88 percent of the actions were rated on the positive end of the scale (above the midpoint) with no striking regional differences.

Table 37

EFFECTIVENESS RATING - SHORE PROTECTIVE ACTION
SIX COUNTY SAMPLE, 1979

Type of Action	Mean Rating ^a
Seawall	5.5
Groin	5.7
Revetment	5.6
Restorative Vegetation Management	5.8
Gabion	5.4
Replacement of Beach Materials	5.4
Repair Maintenance on Existing Structures	6.0
Overall	5.6

^a Effects rated on a seven point scale (1 = very negative, 7 = very positive).

Sample respondents also rated the value of their protective actions in terms of time and money spent. Ratings were made on a five point scale ranging from "poor" to "excellent." The overall mean rating for shore protective action was 3.6 (between "satisfactory" and "good"); again, there were no significant differences among the mean ratings of the various types of action. However, there were some regional differences in satisfaction as Table 38 shows.

Table 38

VALUE OF PROTECTIVE ACTION IN TERMS OF TIME AND MONEY
SIX COUNTY SAMPLE, 1979

	Rating - Percentage of Total Actions			Total ^a
	Poor/Fair	Satisfactory	Good/Excellent	
Region One	27.6	14.4	58.0	100.0
Region Two	10.3	22.4	67.2	100.0
Region Three	11.5	24.1	64.4	100.0
Entire Sample	20.2	18.4	61.3	100.0

^aRows may not sum to totals because of rounding.

Respondents in Region 1 tended to be less satisfied with their investments in shore protection with respect to value received for resources and time spent in installation. Nearly 28 percent of the protective actions were rated poor or fair in Region 1 as compared to only 10 percent in Region 2 and 12 percent in Region 3. In Region 2 the value of over two-thirds of the protective devices was rated as good or excellent.

Use of Contractors

A number of the sample property owners turned to the expertise of private contractors for advice and installation of shoreline protection. Table 39 shows the proportion of shore protective devices which were installed by contractors, both by region and by type of protective action.

Table 39

USE OF CONTRACTORS
SIX COUNTY SAMPLE, 1979

	Protective Devices Installed by Contractor	
	Number	Percent
Region One	91	42.5
Region Two	17	23.6
Region Three	39	40.6
Entire Sample	147	38.5
Seawall	59	56.2
Groin	32	42.7
Revetment	5	12.2
Restorative Vegetation Management	0	0.0
Gabion	14	36.8
Replacement of Beach Materials	13	39.4
Repair Maintenance on Existing Structure	13	44.8
Other	5	25.0

About 39 percent of the sample protective devices were installed by contractors; respondents in Region 2 were less likely to use contractors than those in other regions. Over half of the seawalls were constructed with the use of a contractor, and respondents more frequently employed the services of a contractor in repair maintenance and installation of groins than for other protective devices.

The availability of marine contractors may affect the frequency of their use. Selected Yellow Pages were consulted to determine the number of listings of marine contractors in the sample areas. Results are shown in Table 40. A total of 39 different contractors are listed in the Yellow Pages, 15 located within the regional boundaries, 16 within 50 miles of the borders, and eight farther removed. Listings are the greatest in Region 1 with 11 marine contractors located within the four counties and another ten within 50 miles of the borders. Region 2 has a total of nine listings, of which three are within the county boundaries. In Region 3 there are ten listings but only one marine contractor listed is located within the county.

Although listings in the Yellow Pages are a good indication of the general availability of marine contractors in the areas, few respondents actually used this source as a means of finding out information about the contractors as Table 41 shows. Neighbors were the source most often consulted when seeking information about contractors, followed by recommendations of friends. In Region 2 friends were more often consulted than neighbors. The Yellow Pages were mentioned as an information source only four times, all in Region 1.

For the most part sample property owners did not seek out contractors for advice on the type of protective device to install. Of 144 devices installed by contractors, property owners had a definite device in mind

Table 40

LISTINGS OF MARINE CONTRACTORS - SELECTED YELLOW PAGES
SIX COUNTY SAMPLE, 1979

	Address Not Within Given Area			Total
	Address Within Given Area	Address Within 50 Miles of Border	Address Not Within 50 Miles Of Border	
Region 1				
Allegan	1	9	3	13
Berrien	4	0	4	8
Ottawa	6	11	2	19
Van Buren	0	4	0	4
Total listings	11	24	9	44
Total non-duplicated Region 1 listings	11	10	1	22
Region 2	3	1	5	9
Region 3	1	5	4	10
Total listings not dupli- cated within regions	15	16	10	41
Total listings not dupli- cated across regions	15	16	8	39

before consulting the contractor in 79.2 percent of the cases. Generally the respondents consulted contractors for information about types of devices available, cost information, and design specifications.

Property owners who had employed a contractor in the installation of shoreline protection were asked to rate their satisfaction with the advice and work provided on a scale ranging from "very dissatisfied" (1) through "neutral" (4) to "very satisfied" (7). Table 42 shows the mean ratings by region. On the average respondents were somewhat satisfied with the advice given by contractors; there were no real regional differences in mean ratings. It should be noted that although there are no significant differences in the average ratings, no respondent in Region 2 rated a contractor below "neutral" (4) on his advice while some in Regions 1 and 3 did show dissatisfaction. With respect to work performed by the contractors, the overall average rating was slightly higher with significant differences among regions. Property owners in Region 1 were the least satisfied with a mean rating of 5.2 while those in Region 2 were the most satisfied, giving an average rating of 6.8, very close to the top of the scale. Those in Region 3 assigned a middle rating of 5.7 to the contractors' work. The differences in ratings between property owners in Regions 1 and 2 are probably associated in part with the relative amounts of erosion damage in the two regions and the relative difficulty in protecting the shoreline.

The average costs of shore protection installed with the use of a contractor are greater than those of devices installed by the property owner. However, a meaningful general comparison cannot be made because some of the more costly actions such as seawalls, groins, and repair maintenance are also the installations most likely to be installed by a contractor. The

Table 41

SOURCE OF INFORMATION ABOUT CONTRACTOR
SIX COUNTY SAMPLE, 1979

	Percentage of Total Mentions				Total ^a
	Yellow Pages	Neighbor	Friend	Other	
Region One	4.5	47.2	28.1	20.2	100.0
Region Two	0.0	22.2	44.4	33.3	100.0
Region Three	0.0	42.5	40.0	17.5	100.0
Entire Sample	2.7	42.9	33.3	21.1	100.0

^aRows may not sum to totals because of rounding.

Table 42

SATISFACTION WITH ADVICE AND WORK OF CONTRACTOR
SIX COUNTY SAMPLE, 1979

	Mean Satisfaction Rating ^a	
	Advice of Contractor	Work of Contractor
Region One	5.3	5.2
Region Two	5.4	6.8
Region Three	5.4	5.7
Entire Sample	5.3	5.5
Probability ^b	.9584	.0037

^aRated on a seven point scale: 1 = very dissatisfied; 7 = very satisfied.

^bProbability in an analysis of variance test that differences among subgroup means could result from sampling variability.

numbers of respondents installing seawalls and groins both with and without a contractor were large enough to compare the costs for those two devices, as shown in Table 43.

The average cost of seawalls installed by sample respondents employing a contractor was \$7,886.90, about four times the average cost of those constructed without the use of a contractor. The difference is even more striking with respect to the installation of groins. The average \$4,019.00 cost incurred by property owners using a contractor is 5.8 times greater than the mean \$683.80 cost of property owners who installed groins, themselves.

Table 43

COST OF SHORE PROTECTION WITH USE OF CONTRACTOR, SELECTED DEVICES
SIX COUNTY SAMPLE, 1979

Type of Action	Mean Cost in 1978 Dollars	
	With Contractor	Without Contractor
Seawall	\$7,886.90	\$1,984.90
Groin	4,019.00	683.81

Collective Shore Protective Action

When faced by a common problem, people often band together to pool efforts and resources in its solution or alleviation. Erosion damage along the Great Lakes shoreline can be minimized the most efficiently in some cases by a concerted effort of several adjacent property owners, depending on shore configuration, wave and wind action, land elevation, and other factors. Approximately 11 percent of the sample property owners have participated in collective action and another 14 percent have discussed taking concerted protective action with their neighbors as is shown in Table 44.

Table 44

COLLECTIVE SHORE PROTECTIVE BEHAVIOR
SIX COUNTY SAMPLE, 1979

	Percentage of Respondents			Total ^a
	Have Participated in Collective Action	Have Discussed But Not Engaged in Collective Action	Have Neither Discussed Nor Engaged	
Region One	23.6	21.5	54.9	100.0
Region Two	1.5	5.3	93.2	100.0
Region Three	3.8	15.4	80.8	100.0
Entire Sample	11.1	14.2	74.7	100.0

^a Rows may not sum to totals because of rounding.

