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What Is the Value of a Clean and Healthy Lake to a Local Community?

Prepared for:
Delavan Lake Improvement Association

Prepared by the Fiscal and Economic Research Center
at the University of Wisconsin--Whitewater

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Executive Summary

Delavan Lake is a 2,072-acre lake located in Walworth County, Wisconsin. Its shoreline is about 13 miles long, and the mean depth of the lake is about 21 feet. Delavan Lake supports a variety of recreational activities, most notably boating, fishing, swimming and wading in the summer months. Winter sports such as ice fishing and snowmobiling are popular activities at Delavan Lake as well. In addition, Delavan Lake is a focal point for thousands of full- and part-time residents who own houses on or near the lakeshore.

Over the years, Delavan Lake encountered a number of challenges related to the maintenance of lake water quality. In the early 1980s, Delavan Lake experienced significant problems with algal blooms and, in 1983, a serious blue-green algal bloom incident occurred. Scientists determined that non-point sources of nutrients were contributing to these excessive growths of algae in Delavan Lake.

In response to such environmental problems, agencies at multiple levels of government undertook a $7 million Delavan Lake rehabilitation program between 1989 and 1993. As a result of this program a number of actions were taken to eliminate carp, algae, and phosphorous that feeds the algae. The rehabilitation program was funded by the U.S. Environmental Protection Agency, in collaboration with the U.S. Geological Survey, the U.S. Army Corps of Engineers, the Wisconsin Department of Natural Resources, the City and Town of Delavan, the Delavan Lake Sanitary District, and the University of Wisconsin. Once the wetlands were restored, the lake basin was allowed to refill and game fish were restocked.

The result of the rehabilitation effort was a substantial improvement in the environmental quality of Delavan Lake. However, in recent years continued nutrient loading from agricultural areas and growing urban areas may, once again, be leading to deterioration in the lake's water quality. While future long-term water quality trends cannot be foreseen, in 2003 the lake's summer water quality (as measured by total phosphorus and chlorophyll concentrations) degraded relative to previous years. In 2004, the lake was classified as eutrophic (generally defined as rich in nutrients, extensive plant and/or algal growth, and variable water clarity) on the basis of total phosphorus and chlorophyll concentrations, and Secchi depth readings.

This independent report evaluates and quantifies the importance of Delavan Lake to the local economy. The analysis presented in this study shows that Delavan Lake is vital to the economic stability, social fabric and community well-being of Delavan and, more broadly, all of Walworth County. This Executive Summary summarizes the methods used in the study and highlights several important findings and observations.

To assess the importance of Delavan Lake and, importantly, the water quality of Delavan Lake, we employed three different but interconnected approaches. First, we administered surveys to property owners within the Delavan Lake Sanitary District and day visitors to Delavan Lake. These surveys collected a wide variety of information, including data on how much time and money residents and visitors spend in the Delavan area, characteristics and opinions of visitors

and residents, and information on how individuals say they would alter their behavior if the environmental quality of the lake were to change. These data provide, among other things, baseline estimates of the direct economic impact (via consumer spending) of Delavan Lake on the local economy. We note that an abundance of other useful information was collected from the surveys, and summaries of this information are provided in Appendices A, B, and C. However, given that the focus of this report is on economic issues, we do not discuss these other interesting findings in detail in this report.

Second, using these data we employ input/output analysis to estimate the secondary or indirect effects of initial, direct injections of expenditures into the region's economy. Input-output analysis is a tool used to model the many linkages within a regional economy. It estimates how economic factors such as output, employment, and personal income are affected by a given initial change (e.g., increased spending by tourists in the retail and service sectors) in the economic environment. In this study one objective is to examine how important Delavan Lake is to the regional economy. To accomplish this task, we examine what the regional economy would look like in the absence of Delavan Lake.

Third, given that Delavan Lake underwent a major restoration in the early 1990s, we can estimate the value of the restoration project to lake property owners (both full- and part-time) via increased property values. Here we use a hedonic analysis to determine the increase in property values due to lake restoration relative to properties on other lakes in the region. The hedonic approach is based on the idea that an asset is composed of a bundle of individual components, each of which has an implicit price. The market price of the asset dwelling is the sum of the prices of the individual components. The hedonic analysis in this study is based on several assumptions. First, the value of residential property is assumed to be a function of specific measurable housing and other attributes. Second, general attributes such as rural amenities of southeastern Wisconsin are present for all of the properties included in our analysis. Third, we assert that one identifiable difference between the valuation of lakefront properties on Delavan Lake versus other nearby lakes between 1987 and 2003 is the Delavan Lake restoration project and the resulting change in lake quality.

Major findings of the study are summarized as follows. First, the property owner survey indicates that the average household in the Delavan Lake Sanitary District spends about $24,000[1] annually in the Delavan area, and households in the area that are there because of Delavan Lake spend about $52.6 million per year. A second way in which Delavan Lake contributes to the local economy is by attracting visitors for various activities (i.e., fishing, boating, etc…). A visitor survey conducted at the Delavan Public Boat Launch Area and Lake Lawn Resort indicates that $9.4 million annually is generated in the Delavan area from these visitors. In total, direct spending as a result of the presence of Delavan Lake is about $62 million annually. Using input-output analysis we find that this direct spending results in an additional $15 million of indirect spending, for a total of $77 million annually. We also estimate that 812 jobs are generated from these expenditures.

Second, in terms of the role Delavan Lake plays in the regional economy, the study finds that degradation of water quality to pre-restoration levels would reduce regional economic activity by 8% to 13%. Specifically, we estimate that regional expenditures would decline by $5-$6 million per year in the event of such a decline in lake quality. Similarly, an improvement in the management of Eurasian watermilfoil would increase economic activity by 8% to 11%. Through the application of input-output analysis, we show that lake management issues such as these have a significant effect on direct, indirect and induced spending, and employment. In addition, it is reasonable to expect that the estimated negative impact on regional expenditures due to a return to pre-restoration water quality levels would be similar in magnitude to the positive impact on regional expenditures that likely occurred following the lake's restoration.

Third, a separate, but related, benefit of the lake restoration project involves real estate appreciation attributable to the restoration. The hedonic analysis conducted in this study provides estimates of the magnitude of this second category of benefits. This analysis finds that the lake quality improvement generated by the Delavan Lake Restoration Project caused the average lake shoreline property there to appreciate by approximately $177,000 between 1987 and 2003. It is important to note that the average Delavan Lake property appreciated by more than this amount over the time period, but the hedonic analysis of this study "nets out" that portion of the total appreciation that is attributable to factors other than the restoration of the lake. As a next step, one may combine the estimate of average per-property appreciation with the total number of houses to yield an estimate of aggregate appreciation induced by the restoration. In 2004, there were 565 homes with shoreline on Delavan Lake. This translates into an aggregate increase in valuation of over $99 million dollars. This may be viewed as a direct contribution to the real wealth of the Delavan area as well as, more broadly, Walworth County.

In addition, this augmentation of real wealth has implications for the magnitude of public revenues and incidence of property taxes. On the surface, the property value-related benefits of the restoration project might appear to accrue solely to lakefront property owners. However, the increase in property values also constitutes a shift in the property tax base, which in turn affects relative tax burdens. For clarity, consider the following scenario. The increase in average shoreline property values resulted in an additional $99 million in equalized valuation. Holding constant the local government budgets (town, school district, county, and technical college), the increase in property valuation resulted in a reduction of the necessary mil rate from $18.53 per $1,000 to $16.64 per $1,000 of equalized value (unadjusted for state reimbursements). This translates to a tax saving to the owner of a $200,000 property in the Town of Delavan of $177 in 2003.

Based on the analysis, we conclude that Delavan Lake is a crucial component to the financial, physical, and social fabric of the region. Delavan Lake affects not only the quality of life for local residents, but also has regional economic implications. We also show that a deterioration of lake water quality (water clarity, milfoil) could be expected to lead to reductions in time spent in Delavan by property owners (both full- and part-time) and visitors, which in turn would have economic implications for the local economy.

Glossary of Key Terms

Assessed Valuation
Community (or privately contracted) professional appraisers review sales within each neighborhood and, by comparing the sold to unsold properties, develop estimates of the value of each property in the area.

Contingent Behavior Analysis
Contingent behavior analysis consists of the collection and analysis of responses to what are known as contingent behavior survey questions. A contingent behavior question asks individuals how they would change behavioral aspects of their life, if at all, in response to some specified change (e.g., a change in environmental quality). An example of a contingent behavior question would be: "how many recreational trips would you take to this lake each year if the current clarity of the water were cut in half?"

Coefficient
In regression analysis, a coefficient is estimated for each explanatory variable (also called independent variable) that is included to "explain" the response variable (dependent variable). For any given explanatory variable, its estimated coefficient is the amount by which the response variable is predicted to change if that explanatory variable were to increase in value by one unit (holding the values of all the other explanatory variables constant). As an example, consider the regression model $y = a + bx + cz + ……..$, where the model is estimated across individuals, y denotes the individual's weight (lbs), x denotes the individual's height (inches), z denotes the amount of weekly exercise in which the individual engages, etc. (with other variables added to denote dietary patterns, etc.). Then, the estimated value of the coefficient "b" tells us the change in weight that we predict on average for an additional one inch of height, holding exercise, diet, etc, constant.

Direct/Indirect Spending
Direct spending in the context of tourism includes all expenditures made by those defined as "tourists." Indirect spending results from revenues generated by the suppliers of services to tourist-related businesses such as Lake Lawn Resort.

Hedonic Analysis
The hedonic price technique evaluates willingness to pay for specific characteristics embodied in a good or service. In the context of housing, heterogeneity in price and specific housing characteristics (e.g., square feet of living area, number of bathrooms, garage, acreage, lineal feet of shoreline) makes it possible to generate estimates of willingness to pay (and thus economic value) of these specific characteristics.

Induced Spending
Induced spending is the result of revenue generated in the community from spending by employees of tourism businesses such as Lake Lawn Resort.

Input/Output Analysis
Input-output analysis is a tool used to model the many linkages within a regional economy. Input-output analysis examines how economic factors such as output, employment, and personal income are affected by a given change in the economic environment. See Appendix E for more details.

Leakage
The flow of dollars leaving a community as residents engage in spending in places outside the community.

Mean
The mean of a series of numbers is the average of the numbers. It is computed by summing all of the values in the dataset of interest and then dividing by the number of values in that dataset.

Multiplier
A multiplier estimates the amount of indirect and induced spending generated by direct spending. In the case of tourism, dollars spent by tourists generates additional spending by suppliers of businesses that provide services to tourism-related businesses (induced spending) and additional spending by employees of tourism-related businesses (indirect spending). The multiplier is generated from the input-output analysis.

Regression Analysis
Regression analysis is a type of analysis conducted to investigate a hypothesized behavioral relationship between one or more "explanatory variables" (also called independent variables) and a "response variable" (also called dependent variable) whose value is thought to be dependent upon the explanatory variables. Regression analysis serves to estimate the values of the coefficients (see definition above) of each explanatory variable. In other words, regression analysis estimates the amount by which the response variable would change for a one-unit change in any of the explanatory variables.

Standard Deviation
The standard deviation of a set of numbers is a descriptive measure of the dispersion (spread) of that set of numbers around their mean. Higher values for standard deviation indicate a higher degree of spread, or dispersion, of the set of numbers around their mean (average) value.

1.0 Introduction

Delavan Lake is a 2,072-acre lake located in Walworth County, Wisconsin. Its shoreline is about 13 miles long, and the mean depth of the lake is about 21 feet. Delavan Lake supports a variety of recreational activities, most notably boating, fishing, swimming and wading in the summer months. Winter sports such as ice fishing and snowmobiling are popular activities at Delavan Lake as well. In addition, Delavan Lake is a focal point for thousands of full- and part-time residents who own houses on or near the lakeshore.

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In response to such environmental problems, agencies at multiple levels of government undertook a $7 million Delavan Lake rehabilitation program between 1989 and 1993. As a result of this program a number of actions were taken to eliminate carp, algae, and phosphorous that feeds the algae. The rehabilitation program was funded by the U.S. Environmental Protection Agency, in collaboration with the U.S. Geological Survey, the U.S. Army Corps of Engineers, the Wisconsin Department of Natural Resources, the City and Town of Delavan, the Delavan Lake Sanitary District, and the University of Wisconsin. Once the wetlands were restored, the lake basin was allowed to refill and game fish were restocked.

The result of the rehabilitation effort was a substantial improvement in the environmental quality of Delavan Lake. However, in recent years continued nutrient loading from agricultural areas and growing urban areas may, once again, be leading to deterioration in the lake's water quality. While future long-term water quality trends cannot be foreseen, in 2003 the lake's summer water quality (as measured by total phosphorus and chlorophyll concentrations) degraded relative to previous years. In 2004, the lake was classified as eutrophic (generally defined as rich in nutrients, extensive plant and/or algal growth, and variable water clarity) on the basis of total phosphorus and chlorophyll concentrations, and Secchi depth readings (written personal communication, D. Robertson, U.S. Geological Survey).

In late spring 2004, the Fiscal and Economic Research Center at the University of Wisconsin – Whitewater initiated a research project to examine the economic value of Delavan Lake to the surrounding community, the economic value afforded by the lake rehabilitation program of 1989-93, and the values at stake should the lake once again experience substantial water quality problems as it has in the past. The primary objectives of the study were threefold:

1) To determine the degree to which property values were affected by the 1989-93 Delavan Lake restoration project.

2) To estimate the economic impact of tourism generated from the presence of Delavan Lake.

3) To estimate the degree to which the local economy and tax base would be reduced should water quality return to pre-restoration levels. Also, to examine the likely beneficial impact on recreation and the surrounding economy that could occur if the lake's aquatic weed problem were better controlled.

This report summarizes the methods used in, and chief findings from, our Delavan Lake economic impact study. Our report is organized as follows:

- Section 2 provides a concise overview of the economic characteristics of the Delavan area, to place the study location in economic context.

- Section 3 describes the data collection phases of the project, which were comprised chiefly by 1) design and implementation of a primary survey of Delavan Lake property owners, 2) design and implementation of a primary survey of recreational visitors to Delavan Lake, and 3) the collection of time series, cross sectional data on the values and characteristics of residential properties at Delavan Lake as well as other geographic areas (the latter of which was used as a comparison group of properties).

- Section 4 presents the main findings from the Delavan Lake Property Owner Survey used to support the study's economic impact analyses.

- Section 5 describes the chief results from the Delavan Lake Visitor Survey, which were utilized as inputs for the estimation of economic impacts.

- Section 6 provides a description of the economic impacts estimated to arise from Delavan Lake resident and visitor expenditures.

- Section 7 summarizes our analysis of home and land values to estimate the impacts of the 1989-1993 Delavan Lake restoration program on property values in the area.

- Section 8 offers concluding discussions.

- Finally, the appendices and attachments to this report contain the survey instruments, supplemental data collected from the surveys, and additional detail on the input-output modeling methods used to estimate economic impacts.

2.0 Placing the Delavan Area in Context

Given that Delavan is in Walworth County and is, in some respects, similar to other lake communities in the region, we present an outline of the economic and demographic information

for Walworth County. The county level data will provide a baseline for comparison as we focus in on the Delavan economy.

Although Walworth County is primarily rural in nature, its economy is composed of a fairly diversified group of industries. Data for year 2000 on population, total personal income, household income and other economic and demographic characteristics are provided in Table 2.1.

Table 2.1: Walworth County Economic and Demographic Data, 2000

	Walworth County	Wisconsin
Area (sq. miles)	555	54,310
Population	93,759	5,363,675
Percent Change in Population, 1990-2000	25%	9.6%
Households	34,522	2,084,544
Per Capita Personal Income	$25,064	$21,271
Median Household Income	$46,274	43,791
Median Value of Owner Occupied Housing	$128,400	$112,200
Homeownership Rate	69.1%	68.4%

In many respects, Walworth County resembles the average counties in Wisconsin. The United States Department of Agriculture (USDA) considers these counties to be non-metropolitan and on the fringe of larger communities. Walworth and neighboring counties are between the larger metropolitan counties of Milwaukee and smaller metropolitan counties, such as Dane County. Importantly, Walworth is also within a two-hour drive of the Chicago metropolitan area, and is therefore a prime recreation area for many Chicagoans.

Walworth County is neither rich nor poor relative to the rest of Wisconsin. In 2000, Walworth had a per capita personal income (PCPI) of $25,064, which is slightly higher than the statewide average. The 2000 PCPI increased 4.3% over 1999. The Delavan area per capita income is similar to that of Walworth County.

Walworth County communities also resemble the rest of the state in terms of homeownership. The percentage of housing units that are owner occupied is 68.4% for Wisconsin, whereas it is 69.1% for Walworth County. Waukesha County boasts a homeownership rate of 76.4%, while Dane County (home of the University of Wisconsin-Madison) realizes a rate of 57.6%. Homeownership rates in Delavan are on par with Walworth County figures.

Using other measures of economic well-being, Walworth County resembles or exceeds state averages. Home values exceed the state medians by 14%, and poverty rates are below the state average. Although the unemployment rate for Wisconsin was 6.2% in March 2003, it was just 5.6% for Walworth County.

A key source of income for Walworth County residents is the manufacturing sector, which accounts for about 16% of income earned in the county.[2] State and Local Government, Retail Trade, and Construction each accounted for 10%, 4.4%, and 4.5% of income earned in Walworth County, respectively. We also note that Walworth County maintains a strong agricultural sector. Walworth County is the #1 producer of goats in Wisconsin as well as the #3 producer of lambs. Walworth County produces large quantities of commodities (including corn and soybeans). Even so, Agricultural and Forestry Support Services and Farm Earnings accounted for just 0.1% of total income earned.

Tourism in Southeastern Wisconsin is an important part of the economic base. The Wisconsin Department of Tourism estimates that travelers to Walworth County spend about $170 million annually, which is roughly 6.7% of total income earned in Walworth County. This figure places tourism as the third most important source of income, following manufacturing and state and local government. Walworth County is endowed with natural amenities, including Delavan Lake, and absent such amenities fewer dollars would flow into the region. One goal of this research is to determine the importance of Delavan Lake to the local economy.

Input-output analysis is predicated on the idea of flows. The community benefits when the creation of economic activity within a region provides opportunities to attract revenues from outside the region. For example, in the tourism industry amusement parks draw customers from a national pool of consumers who spend money in the community. In this study, input-output analysis will be used to estimate the importance of Delavan Lake to the local economy.

3.0 Data Collection

To assess the importance of Delavan Lake and, importantly, the water quality of Delavan Lake we employed three different but interconnected approaches. First, we administered surveys to property owners within the Delavan Lake Sanitary District and day visitors to Delavan Lake. As presented in the next section and in the appendix, we obtained a wealth of useful information. Of key relevance is the information collected on time spent in Delavan, income, expenditure patterns, and information on how behavior might be altered given a change in lake water quality. These data provide baseline estimates of the direct economic impact of the presence of Delavan Lake to the local economy. Second, using these data we employ input/output analysis to estimate the secondary or indirect effects of this initial spending. Third, given that Delavan Lake underwent a major restoration in the early 1990s, we can estimate the value of the restoration project to lake property owners (both full- and part-time) as well as to the broader community via increased property values. Here we use a hedonic analysis to determine the increase in property values due to lake restoration relative to properties on other lakes in the region.

[2] This information is provided by the Bureau of Economic Analysis.

More in-depth descriptions of the actual analytical methods employed in this study are provided in subsequent sections, together with the analytical results derived from those methods. For example, Section 6 includes a discussion of what input-output analysis is, and how it is conducted, immediately preceding the presentation of our Delavan input-output model results. Section 7 includes a discussion of the hedonic (property valuation) method along with a presentation of our hedonic model results.

The present section discusses the data that we collected in order to support these various types of analyses. Section 3.1 describes the design and implementation of the property owner and visitor surveys. Section 3.2 describes the data collection steps that we undertook to support the hedonic analysis of property values.

3.1 Property Owner and Visitor Surveys

We designed two survey instruments to collect a wide spectrum of primary information about Delavan Lake property owners and visitors to Delavan Lake. Survey design commenced in spring 2004 with scoping meetings held by members of the UW-W project team, members of the Delavan Lake Improvement Association, and staff of the Delavan Lake Sanitary District. These preliminary discussions helped to identify broad thematic areas that might be addressed, and specific types of information that might be collected, through surveys of residents and visitors. Detailed survey design commenced in June 2004. We describe data collection for the property owner survey and visitor survey, respectively, below.

Property Owner Survey

Our initial scoping meetings identified a number of distinct categories of information that could be targeted through the property owner survey. Survey design began with the categories and questions identified during these meetings, and proceeded through several iterations of refinement and review. The final Delavan Lake Property Owner Survey appears in Attachment A of this report. We summarize below the main types of questions included on the survey:

- **Basic dwelling and occupancy information.** It was important to begin the survey by collecting basic information on where the property is (in relation to Delavan Lake) and how often the dwelling on the property is typically occupied. Questions were included to ascertain distance between the property and the lake; whether the owner has a boat slip; the number of days (by season) that the property typically is used by the respondent, her/his family, or other people; and alternate place of residency for property owners who are not at Delavan Lake full-time. Other questions were included in this section to better characterize the residency patterns of Delavan Lake property owners.

- **The respondent's history and experiences with Delavan Lake.** The survey continued by asking respondents when they bought their property at Delavan Lake and why they originally chose to buy there. The project team also included questions to learn about ways in which respondents think Delavan Lake has changed since they bought their

property (e.g., changes in property values, changes in the factors that originally induced them to buy there, changes in their attitudes toward the lake itself). Next, the survey included a question to find out what kinds of recreational activities (boating, fishing, etc.) the respondent or her/his family typically engages in while at Delavan Lake, and how many days per year on average. This is a key question that helps to establish the current Delavan Lake recreational use patterns of residents. Other questions were included in this section to ascertain how respondents get information about Delavan Lake issues (newspapers, newsletters, etc.) and whether they are DLIA members. Stakeholders in the survey design scoping meetings sought information from these questions in order to enhance communication about lake issues.

- **The respondent's history and experiences with other lakes.** This section was included in the survey for two primary reasons. First, the project team wished to ascertain whether Delavan Lake residents have ever owned property at another lake, whether they still own that property and, if not, why they left the other lake. These questions were motivated in part because of concerns over possible future adverse circumstances at Delavan Lake (deteriorations in water quality, increased spread of aquatic weeds, etc.) that could cause residents to leave and go elsewhere. Including questions about respondents' experiences with other lakes can shed light on which factors are most likely to cause dislocations. Second, this section included questions to identify the other lakes that residents typically go to for recreation, what kinds of recreation they engage in while there, and how many days they typically spend at such other lakes. These questions are necessary in order to characterize the substitute recreation sites that are available to and utilized by current Delavan Lake residents.

- **Lake quality change scenarios.** One of the objectives of the economic analysis described in Section 6 is to estimate how a change in Delavan Lake's environmental quality would affect the surrounding community's economy, via a change in the amount of consumer expenditures made by property owners. In order to collect data to be used as inputs for that analysis, the property owner survey included two hypothetical lake quality change scenarios. The first of these scenarios involves an improvement in the aquatic weed status of the lake, specifically a reduction of the nonnative weed Eurasian watermilfoil (*Myriophyllum spicatum*) that has infested Delavan Lake. The second hypothetical lake quality change scenario involves a decline in water quality, specifically an increase in algae and accompanying decrease in water clarity. After presenting the respondent with a scenario, the survey asked respondents whether they would be likely to change any aspects of their behavior in response to the environmental improvement or degradation. Potential changes in behavior include changes in occupancy levels (the number of days the family spends at their Delavan Lake property) as well as changes in the amount of time spent in water-based recreation. These scenarios are described in detail in Section 4 of this report.

- **Property owner spending in the Delavan area.** The survey asked respondents to estimate the amount that their family spends in the Delavan area (as opposed to other

towns or cities), over the course of the average year, in eleven distinct categories of expenditure (e.g., groceries and liquor, dining out, gas and oil, etc.). The collection of such information was necessary to support the economic impact analysis described in Section 6.

- **Respondent demographic characteristics.** This section of the survey was intended to ascertain characteristics of respondents including annual income, education, age, and involvement in community activities. Such questions support a wide range of economic analyses and also are useful to stakeholders (e.g., knowing more about community involvement and interests can help to better target efforts to improve the quality of life around the lake).

- **Opinions and attitudes regarding the Delavan Lake area.** The final section of the survey was intended to gauge residents' opinions about potential ways to improve the quality of living near the lake; attitudes toward factors about the lake that residents like and dislike; and suggestions for how the DLIA might improve communication about lake issues.

Final revisions to the property owner survey were performed in July 2004 and the survey was mailed that same month to 2,715 residents. The sample frame was comprised of the mailing list of the Delavan Lake Sanitary District. As of the date of the analysis completed for this report, 944 completed surveys had been received and processed, for a response rate of approximately 35%. Additional completed surveys continue to be received albeit at a slower rate.

Response rates for mail-out surveys to households may vary significantly depending on survey procedures, length and type of survey, nature of the sample frame, and other factors. In our experience the response rate for the Delavan property owner survey is excellent given the substantial length and complexity of the survey. In addition, the large number of responses to the open-ended questions on the survey (e.g., as shown in Tables A.22 – A.24 of Appendix A) indicates a high intensity of responsiveness (interest in the issues posed by the survey) within the Delavan Lake property owner population.

Visitor Survey

The visitor survey contained many of the same types of questions included on the property owner survey described above. However, the visitor survey 1) was substantially shorter, 2) naturally did not contain any questions related to residency characteristics or attitudes about living in the Delavan Lake area, and 3) was designed and administered as an intercept survey rather than a mail-out survey. Survey administrators "intercepted" visitors to Delavan Lake at two points of access (the Public Boat Launch and Lake Lawn Resort) and asked them to complete the survey. As discussed above under the property owner survey, development of the visitor survey benefited from scoping discussions with stakeholders as well as iterative rounds of refinement and review by the project team and stakeholders.

The final Delavan Lake Visitor Survey appears as an attachment to this report. We summarize below the main types of questions included on the survey:

- **Information on the nature of the respondent's visit to Delavan Lake, and point of origin**. Questions were included to establish the place of residence of the visitor, length of visit to the Delavan Lake area, size of travel party, place of lodging in the event the visit is an overnight trip, and types and frequency of recreational activities engaged in while at Delavan Lake. All of these questions are standard for a visitor survey intended to support economic analysis of recreational behavior.

- **Lake quality change scenarios.** The lake quality change scenarios included in the visitor survey were identical to those used on the property owner survey, described briefly above. More detail on these scenarios, and how the data from them was used for visitors, is described in Section 5 of this report. The main goal was to estimate how visitors might change their behavior in the event that the lake's quality was to improve or deteriorate.

- **Visitor spending in the Delavan area.** The survey asked respondents to estimate the amount that their travel party had spent (or planned to spend) that day during their trip to Delavan, in twelve distinct categories of expenditure (e.g., groceries and liquor, dining out, gas and oil, etc.). The collection of such information was necessary to support the economic impact analysis described in Section 6.

- **Visitor demographic characteristics.** Questions were included to ascertain characteristics of visitors including annual income, education, and age. Such questions support a wide range of economic analyses of recreational trip behavior.

- **Information on visits to substitute recreation sites.** The survey also collected information on what other lakes visitors tend to go to for recreation, what kinds of recreation they engage in while there, and how many trips per year they typically make to these other sites. These questions are necessary in order to characterize the substitute recreation sites that are available to and utilized by current visitors to Delavan Lake.

Design of the visitor survey was finalized and a pre-test of the instrument was conducted in early July of 2004. The pre-test identified no significant problems or needs for revision. Full implementation of the survey began on July 13, 2004 and continued through Labor Day weekend of 2004. The project team collected 233 completed intercept visitor surveys from visitors to Delavan Lake; the targeted number of completions was 200.

3.2 Property Valuation Data

This section describes hedonic modeling techniques applied to estimate the value of a clean lake. This method, used in the past by Epp and Al Ani (1979), Mendelsohn (1992), and Steinnes (1992), has a rich foundation in economic theory. These studies have shown that water quality has a significant effect on values along waterfront properties. Our panel data (data taken from

both different time periods and different locations) includes properties on the shorelines of lakes and non-lake parcels. It includes housing units from several lakes, including one (Delavan Lake) that experienced a well-publicized restoration project in an attempt to provide a cleaner lake environment. The other two lakes included in our study did not conduct any major restorations during the period of this study. The data consists of housing values, shoreline size, and other attributes. We show that water quality has a significant effect on property values in this region. We calculate this benefit from a specific water quality improvement that provides both an objective indicator of quality (the restoration project) and a subjective indicator (the subsequent publicity and discussion).

In order to conduct this analysis, property values on three lakes were analyzed. The properties were randomly chosen from all homes located in the Delavan Lake, Lake Beulah, and Lauderdale Lakes areas, as well as the Town of Darien. The lakes, all drainage lakes, have similar attributes in terms of amenities and are located in Walworth County, Wisconsin. They are also similar in terms of depth, with the deepest parts of each of the lakes ranging from 44 feet to 58 feet. Since drainage lakes are fed primarily by streams and with outlets into streams or rivers, they are subject to surface runoff problems. Importantly, we also included in the analysis homes in the non-lake Walworth County community of Darien, Wisconsin.

A premise of hedonic valuation is the idea that seemingly homogeneous items, such as housing, are actually made up of many differentiated components. Hedonic analysis is used to determine the contribution of each individual component to the overall value. For example, the market for single-family housing is not determined by a supply of homogeneous homes, but rather housing of varied characteristics. In some cases, these characteristics can be explicit. For example, the cost of a bathroom spa can be calculated through the hardware and labor invested. In a competitive market these input costs translate into an estimate of the monetary value of the bathroom. In other cases, the costs are implicit. When considering the value a city park provides the adjacent single family home, it is impossible to explicitly determine the value of the park and thus the contribution to the overall value of the home. However, with hedonic techniques it is possible to determine the implicit spillover value offered by the park. In a similar manner, we can determine the marginal contribution of a clean lake to the overall value of a lakefront property.

More detail on the specific data used for the hedonic analysis of property values is contained in Section 7 of this report.

4.0 Delavan Lake Property Owner Survey

This section provides a summary of the property owner survey results used to support the Delavan Lake economic analysis. The survey results were important inputs to the economic analysis in two main ways. First, the survey collected information on the magnitudes and types of consumer expenditures of people who own property on and around Delavan Lake. These data were used in the input-output analysis of economic impacts, as described in Section 6 of this

report. Second, the survey collected data on the current dwelling occupancy patterns of property owners, and asked respondents how they would change these patterns in the event of specific environmental quality changes at Delavan Lake. These data were used in the input-output analysis to estimate the economic impacts of potential environmental changes at the lake.

Current consumer expenditure patterns of Delavan Lake property owners are summarized in Section 4.1 below. Current dwelling occupancy patterns, and property owners' responses regarding changes in the amount of time they would spend at Delavan Lake should environmental change occur, are summarized in Section 4.2.

4.1 Expenditure Patterns of Delavan Lake Property Owners

Question 24 of the survey asked respondents to report "the amount your family spends in the Delavan area (as opposed to other towns or cities) on the items listed below over the course of the average year." This question was followed by a list of eleven separate expenditure categories.

The results from this survey question, by expenditure category, are shown in Table 4.1. The largest mean expenditure is for the category "Construction and remodeling." The large mean value may be somewhat surprising at first glance, but it indicates the relative importance of this type of spending by Delavan Lake residents. Out of 944 respondents, 649 (68.75%) responded that they had incurred some expenses on remodeling/construction in the Delavan area.

The second largest expenditure category was "Groceries and liquor" (mean = $2,474/yr). Following that in order of importance were "Dining out" (mean = $1,543), "Shopping – general" (mean = $1,357), and "Gas/oil for vehicles/boats" ($1,008).

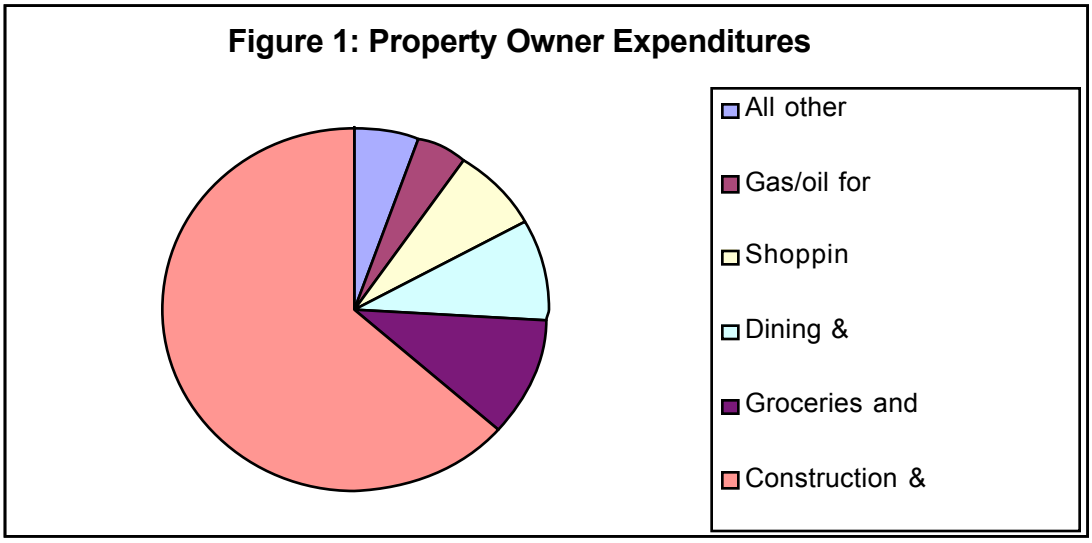
The mean expenditure data included in Table 4.1 (and pictured in collapsed form in Figure 1) represent our best estimates of the annual average direct expenditures per family among Delavan Lake property owners. Direct expenditure numbers are only the starting point, however, for estimating the total economic impact from Delavan Lake resident spending. This is because a portion of these direct expenditures generates income for Delavan area businesses, and in turn a portion of this income is spent on labor and other inputs in the Delavan area. This provides the owners of resources (individuals who supply time and labor; land owners; etc.) with additional income, a portion of which is spent on further goods and services in the Delavan area in a second round of spending. This continuing chain of spending and income, which must be modeled in order to estimate total economic impacts, is described in greater detail in Section 6. That section also uses the mean direct expenditure estimates from Table 4.1 as inputs for calculating total economic impacts.