Collective action is by far the most common in Region 1; over 80 percent of the concerted efforts undertaken by respondents have occurred in the counties making up that region. In addition to the 23.6 percent of the property owners in Region 1 who have taken collective action with their neighbors, another 21.5 percent have discussed undertaking such an effort. Collective action has been minimal in the other regions, involving only 1.5 percent of the property owners in Region 2 and 3.8 percent in Region 3.

Property Owners Associations

Property owners associations are one means by which lakeshore residents can come together to discuss common concerns. Some 125 sample respondents reported membership in 41 different property associations.¹¹ Table IV-20 shows the distribution of association membership.

¹¹ Appendix Table B shows the names and locations of associations reported by respondents.

Table 45

PROPERTY OWNERS ASSOCIATION MEMBERSHIP
SIX COUNTY SAMPLE, 1979

County	Member of Property Owners Association	
	Number of Respondents	Percent of Total
Region One		
Allegan	18	52.9
Berrien	24	36.9
Ottawa	26	24.5
Van Buren	10	37.0
Entire Region	78	33.6
Region Two (Leelanau)	39	19.2
Region Three (Sanilac)	8	6.2
Entire Sample	125	22.2

Although 22.2 percent of the entire sample are members of property owners associations, about one-third of the respondents in Region 1 belong to these organizations, and over half of those in Allegan County are members. Membership is much less common in Region 3 where only eight property owners reported belonging to such an organization. Property owners who are not Michigan citizens more frequently belong to these associations than those who reside in Michigan; 34.2 percent of non-Michigan citizens are members of property owners associations compared to only 18.8 percent of Michigan residents. This variation is probably related to regional residency differences; Region 1 which shows the highest frequency of association membership also has the largest concentration of out-of-state residents who are shoreline property owners.

Sample respondents were asked to rate the property owners associations on a seven point scale with respect to helpfulness of the organization, overall satisfaction with the association, and activity level of the respondent. Table 46 shows the mean ratings assigned to the various aspects of the associations.

Table 46
RATINGS OF PROPERTY OWNERS ASSOCIATIONS
SIX COUNTY SAMPLE, 1979

Issue	Mean Ratings			
	Region 1	Region 2	Region 3	Entire Sample
Helpful in Providing Information on Shore-line Protection ^a	4.08	2.57	3.00	3.54
Helpful for Meeting New and Seeing Old Friends ^a	4.27	5.37	3.00	4.52
Helpful in Representing Membership at Local Hearings and Court Cases ^a	4.76	4.54	2.43	4.55
Helpful in Representing Membership in State Matters of Interest to Property Holders ^a	4.32	3.69	3.25	4.05
Overall Satisfaction With Respective Property Association ^b	5.42	5.26	3.38	5.23
Activity Level of Individual in Respective Property Association ^c	3.55	3.36	2.57	3.43

^a Helpfulness measured on a seven point scale: 1 = Not Helpful; 7 = Very Helpful.

^b Satisfaction measured on a seven point scale: 1 = Very Dissatisfied; 7 = Very Satisfied.

^c Activity level measured on a seven point scale: 1 = Inactive; 7 = Very Active.

Regional differences in mean ratings were not tested because only eight respondents in Region 3 belonged to associations, constituting a group too small for test purposes. Of the four aspects of association helpfulness to the membership, aid in providing information on shoreline protection received the lowest mean rating, 3.54 (for the sample as a whole), slightly below the midpoint or "somewhat helpful" on the scale. Respondents in Region 2 gave this association activity a particularly low rating, 2.57. Region 2 property owners found the associations most helpful in meeting new and seeing old friends while those in Region 1 felt that the property associations were most helpful in representing the membership at local hearings and court cases. Sample respondents were fairly satisfied with the property associations in an overall sense but were not very active within the groups.

Collective Action

Several factors were tested for relationship with the undertaking of collective shoreline protective action. Already noted (Table 26) was the relative frequency of collective action in Region 1 as compared with other regions. The existence of erosion damage, membership in property owners associations, and permanent residency were also examined for relationship to collective action as shown in Table 47.

As might be expected, property owners who have experienced erosion damage are much more likely to have taken or considered collective action than those who have no damage. Likewise, members of property owners associations more frequently join their neighbors in concerted protective actions than non-members; 18.3 percent of association members have participated in collective efforts as compared to 9.3 percent of those who are not members. Association members are also more likely to have discussed collective action with

neighbors. On the other hand, there is no strong and consistent relationship between year-round shoreline residency (as opposed to part-time residency) and the undertaking or consideration of collective action.

Table 47

COLLECTIVE BEHAVIOR--ASSOCIATION WITH SELECTED FACTORS
SIX COUNTY SAMPLE, 1979

Factor	Percentage of All Respondents			Total ^a
	Have Participated in Collective Action	Have Discussed But Not Engaged in Collective Action	Have Neither Discussed Nor Engaged	
Have Experienced Erosion Damage	16.2	19.1	64.8	100.0
No Erosion Damage	1.6	4.4	94.0	100.0
Chi Square = 55.37; Probability = .0000				
Member of Property Owners Association	18.3	23.0	58.7	100.0
Not a Member	9.3	11.8	79.0	100.0
Chi Square = 21.11; Probability = .0000				
Year-round Resident	15.1	11.9	73.0	100.0
Part-year Resident	9.9	14.8	75.3	100.0
Chi Square = 3.43; Probability = .1795				

^aRows may not sum to totals because of rounding.

Table 48 shows the types of collective shore protective actions taken by sample respondents. Half of the collective activity reported by property owners involved the installation of seawalls and another 27 percent groins. Other types of actions reported included seven revetments, three gabions, and two breakwaters. These large construction projects, often requiring substantial

amounts of capital, lend themselves more to collective activity than do the smaller, more individual projects such as vegetative plantings and restoration of beach materials.

Table 48

TYPE OF COLLECTIVE ACTION TAKEN
SIX COUNTY SAMPLE, 1979

	Type of Collective Action							
	Seawall		Groin		Other		Total ^a	
	Number ^b	Percent	Number ^b	Percent	Number ^b	Percent	Number ^b	Percent
Region One	29	52.7	14	25.5	12	21.8	55	100.0
Region Two	1	33.3	1	33.3	1	33.3	3	100.0
Region Three	2	40.0	2	40.0	1	20.0	5	100.0
Entire Sample	32	50.8	17	27.0	14	22.2	63	100.0

^aRows may not sum to totals because of rounding.

^b"Number" here refers to the number of respondents reporting a particular type of collective action. This may not be the number of separate devices installed because two or more respondents from a region may have participated in the same collective action.

About 83 percent of the collective activities undertaken by sample respondents have occurred since 1970. The years 1973-74 were the peak period for collective shore protective action as can be noted in Table 49; about 36 percent of the activity took place in these two years. These years were also the period of highest activity for individual shore protective action, particularly in Region 1 (see Table 34). Installation of seawalls was concentrated more in the earlier part of the period; since 1974 construction of groins and other devices has been more common. Collective installations in which 85.9 percent of those who participated in collective activity took part were still in operation in 1979.

Table 49

YEAR OF INSTALLATION AND CURRENT OPERATION--COLLECTIVE ACTION
SIX COUNTY SAMPLE, 1979

Year	(Number) ^a	Collective Action	
		Still in Operation - 1979 (Number) ^a	(Percent)
1970 and earlier	11	8	72.7
1971-72	13	10	76.9
1973-74	23	22	95.7
1975-76	12	10	83.3
1977-78	5	5	100.0
Total	64	55	85.9

^aRefers to number of respondents reporting collective action.

Respondents who had participated in collective shoreline protective actions were asked to rate the effectiveness of the devices installed on a seven point scale. A rating of 1 denotes ineffective while 7 is very effective. The mean rating for all types of collective action was 5.1 or somewhat effective. There were no striking differences among the mean ratings for different types of collective action. No regional comparisons were made because the number of respondents participating in collective efforts in Regions 2 and 3 was so small.

Costs of Collective Action

On the average shoreline property owners paid \$5,671.80 as their share of the cost of collective efforts to protect the shore. Table 50 shows the mean individual and total costs for collective actions in which respondents participated. The costs of seawalls and groins, the only types of action

for which numbers are large enough to permit comparison, are also shown; the average cost of installing these devices when undertaken by individual property owners is also shown for comparison.