TABLE 4.1. Annual expenditures by Delavan Lake property owners, by expenditure category.[a]

Variable	Obs	Mean	Std. Dev.	Min	Max
Construction & remodeling	944	$15,057	$77,588	$0	$1,700,000
Bait and tackle	944	$88	$222	$0	$3,000
Launch fees	944	$68	$344	$0	$7,500
Dining out	944	$1,543	$2,176	$0	$26,000

Entertainment such as movies, clubs, lounges, sports activities, etc.	944	$612	$1,237	$0	$20,000
Groceries and liquor	944	$2,474	$3,293	$0	$45,000
Gas/oil for vehicles/boats	944	$1,008	$1,387	$0	$12,000
Shopping – general	944	$1,357	$2,052	$0	$20,500
Shopping – tourist	944	$391	$1,041	$0	$15,000
Licenses, registrations, permits (fishing, boat, auto)	944	$162	$297	$0	$5,000
All other expenditures	944	$986	$5,170	$0	$100,000
Total of Mean Values	944	$23,746	$79,696	$0	$1,707,600

[a] Missing responses are treated as zeroes in computing the descriptive statistics in this table. This treatment tends to yield estimated means that may be lower than the true means; for this reason they may be considered lower bound estimates of true average expenditures.



4.2 Property Owner Occupancy and Recreational Behavior: Current Patterns and Changes in Response to Environmental Change Scenarios

This section describes property owner survey data that were collected, in part, to support prediction of economic impacts from potential environmental changes at the lake. We focused on determining the extent to which environmental change might cause residents to spend either more or less time at their Delavan Lake properties. One would expect that, if the environmental quality of the lake were to deteriorate, at least some people might choose to spend less time there. On the other hand, an improvement in environmental quality might cause at least some people to spend more time at Delavan Lake.

The first part of assessing these issues involves collecting data on the amount of time people currently spend at Delavan Lake (occupancy behavior), as well as the recreational activities in which they engage while there. This part of the survey, like the rest of the survey instrument,

collected information on both full- and part-time residents since the instrument was administered to both groups. Question 5 of the survey asked:

"Approximately how many days out of the year is your Delavan Lake property utilized during different seasons, on average?"

Table 4.2 shows summary results, by season, of the data collected via this question. The average number of days spent by the respondent and her/his family at Delavan Lake was highest for the summer season (56 days), and lowest for the winter season (37 days). The average number of days spent during the fall and spring seasons were about the same (43 and 41 days, respectively). Summation of the seasonal means yields an average of approximately 177 days/yr that the respondent or her/his immediate family utilized the typical property in the sample. This is equivalent to approximately 48% of the year.

TABLE 4.2. Number of days the Delavan Lake property is utilized by respondent's family, by season.

Variable	Observations	Mean	Standard Deviation
Days in Summer (June-Aug)	876	55.97	31.31
Days in Fall (Sept-Nov)	845	42.68	36.25
Days in Winter (Dec-Feb)	796	37.21	38.43
Days in Spring (Mar-May)	834	41.17	36.45

Table 4.3 provides a summary of the responses from Question 12 of the property owner survey. This question asked respondents if either they or their family members typically come to their Delavan Lake property to engage in various recreational activities and, if so, about how many days per year. Taken as a whole, the results indicate that Delavan Lake property owners are active recreational users of the lake. The recreational activity that is undertaken most commonly is power boating, which is enjoyed by about 63% of the property owners. The average Delavan Lake property owner (including those who do not power boat, that is, zero days spent on this activity) spends about 21 days/yr on this type of boating. Far fewer residents (about 10%) participate in sailing, with the average resident spending about 2.5 days/yr in this activity.

The next most popular activity appears to be swimming and wading, followed closely by fishing, with participation rates of 48% and 45% respectively. The average respondent reports that they or their family members spend about 14 days/yr swimming or wading, and about 11 days/yr fishing (not including ice fishing). Golf is also a very popular activity, with a participation rate of 32% for an average of about 6 days/yr for the typical property owner.

Delavan Lake residents also engage in winter recreational activities at Delavan Lake, although at significantly lower rates than for summer activities. About 13% of the surveyed residents, for example, reported that they snowmobile or ice fish at Delavan Lake.

TABLE 4.3. Recreational activities undertaken at Delavan Lake by Delavan Lake property owners and their families.[a]

Recreational activity	Percent of residents who engage in specified activity at Delavan Lake	Average number of days/yr spent on specified activity at Delavan Lake[b]
Power boating	63.35%	21.39 (880)
Swimming or wading	48.31%	13.56 (882)
Fishing	45.02%	10.69 (892)
Golf	32.42%	6.12 (920)
Snowmobiling	13.24%	1.66 (936)
Ice fishing	12.82%	1.33 (935)
Sail boating	10.38%	2.55 (937)
Ice boating	2.44%	0.26 (942)

[a] The survey asks respondents if either they or any of their family members typically use the lake for various recreational activities and, if so, typically how many days per year.
[b] The reported mean days/yr includes respondents who indicated zero days for a given recreational activity. The number of observations used to estimate the means are indicated in parentheses.

The results shown in Table 4.3 suggest that Delavan Lake property owners not only live near the lake, but many of them also use the lake for recreation. It is therefore reasonable to expect that many property owners may be attuned to the environmental quality of the lake, as well as fluctuations in quality over the course of a season or from one year to the next. However, would changes in lake quality lead to changes in Delavan Lake property occupancy rates? That is a question of some pertinence for the economic impact analysis presented in Section 6. One of the objectives of that analysis is to estimate how a change in lake quality would affect the surrounding community's economy, via a change in the amount of consumer expenditures made by property owners. Given that two recent studies (Murray, *et al*, 2003**;** Shapiro and Kroll, 2003**)** demonstrate the importance of water quality in economic activity, we included two hypothetical lake quality change scenarios.

The first of these scenarios involves an improvement in the aquatic weed status of the lake, and the second relates to deterioration in water quality. After presenting the respondent with a scenario, the survey asked respondents whether they would be likely to change any aspects of their behavior in response to the environmental improvement or degradation. Potential changes in behavior include changes in occupancy levels (the number of days the family spends at their Delavan Lake property) as well as changes in the amount of time spent in water-based recreation. In this section we focus on respondents' self-reported likely changes in occupancy levels, since a change in occupancy would likely lead to reduced consumer spending in the Delavan area by these property owners. The scenarios, and the data collected from them to support the economic impact analysis, are described briefly below.

The first environmental change scenario (Question 21 of the survey) began by presenting some brief background information on Eurasian watermilfoil (*Myriophyllum spicatum*), a nonnative, invasive aquatic weed that has infested Delavan Lake and other lakes in the area. The presentation of background information is an important part of survey methodology in exploring human responses contingent upon environmental change scenarios. This is because different individuals have different degrees of familiarity with various environmental problems, and the inclusion of brief background information helps to place respondents on a similar level of understanding so that direct comparisons can be made. Therefore the question included short summary information on 1) the negative environmental impacts of Eurasian watermilfoil, 2) the negative impacts that this weed has on human outdoor recreation, and 3) current efforts to control the weed at Delavan Lake. The question then presented respondents with the following scenario:

> "Suppose that Eurasian watermilfoil were controlled to such an extent that it created no perceptible negative impacts on recreational activities (such as boating, fishing, swimming, or wading) and no significant diminishment of your aesthetic enjoyment of the lake. IF this kind of change were to happen at Delavan Lake,

AND you expected the change to persist indefinitely into the future, AND no such change was occurring at other lakes in southeastern Wisconsin, how do you think you might change your activities or lifestyle, if at all? (Please check ANY that apply, and fill in blanks as appropriate.)"

One of the options available to the respondent was to indicate that her/his family would likely spend more days per year at their property on Delavan Lake in response to the described improvement in Eurasian watermilfoil, and if so, how many more days/yr. Out of 944 respondents, 464 (49%) indicated that they would likely spend more time at their property should the Eurasian watermilfoil situation improve. The typical (mean) respondent indicated they would spend about nine (9) more days per year there (Table 4.4). The calculation of this mean includes the zero-values of all those respondents (51% of sample) who did not indicate that they would likely spend more time at Delavan Lake in response to such an improvement in the aquatic weed situation there.

The mean value of 9.06 additional days/yr in response to the control of Eurasian watermilfoil represents a 5.12% increase above the current number of average days (177 days/yr) that property owners spend at Delavan Lake. In Section 6 of this report, we explain how this percentage increase is combined with annual consumer expenditures made by Delavan Lake residents to estimate the likely economic impact of controlling Eurasian watermilfoil.

TABLE 4.4. Number of additional days per year that respondents would likely spend at their Delavan Lake property if Eurasian watermilfoil were controlled.

Variable	Observations	Mean	Standard Deviation
Number of additional days/yr respondent would likely spend at Delavan property	903	9.06	29.93

An approach similar to that described above for Eurasian watermilfoil was used to estimate the impacts that a decline in water quality, specifically an increase in algae and drop in water clarity, would have on the economy of the Delavan area. Question 22 of the survey presented the following scenario to the respondent:

"Suppose that the amount of algae in Delavan Lake were to increase substantially from its current level. This would have impacts on lake water clarity (reduced visibility through water), and likely impacts on the quality of recreational experiences including swimming and wading. In terms of water clarity, for example, in recent years visibility (the ability to look down into the water from above its surface) has averaged about 10 feet during summer months. Suppose that an increase in algae were to cut visibility to 3 feet on average during the summer. As a point of reference, 3 feet was the approximate visibility prior to the Delavan Lake restoration project of 1989. IF this kind of change were to happen at

> Delavan Lake, AND you expected the change to persist indefinitely into the future, AND no such change was occurring at other lakes in southeastern Wisconsin, how do you think you/your family might change your activities or lifestyle, if at all? (Please check ANY that apply, and fill in blanks as appropriate.)"

One of the options available to the respondent was to indicate that they would sell their property at Delavan Lake in response to the deterioration in water quality described in this scenario. Out of 944 respondents, 350 (37%) indicated they would sell their property if water quality were to worsen in this way.

Another option available to the respondent was to indicate that her/his family would keep their property at Delavan Lake but likely spend fewer days per year there. Out of 944 respondents, 273 (29%) indicated that they would likely spend less time at their property if an increase in algae were to cut visibility to 3 feet. The typical (mean) respondent indicated they would spend about four (4) fewer days per year at their property (Table 4.5). The calculation of this mean includes as zeroes all those respondents (71% of sample) who did not indicate that they would keep their property but likely spend less time there. This mean is thus a conservative (low) indicator of the potential decline in occupancy levels, because it incorporates as zeroes all those respondents (37% of the sample) who said that they would sell their property (i.e., leave altogether), as described in the preceding paragraph. While it is important to recognize that this figure provides a conservative indicator for use in predicting economic impacts, it is also important to realize that one cannot know precisely how occupancy rates for the properties of selling respondents would change. Put simply, the occupancy behavior of the potential new buyers of such properties is unobservable. We therefore consider that the primary economic impact along these lines would accrue from periods of vacancy occurring while properties were on the market, and the reductions in consumer spending that would result.

The mean value of 3.80 fewer days/yr in response to the decline in lake clarity represents a 2.17% decrease below the current number of average days (177 days/yr) that property owners spend at Delavan Lake. In Section 6 of this report, it is shown how this percentage decrease is applied to annual consumer expenditures made by Delavan Lake residents to estimate the likely economic impact of the impairment in lake water quality.

TABLE 4.5. Number of fewer days per year that respondents would likely spend at their Delavan Lake property if lake water clarity (visibility) were reduced from a baseline of 10 feet to a new level of 3 feet.

Variable	Observations	Mean	Standard Deviation
Number of fewer days/yr respondent would likely spend at Delavan property	891	3.80	13.28

In this section we provided the core information required to conduct the economic impact analysis. We note that supplementary information obtained from the property survey is provided in Appendix A. Attachment A contains a copy of the actual survey.

5.0 Delavan Lake Visitor Survey

We also administered a similar questionnaire to visitors of Delavan Lake from outside the region. In this section we provide a summary of the visitor survey expenditure-related results used to support the Delavan Lake economic analysis. The survey results were important inputs to the economic analysis in two main ways. First, the survey collected information on the magnitudes and types of consumer expenditures of people who visited Delavan Lake. These data were used in the input-output analysis of economic impacts, as described in Section 6 of this report. Second, the survey collected data on the visitation patterns and purposes of nonresidents, and asked respondents how they would change these patterns in the event of specific environmental quality changes at Delavan Lake. These data were used in the input-output analysis to estimate the economic impacts of potential environmental changes at the lake. Our focus in this section is on expenditure patterns and related economic content generated from the survey, but we report other visitor survey results in the accompanying Appendices B and C. Given that the weight of the study centers on property owner activity, we provide only a brief overview of visitor activity.

Visitor survey information collected at the Delavan Lake Public Boat Launch on consumer expenditure patterns and responses regarding changes in the amount of time they would spend at the lake should environmental change occur are summarized in Section 5.1 below. Corresponding results from surveys collected at Lake Lawn Resort are summarized in Section 5.2. The Delavan Lake Public Boat Launch and Lake Lawn Resort are the two key entry points for visitors. We note that 97% of all respondents indicated that they did not live in the Delavan community. We present data on the boat launch and Lake Lawn Resort surveys separately because the spending patterns differ dramatically between the two groups.

5.1 Public Boat Launch Survey Results

Question 14 of the survey asked respondents to report the "amount you and your immediate travel party spent during the past 24 hours on each type of expenditure." This question was followed by a list of twelve separate expenditure categories.

The results from this survey question, by expenditure category, are shown in Table 5.1. Total daily expenditures are just $34.97 with the bulk of spending allocated to boat launch fees, dining out, and gasoline. Other expenditures were relatively minor.

The mean expenditure data was combined with data collected by the Delavan Lake Sanitary District on number of visitors during the summer season (May through September). Total annual spending by boat launch visitors is about $500,000. Given that we exclude off-season visitors,

this number is a relatively conservative estimate of total spending.[3] The mean expenditure data included in Table 5.1 represent our best estimates of the average direct expenditures per visitor party. As with the property owner expenditure data, these direct expenditure numbers are only the starting point. As presented in Section 6, we must use these figures to also generate indirect spending to estimate total economic impacts.

Table 5.2 presents information from question 15, which asks respondents how they might change their behavior should Eurasian watermilfoil be controlled more effectively. Given that we have provided detailed information regarding the nature of the question in the previous section, we omit it here.

One of the options available to the respondent was to indicate that her/his party would likely spend more days per year fishing on Delavan Lake in response to the described improvement in Eurasian watermilfoil, and if so, how many more days/yr. Out of 186 respondents, 39 percent indicated that they would likely spend more days fishing should the Eurasian watermilfoil situation improve. The typical (mean) respondent indicated they would spend about four (4.07) more days per year there. The calculation of this mean includes the zero-values of all those respondents (61% of sample) who did not indicate that they would likely spend more time at Delavan Lake in response to such an improvement in the aquatic weed situation there.

The mean value of 4.07 additional days/yr in response to the control of Eurasian watermilfoil represents a 25.95% increase above the current number of average days (15.68 days/yr) that visitors spend at Delavan Lake. Eighty-five percent of the respondents indicated that they came to Delavan Lake to fish. In Section 6 of this report, we explain how this percentage increase is combined with annual consumer expenditures made by Delavan Lake visitors to estimate the likely economic impact of controlling Eurasian watermilfoil.

Table 5.1. Mean daily expenditures by Delavan Lake Boat Launch visitors, by expenditure category.[a]

Expenditure category	**Mean expenditure with missing responses treated as zeroes**
Lodging accommodation (Hotel fee for ONE NIGHT)	$2.55
Groceries and liquor	$3.22
Bait and tackle	$2.70
Launch fees	$8.93
Dining out	$ 8.67
Entertainment such as movies, clubs, lounges, sports activities	$0.21

[3] Respondents indicated that, on average, they spend 1.5 days a year ice fishing and a total of 13 days a year fishing and/or boating. Thus, it would be safe to increase the average number of visitations (and thus spending) by about 11 percent. Therefore a less conservative total spending figure that accounts for off-season activity for visitors to the boat launch area is $551,966.

clubs, lounges, sports activities, etc…	
Shopping—tourist	$0.16
Shopping—general	$2.46
Gas/oil for vehicles/boats	$6.02
Licenses, registrations, permits (fishing, boat, auto)	$3.57
All other expenditures	$1.91
Total daily expenditures	**$34.97**
Estimated number of visitor parties annually [b]	14,219
Total annual expenditures from boat launch area [c]	$497,267

[a] Statistics presented in this table are based on analysis of an interim survey dataset containing data from 186 survey respondents.

[b] This number is generated by multiplying the percent of visitors who do not live in Delavan (97% from survey data) by the estimated number of visitors from data provided by the Delavan Lake Sanitary District.

[c] This number is generated by multiplying the number of visitor parties by average daily per-party expenditures.

TABLE 5.2**.** Number of additional fishing days per year that respondents would likely spend at Delavan Lake if Eurasian watermilfoil were controlled.[a]

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of additional days/yr respondent would likely spend on Delavan Lake fishing	186	4.07	1.44	0	60

[a] The precise scenario described in the survey reads: "suppose that Eurasian watermilfoil were controlled to such an extent that it created no perceptible negative impacts on recreational activities (such as boating, fishing, swimming, or wading) and no significant diminishment of your aesthetic enjoyment of the lake.

Table 5.3 presents information from question 16, which asks respondents how they might change their behavior should water clarity be reduced. Again, for brevity we do not reproduce details of the question here.