Table 50
COSTS OF COLLECTIVE SHORE PROTECTIVE ACTION
SIX COUNTY SAMPLE, 1979

Type of Action	Mean Cost in 1978 Dollars				
	Collective Action			Individual Action	
	Individual Share	Cost per Foot	Total Cost	Total Cost	Cost per Foot
Seawall	\$8,248.20	\$71.31	\$43,775	\$6,155.60	\$59.31
Groin	2,187.20	28.17	12,306	2,697.50	38.80
All Types	5,671.80	60.93	51,975	3,694.80	34.77

Seawalls were more expensive on the average to the property owner when undertaken collectively than individually; the individual share of the total collective cost was \$8,248.20 or \$71.31 per front foot as compared to \$6,155.60 or \$59.31 per foot in individual action. It could not be determined from the data whether the seawalls installed collectively were more elaborate in construction than the individual structures. On the other hand, groins constructed collectively were less costly to the individual property owner than those undertaken alone. With respect to all types of protective action taken together, the average collective action was approximately \$2,000 more costly than individual efforts. However, the more elaborate and costly structures are probably the most likely to be undertaken collectively.

Problems with Collective Action

Any collective effort has the potential for more problems arising than with individual projects because a group of persons with possibly different goals and financial ability must agree on a common goal, methods of attaining it, and level of effort. Sample property owners who had participated in collective action were questioned about difficulties which arose in their effort. About one-quarter of them reported problems with agreeing on the method of protection. A much smaller proportion, only 8.3 percent, said that they had trouble agreeing on a means of payment. This group did manage to overcome these difficulties and carried out collective shore protective action.

Among those property owners who had discussed taking collective action with their neighbors but had not gone through with the effort, 74 percent reported that they were unable to come to an agreement on the method of shore protection to employ. Approximately 69 percent said that the collective action was not carried out because one or several neighbors were unwilling to participate. In all, 83 respondents reported unfruitful attempts at neighborhood organization of collective shore protection action.

Expectations about Future Shore Protection

To aid in judging the future markets for shore protection, respondents were asked to estimate the probability that they would take shore protective action in the future. The resulting mean probabilities stratified in several ways are presented in Table 51.

On the average property owners saw about a 23 percent probability of future collective action and a 24 percent probability of undertaking individual shore protective efforts in the future. For the sample as a whole collective action was just about as likely as individual action. Regionally there were some significant differences. Region 1 property owners are much more likely

Table 51

PROBABILITY OF FUTURE SHORE PROTECTIVE ACTION
SIX COUNTY SAMPLE, 1979

	Mean Probability of Future Collective Action	Proba- bility ^a	Mean Probability of Future Individual Action	Proba- bility ^a	Mean Increment-- Collective over Individual	Proba- bility ^a
Region One	32.31		25.30		6.01	
Region Two	16.89		19.78		-2.84	
Region Three	16.94		29.63		-13.08	
Entire Sample	23.17		24.19		-1.56	
		.0001		.044		.0001
Have Experienced Erosion Damage	26.79		28.62		-2.45	
No Erosion Damage	15.84		15.00		.88	
		.0001		.0001		.35
Have Taken Action	31.32		41.42		-10.77	
Have Not Taken Action	18.13		13.29		4.43	
		.0001		.0001		.0001
Have Invested in Collective Action	53.04		30.52		21.09	
Discussed, Not En- gaged in Collec- tive Action	28.16		37.71		-10.43	
Neither Discussed Nor Engaged in Collective Action	17.53		20.55		-3.14	
		.0001		.0001		.0001

^aProbability in an analysis of variance test that differences among subgroup means could result from sampling variability.

to participate in collective undertakings than those in the other two regions, while individual action is the most likely in Region 3. Only in Region 1 is the probability of collective action greater than the probability of individual action. The difference between the probabilities of collective and individual action is particularly striking in Region 3 where presently only five sample

respondents (3.8 percent) have participated in collective action and only eight are members of shoreline property owners associations.

As might be expected, the likelihood of future protective action, both collective and individual, is much greater among respondents who have experienced erosion damage than among those who have not. Similarly, those who have taken some type of action, either collective or individual, are more likely to continue investment in shore protection in the future than those who have never taken any protective action.

Property owners who have invested in collective action in the past see a better than even chance of future participation in joint neighborhood efforts at shore protection, but only about three chances in ten of individual action. On the other hand, those who have discussed collective action but failed to come to agreement with their neighbors are much less likely than the first group to take collective action but more likely to make individual efforts. Participation in collective action apparently predisposes property owners to invest in future joint protection, while unsuccessful attempts to organize collective action may incline them toward individual action.

Respondents to the questionnaire were also asked to estimate how often they felt that they would have to invest in shore protection. For the sample as a whole, 17.1 percent thought that they would need to invest in shore protection at least every ten years, 15.4 percent less often than every ten years, 22 percent felt that they would never take protective action, and 45.5 percent were uncertain about the frequency of investment. There were no striking regional differences with respect to the expected frequency of investment; Table 52 shows differences among sample subgroups stratified by other variables. Chi square tests performed on all three distributions were significant at the .01 level.

Table 52

EXPECTED FREQUENCY OF INVESTMENT IN SHORE PROTECTION
SIX COUNTY SAMPLE, 1979

	Percentage of Respondents				
	At Least Every 10 Years	Less Often Than Every 10 Years	Never	Don't Know	Total
Have Experienced					
Erosion Damage	23.4	14.6	14.6	47.4	100.0
No Erosion Damage	3.7	17.2	36.2	42.9	100.0
Have Taken Action	33.0	20.9	7.8	38.3	100.0
Have Not Taken Action	6.4	11.5	31.4	50.6	100.0
Have Invested in Collective Action	18.6	30.5	11.9	39.0	100.0
Discussed, Not En- gaged in Collec- tive Action	35.9	11.5	12.8	39.7	100.0
Neither Discussed Nor Engaged in Collective Action	12.9	13.6	25.5	48.0	100.0

A much larger percentage of property owners who had experienced erosion damage felt that they would have to take shore protective action at least every ten years than those who had perceived no erosion damage. Approximately 36 percent of those with no damage feel that they will never invest in shore protection as compared to about 15 percent of those with damage. Over 40 percent of both groups are uncertain about the frequency of future investment.

About a third of the property owners who have taken some kind of protective action, either collective or individual, expect to invest in protection at least every ten years and another 21 percent expect to take action less often than every ten years. These percentages are much smaller among those who have

not yet taken any protective action. There is much more uncertainty among those who have not had experience in shore protection; over half said that they did not know how often they would have to invest. With respect to collective behavior, those who have discussed but not engaged in joint protective undertakings on the average see a more frequent need for investment in shore protection than those who have participated in collective action and those who have never considered collective action.

RATIONALITY OF INVESTMENT IN SHORE PROTECTION

The purpose of this chapter is to evaluate the rationality of consumer investment in shore protection with respect to the value of the property being protected. Any attempt to judge consumer rationality is perhaps presumptuous in the face of the impossibility of making interpersonal comparisons of utility. One cannot know the amount of satisfaction a property owner may derive from a particular holding of shore land; sentimental attachment may dictate investment in shore protection far beyond that which the detached observer might judge reasonable. If knowledge were perfect, all investments might be deemed rational from the point of view of the individual property owner. Outside judgments of the rationality of investment in shore protection can be made only in terms of outside market standards such as the return to investment as measured by the interest rate and other indicators. General consumer behavior can be examined with respect to these norms; evaluations cannot be made on a subjective case-by-case basis.

To compare investment in shore protection with property value, both must be measured in comparable terms. For that purpose all money amounts have been inflated to 1978 dollars employing relevant components of the Consumer Price Index. Because of the unavailability of comparable indices before 1953, the data set has been reduced for analysis in this chapter only to those respondents who acquired their shore properties in 1953 or later. This includes 459 respondents of whom 411 reported original purchase cost and 379 estimated current property value. Some 140 of these property owners had made investments in shore protection which could be compared with property value.

Investment in Shore Protection

Table 53 shows various measures of the investment in shore protection made by respondents who are part of the reduced data set considered in this chapter.

Table 53

INVESTMENT IN SHORE PROTECTION
SIX COUNTY SAMPLE, 1979

Respondents Who Purchased Property after 1952 and Who Invested in Shore Protection					
Mean Investment in Shore Protection in 1978 Dollars					
	Collective Action	Individual Action	Total Investment	Investment per Front Foot	Average An- nual Investment
Region One	\$5,403.30	\$8,479.70	\$8,815.00	\$ 83.04	\$686.40
Region Two	3,638.50	1,265.40	1,480.10	9.45	161.85
Region Three	2,699.00	6,909.60	6,741.20	105.08	866.84
Entire Sample	5,267.80	6,422.50	6,964.50	72.72	613.19

Of those respondents who took some type of shore protective action and acquired their property after 1952, the average investment amounted to \$6,964.50. The individual share of those who invested in collective action with their neighbors averaged \$5,267.80; all but three of these collective efforts were undertaken in Region 1. On the average, individual shore protective action has cost the respondent \$6,422.50 since acquisition of the property. For the sample as a whole, respondents who have invested in shore protection have spent an average \$72.72 per shore front foot; per foot investment has amounted to \$83.04 in Region 1, \$9.45 in Region 2, and \$105.08 in Region 3. Although average total investment is greater in Region 1, per foot investment is the greatest in Region 3 where the average lake front lot is some 22 feet narrower.

In general, the subsample of respondents who have acquired their properties since 1952 is representative of the whole sample. Mean investments in collective and individual action are slightly smaller and per foot investment slightly larger for the reduced data set than for the larger group (see Table 28. For Region 1 none of the measures of investment are notably different for the two groups; for Region 2 average investment in individual action is approximately one thousand dollars smaller for the reduced data set than for the whole sample and per foot investment is about \$2.50 less. The most striking differences between the subsample and the whole sample occur in Region 3; here investments for the group acquiring their properties after 1952 are on the average considerably greater than for the sample as a whole. Respondents acquiring their property after 1952 have invested an average \$6,741.20 or \$105.08 per front foot in shore protection as compared to a mean \$4,140.50 or \$79.65 per front foot for the sample as a whole. Apparently shore protection activity has been the strongest in Region 3 among those who acquired their properties in 1953 or later.

Average annual investment in shore protection was computed on a per case basis; means for the sample as a whole and for the regions are shown in the last column of Table 53. In general respondents in the reduced data set who have taken some type of shore protective action have invested an average \$613.19 per year. Annual investment averages \$686.40 for Region 1, \$161.85 for Region 2, and \$866.84 for Region 3. These means are probably representative of the whole sample for Regions 1 and 2 but may be high for Region 3 because of the greater average investment by the subsample in that area as noted earlier.

Property Value

Since very few of the lake front properties in the sample have been on the market recently, current property value is a somewhat subjective matter. Two methods were employed to estimate property value. First, respondents were asked to estimate the market value of their properties at the time of answering the questionnaire (early 1979); their perceptions are shown in the first column of Table 54. As a check, the property value at the time of acquisition as provided by respondents was inflated to 1978 dollars using the housing component of the Consumer Price Index. The second column of Table 54 shows these estimates.

Table 54

LAKE SHORE PROPERTY VALUES
SIX COUNTY SAMPLE, 1979

	Mean Current Property Value	
	As Perceived By Respondents	Value at Acquisition Inflated to 1978 Dollars
Region One	\$65,883	\$35,060
Region Two	51,511	25,235
Region Three	47,159	31,549
Entire Sample	56,300	30,452

As can be noted, there is considerable discrepancy between the two measures of property value; the inflated acquisition value averages only 54 percent of the perceived current property value for the entire sample. Several factors may contribute to this discrepancy. In one respect the housing component of the Consumer Price Index is biased downward; in many cases very high-priced housing is sold under a land contract and the sale price not recorded for tax reasons. This practice results in a reduced

average cost of housing for the Index and would cause an inflator based upon it to be too low. However, this error could not account for a discrepancy as large as that shown in Table 54.

The housing component of the Consumer Price Index is an average based on various types of housing in all geographic areas in the United States. The difference between the perceived current value of shore housing and the inflated acquisition value could be based, in part, on the calculation of the inflator using a general housing index rather than one taking into account only the rise in price of shore housing. However, this could explain the discrepancy only if the rate of inflation is considerably greater for shore housing than for housing in general because the original acquisition value already reflected the higher values of property located on a lake.

Another factor which may contribute to the difference between the two measures of value is an over-valuation of their property by respondents. To check this possibility realtors in all three regions were asked for a range of prices for developed lake shore property. Prices were estimated on a per foot of shore front basis to allow comparisons. It should be noted that the realtor contact was not a systematic sampling process, and the estimates should be regarded as broad approximations albeit by detached experts in property valuation. Current property values as perceived by respondents, inflated acquisition values, and realtor estimates are all shown on a per foot of shore front basis in Table 55.

Sample property owners appear to have considerably overestimated the value of their shore holdings if the ranges quoted by area realtors are considered valid. The average per foot value of shore property estimated by respondents in Region 1 is \$274 higher than the upper end of the range given by realtor. Property owners in Region 2 may be somewhat more realistic; their

Table 55

PROPERTY VALUE PER FOOT OF SHORE FRONT: THREE ESTIMATES
SIX COUNTY SAMPLE, 1979

	Mean Current Property Value per Foot of Shore Front		
	As Perceived By Respondents ^a	Value at Acquisition Inflated to 1978 Dollars ^b	As Estimated by Area Realtors
Region One	\$773.56	\$295.82	\$350-500
Region Two	426.03	168.81	350-400
Region Three	584.53	327.07	200-350
Entire Sample	592.50	240.44	200-500

^aAverages on a per case basis.

^bAverages based on an average of means.

average per foot estimate is only \$26 above the upper end of the realtors' range. In Region 3 the average per foot value estimated by property owners is \$235 greater than the upper end of the realtors' estimate. The over-estimation of property value may be influenced in part by an expectation of a steep rise of prices in the present low water stage of the Great Lakes as compared to the prices in effect at high water periods of the cycle when many properties were purchased. If the price change had already been discounted at the time of purchase, a sharp rise in price would likely not occur.

Except in Region 3, the average acquisition value inflated to 1978 dollars tends to fall below the estimated range of area realtors. In Region 1 the inflated acquisition value falls \$55 below the lower end of the realtors' range, while the shortfall in Region 2 amounts to \$180. However, in Region 3 the mean inflated acquisition value falls within the range estimated by realtors. This would tend to indicate that lake shore property values in that area have been rising at about the same rate or only slightly above property values in general in the United States.

Investment in Relation to Property Value

Evaluation of the rationality of property owners' investment in shore protection requires use of the proper measures of both the investment and property value. As has been noted, both concepts can be measured in several ways. Investment in shore protection can be expressed as amounts spent on individual protective action, collective action, total investment in protection, amounts invested per foot of shore front, and average annual investment. In addition, financial resources expended can be measured in nominal dollars or in dollars indexed to a common year. Average annual investment in shore protection expressed in 1978 dollars is the concept considered here. Average annual investment is used rather than total investment because of the relatively long expected life of shore protective devices. Although the actual financial investment may take place in a single year, the protective device is expected to be productive over a period of time. Considering average annual investment smoothes the investment process so that the expenditures of a long-standing shore resident who may have installed several devices may be meaningfully compared to those of a more recent resident who may have invested only once in shore protection. Financial investment is also indexed to 1978 dollars for the sake of meaningful comparison. For each case, investments are inflated to 1978 dollars, summed, and divided by the number of years the property has been held.

In the previous section property value, which is somewhat subjective in nature, was measured in three ways: as perceived by the respondent, purchase price inflated to 1978 dollars, and as evaluated by area realtors. Except in the case of Region 3, the evaluation of realtors was bracketed by respondent perceptions which were higher and inflated purchase prices which were lower. In Region 3 the inflated purchase price fell within the range provided by realtors.

The choice of the correct property value to use depends on the purpose of comparison. From the standpoint of evaluating rationality within the framework of the respondents' perceptions, the current property value as reported by sample property owners is the proper concept to use. On the other hand, if the purpose is to determine if property owners are making reasonable expenditures to protect their investment in the property from the standpoint of a detached observer, then inflated purchase price provides a more conservative estimate of property value.

In Table 56 average annual investment in shore protection is shown as a percentage both of current property value as perceived by respondents and of inflated acquisition value.

Table 56

AVERAGE ANNUAL INVESTMENT IN SHORE PROTECTION
AS A PERCENTAGE OF PROPERTY VALUE
SIX COUNTY SAMPLE, 1979

	Annual Investment in Shore Protection as Percent of:	
	Current Property Value As Perceived by Respondents	Property Value at Acquisition Inflated to 1978 Dollars
Region One	1.2	7.3
Region Two	0.2	0.7
Region Three	1.1	3.2
Entire Sample	1.1	5.2

The values in Table 56 may be viewed as the percentage of the given property value which is invested in shore protection annually and may be compared to the annual rate of return which might be expected from an investment. One would not expect a property owner to invest more annually to protect his investment in the property than that investment could be expected to yield in a year. Neither measure of property value yields a rate of annual investment greater than a general ten percent return on investment.

With respect to the current property value as perceived by respondents, property owners who took protective action invested an average 1.1 percent of the property value in shore protection annually, ranging from 0.2 percent in Region 2 to 1.2 percent in Region 1. Expenditure of only slightly over one percent of the property value to protect the investment would have to be judged a rational action when compared to the annual return to capital.

In the judgment of an outside observer, the properties may not be worth as much as the property-owners believe. If the inflated acquisition property value concept is used, the rate of annual investment in shore protection averages 5.2 percent for the sample as a whole, varying from 0.7 percent in Region 2 to 7.3 percent in Region 1. Although the rate in Region 1 may begin to approach the return to capital, it should be noted that the inflated acquisition value probably understates the property values in Regions 1 and 2 as estimated by realtors. The rate of annual expenditures in shore protection is therefore overstated for those regions. The detached observer would consider these expenditures a reasonable amount to spend for the protection of an investment.