One of the options available to the respondent was to indicate that her/his party would likely spend fewer days per year fishing on Delavan Lake in response to the described reduction in water clarity, and if so, how many fewer days/yr. Out of 186 respondents, 46 percent indicated that they would likely spend fewer days fishing should the water clarity decline. The typical (mean) respondent indicated they would spend about 5.3 more days per year there. The calculation of this mean includes the zero-values of all those respondents (54% of sample) who did not indicate that they would likely spend fewer days fishing at Delavan Lake in response to such a decline in water clarity.

The mean value of 5.3 fewer days/yr in response to the decline in water clarity represents a 33.8% decline from the current number of average days (15.68 days/yr) that visitors spend at Delavan Lake. In Section 6 of this report, we explain how this percentage decrease is combined with annual consumer expenditures made by Delavan Lake visitors to estimate the likely economic impact of water clarity reductions.

TABLE 5.3. Number of fewer fishing days per year that respondents would likely spend visiting Delavan Lake if lake water clarity (visibility) were reduced from a baseline of 10 feet to a new level of 3 feet.[a]

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of fewer days/yr respondent would likely spend on Delavan Lake fishing	186	5.30	28.76	0	200

[a] The precise scenario described in the survey reads: "Suppose that the amount of algae in Delavan Lake were to increase substantially from its current level. This would have impacts on lake water clarity (reduced visibility through water), and likely impacts on the quality of recreational experiences including swimming and wading. In terms of water clarity, for example, in recent years visibility (the ability to look down into the water from above its surface) has averaged about 10 feet during summer months. Suppose that an increase in algae were to cut visibility to 3 feet on average during the summer. As a point of reference, 3 feet was the approximate visibility prior to the Delavan Lake restoration project of 1989."

5.2 Lake Lawn Resort Survey Results

We now turn to survey findings from Lake Lawn Resort visitors. Question 14 of the survey asked respondents to report the "amount you and your immediate travel party spent during the past 24 hours on each type of expenditure." This question was followed by a list of twelve separate expenditure categories.

The results from this survey question, by expenditure category, are shown in Table 5.4. Total daily expenditures are $174.08 with the bulk of spending allocated to lodging, dining out, and shopping.[4] Note that spending by Lake Lawn Resort visitors is substantially more than boat Public Boat Launch visitors.

The mean expenditure data was combined with occupancy data provided by Lake Lawn Resort to generate total annual spending by Lake Lawn visitors of about $8.9 million. Again, these direct expenditure numbers are used in the input/output analysis found in Section 6.

Table 5.5 presents information from question 15, which asks respondents how they might change their behavior should Eurasian watermilfoil be controlled more effectively. Given that we have already presented the details of the question, we omit it here and move directly to the summary findings.

One of the options available to the respondent was to indicate that her/his party would likely spend more days per year boating on Delavan Lake in response to the described improvement in Eurasian watermilfoil, and if so, how many more days/yr. Of the respondents, 28% indicated that they would likely spend more days boating should the Eurasian watermilfoil situation improve. The typical (mean) respondent indicated they would spend 2.19 more days per year there. The calculation of this mean includes the zero-values of all those respondents (72% of sample) who did not indicate that they would likely spend more time at Delavan Lake in response to such an improvement in the aquatic weed situation there.

The mean value of 2.19 additional days/yr in response to the control of Eurasian watermilfoil represents a 23.45% increase above the current number of average days (9.34 days/yr) that visitors spend at Delavan Lake. In Section 6 of this report, we explain how this percentage increase is combined with annual consumer expenditures made by Delavan Lake visitors to estimate the likely economic impact of controlling Eurasian watermilfoil.

Table 5.6 presents information from question 16, which asks respondents how they might change their behavior should water clarity be reduced. An approach similar to that described above for Eurasian watermilfoil was used to estimate the impacts that a decline in water quality, specifically an increase in algae and drop in water clarity, would have on the economy of the Delavan area. Again, because we have already presented the specifics of the scenario and question, we do not repeat it here.

[4] The questionnaire was administered in August (16 surveys) and then again over the Thanksgiving holiday (31 surveys). Given that the bulk of surveys were completed in the off-season, these estimates, particularly lodging expenses, are likely to be lower-bound estimates.

Table 5.4. Mean daily expenditures by Delavan Lake Lawn Resort visitors, by expenditure category.[a]

Expenditure category	**Mean expenditure with missing responses treated as zeroes**
Lodging accommodation (Hotel fee for ONE NIGHT)	$92.51
Groceries and liquor	$13.72
Bait and tackle	$1.68
Launch fees	$2.27
Dining out	$22.97
Entertainment such as movies, clubs, lounges, sports activities, etc.	$8.82
Shopping—tourist	$8.30
Shopping—general	$14.36
Gas/oil for vehicles/boats	$7.75
Licenses, registrations, permits (fishing, boat, auto)	$1.70
All other expenditures	$0.00
Total daily expenditures	**$174.08**
Estimated number of visitor parties annually [b]	51,100
Total annual expenditures from Lake Lawn Resort [c]	**$8,895,488**

[a] Statistics presented in this table are based on analysis of survey dataset containing data from 47 survey respondents.

[b] This number is obtained by multiplying the number of rooms at Lake Lawn Resort by the occupancy rate.

[c] This number is generated by multiplying the number of visitor parties at Lake Lawn Resort by average daily per-party expenditures.

TABLE 5.5**.** Number of additional days per year that respondents would likely spend at Delavan Lake if Eurasian watermilfoil were controlled.[a]

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of additional days/yr respondent would likely spend on Delavan Lake	47	2.19	8.81	1	30

[a] The precise scenario described in the survey reads: "suppose that Eurasian watermilfoil were controlled to such an extent that it created no perceptible negative impacts on recreational activities

(such as boating, fishing, swimming, or wading) and no significant diminishment of your aesthetic enjoyment of the lake.

One of the options available to the respondent was to indicate that her/his party would likely spend fewer days per year boating on Delavan Lake in response to the described reduction in water clarity, and if so, how many fewer days/yr. Of the respondents, 32% indicated that they would likely spend fewer days boating should the water clarity decline. The typical (mean) respondent indicated they would spend 2.09 fewer days per year there. The calculation of this mean includes the zero-values of all those respondents (68% of sample) who did not indicate that they would likely spend fewer days at Delavan Lake in response to such a decline in water clarity.

The mean value of 2.09 fewer days/yr in response to the potential reduction in water clarity represents a 22.38% decrease below the current number of average days (9.34 days/yr) that visitors spend at Delavan Lake. In Section 6 of this report, we explain how this percentage decrease is combined with annual consumer expenditures made by Delavan Lake visitors to estimate the likely economic impact of a reduction in water clarity.

TABLE 5.6**.** Number of fewer days per year that respondents would likely spend visiting Delavan Lake if lake water clarity (visibility) were reduced from a baseline of 10 feet to a new level of 3 feet.[a]

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of fewer days/yr respondent would likely spend on Delavan Lake	47	2.09	9.30	0	30

[a] The precise scenario described in the survey reads: "Suppose that the amount of algae in Delavan Lake were to increase substantially from its current level. This would have impacts on lake water clarity (reduced visibility through water), and likely impacts on the quality of recreational experiences including swimming and wading. In terms of water clarity, for example, in recent years visibility (the ability to look down into the water from above its surface) has averaged about 10 feet during summer months. Suppose that an increase in algae were to cut visibility to 3 feet on average during the summer. As a point of reference, 3 feet was the approximate visibility prior to the Delavan Lake restoration project of 1989."

In Sections 4 and 5, we presented the key information that is used to calculate the total economic impact of Delavan Lake on the local economy. We can also generate the total economic impact of changes in lake water quality. We now use these data to estimate the total impacts using input/output analysis as presented in Section 6. Supplementary information obtained from the visitor survey is provided in Appendices B and C, and a copy of the survey itself is provided in Attachment B.

6.0 Input/Output Analysis

The impact of receipts and expenditures attracted to Delavan because of the presence of Delavan Lake is felt throughout the entire local economy. Mortgage payments, grocery bills, and new cars are all affected by expenditures made by property owners as well as lake visitors. As a result, the revenue of banks, supermarkets, car dealers, etc… are affected by these expenditures.

The linkages between sectors within the regional economy can be measured using multipliers. While we use three types of multipliers in this analysis, we present a brief explanation of one (the expenditure multiplier) to illustrate this concept. Multipliers are composed of direct, indirect, and induced effects. The direct effect occurs in the first round through the direct expenditures of households and visitors. The indirect and induced effects focus on how the direct expenditures cause a ripple effect, which lead to additional spending in other sectors of the economy. The induced multiplier effect is generated from the proportion of total expenditures spent by property owners and visitors in the Delavan region. On the other hand, any expenditures incurred outside the Delavan economy are considered leakages.[5]

Analysts use the multiplier to describe and quantify the relationships, or linkages, between various economic entities within an economy. Multipliers describe these relationships using several different economic indicators such as industry output, personal income, and employment.

This study will use the three indicators most commonly used in economic impact analysis: total expenditure, employment, and personal income. Total expenditures provide a measure of total economic activity that is occurring within a specific sector as well as how it relates to total economic activity in the region. Similarly, employment estimates provide an evaluation of the number of jobs in a sector or specified sub-sector of the economy. Finally, personal income, defined as the wages, profits and other types of earned income, provides an indication of employee earnings attributable to a particular sector of the economy.

6.1 Economic Impact Analysis

One key objective of this report is to quantify the importance of the presence of Delavan Lake to the local economy. Due to the interrelationships between different sectors of an economy we must consider how the tourism sector is linked to the rest of the economy. Importantly, we must quantify not only the direct economic impact of Delavan Lake area households and visitors,

[5] A leakage is defined as a flow of dollars leaving the community as residents spend money in other communities.

but also the indirect and induced effects.[6] To illustrate, consider the largest component of Delavan Lake expenditures—spending by households. A portion of spending by these households occurs in the Delavan area, thereby supporting other economic activity. However, not all household spending occurs in the defined region. We must take into consideration a leakage such as this. When a portion of these expenditures is made in the region a multiplier effect occurs: Household spending in Delavan stimulates additional spending in the local economy. Input-output analysis enables us to capture the linkages between the tourism sector and the rest of the local economy. It does so by using regional data to generate multipliers, which are used to quantify the relationships between firms and households. In this context, we will use the multipliers to estimate the total economic impact of households and visitors coming to the region because of Delavan Lake on the regional economy.

The software used to conduct the input-output analysis is IMPLANPro. Appendix D provides a more detailed description of IMPLANPro and input-output analysis. While other software packages can be used to conduct this type of analysis, IMPLANPro was chosen because of its flexibility, modeling capability, ease of data management and interpreting impact analysis results. IMPLANPro utilizes secondary county-level (for Walworth County) data such as economic output, employment, and personal income for the year 2001 obtained from published sources such as the Bureau of Census, the Bureau of Labor Statistics, and Regional Economic Information Systems (REIS).

The following approach was used to estimate the importance of Delavan Lake households and visitors to the local economy. First, information about household and visitor expenditures was collected from a questionnaire that was completed by households in the Delavan Lake Sanitary District as well as other visitors (Public Boat Launch and Lake Lawn Resort). Information on total expenditures and other detailed expenditure categories was collected. These data in conjunction with IMPLANPro are then used to determine the economic impact of Delavan Lake on the regional economy. The results of the economic impact analysis are presented below.

6.2 Results

As shown in Table 6.1, Delavan Lake is an important component of the local economy. Assuming that in the absence of Delavan Lake the eight square mile area around the lake would have the average number of households per square mile in Walworth County (62.2), spending by property owners accounted for more than $52 million in direct local expenditures and with the

[6] Indirect spending results from revenues generated by the suppliers of services to direct tourism businesses such as Lake Lawn Resort. Induced spending is the result of revenue generated in the community from spending by employees of tourism businesses such as Lake Lawn Resort.

multiplier effect generates about $64 million of total spending in the local economy.[7] In total, economic activity associated with property owner spending results in about 541 jobs and $11.8 million in labor income.

Data from the visitor surveys indicate that about $9.4 million is generated annually from Lake Lawn Resort and the Public Boat Launch visitors from outside of Delavan. With multiplier effects, this activity generated about $13 million in local spending. Note also that visitor spending generates about 217 jobs and $5.3 million in labor income.

In total, on an annual basis we estimate that Delavan Lake is responsible for generating more than $77 million in local spending, 812 jobs, and $17 million in labor income. Of this amount, approximately 83% is attributable to property owner spending.

Table 6.1: Economic Impact of Delavan Lake on Local Economy
Input-Output Table[8]

	Direct	Indirect/Induced	Total
Property Owner Spending			
Expenditures	$52,644,880	$11,222,364	$63,867,244
Labor Income	$8,072,324	$3,688,959	$11,761,283
Employment	384.5	156.9	541.4
Visitor Spending			
Expenditures	$9,392,765	$3,803,445	$13,196,210
Labor Income	$4,102,834	$1,260,353	$5,363,187
Employment	216.8	54.2	271
Total Spending			
Expenditures	$62,037,645	$15,025,809	$77,063,454
Labor Income	$12,175,158	$4,949,312	$17,124,470
Employment	601.3	211.1	812.4

[7] The study area (Delavan Lake Sanitary District) contains approximately 2,700 households within an eight square mile area and comprises more than 80% of the Delavan Township. On average, there are about 62 households per square mile in Walworth County. Using an average household density of 62 households per square mile as a baseline, in the absence of Delavan Lake there would be roughly 498 households in the district. Thus, we estimate conservatively that the lake attracts more than 2,200 households to the region.

[8] Expenditures represent the sum of all tourism-related spending. Labor income is defined as all income generated as a result of tourism-related activity. Employment is the estimated number of full-time jobs created by tourism-related activity.

Although the total economic impact of Delavan Lake is of use, we also endeavor to understand how the local economy would be affected by changes in lake conditions. With this objective in mind, we included two questions regarding Eurasian watermilfoil and water clarity in the property owner and visitor surveys. Based on these questions we estimate that time spent/visitations in Delavan by property owners and visitors would increase by 5.1% and 23.5%, respectively, should Eurasian watermilfoil be reduced substantially. In total, the increase in time spent at Delavan Lake would result in an additional $6.4 million in spending and an additional 91 jobs in the Delavan area. Similarly, a decline in water clarity is estimated to reduce time spent by property owners and visitors by 2.2% and 33.8%, respectively. As a result, total spending and employment would be reduced by $5.8 million and 103 jobs, respectively. These results also have important implications for the City of Delavan in that a reduction in visitations translates to reduced hotel tax and boat launch fee revenues—revenues that might otherwise be collected via the property tax.

Table 6.2: Economic Impact of Changing Water Quality

Input-Output Analysis—Improvement in Water Quality

	Total Economic Impact from Table 6.1	Improvement in Milfoil		Decline in Clarity	
Property Owner Spending					
		%Change	**$ Impact**	**% Change**	**$ Impact**
Expenditures	$63,867,244	5.12%	$3,270,003	-2.15%	($1,373,146)
Labor Income	$11,761,283	5.12%	$602,178	-2.15%	($252,868)
Employment	541.4	5.12%	27.7	-2.15%	-11.6
Visitor Spending					
		%Change	**$ Impact**	**% Change**	**$ Impact**
Expenditures	$13,196,210	23.45%	$3,094,511	-33.80%	($4,460,319)
Labor Income	$5,363,187	23.45%	$1,257,667	-33.80%	($1,812,757)
Employment	271	23.45%	63.5	-33.80%	-91.6
Total Spending					
		%Change	**$ Impact**	**% Change**	**$ Impact**
Expenditures	$77,063,454	8.26%	$6,364,514	-7.57%	($5,833,465)
Labor Income	$17,124,470	10.86%	$1,859,845	-12.06%	($2,065,625)
Employment	812.4	11.23%	91.3	-12.71%	-103.2

6.3 Comparisons with Other Studies

Two recent studies have evaluated the economic impact of lake-amenities to regional economies. Both comparison studies examine the economic impact in primarily rural areas, and thus provide a reasonable benchmark for this study. Murray, et al (2003) examines the economic impacts of a two-month delay in annual drawdown (reducing lake levels) by the Tennessee Valley Authority. They find significant changes in economic activity resulting from reduced lake levels. To estimate the total economic impact Murray, et al (2003) employ a multiplier of 1.4, which is similar in magnitude to the multipliers used in this study. In another study, Shapiro and Kroll (2003) estimate the economic value of New Hampshire lakes, rivers, streams, and ponds. They also use a survey method to determine direct expenditures by water-amenity users. The multipliers used by Shapiro and Kroll (2003) range from 1.26-1.85. Again, this range is in line with but somewhat higher than the multipliers used in the present study. Perhaps this is not surprising given that the Shapiro and Kroll study area is much larger (the entire state of New Hampshire), whereas we study just one locality within Walworth County, Wisconsin. These comparisons, as presented in Table 6.3, give us confidence in our methodology and the magnitude of the estimated multiplier.

Table 6.3: Comparing Multipliers with Other Studies

Study	Output Multiplier	Employment Multiplier	Income Multiplier
Eiswerth, Kashian and Skidmore (2004)	1.21	1.35	1.40
Murray, et al (2003)	1.40		
Shapiro and Kroll (2003)	1.26-1.85		

6.4 Implications for the Local Economy

The preceding analysis demonstrates that Delavan Lake plays a vital role in the regional economy. Importantly, it also links economic activity with lake water quality. The analysis indicates that both property owners and visitors are likely to visit less often should water clarity be reduced. In fact, the estimates show that if water clarity were to return to the pre-restoration levels, economic activity would be reduced by 8% to 13%, depending on the measure of economic activity. Improvement in the management of Eurasian watermilfoil would increase

economic activity by 8% to 11%. This information provides lake managers and policymakers with new information that may be useful in determining how much of limited public resources should be used in lake management.