The percentages in Table 56 are means; some individual property owners may be spending more on shore protection than might be judged reasonable. Table 57 shows the distribution of rates of expenditure on shore protection. About 88 percent of the property owners investing in shore protection have spent less than 8.3 percent of the property value annually; 72 percent have expended less than 4.1 percent annually. Only four respondents or 2.8 percent of the total have invested more than 12.4 percent. The two respondents in the highest class have each invested more than 100 percent of the property value annually; these probably represent persons who have recently purchased their properties and who have taken a very costly action such as relocating the residence.

Table 57

DISTRIBUTION OF RATES OF EXPENDITURE ON SHORE PROTECTION
SIX COUNTY SAMPLE, 1979

Annual Expenditures As Percent of Acquisi- tion Value Inflated to 1978 Dollars	Number of Cases	Percent of Cases ^a
0.0 - 4.1	101	72.1
4.2 - 8.2	22	15.7
8.3 - 12.3	9	6.4
12.4 - 16.4	4	2.9
16.5 - 20.5	2	1.4
Greater than 20.5	2	1.4
Total	140	100.0

^aColumn may not sum to total because of rounding.

Although a few sample property owners have made seemingly uneconomic investments in shore protection, it appears that on the average they have behaved rationally with respect to the amount of financial resources expended both from the standpoint of their own perceptions about property values and from the view of a disinterested observer. This analysis, of course has dealt only with the dollar amount of investment in shore protection and not with the effectiveness of the devices installed. A reasonable investment in terms of the dollar amount expended may not be considered reasonable if the protective device installed has little or no effect in arresting erosion damage. This study did not undertake engineering evaluations of the effectiveness of the devices installed; however, the respondents themselves did not rate the effectiveness of the protection overwhelmingly high--an average 5.6 on a scale from 1 to 7. In terms of satisfaction with the "value for money spent" the shore protection installed was given a mean 3.6

rating on a scale from 1 to 5. It is possible that if a larger investment could purchase more effective, "permanent" protection, greater expenditures on shore protection might be considered more reasonable than the average amounts reported in this study.

VI

CONCLUSION

Highlights of the Study

Of the 573 Michigan shoreline property owners studied, 380 or about two-thirds have perceived some type of erosion damage to their properties since acquisition although only about 24 percent reported visible erosion damage at the time of acquisition. Damage has apparently been less severe in Region 2, the Grand Traverse Bay area; only 44 percent of respondents from Leelanau County have experienced erosion damage during their tenure. The large majority of property owners with damage blamed wave action, wind action, and water levels for the erosion, but 61 percent also cited the absence or inadequacy of shore protection indicating some belief in the potential of these devices to retard erosion.

Reactions to the realization of erosion damage were varied including the purchase of insurance, special off-season trips to inspect for damage, attendance at public hearings and court cases, and attempted sale of property, but 53 percent of those who experienced erosion damage invested in some type of shore protection. Of the factors tested, the presence of a permanent dwelling on the property and the presence of some type of shore protection device at acquisition were the most closely related with investment in shore protection. Approximately 20 percent of those with some type of erosion damage expressed some degree of futility noting that shore protection could not have reduced the damage.

Friends and shoreline neighbors were the most common sources of information about shore protection, consulted by nearly half of the sample property owners. However, private consulting engineers, private marine contractors,

and shoreline neighbors were considered to have given the most reliable advice by those who had taken some type of shore protective action.

About one-third of the sample property owners have individually invested in shoreline protection and about 11 percent have joined their neighbors in collective action. Property owners who invested in individual action expended an average \$6,603 over the time that they held the shoreline property; the individual share of collective action averaged \$5,834. Seawalls and groins were the most commonly installed devices both in individual and collective efforts. Respondents who individually invested in shoreline protection rated the effects between "somewhat positive" and "positive" on the average (5.6 on a 7 point scale). Those who took collective action gave a mean effectiveness rating of 5.1. About 40 percent of those who took individual action employed the services of a contractor and on the average were moderately satisfied with the advice and work performed.

Among those who invested in shore protection the average annual expenditure was \$613. On the average, investment in shore protection appears to be within the bounds of rationality in terms of amounts expended to protect the original investment in the property. Average annual investment as a percentage of property value falls below the annual rate of return to capital. However, the potential for over-investment exists in that property owners generally overestimate the value of their property. On a per foot of shore basis the mean value estimated by property owners fell considerably above the top end of the range estimated by realtors in all three regions. If property owners consistently overvalue their property, they may invest resources which, though reasonable within their own value framework, are greater than the amounts which would be considered rational with respect to an outside judgment

of property value. At the present, however, evidence from this study suggests that investment in shore protection is reasonable even when the property value is estimated conservatively.

Policy Suggestions

It is evident that shoreline property owners are going to be investing in shore protection in the future. As was shown in Table 51, across the entire sample property owners, on the average, estimated a probability of about one chance in four of both individual and collective action. Among those who have already taken shore protective action, respondents estimated a 31 percent chance of collective action and a 41 percent chance of individual action.

Investment of large sums of money in often specialized engineering projects involving complicated natural forces requires technical and financial information. However, by far the most common sources of information about shore protection noted by respondents were shoreline neighbors and friends. Friends and neighbors, though understandably considered trustworthy by property owners, are perhaps not the best sources of accurate, technical information.

Lack of information and uncertainty about the potential and limitations of shore protection devices have been evident throughout this study. Although 61 percent of respondents with damage cited absent or inadequate shore protection as a cause for their erosion damage, nearly 20 percent expressed that they were uncertain what actually caused the damage, a more frequent response than any other cause of damage. As noted in Table 25 a lack of confidence in the ability of shore protection to reduce erosion damage was displayed by about 20 percent of respondents experiencing damage. At

another point, those who had considered investing in shore protection but decided against it were asked for their reasons. About 15 percent felt that "nothing would help." Part of this sense of futility may be based on fact and experience, but part likely stems from a lack of knowledge.

There is evidence that at least some respondents have been disappointed with the effectiveness of the shore protective devices installed. Several had much shorter productive lives than had been expected including two installed as permanent operations which lasted only two years. Respondents were not overwhelmingly enthusiastic in rating the value of their protective actions in terms of time and money spent, assigning a mean 3.6 points on a five point scale. Approximately 20 percent of respondents gave their protective devices a poor or fair rating; in Region 1, the southwestern Lake Michigan shore, over one-fourth rated the devices less than satisfactory in terms of time and money spent. Better information might have prompted property owners to alter the actions they took or modified their expectations about effectiveness. It is certainly possible that additional knowledge might have changed both the nature and amount of subsequent investment.

Sample property owners were queried about three publications available on shore protection. Only about 9 to 12 percent of the respondents were familiar with the three brochures; a larger percentage of those in Region 1, particularly members of property owners associations, had read the publications. Those who were familiar with the brochures generally found them helpful and many had recommended them to a friend.

The respondents showed a need for accurate, reliable, and current information about shore protection which was not being met by the current level of distribution of publications or by such government services as county extension agents, the state Department of Natural Resources, or the Army Corps of

Engineers. A need exists for a reliable information source which presents a high profile to shore property owners who otherwise receive little direction in their search for information. Distribution of printed literature could be achieved partially through property owners' associations, particularly in Region 1 where the largest proportion of property owners belong to such groups.

While the Department of Natural Resources would be an obvious suggestion as a source of information, its image as a source of help to shore property owners varied widely. Although the Department appears to have a fairly good image in Region 2, property owners in Regions 1 and 3--the areas with the greatest erosion problems--rated it as less than "somewhat helpful" as a source of information about shore protection. The rating was particularly low in Region 1, an average 3.38 on a seven point scale. With respect to reliability of information provided, Region 1 respondents rated the department less than "somewhat reliable" though property owners in Regions 2 and 3 gave an average rating above the midpoint on the scale. Efforts will need to be made to improve the public image of the Department of Natural Resources in some areas and to increase outreach programs if it is to serve as an effective source of information.

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APPENDIX A

INDEXING METHODS EMPLOYED

To achieve comparability and allow mathematical and statistical manipulation of dollar amounts pertaining to financial transactions occurring in different years, the nominal amounts reported by respondents for property purchase and installation costs of shore protective devices were all indexed to 1978 dollars. Amounts reported in the tables and text are in terms of 1978 dollars.

Different components of the Consumer Price Index were utilized in indexing the various types of costs. For purchase price of the property, the housing purchase component was employed. For materials costs of shore protective actions, the maintenance and repair commodities index was used and for labor costs, the maintenance and repair services index from 1964 to 1978. Prior to 1964, maintenance and repair commodities are estimated using the price index for exterior house paint, and maintenance and repair services are estimated using the price index for reshingling house roofs. Where only the total cost of the action is reported, the combined maintenance and repair index has been used to calculate equivalent 1978 cost. Because of problems with indexing costs before 1953, purchases and actions before that year have been treated as missing data with respect to the financial calculations. Of the 573 respondents, 459 have purchased their properties in 1953 or later; 336 actions have been taken during that time period.

Equivalent 1978 costs have been calculated using percentage change as follows:

$$(1) \quad [\text{Index (1978)}] - [\text{Index (Year of purchase/action)}] = [\text{Index Change}]$$

$$(2) \quad [\text{Index Change}] \div [\text{Index (Year of purchase/action)}] = [\text{Rate of Change}]$$

(1) [Rate of Change] x [100] = [Percentage Change]

(2) [Percentage Change] x [Price/Cost (Year of purchase/action)] =
[Price/Cost (1978)]

Appendix Table A shows the values of the indices used from 1953 through 1978.

Appendix Table A
 CONSUMER PRICE INDICES
 1967 = 100

Year	Maintenance and Repair			
	Housing Purchase	Commodities	Services	Combined
53	75.0	80.0	59.5	71.2
54	76.3	82.1	63.1	72.4
55	77.0	82.6	65.2	74.1
56	78.3	86.6	69.7	77.2
57	81.7	91.8	73.1	80.5
58	83.5	93.4	76.0	81.8
59	84.4	92.8	79.6	83.2
60	86.3	92.7	82.3	84.6
61	86.9	94.1	84.1	85.9
62	87.9	94.8	85.4	86.5
63	89.0	93.9	86.6	87.7
64	90.8	95.1	87.0	89.5
65	92.7	95.8	89.4	91.3
66	96.3	97.7	94.2	95.2
67	100.0	100.0	100.0	100.0
68	105.7	103.8	107.1	106.1
69	116.0	110.8	116.9	115.0
70	128.5	113.7	128.4	124.0
71	133.7	119.0	140.0	133.7
72	140.1	124.1	147.9	140.7
73	146.7	136.2	157.3	151.0
74	163.2	151.6	180.2	171.6
75	181.7	160.9	199.0	187.6
76	191.7	168.2	213.2	199.6
77	204.9	179.8	229.8	214.7
78	227.2	190.0	249.9	231.6

Source: Handbook of Labor Statistics 1978. U.S. Department of Labor,
 Bureau of Labor Statistics Bulletin 2,000, 1979.

Appendix Table B

PROPERTY ASSOCIATION MEMBERSHIP
BY REGION

Name of Association	Number of Members in Sample	County of Membership (Region One Only)
<u>Region One</u>		
Lake Shore Property Owners	16	Allegan, Berrien, Van Buren
North Shore Estates	9	Allegan, Ottawa
Lake Michigan Shore Owners	6	Allegan, Van Buren
Douglas Lakeshore	8	Allegan
Grand Mere	4	Berrien
Union Pier	1	Berrien
Dunewood	2	Berrien
Waverland Beach	1	Berrien
Tower Hills Shorelands	1	Berrien
Chikaming Township	1	Berrien
Sunset Shores .	3	Ottawa
Central Highland Park	3	Ottawa
Eagle Cress Water Assn.	1	Ottawa
Grand Haven Beach Assn.	4	Ottawa
South Highland	2	Ottawa
Idlewood Beach Improvement	2	Ottawa
Huizenga Shores	1	Ottawa
Wilderness	1	Ottawa
Forrest Dunes	3	Van Buren
Thunder Mountain Heights	4	Van Buren
Sand Haven	1	Van Buren
	<u>74</u>	
<u>Region Two</u> (Leelanau County)		
Cherry Homes	14	
Northport	7	
Lighthouse-Clipper Cove	1	
Glen Lake	1	
Sleeping Bear Dune	1	
Roaring Brook	1	
Sugar Bush Lane	2	
Empire Beach	2	
Cathead Bay	3	
Omena Woods	1	
Birchwood Shores	2	
Paradesia Point Cottage Owners	1	
S.W. Leland Township Improvement	1	
Sleeping Bear Citizens Council	1	
	<u>38</u>	
<u>Region Three</u> (Sanilac County)		
Great Lake Shores	2	
Lexington Heights Corp.	1	
Huron Heights	1	
South Lake	1	
Blue Water Beach	1	
Worth Township Club	1	
	<u>7</u>	
Total, All Regions	119	

Appendix C

SAMPLE QUESTIONNAIRE



DIVISION OF RESEARCH ■ GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
THE UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN 48109

ALFRED L. EDWARDS
Director

Dear Shoreline Property Owner:

Several weeks ago we sent a postcard stating that you are among the Michigan shoreline property owners selected to participate in a University of Michigan study of private investment in shoreline protection. Please find enclosed the questionnaire and business reply envelope for your response. Your quick and accurate attention to completing and returning this questionnaire will be appreciated.

Participation in this study affords you, the property owner, the opportunity to express anonymously your thoughts and feelings about experiences you have had since acquiring shoreline property. The Division of Research assures the confidentiality of your responses. We also assure you that in our role as data analysts, we will maintain high ethical standards and report only general trends and characteristics of groups of individuals. This type of aggregate treatment will make it possible for all Michigan shoreline property owners to benefit from information about common, frequently occurring problems and the various ways in which groups of our respondents dealt with them.

We trust you will see the merit of this important project and complete and return the questionnaire today. If you have any questions about the project or the questionnaire, please feel free to call, collect, Dr. Patricia L. Braden or James H. Leigh, principal investigator and research fellow respectively, at the Division of Research: (313) 764-1366. Thank you for your cooperation.

Sincerely yours,

Alfred L. Edwards
Alfred L. Edwards
Director

P.S. You may expect to receive a copy of the first report no later than May, 1979.

PRIVATE INVESTMENT IN
SHORELINE PROTECTION

INSTRUCTIONS:

Please answer each set of questions that applies to you as accurately and completely as you can. Some of the questions in a set are to be answered only if you responded in a certain way on a previous question.

For example, look at 5 at the bottom of this page. If you are a Michigan resident, you will then answer the questions in the box on the left with the arrow leading from the YES box before progressing to the next set of questions. If you're not currently a Michigan resident, you will answer first the question in the right box asking if you have ever been a Michigan resident. If the appropriate response is no, you will then proceed to the next set of questions. If yes you have been a resident before, then you will indicate the length of your residence before starting 6.

The small numbers in the margin and by the questions are for the purposes of key punching and computer coding; please ignore them.

Thank you.

SECTION ONE
GENERAL INFORMATION

1. Your age:

- | | | |
|------|------------------------------|--------------|
| 1:16 | 1[] 25 years old or younger | 4[] 46 - 55 |
| | 2[] 26 - 35 | 5[] 56 - 65 |
| | 3[] 36 - 45 | 6[] Over 65 |

2. Please check your highest educational achievement to date:

- | | | |
|------|------------------------------------|--------------------------------|
| 1:17 | 1[] Not a primary school graduate | 5[] Some college |
| | 2[] Finished primary school | 6[] Bachelor's degree |
| | 3[] Some high school | 7[] Some advanced degree work |
| | 4[] High school graduate | 8[] Advanced degrees(s). |

1:18-19 3. Your present occupation: _____ . If retired, please
1:20-21 indicate your occupation before retiring: _____

4. Your annual income:

- | | | |
|------|------------------------|------------------------|
| 1:22 | 1[] \$6000 or less | 5[] \$30,001 - 50,000 |
| | 2[] \$6001 - 10,000 | 6[] \$50,001 - 80,000 |
| | 3[] \$10,001 - 20,000 | 7[] Over \$80,000 |
| | 4[] \$20,001 - 30,000 | |

1:23 5. Are you a Michigan resident? 1[] Yes 2[] No

1:24
1:25

Are you a registered voter in the county where this shoreline property is held? 1[] Yes 2[] No Are you a registered voter in Michigan? 1[] Yes 2[] No

Have you ever been a Michigan resident? 1[] Yes 2[] No If yes, for how long? _____
--

1:26
1:27-28

7. Have you ever attended any zoning or other public hearings because the outcome might affect this property?

1:46

1[] Yes

2[] No

1:47

How many? _____

1:48-49

What issues were involved? _____

8. Have you ever attended a court case because the outcome might affect this property?

1:50

1[] Yes

2[] No

1:51

How many? _____

1:52-53

What issues were involved? _____

9. Have you ever permanently resided (the year around) within 10 (ten) miles of a major body of water, such as one of the oceans, gulfs, bays or Great Lakes?

1:54

1[] Yes

2[] No

1:55-56

For how long? _____ years.