7.0 Hedonic Analysis

In the early 1980's Delavan Lake experienced significant problems with algal blooms. Scientists determined that non-point sources of nutrients contribute to the excessive growth of algae. In response to the problem, multiple government agencies undertook a rehabilitation project between 1989 and 1993. This program included a number of actions to eliminate those factors that feed the algae. The result of the rehabilitation effort is the dramatic improvement in the environmental quality of Delavan Lake. In this section, using hedonic analysis we evaluate the financial impact the restoration project had on the lakefront property owners and the broader community.

In order to conduct this analysis, information on property valuation and housing characteristics was collected for numerous residential properties on and near three lakes in Walworth County, Wisconsin. These lakes, all drainage lakes, are similar in location in Walworth County. They are also similar in terms of depth, with the deepest parts of each lake ranging from 44 feet to 58 feet. Since drainage lakes are fed primarily by streams and with outlets into streams or rivers, they are particularly vulnerable to surface runoff problems. Importantly, we also included in the analysis homes in the non-lake Walworth County community of Darien, Wisconsin.

A premise of hedonic valuation is the idea that seemingly homogeneous items, such as housing, are actually comprised of many differentiated components. Hedonic analysis is used to determine the contribution of each individual component to the overall value. For example, the market for single-family housing is not determined by a supply of homogeneous homes, but rather housing of varied characteristics. In some cases, these characteristics can be explicit. For example, the cost of a bathroom spa can be calculated through the hardware and labor invested. In a competitive market these input costs translate into an estimate of the monetary value of the bathroom. In other cases, the costs are implicit. When considering the value a city park provides the adjacent single family home, it is impossible to explicitly determine the value of the park and thus its contribution to the overall value of the home. However, with hedonic techniques it is possible to determine the implicit spillover value offered by the park. In a similar manner, it is possible to determine the marginal contribution of a clean lake to the overall value of a lakefront property.

While the literature on many environmental goods (such as clean air) is rich, the existing research using the hedonic method to determine the value of water quality is more limited. Waterfront housing offers unique and measurable qualities. It incorporates similar housing sets in two different environments (waterfront and non-waterfront) that produce different values due to the spillover amenity value offered in just one of the two types of properties. However, some barriers to analysis exist. One barrier is a lack of water quality measurement for the average consumer: water borne particulates are often microscopic and thus unobservable. It is only when the concentrations are egregious that they are noticed by homeowners. In addition, lakes present a non-homogeneous environment: covers and inlets may store pollutants for their homeowners while open areas of the lake appear clean. As a result, a single lake may not be considered a single market (Leggett and Bockstael, 2000). Finally, there is often a difference between perceived water quality and reality (Poor, et al 2001). The well-publicized lake restoration project conducted on Delavan Lake in Southern Wisconsin offers a unique opportunity to estimate the value of a change in water quality on lakefront property values.

We employ hedonic techniques to evaluate price variations over time and across homes in a heterogeneous housing market that are sold in well-integrated markets. Our objective is to isolate the effect of a change in lake water quality on the value of such properties. By using properties located on several similar, yet unique waterfronts, this research evaluates the impact that the restoration project had on Delavan Lake properties relative to other lakefront properties.

Real estate presents a commodity composed of differentiated characteristics. Residential housing units are comprised of differing numbers of bedrooms, square footage, bathrooms, and other amenities. Any given house provides a total utility based on the utility yielded by the characteristics of the differentiated good. For years hedonic regressions have been used to evaluate the contributions of the specific characteristics to the price of composite goods. Rosen (1974) provided the original theoretical framework that has been used as a basis for hedonic empirical analysis. The general idea of the hedonic technique is to take observations on prices and specific characteristics of a good and use the heterogeneity in prices and characteristics to obtain implicit prices for the individual components of the good embodied therein.

While research that attempts to obtain the implicit price of water quality in residential housing is limited, the academic literature is replete with the analysis of the hedonic value in residential real estate. Residential housing is obviously a differentiated product, and obtaining the necessary data is manageable. Estimating the value of specific housing characteristics has been desirable for a number of reasons. Just as information on the parameters of the demand function in explicit markets is useful, the same information is important in implicit markets. This is particularly true

for shoreline valuation because the lake quality characteristic contains the nature of a public good, so that information on the value of such goods are not readily available except in implicit markets.

7.1 Hedonic Literature Review

A given housing unit is best characterized as consisting of a bundle of attributes which in sum describe the structure itself, the land upon which it is built, and the relevant locational characteristics. Much of the previous research that examines housing markets has used the hedonic framework. We likewise use the hedonic approach to separate the internal property attributes (baths, bedrooms, square feet, etc) from the external public good attributes. In the case of shoreline, this attribute focuses on its proximity and access to water and water-related open space.

David's (1968) hedonic study examines the correlation between lakeshore property values on artificial lakes in Wisconsin and water quality. Although the measure of water quality is correlated with property prices, the subjective measure of water "quality" is a limitation of this initial research. Epp and Al-Ani (1979) also test the relationship between changes in water quality and house values. This work provides support for pro-active efforts in water quality retention. A key conclusion of this work is that the price of houses adjacent to good water quality are sensitive to changes in water quality, but marginal improvement in areas of poor water quality offer no benefit in valuation. Young and Teti (1984) examine a case in which the water quality around St. Albans Bay in Northern Vermont was degraded. This research concludes that property values around St. Albans Bay suffered relative to the properties outside the bay. Brashares (1985) uses an approach similar to that of David (1968) to examine the effect of water quality on Lake Michigan on property valuation, except that he improves upon David's research by including 39 specific objective measures of Lake Michigan water quality. Brashares finds that observable water quality measures are capitalized into the price of lakefront real estate.

The work of Steinnes (1992) examines the importance of perception to the literature by examining the relationship between the perception of poor quality and property values. Steinnes finds that the presence of tannic acid, which gives the water a dark brown color, negatively affects property values. Note, however, that while tannic acid discolors water it has no true negative effects on water quality in terms of environmental degradation. Mendelsohn, *et al* (1992), however, shows that true diminished water quality does not affect property values until awareness is elevated. In a survey of 500 property owners on 34 Maine lakes, Michael, Boyle and Bouchard (1996) determine that water quality issues influenced the purchase decision for potential property owners. Using the alternate technique of willingness to pay (WTP), Boyle, *et*

al (1998) determined that there is a willingness to pay for improved water quality. This WTP offers an economic demand for water quality by lakeshore property owners.

Michael, Boyle and Bouchard (2000) revisit the issue of perceived water quality and valuation. Within a hedonic pricing model, their water quality variables significantly affected housing prices. Finally, readily available water quality measures had a significant effect on property values along the Chesapeake Bay (Leggert and Bockstael, 2000). This body of research demonstrates that the use of objective water quality measures (as opposed to subjective measures) is important for estimating the implicit value of water quality in hedonic modeling (Poor, et al 2000). However, this body of work also suggests that awareness of water quality issues is also important. In summary, these studies show that water quality can significantly affect property prices. However, water quality measures that are not perceivable to the general public, although important, may not be capitalized into property values.

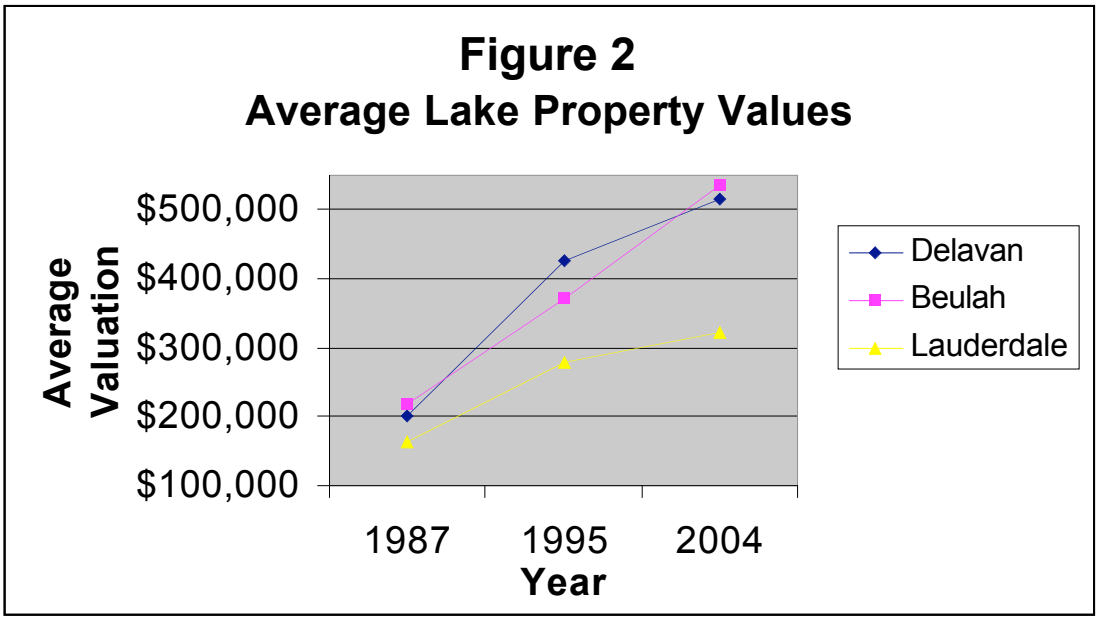
7.2 Data for Hedonic Analysis

In the present study, we compile data on housing prices and characteristics for 1987, 1995, and 2003 from three lake districts and one non-lake district in Walworth County, Wisconsin. In this region property values, especially lake property values, are influenced by the Chicago market. Walworth County is just a two-hour drive from the Chicagoland and thus serves as a recreational area for many Chicago residents. The properties were randomly chosen from all homes located in the Delavan Lake, Lake Beulah, and Lauderdale Lakes areas, as well as the Town of Darien. Delavan Lake is located in the Town of Delavan, Lake Beulah is located in the Town of East Troy, and properties on the Lauderdale Lakes are located in the Town of Lagrange. The properties from the Town of Darien provide comparison real estate market without lake frontage. A number of explanatory variables are included in the hedonic regressions to capture the factors that are typically found to influence residential property prices.

Data on housing prices and characteristics come from several sources. The land and improvement valuations for 2003 are provided by Walworth County. Lake frontage is provided through Walworth County plat maps. The individual townships provided the land and improvement valuations for 1987 and 1995. Due to a large number of missing variables, assessment data for 1994 is used for the Delavan properties. However, in reviewing the assessment rolls from 1993, 1994 and 1996, this was a midpoint assessment period and thus does not affect assessed valuation. The various town assessors provide the housing characteristics, used in the hedonic equations. The values of the randomly selected properties are based on tax rolls provided by Walworth County. In each community, several properties are omitted due to their status as commercial, not residential real estate. Finally, only improved properties in existence in 1987 are

included.

In addition to a series of variables that characterize the properties, time indicator variables are included for 1995 and 2003 to control for the average increase in all properties over time. This provides the basis for analyzing the effect of the Delavan Lake restoration project that occurred between 1989 and 1993 on the value of lake property, relative to comparative properties on other nearby lakes. The dataset consists of 942 observations. The characteristics of 314 homes at three different points in time constitute this dataset. Before turning to the regression results, consider Figure 2, which shows that relative to Beulah and Lauderdale lakefront properties, Delavan values appear to have appreciated at a faster pace, particularly between 1987 and 1995, the period during which lake restoration took place.



7.3 Development of the Hedonic Models

As previously outlined, housing is distinguished by the bundle of characteristics. The use of hedonic pricing follows the lead of Rosen (1974), who shows that the price of a good is a function of the bundle of characteristics embodied in the good: A final price of a good increases as more desirable attributes are included. In the context of property values we focus on the existence of lakefront and the number of feet of shoreline as the relevant determinants of a property's value. Not surprisingly, we hypothesize that lake frontage will increase the value of the property. In addition, it may be that the contribution of lake frontage to the value of a property changes over time. In particular, we are interested in identifying whether the

restoration project on Delavan Lake that occurred between 1987 and 1995, increased the value of Delavan Lake properties more so than lakefront properties on Beulah or the Lauderdale Lakes. To address this issue, we interact a variable that measures the lineal feet of lakefront on Delavan Lake with the time indicator variables. Similarly, we interact a variable that measures the number of lineal feet of lake frontage on Beulah and Lauderdale Lakes with the time indicator variables. These two sets of interactions allow us to examine the contribution of lake frontage (of Delavan Lake and comparison lakes) to the value of the property over time. We hypothesize that due to the restoration project on Delavan Lake, property values on Delavan Lake increased between 1987 and 1995 more so than did properties on the comparison lakes. The differential measured over time between the contribution of lake frontage for Delavan Lake relative to the comparison lakes is a measure of the economic benefit of the lake restoration project. The central hypothesis is that relative to other nearby lake and non-lake properties, property values on Delavan Lake appreciated more subsequent to the restoration event.

The assessed property value is the dependent variable. A number of traditional explanatory variables are typically found to influence heterogeneous residential property values. These include variables such as number of bedrooms, number of bathrooms, square feet of living space, the size of an attached garage, the existence of a basement, the existence of central air conditioning, and the existence of a natural fireplace. These variables are comparable to those used by Palmquist (1984).

Following Palmquist (1984), we also include the square of shoreline feet to control for diminishing marginal benefit. While we expect the coefficient on shoreline feet to be positive, we hypothesize that that the coefficient of shoreline feet squared will be negative. The decreasing marginal benefit argument suggests that while shoreline is valuable, an additional foot of shoreline is not as valuable as the initial foot.

Table 7.1
Descriptive Statistics

Variable	Observations	Mean	Standard Deviation
Real Land Value ($)	938	93,293	123,509
Real Total Property Value ($)	938	184,892	196,252
Lake Frontage (feet)*	942	52	83
Basement (square feet)	939	810	706
Natural Fireplace (1 if yes)	942	0.36	0.52
Attached Garage (square feet)	939	161	275

Central Air Conditioning (1 if yes)	942	0.45	0.5
Full Bath (number)	942	1.6	0.9
Half Bath (number)	939	0.33	0.5
Bedroom (number)	942	3	1
Living Area (square feet)	939	1,702	1,061
* The actual mean footage for shoreline property is about 105 feet. The value presented here is smaller because non-lakefront properties are included in the sample.			

7.4 Estimation of the Hedonic Price Function

The ultimate goal of the analysis is to calculate the real estate appreciation for lake properties in light of an objective improvement in lake quality. Table 7.1 defines and provides summary statistics for all variables that used in the hedonic analysis. We estimate a series of regressions using two alternative dependent variables: (1) assessed value of the land and improvement (with structure), and (2) assessed value of the land only. The first model captures the idea that hedonic characteristics, such as housing components, are different between sites. For example, older homes on a shoreline may diminish the value of the shoreline. This model is further examined in two fashions. First, we examine the existence of lake frontage as a dependent variable to valuation (shoreline length is not a variable). This variable takes on a value of one if the property is lakefront property, and zero otherwise. This model is represented by the following equation:

$$V_{it} = \alpha + \Sigma\beta_{it}(Time_{it}xShorelineD_{it}) + \Sigma\delta_t (X_{it}) + \Sigma\phi_t(Time_t) + \varepsilon_{it} \quad (1)$$

where $Time_{it}xShorelineD_{it}$ is a series of interaction terms between the time indicator variables and either the Delavan Lake shoreline indicator variable or the comparison lakes shoreline indicator variable, X_{it} includes the housing characteristics mentioned above, and $Time_t$ includes the time indicator variables.[9]

An additional associated model alters the equation to include shoreline feet as the key explanatory variable (zero feet is recorded for non-lake housing). This model appears as:

$$V_{it} = \alpha + \Sigma\beta_{it}(Time_{it}xShoreline_{it}) + \Sigma\delta_t (X_{it}) + \Sigma\phi_t(Time_t) + \varepsilon_{it} \quad (2)$$

[9] The 1987 time indicator variable is omitted to avoid perfect multicolinearity.

where $Time_{it}xShoreline_{it}$ is a series of interaction terms between the time indicator variables and either the Delavan Lake shoreline lineal feet variable or the comparison lakes shoreline lineal feet variable, X_{it} includes the housing characteristics mentioned above, and $Time_t$ includes the time indicator variables.

Equation 3 reflects the idea that the existence of lake frontage is a factor that creates a difference in land valuation (without improvements). Once again, this model is examined in two fashions. As illustrated by equation (3), the lake frontage indicator variable is a contributing factor to valuation. The model appears as:

$$LV_{it} = \alpha + \Sigma\beta_{it}(Time_{it}xShorelineD_{it}) + \Sigma\phi_t(Time_t) + \varepsilon_{it} \quad (3)$$

where LV_{it} is the value of land excluding improvements. The final model examines shoreline feet (zero feet is recorded for non-lake housing). This model is represented by:

$$LV_{it} = \alpha + \Sigma\beta_{it}(Time_{it}xShoreline_{it}) + \Sigma\phi_t(Time_t) + \varepsilon_{it} \quad (4)$$

7.5 Hedonic Model Results

Hedonic Equation (1)

The estimation results of the hedonic regression based on equation (1) is given in Table 7.2. By and large, the coefficients have the expected signs and magnitudes. The housing characteristics all fall into the anticipated sign. Basement size, living space, number of bathrooms, and the size of an attached garage are all significant. In addition, the time indicator variables are also positive, indicating the general appreciation of property over time. In reference to the hypothesis of the restoration event, the relative increase in the value of lake frontage on Delavan Lake between 1987 and 1995 is noticeable. Controlling for other factors and the general increase in all property values, the value of lake frontage on Delavan Lake increased from $57,587 in 1987 to $261,406 in 1995—a 354% increase. During the same period, the value of lake frontage on Lake Beulah and the Lauderdale Lakes (Other Lakes) increased in value by 222%. Other than the restoration project, it is difficult to imagine why Delavan Lake properties appreciated so much more than the other lake properties. However, once the benefit of the restoration project was fully capitalized into the value of property, the appreciation attributable to lake frontage slowed: Between 1995 and 2003, Lauderdale and Beulah properties appreciated 57%, while Delavan properties appreciated just 22%.