Was this near one of the Great Lakes?

1:57

1[] Yes

2[] No

1:58-59

Which ones? _____

10. Do you hold any Great Lakes shoreline properties?

1:60

1[] Yes

2[] No

1:61

How many? _____

1:62-63

On which lakes are they located? _____

11. Below is a map of Michigan which is divided into 6 (six) sections. For each section, please answer the following questions:

	Record the number below that best describes how familiar you are with each section: <i>Unfamiliar</i> <i>Somewhat Familiar</i> <i>Very Familiar</i> 1 2 3 4 5 6 7	What source or sources best describe how you became familiar with each area: 1. Personal experience or observation 2. Friends' experiences or observation 3. Radio and television news and documentaries 4. Books, magazines, and other printed matter 5. Not familiar	How would you rate the risk of damage to shoreline property in each area? 1. Low 2. Medium 3. High 4. Don't know	What time of year do you think each area would be most susceptible to damage? 1. Spring 2. Summer 3. Fall 4. Winter 5. Don't know	Which types of damage do you think are most likely to occur in each area? 1. Erosion 2. Flooding 3. Ground Seepage 4. Don't know
Section 1	_____	_____	_____	_____	_____
Section 2	_____	_____	_____	_____	_____
Section 3	_____	_____	_____	_____	_____
Section 4	_____	_____	_____	_____	_____
Section 5	_____	_____	_____	_____	_____
Section 6	_____	_____	_____	_____	_____

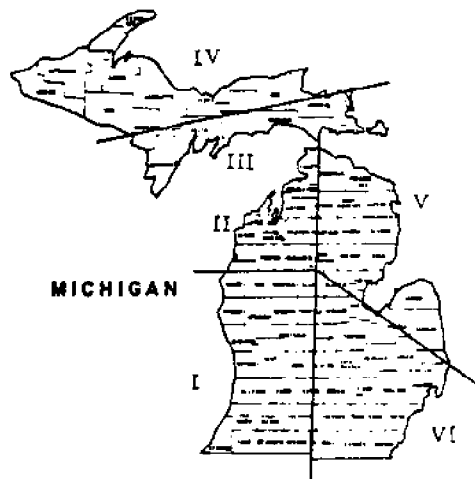
1:64-69

2:10,15,20,25
30,35-39

2:40-45

2:46,51,56,
61,66,71-75

3:10,14,18,22,
26,30-33



SECTION TWO
PROPERTY ACQUISITION

Instructions: For this and the following sections, please answer the questions about only one of your Michigan shoreline properties if you own several.

12. Do you now or did you ever own shoreline property in Michigan?

- 3.34 1[] Currently own 2[] Previously owned 3[] Never owned

3.35-38
3.39-44

When did you sell this property?

What was the selling price?

Thank you for participating.
Please return the question-
naire in the postage-paid
envelope.

3.45-48 13. When did you acquire this property? _____

14. How did you acquire this property?

- 3.49 1[] Purchased from individual property owner
- 2[] Purchased through realtor
- 3[] Purchased from developer
- 4[] Gift
- 5[] Inherited property
- 6[] Other _____

15. Do you live at this shoreline property the year around?

- 3.50 1[] Yes 2[] No

Do you or other family members use the property during all seasons of a year?

3.51 1[] Yes 2[] No

3.52-53 What month of the year do you usually open up your property?

3.54-55 What month of the year do you usually close it up for the season?

3.56-57 How many times per year do you or other family members use the property?
_____ times, which amounts to _____ total days.

3.58-60

3.61-62 How many times per year do others besides you and your family use this shoreline
3.63-65 property? _____ times which amounts to _____ total days.

Do you or others in your family ever make special trips to this property during the
period between late fall and early spring for reasons other than recreation?

3.66 1[] Yes 2[] No

Why do you make the trips?

3.67 1[] Check on possible storm damage

3.68 1[] Make minor repairs

3.69 1[] Check for pilferage

3.70 1[] Other _____

3.71-72 How many of these trips do you normally
make per year? _____ trips.

20. Had your adjacent neighbors installed shore protection prior to your acquisition?

4 46

1[] Yes

2[] No

4 47

Which neighbor? 1 [] Upcurrent
 2 [] Downcurrent
 3 [] Both

What type of protection was installed? _____

4 48-49

SECTION THREE
BUILDINGS AND IMPROVEMENTS

21. Is there a mobile home or trailer located on your property?

4 50

1[] Yes

2[] No

22. Are there any permanent dwellings located on this shoreline property?

4 51

1[] Yes

2[] No

More than one?

4 52

1[] Yes

2[] No

4 53-54

How many? _____
 Please answer the remaining
 questions in this box about the
 dwelling that you use.

4 55-56

How old is this dwelling? _____ years

4 57-59

What is the setback today? _____ feet

What is the condition of this dwelling?

4 60

- 1[] Poor
- 2[] Fair
- 3[] Satisfactory
- 4[] Good
- 5[] Excellent

Have you undertaken any major improvements on the dwelling since you acquired the property or constructed the building?

4 61

1[] Yes

2[] No

Do you plan to invest in improvements in the future?

4 62

1[] Yes

2[] No

4 63-64

What do you plan to do? _____

4 65-68

When? _____

4 69-74

How much do you expect to spend?
\$ _____

5 33-35 29. Approximately how far is it from your property to the city limits of the nearest city with 5000 or more residents? _____ miles (Please indicate 0 if property is located within city limits.)

5 36-38 30. Approximately how far is it from your property to the city limits of the nearest lakefront city with 5000 or more residents? _____ miles.

31. What were the overall dimensions of this property at the time you acquired it?

5 39-42 Length of beach _____ feet

5 43-46 Depth of lot _____ feet

32. What are the overall dimensions of this property today?

5 47-50 Length of beach _____ feet

5 51-54 Depth of lot _____ feet

33. At the time you acquired it, how wide was the beach (e.g., between the water's edge and the bottom of the bluff):

5 55-58 During normal summer conditions _____ feet

5 59-62 During typical storms (if waves strike a bluff, mark 0) _____ feet

34. How wide is the beach now:

5 63-66 During normal summer conditions _____ feet

5 67-70 During typical storms _____ feet

35. What was the predominant visible beach material at the time of acquisition? (If no beach, mark nonexistent.)

5 71

- 1[] Sand
- 2[] Loose rock
- 3[] Solid rock
- 4[] Clay
- 5[] Loose soil
- 6[] Nonexistent
- 7[] Other (Please specify) _____

36. What is the predominant beach material that is visible today?

5 72

- 1[] Sand
- 2[] Loose rock
- 3[] Solid rock
- 4[] Clay
- 5[] Loose soil
- 6[] Nonexistent
- 7[] Other _____

7.10 43. Is this property investment insured by a private firm? 1[] Yes 2[] No

7.11-13 What percentage of the property value is covered? _____ %

7.14 44. Were you ever denied insurance because the property is located on the shoreline? 1[] Yes 2[] No

7.15 By how many firms? _____

7.16 45. Have you considered selling your property? 1[] Yes 2[] No

7.17 Have you tried listing the property with a realtor? 1[] Yes 2[] No
7.18 If yes, were you successful? 1[] Yes 2[] No

7.19 46. Have any of your neighbors tried selling their property recently? 1[] Yes 2[] No 3[] Don't know

7.20 Were they successful? 1[] Yes 2[] No 3[] Don't know

<p>7.21 Was the selling price _____ you expected</p> <p>1[] Less than you expected 2[] About the same as you expected 3[] More than you expected 4[] Don't know</p>	<p>7.22 Why do you think they were unsuccessful? _____</p> <p>_____</p> <p>_____</p>
---	--

7.23 47. Do you think your property is currently marketable at a reasonable rate of return? 1[] Yes 2[] No 3[] Don't know

7.24-25 Why not?