Hedonic Equation (2)

The estimation results of the hedonic regressions based on equation (2) are given in Table 7.3. The results show that the appreciation of lake frontage on Delavan Lake between 1987 and 1995 exceeded the appreciation of lake frontage on the other two Walworth County lakes. Lake frontage was valued at $665 per foot of lakeshore owned in 1987. This compared with $539 per foot for the lakeshore properties on Lake Beulah and the Lauderdale Lakes. Following the Delavan Lake restoration (more precisely, between 1987 and 1995), the value of the shoreline increased by 352% on Delavan (to $3,010 in inflation adjusted dollars). The other two lakes saw a rise of 282% (from $539 to $2,060).

However, as in Equation (1), this advantage accrued by Delavan in the early 1990's did not continue as the value of shoreline from 1995 to 2003 increased on Delavan by only 10%, while it appreciated by 54% on the other two lakes. The remaining hedonic variables continued to produce anticipated results. It is noteworthy that a natural fireplace added value (at the 10% significance level) while central air conditioning produced a negative (though not statistically significant) coefficient.

Table 7.2. Hedonic Equation (1): Value of land plus dwelling regressed on *shoreline binary indicator times year* interaction terms and other variables.

Regression Results with correction for heteroskedasticity-consistent standard errors.
Dependent variable is the combined value of land plus improvements (dwelling).

Variable	Coefficient	t-statistic
Intercept	-$13,237	-0.69
Time1995	$15,425	2.26**
Time2003	$36,474	6.03***
Delavan Lake ShorelineDxTime1987	**$57,587**	**2.82*** **
Other Lakes ShorelineDxTime1987	**$59,819**	**4.57*** **
Delavan Lake ShorelineDxTime1995	**$261,406**	**8.23*** **
Other Lakes ShorelineDxTime1995	**$192,504**	**13.03*** **
Delavan Lake ShorelineDxTime2003	**$318,566**	**6.38*** **
Other Lakes ShorelineDxTime2003	**$301,782**	**15.56*** **
Basement Square Feet	$47	5.38***
Natural Fireplace (1 if yes)	$10,771	1.29
Attached Garage Square Feet	$65	3.49***
Central Air (1 if yes)	-$11,684	-1.46
Number of Bathrooms	$22,459	3.04***
Number of Bedrooms	-$2,792	-0.42
Living Area Square Feet	$37	3.10***
Adjusted $R^2 = 0.695$		

Number of observations = 926
***significant at the 1% level
**significant at the 5% level
* significant at the 10% level

Finally, we find limited evidence that shoreline exhibits decreasing marginal valuation. This is reflected in the coefficient on the square of shoreline appearing as negative and significant in 1995 and 2003 for Lake Beulah and the Lauderdale Lakes. Somewhat surprisingly, the coefficient on the square of shoreline is not significant for Delavan Lake.

Table 7.3. Hedonic Equation (2): Value of land plus dwelling regressed on *shoreline length times year* interaction terms and other variables.

Regression Results with correction for heteroskedasticity-consistent standard errors.
Dependent variable is the combined value of land plus improvements (dwelling).

Variable	Coefficient	t-statistic
Intercept	$50.933	3.10***
Time1995	$17,264	2.52**
Time2003	$45,811	5.94***
Delavan Lake Shoreline Length x Time1987	**$665**	**1.14**
(Delavan Lake Shoreline Length x Time1987)^2	-$0.12	-0.03
Other Lakes Shoreline Length x Time1987	**$539**	**3.14*****
(Other Lakes Shoreline Length x Time1987)^2	-$0.34	-1.12
Delavan Lake Shoreline Length x Time1995	**$3,010**	**2.79*****
(Delavan Lake Shoreline Length x Time1995)^2	-$2.86	-0.28
Other Lakes Shoreline Length x Time1995	**$2,060**	**11.89*****
(Other Lakes Shoreline Length x Time1995)^2	-$2.09	-5.30***
Delavan Lake Shoreline Length x Time2003	**$3,325**	**1.73***
(Delavan Lake Shoreline Length x Time2003)^2	-$1.05	-0.06
Other Lakes Shoreline Length x Time2003	**$3,179**	**10.22*****
(Other Lakes Shoreline Length x Time2003)^2	-$3.56	-4.09***
Basement Square Feet	$28	5.38***
Natural Fireplace (1 if yes)	$15,182	1.65*
Attached Garage Square Feet	$47	2.85***
Central Air (1 if yes)	-$10,069	-1.33
Number of Bathrooms	$21,077	3.21***
Number of Bedrooms	-$4,794	-0.92
Living Area Square Feet	$28	2.82***
Adjusted $R^2 = 0.756$		

Number of observations = 926
***significant at the 1% level
**significant at the 5% level
* significant at the 10% level

Hedonic Equation (3)

The estimation results of the hedonic regressions based on equation (3) are given in Table 7.4. Here we focus on land valuation only, which simplifies the analysis by removing the value of the housing structure as well as its characteristics. In this model we use as the dependent variable the value of the land only (i.e., excluding improvements). In equation (3), an indicator variable denoting simply whether a lot is on or off the lake (as opposed to the feet of shoreline) is interacted with indicator variables denoting the year. In this way equation (3) is similar to equation (1) above.

Table 7.4. Hedonic Equation (3): Value of land regressed on *shoreline binary indicator times year* interaction terms and other variables.

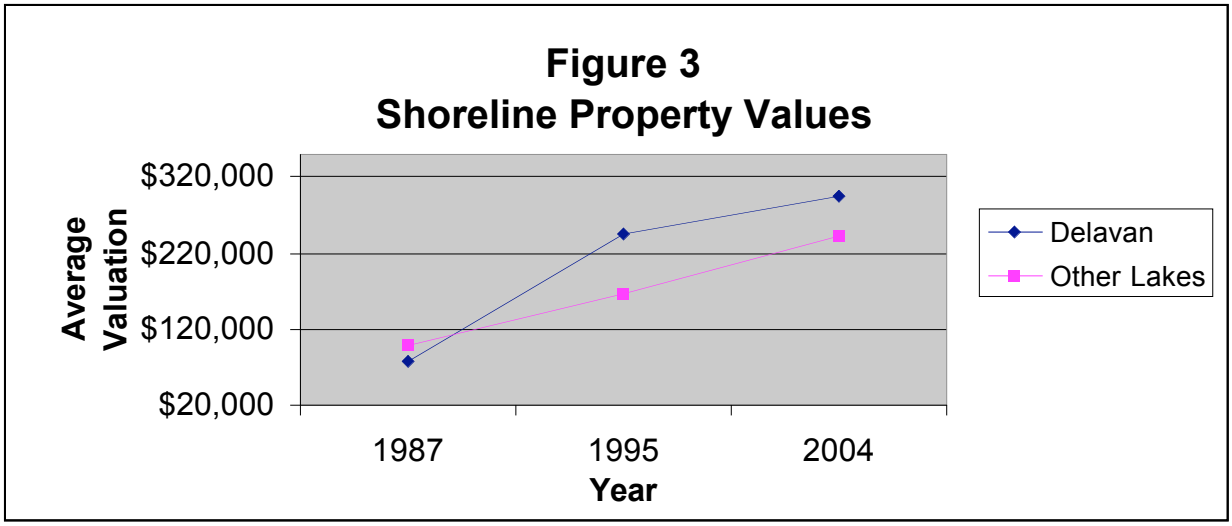
Regression Results with correction for heteroskedasticity-consistent standard errors.
Dependent variable is the value of land.

Variable	Coefficient	t-statistic
Intercept	$21,725	9.51***
Time1995	$2,410	0.88
Time2003	$7,733	2.60***
Delavan Lake ShorelineDxTime1987	**$78,848**	**7.64*** **
Other Lakes ShorelineDxTime1987	**$97,385**	**13.38*** **
Delavan Lake ShorelineDxTime1995	**$244,656**	**9.07*** **
Other Lakes ShorelineDxTime1995	**$167,612**	**18.34*** **
Delavan Lake ShorelineDxTime2003	**$294,185**	**7.17*** **
Other Lakes ShorelineDxTime2003	**$242,345**	**18.39*** **
Adjusted $R^2 = 0.594$		

Number of observations = 938
***significant at the 1% level
**significant at the 5% level
* significant at the 10% level

Once again, the appreciation of Delavan Lake lots far exceeded that of the comparable lakes between 1987 and 1995 (210% to 72%) but lagged in the later period (20% to 45%). This provides support to the hypothesis that the Delavan Lake restoration project led to an increase in property values.

Figure 3 further illustrates this result by showing that relative to the other shoreline properties, Delavan values appreciated at a faster pace, particularly between the 1987 and 1995, the period during which lake restoration took place.



Hedonic Equation (4)

The estimation results of the hedonic regressions based on equation (4) are given in Table 7.5. This model is quite similar to equation (3) except that actual length of shoreline, as opposed to a indicator variable denoting whether a property has lake shoreline or not, is embedded in the (shoreline x year) interaction terms. In results relevant to the Delavan Lake restoration project, the regression shows that price appreciation of homes on Delavan Lake exceeded the appreciation for lake frontage on the other two Walworth County lakes. In 1987 lake frontage was valued at $797 per foot on Delavan Lake, as compared to $1,031 per foot for Lake Beulah and the Lauderdale Lakes. Following the Delavan Lake restoration project, the value of the shoreline increased by 239% on Delavan (to $2,702 in inflation adjusted dollars), whereas the other two lakes saw a rise of 70% (from $1,031 to $1,829).

However, the rate of increase in lakefront valuation on Delavan Lake in the early 1990's did not continue as the value of shoreline from 1995 to 2003 increased on Delavan by only 10%, whereas it appreciated by 41% on the other two lakes. Finally, as with equation (2), we find some evidence of decreasing marginal valuation of shoreline on Lake Beulah and the Lauderdale Lakes. However, on Delavan Lake, this anticipated result does not occur. This is an unexplained finding that is left open to further research since the average length in the sample for all lake properties is quite similar: The shoreline length of the sample parcels on Delavan Lake and the other two lakes combined is 104 feet and 106 feet, respectively.

Table 7.5. Hedonic Equation (4): Value of land regressed on *shoreline length times year* interaction terms and other variables.

Regression Results with correction for heteroskedasticity-consistent standard errors.
Dependent variable is the value of land.

Variable	Coefficient	t-statistic
Intercept	$25,314	9.05***
Time1995	$2,965	0.82
Time2003	$13,526	2.72***
Delavan Lake Shoreline Length x Time1987	**$797**	**3.16*** **
(Delavan Lake Shoreline Length x Time1987)^2	-$0.35	-0.17
Other Lakes Shoreline Length x Time1987	**$1,031**	**9.58*** **
(Other Lakes Shoreline Length x Time1987)^2	-$1.17	-4.45***
Delavan Lake Shoreline Length x Time1995	**$2,702**	**5.09*** **
(Delavan Lake Shoreline Length x Time1995)^2	-$2.89	-0.71
Other Lakes Shoreline Length x Time1995	**$1,829**	**17.18*** **
(Other Lakes Shoreline Length x Time1995)^2	-$2.05	-6.74***
Delavan Lake Shoreline Length x Time2003	**$2,986**	**4.15*** **
(Delavan Lake Shoreline Length x Time2003)^2	-$1.57	-0.24
Other Lakes Shoreline Length x Time2003	**$2,574**	**13.05*** **
(Other Lakes Shoreline Length x Time2003)^2	-$2.98	-5.02***
Adjusted R^2 = 0.723		

Number of observations = 938
***significant at the 1% level
**significant at the 5% level
* significant at the 10% level

7.6 Implications of Hedonic Analysis

In this research, the use hedonic analysis to evaluate the effect of the Delavan Lake restoration project on property values. We show that this event produced financial benefits to the homeowners in the years following the lake restoration. In a stylized analysis, shoreline properties located on Lake Beulah and the Lauderdale Lakes appreciated by 148% between 1987 and 2003. Our analysis demonstrates that the above market returns on Delavan Lake properties is attributable to the lake restoration project.[10] Without it, we suggest that forces would have led

[10] We acknowledge that it is possible that some other factor is causing the relative higher increase in Delavan Lake property valuation between the 1987-1995 period. However, discussions with residents and real estate agents

to a market appreciation of 148% instead of the actual 273% appreciation. In that event, shoreline lots on Delavan Lake would have appreciated from $78,848 to $117,367 rather than the actual appreciation to $294,185. As a result, for the owner of an average Delavan Lake property there was a windfall return of $176,818. In 2004, there were 565 homes with shoreline on Delavan Lake. This translates into an aggregate increase in valuation of over $99 million. This is a contribution to the real wealth of Walworth County, Wisconsin, and it is important to note that this also results in a redistribution of property tax burden within the community.

In 2003, the equalized value of all property in the Town of Delavan was $702 million, which generated $1,843,273 in Township property tax revenues. Assuming that the Township operates efficiently and there are no areas in which to trim the budget, in the absence of the $99 million increase in valuation attributable to lake restoration, property tax rates would have been higher than they are. In this scenario, we estimate that off-lake properties experienced a reduction in property taxes of 14%. Of course, this effect repeats itself at the county and school district levels.[11] In aggregate, we estimate that the mil rate for the Town of Delavan property owner would have been $0.89 higher had the restoration project not occurred, which generates a tax saving on a $200,000 property of $178. This analysis excludes any reduction in the State of Wisconsin and the Vocation Technical College portion of the property tax, but we note that if portions were to be included, the tax saving estimate would be slightly higher.

8.0 Conclusions

Major findings of this study include the following:

- **Residents (both full- and part-time) within the Delavan Lake Sanitary District spend significant amounts of money in the Delavan area.** The property owner survey implemented under this study shows that the average household spends about $24,000 per year in the Delavan area.[12] Annual aggregate spending by all households is estimated to be approximately $53 million.

- **Visitors to Delavan Lake contribute significantly to the total level of consumer spending in the Delavan area.** The visitor survey conducted at the Delavan Public Boat

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familiar with the Delavan market did not reveal other possible causes.

[11] Conceptually, we could also make similar calculations for the Delavan Lake Sanitary District. However, since the sanitary district services primarily residents on and around Delavan Lake, it seemed inappropriate to include it in this portion of the analysis.

[12] We note again that $24,000 is a conservative estimate.

Launch Area and Lake Lawn Resort indicates that visitors spend about $9 million annually in the Delavan area.

- **The sum of direct, indirect, and induced spending as a result of the existence of Delavan Lake is estimated to be in the range of $70-$80 million per year.** In total, direct spending as a result of the presence of Delavan Lake is about $62 million annually. Using input-output analysis we find that this direct spending results in an additional $15 million of indirect/induced spending, for a total of $77 million. We also estimate that 812 jobs are generated from these expenditures.

- **A decline in water quality (increased algae and reduced water clarity) to pre-restoration levels would reduce total regional expenditures by about 8 percent, or approximately $6 million per year.** Furthermore, it is reasonable to expect that the positive impact on regional expenditures that likely occurred following the lake's restoration was similar in magnitude (~$6 million/yr in current dollars).

- **In addition to augmenting consumer spending, the Delavan Lake restoration project also sparked an increase in the value of Delavan Lake shoreline properties.** After controlling for other factors that influence changes in property values over time, the restoration was estimated to cause the average Delavan Lake property to appreciate by $177,000 between 1987 and 2003. This translates into an aggregate increase in valuation of over $99 million.

The findings of this study support the conclusion that Delavan Lake is a crucial component to the financial, physical, environmental, and social fabric of the region. Delavan Lake affects not only the quality of life for local residents, but also has regional economic implications.

Based on our analysis, we conclude that lake management policies can and do have important economic and public finance implications. In particular, results of the hedonic study show that the Delavan Lake restoration project generated substantial increases in lakefront property values. Further, we demonstrate that this increase not only benefits lake property owners, but the community as a whole via reduced tax burdens on non-lakefront properties. The input-output analysis also illustrates the link between Delavan Lake and lake water quality and the local economy.

The Delavan Lake community is currently at a crossroads. Development pressures around the lake and within its drainage basin and invasive aquatic species threaten the health of the lake. Importantly, it should be recognized that effective management of this valuable natural resource

must continue to include the participation of multiple levels of government. A coordinated and informed consortium of governmental units could implement effective policies to guide development in the areas surrounding the lake and the drainage basin, which could yield high returns in terms of maintaining and improving lake quality. This study shows clearly the connection between lake quality, the property tax base, and local economic activity. We hope that this research serves as a catalyst for renewed interest in intergovernmental cooperation and a review (and if necessary the augmentation) of the watershed management plan for the mutual benefit of all stakeholders in the region.

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Appendix A: Summary Statistics from the Delavan Lake Property Owner Survey

A.1 Property Owners' Use of and Experiences with Delavan Lake

TABLE A.1. Proximity of survey respondents to Delavan Lake shoreline.

Distance from house to shoreline	Frequency	Percent
Directly on shore	333	35.61
Less than one block	161	17.22
One block	116	12.41
Two blocks	125	13.37
Three blocks	53	5.67
Four blocks	52	5.56
Between _ and _ mile	62	6.63
Between _ and 1 mile	23	2.46
Between 1 and 2 miles	8	0.86
More than 2 miles	2	0.21
Total	935	100

TABLE A.2. Number of survey respondents with a boat slip on Delavan Lake.

Does respondent have boat slip on Delavan Lake	Frequency	Percent
Yes, respondent has a slip	584	62.66
No, respondent does not have a slip	348	37.34
Totals	932	100.00

TABLE A.3. Number of days the Delavan Lake property is utilized by respondent's family, by season.

Variable	Obs	Mean	Std. Dev.	Min	Max
Days in Summer (June-Aug)	876	55.97	31.31	0	120
Days in Fall (Sept-Nov)	845	42.68	36.25	0	191
Days in Winter (Dec-Feb)	796	37.21	38.43	0	95
Days in Spring (Mar-May)	834	41.17	36.45	0	95

TABLE A.4. If you are NOT a full-time resident, do you intend to become a full-time resident at Delavan Lake at some future point?

Does respondent intend to become full-time resident	Frequency	Percent
Yes, intend to become a full-time resident	162	29.0
No, do not intend to become a full-time resident	396	71.0
Totals	558	100.00

TABLE A.5. If you are not a full-time resident at Delavan Lake but you intend to become one at some future point, then WHEN?

When does respondent intend to become full-time resident at Delavan Lake	Frequency	Percent
In less than 1 year	8	4.3
In 1-5 years	73	39.5
In 6-10 years	61	33.0
Over 10 years from now	43	23.2
Totals	185	100.00

TABLE A.6. Year in which respondents purchased their property at Delavan Lake.

Year of purchase	Frequency	Percent
Before 1960	57	6.23
1960-1969	56	6.12
1970-1979	88	9.62
1980-1984	41	4.48
1985	14	1.53
1986	28	3.06
1987	22	2.4
1988	23	2.51
1989	27	2.95
1990	28	3.06
1991	25	2.73
1992	28	3.06
1993	25	2.73
1994	21	2.3
1995	31	3.39
1996	34	3.72
1997	23	2.51
1998	47	5.14
1999	61	6.67
2000	62	6.78
2001	51	5.57
2002	47	5.14
2003	63	6.89
2004	15	1.64
Total	915	100

TABLE A.7. Respondents' stated importance (on a 1-5 scale) of various reasons for originally choosing to buy property at Delavan Lake.

Potential reason for buying property at Delavan Lake	Not at all important 1	2	3	4	Very important 5	Row Totals
The experience of living close to the lake	87 (9.89%)	37 (4.20%)	75 (8.52%)	105 (11.93%)	576 (65.45%)	880 (100%)
				Mean=4.2		
The ability to boat on the lake	123 (13.96%)	50 (5.68%)	83 (9.42%)	134 (15.21%)	491 (55.73%)	881 (100%)
			Mean=3.9			
Proximity to fishing	272 (31.66%)	125 (14.55%)	180 (20.95%)	121 (14.09%)	161 (18.74%)	859 (100%)
		Mean=2.7				
The water in Delavan Lake was cleaner than other nearby lakes	148 (18.12%)	100 (12.24%)	249 (30.48%)	166 (20.32%)	154 (18.85%)	817 (100%)
			Mean=3.1			
I had family or friends in the immediate area	370 (42.87%)	78 (9.04%)	100 (11.59%)	118 (13.67%)	197 (22.83%)	863 (100%)
		Mean=2.6				
The prices of properties at Delavan Lake were less than at other, similar lakes in the region	151 (18.02%)	83 (9.90%)	263 (31.38%)	202 (24.11%)	139 (16.59%)	838 (100%)
			Mean=3.1			
I thought buying property here would be a good investment	96 11.05	67 7.71	151 17.38	255 29.34	300 34.52	869 (100%)
			Mean=3.7			

TABLE A.8. Percentage amount by which respondents think their Delavan Lake property has changed in value since time of purchase.

Perceived percent change in property value	Frequency	Percent
Value has decreased [a]	11	1.34
1-10%	125	15.24
11-20%	110	13.41
21-30%	78	9.51
31-40%	66	8.05
41-50%	68	8.29
51-75%	69	8.41
76-100%	70	8.54
101-150%	55	6.71
151-200%	33	4.02
>200%	135	16.46
Total	820	100

[a] Eleven respondents out of 820 indicated that they felt the values of their property had decreased since time of purchase. The survey instrument did not ask respondents to specify the percentage amount of a perceived decrease.

TABLE A.9. Delavan Lake characteristics that residents think have changed since purchase of their Delavan property.[a]

Significant changes noticed at Delavan Lake	Number of respondents
Algae/Weed: Worse	196
Water quality: Worse	77
More congested/crowded/population	63
More development, housing, building, commercial, subdivision, condo, resort	62
More boats	47
Lake: Dirtier	40
More Traffic: Boat	39
Lake: Cleaner	38
Water quality: Better	29
Odor/Smell bad	23
Fishing: Better	16
More fishermen	12
Houses look nicer, more upgraded	11
Lost small town/country feeling, atmosphere	10
Tax: higher	8
Water level: Lower/Down/ Less depth	8
Algae/Weed: Better	7
More Traffic (not specific)	7
Cost of living/ price: More expensive	7
Busier (not specific)	7
More Traffic: Car	6
Fishing: Worse	2
Size of fish: smaller	2

[a] This table displays responses to an open-ended question on the survey (Q#10, part 2) that asked respondents: "what significant changes have you noticed at Delavan Lake?" Respondents were asked to fill in this question if they answered "Yes" to part 1 of Q#10, which read: "When thinking about the factors that originally drew you to the lake, have any of these characteristics about the lake noticeably changed since you first bought your property?" The UW-W project team then grouped the open-ended responses into the categories that appear in the first column of the table.

TABLE A.10. Do you like Delavan Lake as much as, the same, or less than, when you first bought property here?

Response	Frequency	Percent
I like it less now than before	219	23.6
I like it more now than before	228	24.5
I like it about the same now as when I first bought property here	482	51.9
Totals	929	100.00

TABLE A.11. Recreational activities undertaken at Delavan Lake by Delavan Lake property owners and their families.[a]

Recreational activity	Percent of residents who engage in specified activity at Delavan Lake	Average number of days/yr spent on specified activity at Delavan Lake[b]
Fishing	45.02%	10.69 (892)
Ice fishing	12.82%	1.33 (935)
Power boating	63.35%	21.39 (880)
Sail boating	10.38%	2.55 (937)
Ice boating	2.44%	0.26 (942)
Snowmobiling	13.24%	1.66 (936)
Golf	32.42%	6.12 (920)
Swimming or wading	48.31%	13.56 (882)

[a] The survey asks respondents if either they or any of their family members typically use the lake for various recreational activities and, if so, typically how many days per year.
[b] The reported mean days/yr includes respondents who indicated zero days for a given recreational activity. The number of observations used to estimate the means are indicated in parentheses.

A.2 Delavan Lake Property Owners' Experiences with other Lakes

TABLE A.12. Number of surveyed Delavan Lake residents who have owned property on or near another lake.

Has respondent ever owned property on or near another lake	Frequency	Percent
Yes	173	18.9
No	745	81.1
Totals	918	100.00

TABLE A.13. Respondents' reasons for selling a previously owned property at another lake.[a]

Reason	Number of respondents	Percent[b]
High property taxes	33	26.6
Too much boat congestion on the lake	27	21.8
Problem with aquatic weeds	17	13.7
Too much automobile congestion around lake area	14	11.3
Water quality was not good	13	10.5
Slip or boat launch fees too high	10	8.1
Association or other membership fees too expensive	8	6.4
Other reasons	78	62.9

[a] Respondents are asked to check all reasons that apply; numbers do not sum to total respondents answering the question.
[b] Percent is calculated as number of respondents checking a specific reason divided by the total number of respondents who indicated they had sold a property on another lake (124).

TABLE A.14. Number of surveyed Delavan Lake residents who typically have gone to lakes other than Delavan Lake for recreation over the past three years.

Has respondent typically gone to other lakes for recreation over past 3 years	Frequency	Percent
Yes	355	39.1
No	552	60.9
Totals	907	100.00

A.3 Expenditure Patterns of Delavan Lake Property Owners

Table A.15. Annual expenditures by Delavan Lake property owners, by expenditure category.[a]

Variable	Obs	Mean	Std. Dev.	Min	Max
Construction & remodeling	944	$15,057	$77,588	$0	$1,700,000
Bait and tackle	944	$88	$222	$0	$3,000
Launch fees	944	$68	$344	$0	$7,500
Dining out	944	$1,543	$2,176	$0	$26,000
Entertainment such as movies, clubs, lounges, sports activities, etc.	944	$612	$1,237	$0	$20,000
Groceries and liquor	944	$2,474	$3,293	$0	$45,000
Gas/oil for vehicles/boats	944	$1,008	$1,387	$0	$12,000
Shopping – general	944	$1,357	$2,052	$0	$20,500
Shopping – tourist	944	$391	$1,041	$0	$15,000
Licenses, registrations, permits (fishing, boat, auto)	944	$162	$297	$0	$5,000
All other expenditures	944	$986	$5,170	$0	$100,000

[a] Missing responses are treated as zeroes in computing the descriptive statistics in this table.

A.4 Characteristics and Opinions of Delavan Lake Property Owners

TABLE A.16. Total annual household income reported by survey respondents.

Income range	Number of respondents	Percent
Below $20,000	19	2.4
$20,000 - $34,999	61	7.9
$35,000 - $49,999	66	8.5
$50,000 - $74,999	139	17.9
$75,000 - $99,999	119	15.3
$100,000 - $149,999	132	17.0
$150,000 - $199,999	76	9.8
$200,000 - $299,999	55	7.1
Over $300,000	109	14.0

Total	776	100.0

TABLE A.17. Surveyed residents' extent of membership in the Delavan Lake Improvement Association.

Is respondent a member of the Delavan Lake Improvement Association?	Frequency	Percent
Yes, respondent is a member	265	29.6
No, respondent is not a member	630	70.4
Totals	895	100.00

TABLE A.18. What are your sources of information about issues/events relevant to Delavan Lake?[a]

Source of information	Frequency	Percent
I get information on Delavan Lake from the local newspapers	744	78.8
The Beacon	406	43.0
The Delavan Enterprise	479	50.7
Other newspapers	128	13.6
I read the Delavan Lake Improvement Association newsletter	567	60.1
I attend meetings of the Delavan Lake Improvement Association	80	8.5
I log on to the Delavan Lake Improvement Association website	46	4.9
Other	119	12.6

[a] Since any given respondent may check multiple boxes for multiple sources of information, the frequencies do not sum to the total number of survey respondents (n=944) and the percents do not sum to 100%.

TABLE A.19. How likely would you be to sell your Delavan Lake property if any of the following things were to happen?

If the things below happened…	Very unlikely to leave 1	Somewhat unlikely to leave 2	Neutral 3	Somewhat likely to leave 4	Very likely to leave 5	Row Totals
If population in the Delavan Lake area doubled	203 (22.4%)	118 (13.0%)	234 (25.9%) Mean=3.0	210 (23.2%)	140 (15.5%)	905 (100%)
If boat congestion on the lake doubled	196 (21.8%)	104 (11.5%)	186 (20.6%) Mean=3.1	234 (26.0%)	181 (20.1%)	901 (100%)
If the amount of Eurasian watermilfoil in Delavan Lake tripled	166 (18.3%)	65 (7.2%)	124 (13.7%) Mean=3.5	227 (25.0%)	325 (35.8%)	907 (100%)

TABLE A.20. Surveyed residents' extent of participation in various activities in the Delavan Lake area.

Survey question	Yes	No	Totals
Are you a member of a community or service organization (e.g., Rotary Club, Lions Club, etc.) in the Delavan Lake area?	84 (8.9%)	860 (91.1%)	944 (100%)
Are you a regular attendee of a church in the Delavan Lake area?	326 (34.5%)	618 (65.5%)	944 (100%)
Are you a regular spectator at events in the Delavan Lake area (such as plays, concerts, dances, or sports games)?	207 (21.9%)	737 (78.1%)	944 (100%)

TABLE A.21. Residents' opinions (on a 1-5 scale) about potential activities to enhance the quality of living on or near Delavan Lake.

Potential activities/efforts	Bad Idea		Neutral		Great Idea	Row
	1	2	3	4	5	Totals
The town or city could plan and implement more festivals or activities at the lake	67 (7.8%)	42 (4.9%)	369 (43.3%) Mean=3.4	198 (23.2%)	177 (20.8%)	853 (100%)
The Delavan Lake Improvement Association could plan more activities for members	45 (5.5%)	37 (4.5%)	507 (61.7%) Mean=3.2	138 (16.8%)	95 (11.6%)	822 (100%)
More restaurants could be built	121 (14.2%)	64 (7.5%)	314 (36.9%) Mean=3.2	189 (22.2%)	163 (19.2%)	851 (100%)
More park or playground areas could be created	71 (8.4%)	47 (5.6%)	396 (46.9%) Mean=3.3	178 (21.1%)	152 (18.0%)	844 (100%)

TABLE A.22. Characteristics that residents like the most about being in the Delavan Lake area.[a]

Characteristics residents LIKE the most	Number of respondents
Serenity, quietness, tranquility, peacefulness	158
Lake	136
Country/rural setting, Small town atmosphere, sense of community	122
People, neighborhood, friendliness	113
Boating	77
Landscape, scenery, beautiful area	70
Proximity to Home, primary residence	68
Proximity to Big Cities (Chicago, Milwaukee, etc.)	62
Fishing	54
Relaxing/a resort feeling	53
Close to convenience (stores, entertainment, highway)	51
Recreation, activities	42
Getaway place	41
Restaurants	38
Not congested (compared to a big town, e.g. Geneva lake)	37
Water activities	36
Shopping	27
Slow pace of life, lifestyle	22
Golf	19
Greenery, wooded area	16
Safety	16
Wildlife	13
Proximity to Work	11
Size of lake	10
Privacy	10
Season changing, weather	9
Quality of life	8
Clean air	7
Place to retire	6
Cheaper (compared to Lake Geneva)	4
School	3

[a] This table displays responses to an open-ended question on the survey (Q#30) that asked respondents: "What things do you like the most about being in the Delavan Lake area?" The UW-W project team then grouped the open-ended responses into the categories that appear in the first column of the table.

Table A.23. Characteristics that residents dislike the most about being in the Delavan Lake area.[a]

Characteristics residents DISLIKE the most	Number of respondents
Weeds, Algae	160
Boat traffic	89
Water/Lake quality	83
Traffic (HWY 50)	61
Commercial, Chain stores (e.g., Walmart)	55
Crowded/ congestion	55
Construction (condo, subdivision, resort, housing)	51
Property tax (too high)	44
Water activities (Jet ski)	21
Growth (too fast)	19
Noise	19
Tourists	17
People don't keep up their properties	17
Park/ Launch Fee	13
Smell (stink)	12
Pay tax but get nothing (not enough service)	11
Town Government	10
Sense of community/ country feeling disappear	9
Vandalism	9
Officer (not polite)	5
Cost of living (high)	5
Chemical in weed control	3
Mosquitoes	3

[a] This table displays responses to an open-ended question on the survey (Q#31) that asked respondents: "What things do you dislike the most about being in the Delavan Lake area?" The UW-W project team then grouped the open-ended responses into the categories that appear in the first column of the table.

TABLE A.24. Residents' suggestions for how the Delavan Lake Improvement Association could do a better job.[a]

Specified suggestions for DLIA	Number of respondents
Better communication (list agenda, meeting, even part-time residents)	67
Limit boat slips	47
Newsletter, Flyer, mail	47
Lake needs to be cleaned up	46
Find new method (more efficient) of weed control	34
No more development/develop more slowly	25
Revitalize/ improve downtown	16
Limit size of boats	16
Enforce the law	15
Rise fees	14
Need website	13
Street repair (put sign, light for traffic, road repair)	12
Educate people how to help	11
Get resident more involved	10
Need more patrols	10
Limit speed of boats	10
Expand membership	5
Clean/check up boat before launching	5
Improve water quality	5
Ban fertilizer (Phosphorus)	5
Dredge outlet	4
Free launch for residents	4
Implement, not just talking/ meeting	3
Lower Tax	3
Publish the result of survey	3
Ban motorboat, jet ski	2

[a] This table displays responses to an open-ended question on the survey (Q#32) that asked respondents: "Do you have any suggestions for how the Delavan Lake Improvement Association could do a better job of defining priorities for action, or communicating facts and issues to Delavan Lake property owners?" The UW-W project team then grouped the open-ended responses into the categories that appear in the first column of the table.