7.26 48. Nearby shoreline property values are expected to _____ over the next 2 years?
1[] Decrease
2[] Remain the same
3[] Increase
4[] Don't know

SECTION SIX
DAMAGE

49. How would you describe the damage to your property?

		Not applicable	Much less	Less	Somewhat less	About the same	Somewhat more	More	Much more
7.27	With respect to other shoreline properties in the county	N/A	1	2	3	4	5	6	7
7.28	With respect to your upcurrent neighbor's damage suffered	N/A	1	2	3	4	5	6	7
7.29	With respect to your downcurrent neighbor's damage suffered	N/A	1	2	3	4	5	6	7

50. Has this property experienced erosion damage since you acquired it?

7.30 1 [] Yes 2 [] No ----> **Please skip to Section Seven.**

	Since acquiring this property, have you suffered:	Since acquiring this property, has the damage you've experienced seemed to increase, decrease or remain the same?	Do you think adequate shore protection could have reduced the damage?
7.31-33	Beach Erosion 1 [] Yes--If yes--> 2 [] No 3 [] Not applicable	1 [] Decreased 2 [] Remained the same 3 [] Increased	1 [] Yes 2 [] No 3 [] Don't know
7.34-36	Bluff Erosion 1 [] Yes--If yes--> 2 [] No 3 [] Not applicable	1 [] Decreased 2 [] Remained the same 3 [] Increased	1 [] Yes 2 [] No 3 [] Don't know
7.37-39	Loss of Beach Vegetation 1 [] Yes--If yes--> 2 [] No 3 [] Not applicable	1 [] Decreased 2 [] Remained the same 3 [] Increased	1 [] Yes 2 [] No 3 [] Don't know
7.40-42	Loss of Bluff Vegetation 1 [] Yes--If yes--> 2 [] No 3 [] Not applicable	1 [] Decreased 2 [] Remained the same 3 [] Increased	1 [] Yes 2 [] No 3 [] Don't know
43-45	Loss of Yard Vegetation 1 [] Yes--If yes--> 2 [] No 3 [] Not applicable	1 [] Decreased 2 [] Remained the same 3 [] Increased	1 [] Yes 2 [] No 3 [] Don't know
46	Damage to Dwelling Structure 1 [] Yes 2 [] No 3 [] Not applicable		

Which factors do you think partially caused your property damage? (Please circle your answer.)

	Yes	No	Not Applicable	Don't know
747 Upcurrent neighbor's shore protection actions	1	2	3	4
748 Downcurrent neighbor's shore protection	1	2	3	4
749 Ground seepage	1	2	3	4
750 Wave Action	1	2	3	4
751 Water levels	1	2	3	4
752 Wind Action	1	2	3	4
753 Storm damage	1	2	3	4
754 Winter ice formations	1	2	3	4
755 Spring thaw	1	2	3	4
756 Absent or inadequate shore protection	1	2	3	4
757 Other _____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4

SECTION SEVEN
SHORE PROTECTION

Here is a list of several alternative types of shore protection that you or your neighbors may have taken or will take in the future. The self-explanatory actions are not defined, but definitions are included with the less obvious terms. If we missed other actions, we would appreciate your adding them to the list in the space provided. They are listed to assist you with the questions in this section.

- Abandonment of Dwelling
- Breakwater -- An offshore structure located parallel to the beach which protects the shore area from wave action.
- Groin -- A Structure constructed perpendicular or nearly perpendicular to the beach to trap beach materials propelled by currents.
- Groundwater seepage interceptors -- A series of underground devices for channeling seepage into the lake without eroding the bluff or embankment.
- Repair maintenance on existing shore protection structure.
- Relocation of buildings.
- Replacement of beach materials
- Restorative vegetation management -- Planting trees, grass, and/or shrubs on exposed bluff or beach areas for the expressed purpose of retarding erosion damage.
- Revetment -- A facing of stone, concrete, or other heavy materials that protects a bluff or embankment from the effects of wave action.
- Seawall -- A structure separating land and water areas, which is constructed parallel to the beach and at the water's edge in order to reduce the effects of wave action and erosion.
- Other _____

52. Below are several potential sources of information you might contact when considering shore protection. Please answer the questions about each potential source of information.

		How helpful is this source of information for learning about shore protection?								How reliable is this information for making shore protection decisions?								Have you obtained information from this source when making previous shore protection decisions?									
		Not helpful		Somewhat helpful				Very helpful		Don't know		Not reliable		Somewhat reliable					Very reliable		Don't know						
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2
7:70-72	The County Extension Agent																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
7:73-75	The Department of Natural Resources																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
7:76-78	Friends																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
8:10-12	Private Consulting Engineers																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
8:13-15	Private Marine Contractors																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
8:16-18	Property Associations																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
8:19-21	Shoreline Neighbors																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
8:22-24	U.S. Army Corps of Engineers																									1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	

53. Have you talked with your neighbors about taking some form of collective or group shore protection action?

8:25

1[] Yes

2[] No

Please skip to 54

Was a collective action carried out?

8:26

1[] Yes

2[] No

8:27

Were you able to come to an agreement on the method to use for shore protection? 1[] Yes 2[] No

8:28

Was it not carried out because one or several neighbors were unwilling to participate? 1[] Yes 2[] No

8:29

Did you and your neighbors try to obtain financing for such a venture? 1[] Yes 2[] No

8:30-31

If yes, in what city was application made?

8:32

Were you successful? 1[] Yes 2[] No

8:33-34

What was done? _____

8:35-38

When? _____

8:39-46

What was the total cost? \$ _____

8:47-54

What was your cost? \$ _____

How effective was the action? _____

8:55

Ineffective _____ : _____ : _____ : _____ : _____ : _____ : _____ Very effective
1 2 3 4 5 6 7

8:56

Is it still in operation? 1[] Yes 2[] No

8:57

Did you and the other members have trouble coming to an agreement on the method of protection? 1[] Yes 2[] No

8:58

Did you and the other members have trouble coming to an agreement on the means of payment? 1[] Yes 2[] No

How was the protective action paid for?

8:59

- 1[] Obtained financing as a group
- 2[] Obtained financing individually
- 3[] Part of group obtained financing, part paid cash
- 4[] All paid cash
- 5[] No dollar transaction necessary
- 6[] Don't know

Questions About Your Shore Protection Actions

INSTRUCTIONS:

Due to the large number of protective actions that many of you have taken in recent years, a separate format for the action-related questions was developed. Four copies of this separate portion of the questionnaire are included in this packet. Additional copies may be obtained by calling, collect, the Division of Research at (313) 764-1366, should you need them.

Please begin with the most recent property protection action and work backwards over time. Each action you have taken since acquiring the property should be reported on one of the enclosed sheets and then the questions should be answered as they pertain to that action. If you did several things together, please report each as a separate action.

When you have completed reporting your shore protection actions, please return the questionnaire and supplements in the postage-paid envelope provided for your convenience. **THANK YOU.**

1:15-16 What action did you take? _____

1:17-20 When was the action taken? _____

1:21-22 At the time you installed it, how long did you expect it to last? _____ years.

1:23-24 What was its actual useful life? (If still in operation, mark current.) _____ years.

What type of effects did the action have?

	Very Negative	Negative	Somewhat Negative	Neither Positive nor Negative	Somewhat Positive	Positive	Very Positive
1:25	1	2	3	4	5	6	7

What was the value of this action in terms of the time and money spent?

	Poor	Fair	Satisfactory	Good	Excellent
1:26	1	2	3	4	5

Was this action done in conjunction with an action of an adjacent neighbor?

1:27 1[] Yes 2[] No 3[] Don't know 4[] Not applicable

Was the action taken as a result of damage caused by an adjacent neighbor's protection action?

1:28 1[] Yes 2[] No 3[] Don't know 4[] Not applicable

1:29-30 What type of shore protection structure caused your damage? _____

Was the neighbor located upcurrent or downcurrent from you?

1:31 1[] Upcurrent
2[] Downcurrent

Did you finance your shore protection?

1.32

1 [] Yes

2 [] No

Where did you obtain financing?

1 [] At different institution from mortgage, but in same county as shoreline property

2 [] At different institution from mortgage and in different county from shoreline property

3 [] At same institution that granted mortgage, which is located in same county as shoreline property

4 [] At same institution that granted mortgage, which is located in different county from shoreline property

5 [] Other _____

How did you pay for it?

1 [] Cash

2 [] No dollar transaction necessary

3 [] Other _____

1.33

1.34

1.35-40 How much did you spend for materials? \$ _____

1.41-46 How much did you spend for labor? (If you did the

1.47-52 work yourself mark \$0 and skip the remaining questions.) \$ _____

TOTAL \$ _____

Did you employ the services of a contractor to do the work?

1.53

1 [] Yes

2 [] No

1.54

Did you design and supervise the action performed?

1 [] Yes

2 [] No

1.55

When you contacted the contractor, did you have a definite device in mind?

1 [] Yes 2 [] No

What is the nature of the expertise provided?

1.56

1 [] Supplied advice on the types of devices available

6 [] Cost and design specifications

2 [] Supplied advice on design specifications

7 [] Types available, design specifications, and cost

3 [] Supplied cost information

8 [] Other _____

4 [] Types available and design specifications

5 [] Types available and cost information

How satisfied are you with the professional advice the contractor supplied?

1.57

Very Dissatisfied

Neutral

Very Satisfied

No advice given

1

2

3

4

5

6

7

8

How satisfied are you with the work the contractor performed?

1.58

Very Dissatisfied _____ Very Satisfied

How did you find out about this contractor?

1.59-64

1 [] Yellow pages

1 [] County Extension Agent

1 [] Recommendation of Neighbor

1 [] Other _____

1 [] Recommendation of Friend

1 [] Don't Know