Appendix B: Summary of Boat Launch Survey Results

Question 1 of the survey asked:

On this trip, are you are:

1-[ ] a home/property owner in the city or town of Delavan
2-[ ] staying overnight at the home or vacation home of friends or family
3-[ ] an overnight guest in one of Delavan's hotels, motels, or condominiums
4-[ ] an overnight guest in one of the area lodgings outside of Delavan
5-[ ] an overnight guest at campground in the area
6-[ ] visiting for the day
7-[ ] other (please specify) _____

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
a home/property owner in the city or town of Delavan	182	0.033	0.179
staying overnight at the home or vacation home of friends or family	182	0.022	0.147
an overnight guest in one of Delavan's hotels, motels, or condominiums	182	0.011	0.105
an overnight guest in one of the area lodgings outside of Delavan	182	0.016	0.128
an overnight guest at campground in the area	182	0.011	0.105
visiting for the day	182	0.852	0.351
other (please specify) _____	182	0.011	0.105

Question 2 of the survey asked:

Do you typically use the lake for (check all that apply):

1-[ ] Fishing, typically about _____ (fill in) days per year
2-[ ] Swimming or wading, typically about _____ (fill in) days per year
3-[ ] Motor boating, typically about _____ (fill in) days per year
4-[ ] Water skiing, typically about _____ (fill in) days per year
5-[ ] Sail boating, typically about _____ (fill in) days per year
6-[ ] Ice fishing, ice boating and snowmobiling, typically about _____ (fill in) days per year
7-[ ] Other (please specify) _____

Variable	Number of Observations	Percent of Residents Responding Positively	Mean Number of Days
Fishing, typically about _____ (fill in) days per year	182	0.852	12.08
Swimming or wading, typically about _____ (fill in) days per year	182	0.055	0.262
Motor boating, typically about _____ (fill in) days per year	182	0.142	1.169

Water skiing, typically about _____ (fill in) days per year	182	0.077	0.623
Sail boating, typically about _____ (fill in) days per year	182	0.005	0.000
Ice fishing, ice boating and snowmobiling, typically about _____ (fill in) days per year	182	0.175	1.536
Other (please specify) _____	182	0.027	0.000

Question 3 of the survey asked:

How many nights do you intend to spend on this trip? #number of nights_____

Variable	Number of Observations	Percent of Residents Responding Positively	Mean Number of Nights
How many nights do you intend to spend on this trip? #number of nights_____	183	0.656	6.656

Question 4 of the survey asked:

Including yourself, how many people are in your immediate travel party? #_____

Variable	Number of Observations	Mean	Standard Deviation
Including yourself, how many people are in your immediate travel party? #_____	181	3.956	15.56

Question 5 of the survey asked:

Are you currently a resident of:

1-[ ] Delavan, Wisconsin
2-[ ] Other Wisconsin: city/town _____, zip code _____
3-[ ] Illinois: city/town _____, zip code _____
4-[ ] Another state: _____, city/town_____, zip code _____
5-[ ] Another country: _____

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Delavan, Wisconsin	183	0.027	0.163
Other Wisconsin: city/town _____, zip code _____	183	0.475	0.501
Illinois: city/town _____, zip code _____	183	0.475	0.501
Another state: _____, city/town_____, zip code _____	183	0.005	0.741
Another country: _____	183	0.000	0.000

Question 6 of the survey asked:

On average, how much time does it take to drive from your home to Delavan (one way)? _____

Variable	Number of Observations	Mean	Standard Deviation
On average, how much time does it take to drive from your home to Delavan (one way)? _____	172	55.91	0.5589

Question 7 of the survey asked:

What is your age? _____

Variable	Number of Observations	Mean	Standard Deviation
What is your age? _____	173	43.16	12.33

Question 8 of the survey asked:

What is the highest level of education you have completed?

1-[ ] Grade school
2-[ ] High school
3 [ ] Some college or technical school
4 [ ] Technical training in the armed forces
5-[ ] Completed college
6-[ ] Completed some graduate school
7-[ ] Completed Masters degree
8-[ ] Completed PhD degree

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Grade school	172	0.011	0.104
High school	172	0.301	0.460
Some college or technical school	172	0.322	0.469
Technical training in the armed forces	172	0.060	0.238
Completed college	172	0.005	0.074
Completed some graduate level	172	0.104	0.306
Completed Masters degree	172	0.033	0.179
Completed PhD degree	172	0.066	0.248

Question 9 of the survey asked:

What is your annual household income?

1-[ ] Below $20,000
4-[ ] 50,000 to 74,999
7-[ ] 150,000 to 199,999

2-[ ] 20,000 to 34,999
3-[ ] 35,000 to 49,999
5-[ ] 75,000 to 99,999
6-[ ] 100,000 to 149,999
8-[ ] 200,000 to 299,999
9-[ ] Over 300,000

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Below $20,000	146	0.027	0.163
20,000 to 34,999	146	0.066	0.248
35,000 to 49,999	146	0.120	0.326
50,000 to 74,999	146	0.246	0.432
75,000 to 99,999	146	0.158	0.366
100,000 to 149,999	146	0.120	0.326
150,000 to 199,999	146	0.027	0.163
200,000 to 299,999	146	0.016	0.127
Over 300,000	146	0.016	0.127

Question 10 of the survey asked:

In your opinion, which of the following is a water quality problem at Delavan Lake? (check all that apply)

1-[ ] Algae
2-[ ] Weeds
3-[ ] Muddy water/bottom
4-[ ] Not enough game fish
5-[ ] Undesirable species of fish
6-[ ] Smell of the water
7-[ ] Swimmer's itch
8-[ ] Other

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Algae	180	0.530	0.500
Weeds	180	0.409	0.494
Muddy water/bottom	180	0.087	0.285
Not enough game fish	180	0.131	0.341
Undesirable species of fish	180	0.005	0.075
Smell of the water	180	0.115	0.322
Swimmer's itch	180	0.060	0.240
Other	180	0.098	0.301

Question 11 of the survey asked:

Which of the following lakes in the Southeast Wisconsin region would you consider visiting instead of or in addition to Delavan Lake? (check all that apply)

1-[ ] Lake Beulah
2-[ ] Lauderdale Lake
3-[ ] Lake Geneva
4-[ ] Whitewater Lake
5-[ ] Chain of Lakes (Illinois)
6-[ ] Other _____

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Lake Beulah	182	0.186	0.391
Lauderdale Lake	182	0.148	0.356
Lake Geneva	182	0.514	0.501
Whitewater Lake	182	0.224	0.419
Chain of Lakes (Illinois)	182	0.109	0.314
Other _____	182	0.197	0.399

Question 12 asked:

Please fill in the table below for the other lake(s) to which you have gone over the past three years (3 lakes maximum).

Name of Lake	Average number of days/yr to this lake	Primary activity engaged in at lake (fishing, etc.)
a)		
b)		
c)		

Most Common Responses	Mean number of days/yr to this lake
Lake Geneva	17
Whitewater Lake	7
Lake Michigan	5
Waukesa Lake	5
Lake Wisconsin	5

Question 13 (part a) of the survey asked:

For how many years have you been visiting Delavan Lake? _____

Variable	Number of Observations	Mean	Standard Deviation
For how many years have you been visiting Delavan Lake? _____	158	6.973	11.89

Appendix C: Summary of Lake Lawn Resort Survey Results

Question 1 of the survey asked:

On this trip, are you are:

1-[ ] a home/property owner in the city or town of Delavan
2-[ ] staying overnight at the home or vacation home of friends or family
3-[ ] an overnight guest in one of Delavan's hotels, motels, or condominiums
4-[ ] an overnight guest in one of the area lodgings outside of Delavan
5-[ ] an overnight guest at campground in the area
6-[ ] visiting for the day
7-[ ] other (please specify) _____

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
a home/property owner in the city or town of Delavan	47	0.106	0.311
staying overnight at the home or vacation home of friends or family	47	0.000	0.000
an overnight guest in one of Delavan's hotels, motels, or condominiums	47	0.851	0.360
an overnight guest in one of the area lodgings outside of Delavan	47	0.000	0.000
an overnight guest at campground in the area	47	0.000	0.000
visiting for the day	47	0.043	0.204
other (please specify) _____	47	0.000	0.000

Question 2 of the survey asked:

Do you typically use the lake for (check all that apply):

1-[ ] Fishing, typically about _____ (fill in) days per year
2-[ ] Swimming or wading, typically about _____ (fill in) days per year
3-[ ] Motor boating, typically about _____ (fill in) days per year
4-[ ] Water skiing, typically about _____ (fill in) days per year
5-[ ] Sail boating, typically about _____ (fill in) days per year
6-[ ] Ice fishing, ice boating and snowmobiling, typically about _____ (fill in) days per year
7-[ ] Other (please specify) _____

Variable	Number of Observations	Percent of Residents Responding Positively	Mean Number of Days
Fishing, typically about _____ (fill in) days per year	47	0.213	2.343
Swimming or wading, typically about _____ (fill in) days per year	47	0.255	0.362
Motor boating, typically about _____ (fill in) days per year	47	0.468	1.596

Water skiing, typically about _____ (fill in) days per year	47	0.064	0.298
Sail boating, typically about _____ (fill in) days per year	47	0.000	0.000
Ice fishing, ice boating and snowmobiling, typically about _____ (fill in) days per year	47	0.085	1.277
Other (please specify) _____	47	0.383	0.000

Question 3 of the survey asked:

How many nights do you intend to spend on this trip? #number of nights_____

Variable	Number of Observations	Percent of Residents Responding Positively	Mean Number of Nights
How many nights do you intend to spend on this trip? #number of nights_____	47	2.489	1.381

Question 4 of the survey asked:

Including yourself, how many people are in your immediate travel party? #_____

Variable	Number of Observations	Mean	Standard Deviation
Including yourself, how many people are in your immediate travel party? #_____	47	4.681	4.228

Question 5 of the survey asked:

Are you currently a resident of:

1-[ ] Delavan, Wisconsin
2-[ ] Other Wisconsin: city/town _____, zip code _____
3-[ ] Illinois: city/town _____, zip code _____
4-[ ] Another state: _____, city/town_____, zip code _____
5-[ ] Another country: _____

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Delavan, Wisconsin	47	0.106	0.312
Other Wisconsin: city/town _____, zip code _____	47	0.234	0.428
Illinois: city/town _____, zip code _____	47	0.553	0.503
Another state: _____, city/town_____, zip code _____	47	0.106	0.312
Another country: _____	47	0.000	0.000

Question 6 of the survey asked:

On average, how much time does it take to drive from your home to Delavan (one way)? _____

Variable	Number of Observations	Mean	Standard Deviation
On average, how much time does it take to drive from your home to Delavan (one way)? _____	42	97.34	105.66

Question 7 of the survey asked:

What is your age? _____

Variable	Number of Observations	Mean	Standard Deviation
What is your age? _____	45	42.55	16.41

Question 8 of the survey asked:

What is the highest level of education you have completed?

1-[ ] Grade school
2-[ ] High school
3 [ ] Some college or technical school
4 [ ] Technical training in the armed forces
5-[ ] Completed college
6-[ ] Completed some graduate school
7-[ ] Completed Masters degree
8-[ ] Completed PhD degree

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Grade school	47	0.064	0.247
High school	47	0.021	0.146
Some college or technical school	47	0.128	0.337
Technical training in the armed forces	47	0.000	0.000
Completed college	47	0.319	0.471
Completed some graduate level	47	0.191	0.398
Completed Masters degree	47	0.170	0.380
Completed PhD degree	47	0.106	0.312

Question 9 of the survey asked:

What is your annual household income?

1-[ ] Below $20,000
4-[ ] 50,000 to 74,999
7-[ ] 150,000 to 199,999

2-[ ] 20,000 to 34,999 5-[ ] 75,000 to 99,999 8-[ ] 200,000 to 299,999
3-[ ] 35,000 to 49,999 6-[ ] 100,000 to 149,999 9-[ ] Over 300,000

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Below $20,000	43	0.021	0.146
20,000 to 34,999	43	0.085	0.282
35,000 to 49,999	43	0.043	0.204
50,000 to 74,999	43	0.106	0.312
75,000 to 99,999	43	0.128	0.337
100,000 to 149,999	43	0.106	0.312
150,000 to 199,999	43	0.191	0.398
200,000 to 299,999	43	0.191	0.398
Over 300,000	43	0.043	0.204

Question 10 of the survey asked:

In your opinion, which of the following is a water quality problem at Delavan Lake? (check all that apply)

1-[ ] Algae
2-[ ] Weeds
3-[ ] Muddy water/bottom
4-[ ] Not enough game fish
5-[ ] Undesirable species of fish
6-[ ] Smell of the water
7-[ ] Swimmer's itch
8-[ ] Other

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Algae	47	0.532	0.504
Weeds	47	0.426	0.500
Muddy water/bottom	47	0.298	0.462
Not enough game fish	47	0.149	0.359
Undesirable species of fish	47	0.068	0.247
Smell of the water	47	0.617	0.491
Swimmer's itch	47	0.098	0.301
Other	47	0.043	0.204

Question 11 of the survey asked:

Which of the following lakes in the Southeast Wisconsin region would you consider visiting instead of or in addition to Delavan Lake? (check all that apply)

1-[ ] Lake Beulah
2-[ ] Lauderdale Lake
3-[ ] Lake Geneva
4-[ ] Whitewater Lake
5-[ ] Chain of Lakes (Illinois)
6-[ ] Other _____

Variable	Number of Observations	Percent of Residents Responding Positively	Standard Deviation
Lake Beulah	47	0.149	0.360
Lauderdale Lake	47	0.149	0.360
Lake Geneva	47	0.681	0.471
Whitewater Lake	47	0.128	0.337
Chain of Lakes (Illinois)	47	0.106	0.311
Other _____	47	0.085	0.282

Question 12 asked:

Please fill in the table below for the other lake(s) to which you have gone over the past three years (3 lakes maximum).

Name of Lake	Average number of days/yr to this lake	Primary activity engaged in at lake (fishing, etc.)
a)		
b)		
c)		

Most Common Responses	Mean number of days/yr to this lake
Lake Geneva	12
Lake Beulah	3
Lake Michigan	3
Lauderdale Lake	3
Powers Lake	2

Question 13 (part a) of the survey asked:

For how many years have you been visiting Delavan Lake? _____

Variable	Number of Observations	Mean	Standard Deviation
For how many years have you been visiting Delavan Lake? _____	35	11.34	15.08

Question 13 (part b) of the survey asked:

b. Approximately how many days out of the year do you visit Delavan Lake during different seasons, on average? *(Please fill in blanks with best estimates.)*

<u>At Lake Lawn Resort</u>: *<u>At other Delavan Lake sites:</u>*

____ days in Summer (June-Aug) ____ days in Summer (June-Aug)

____ days in Fall (Sept-Nov)
____ days in Winter (Dec-Feb)
____ days in Spring (Mar-May)

____ days in Fall (Sept-Nov)
____ days in Winter (Dec-Feb)
____ days in Spring (Mar-May)

Variable	Observations	Mean	Standard Deviation
At Lake Lawn Resort:			
____ days in Summer (June-Aug)	30	5.001	15.27
____ days in Fall (Sept-Nov)	30	1.662	2.773
____ days in Winter (Dec-Feb)	30	0.596	2.413
____ days in Spring (Mar-May)	30	0.383	2.061

Variable	Observations	Mean	Standard Deviation
At other Delavan Lake sites:			
____ days in Summer (June-Aug)	30	1.106	4.299
____ days in Fall (Sept-Nov)	30	0.043	0.365
____ days in Winter (Dec-Feb)	30	0.043	0.365
____ days in Spring (Mar-May)	30	0.511	2.551

Appendix D: ImplanPro and Input-Output Analysis

ImplanPro is an input-output analysis computer software package. Input-output analysis is a tool used to model the many linkages within a regional economy. ImplanPro is designed to use the linkages within an economy to conduct an economic impact analysis. More specifically, it enables a researcher to forecast the degree to which the regional economy will be affected given a defined change in the regional economy. Input-output analysis examines how economic factors such as output, employment, and personal income are affected by a given change in the economic environment. In this study the objective is to examine how important Delavan Lake is to the regional economy. To accomplish this task, we examine what the regional economy would look like in the absence of Delavan Lake.

The impact analysis generates economic multipliers for the regional economy. These multipliers generate three types of effects on the regional economy: direct, indirect and induced effects. The direct effect is the result of the initial change in the economic environment. In this case, we subtract $64 million from the household and hotel sectors to mimic the absence of Delavan Lake from the regional economy. The indirect effects are the result of the reduced demand for services by the household and hotel sector, which includes reduced purchases in the local economy such as cleaning supplies, food, services, etc… The reduction then creates a chain reaction within the local economy. The induced effects are the result of a reduction of local purchases by employees of Lake Lawn Resort, etc... Accompanying a reduction in wages and salaries is a reduction in household spending. The sum of the direct, indirect, and induced effects is the total effect.

Input-output analysis is demand driven, which means that industries respond directly and indirectly to meet changes in demand. Input-output analysis is also a linear model in which industries are assumed to exhibit constant returns to scale. This means that when demand for a good/service increases (decreases), industries respond by increasing (decreasing) production in a proportional way to meet the change in demand. The model also assumes that there are no constraints in supply and that the production of goods and services is only limited by the demand for such goods and services. Input price changes are also assumed to have no effect on output. Lastly, the inputs required for production are assumed to be fixed. The implication of this is that while changes in the economy affect the output of industries, the mix of inputs required for production is not changed.

For a further explanation and discussion about ImplanPro and Input-Output analysis see the following reference:

MIG. (2000). IMPLAN Pro Version 2.0. Available from the Minnesota IMPLAN Group, Inc., 1940 S. Greeley Street, Suite 201, Stillwater, MN 55082.

Attachment A: Property Owner Survey Instrument

Attachment B: Visitor Survey Instrument