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PUBLIC ATTITUDES AND PREFERENCES REGARDING WETLAND PRESERVATION IN MERIDIAN AND WILLIAMSTOWN TOWNSHIPS, MICHIGAN

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Shannon Lorayne Ruby

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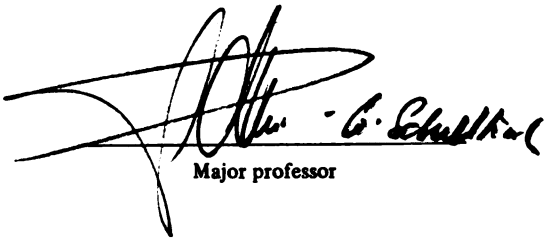

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PUBLIC ATTITUDES AND PREFERENCES REGARDING WETLAND PRESERVATION IN MERIDIAN AND WILLIAMSTOWN TOWNSHIPS, MICHIGAN

By

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ABSTRACT

PUBLIC ATTITUDES AND PREFERENCES REGARDING WETLAND PRESERVATION IN MERIDIAN AND WILLIAMSTOWN TOWNSHIPS, MICHIGAN

By

Shannon L. Ruby

Wetland preservation requires scientific information for decision making pertinent to regulating development. In addition, local planners should determine public opinions regarding wetland preservation, a practice lacking in this type of decision making which may provide answers for future land use planning. The objective of this study is to determine whether socio-economic characteristics effect personal preferences regarding wetland functions and the willingness-to-pay to preserve wetland quality.

A survey of residents in Meridian and Williamstown Townships (Michigan) was used to acquire qualitative data on public preferences regarding wetland functions and values. Analysis of the data presents public perspectives about wetland importance and the willingness-to-pay to preserve individual wetland functions. Findings show that perspectives on wetland preservation tend to be similar between townships. Statistically significant differences do exist between education level, the importance of biodiversity, and the importance of hunting. Socio-economic characteristics effecting wetland functions include income, education, property values, and land use.

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CHAPTER I

INTRODUCTION

Introduction to the Problem

Wetland acreage across Michigan has been declining through the years even though the functions wetlands provide make them one of Michigan's most valuable landforms. In fact, according to the US Fish and Wildlife Service (1990), Michigan has lost about 50% of original wetlands since it was inhabited by European settlers, a loss of over 5,600,000 acres (Cwikiel, 1992). When Europeans first settled in the United States wetlands covered approximately 200 million acres. Today, more than half, some 100 million acres of wetland habitat, have been lost (USEPA, 1995). Wetland acreage is still declining in the United States and Michigan, in spite of federal and state regulations to reverse this trend.

The lack of general guidelines for wetland assessment at the township level in Michigan is apparent. Some townships have made provisions or ordinances for wetland preservation while others have neither zoning laws nor wetland ordinances to guard against over-development and impacts on critical wetland acreage. One step toward the protection of wetlands at the local level is to determine which wetlands and functions are most important. Protection measures may include land use controls based on risk assessment. Supplemental regulations are specific standards and criteria that apply to land use activities. Land use controls (incorporated in zoning ordinances) can provide standards for regulating activities that affect wetland resources (Cwikiel, 1992). An

example of one such land use control is sanitary codes or local ordinances which regulate where septic tanks are placed. Prohibiting septic tanks where the water table is high (including near wetland zones) may deter development and therefore indirectly act as a wetland protection measure.

It seems that the way to save wetland acreage at the local level is to develop regulations and land use controls that can withstand litigation. Developing these plans requires the input of local decision makers and residents of the area. One must know the functions of the various wetlands in the area and create a valuation system to determine the relative importance of wetlands and the need for protection and conservation measures. If the functions and values are not known, little can be done to protect the most important wetlands and to develop adequate land use policies and guidelines. Therefore, there is a need for research on public preferences and the willingness-to-pay to preserve wetlands.

This research consists of a survey of the general public in two townships, developing a data set, and statistical analyses of these preferences and the willingness-to-pay. Outputs include general trends on public preferences to preserve wetlands, comparative trends for preferences in each township, preferences regarding wetland functions associated with water quantity and quality, biodiversity, and recreation and aesthetics, general opinions of how to obtain funds for preservation, and general and comparative trends for the willingness-to-pay for wetland preservation in the two townships.

Federal Wetland Protection Initiatives

At the national level, the US Environmental Protection Agency is ultimately responsible for the Clean Water Act. In 1977, the act was revised from the original of 1972, to include explicit provisions for wetland protection (Section 404). While the EPA administers and has primary responsibility of Section 404, the US Army Corps of Engineers (Corps) shares the responsibility of enforcement of the Clean Water Act with the Michigan Department of Natural Resources. In 1984, a Memorandum of Agreement, known as MOA, was signed between the state of Michigan and the Corps. This agreement waived delegated permit review to the Michigan Department of Natural Resources by allowing for wetland development permits to be processed at the state level (MOA, 1984). The primary focus of Section 404 is to regulate discharge of dredge or fill into US waters and adjacent wetlands. The primary goal of Section 404 regarding wetlands is to minimize adverse impacts by preventing the unnecessary loss of wetlands.

Another federal policy to protect against wetland loss is the no net loss Wetland Action Plan (FWS, 1990). The US Fish and Wildlife Service (FWS, 1990) is in charge of conservation practices to eliminate the net loss of wetlands, while using existing laws and governing bodies to adopt these conservation practices and eliminate the decline in wetland acreage (ibid.). Prior to 1985, farmers could drain wetlands for commodity crops and were able to collect farm support payments. At that time, wetland policies and agricultural policies were at odds. The 1985 Farm Act and the 1986 Tax Reform Act included the "swampbuster" provision which reversed the incentives for wetland drainage and introduced potential loss of farm benefits if wetlands were drained for crop production

(O'Brien, 1996). Due to conflict over "swampbuster", amendments to the provision were incorporated into the 1996 Farm Bill. The act now expands agricultural lands to include pasture, rangelands, and other lands used in the production of livestock or trees. In addition, the act allows the US Department of Agriculture to determine which subsidy to withhold if a wetland is drained. The US Department of Agriculture is now the primary agency in charge of wetlands. Lands that have already been examined and deemed non-wetlands cannot be questioned even if classified improperly. Therefore, many conservationists feel that revisions may lead to increases in small, farmed wetlands due to record food prices which provide monetary benefits for private landowners as opposed to publicly recognized, non-market values that wetlands possess (O'Brien, 1996). Other federal programs that help protect wetlands and their functions include the Fish and Wildlife Act of 1956, the Migratory Marine Game-Fish Act, the Fish and Wildlife Coordination Act, the Endangered Species Act, The National Environmental Policy Act of 1969, and Section 10 of the Rivers and Harbors Act of 1899. Wetlands have and will continue to be an important topic of concern, but matters at the local level of government require further attention be placed on wetland development and preservation.

Michigan Wetland Protection Initiatives

Michigan's state government has established laws protecting wetlands. The primary law in Michigan for protecting and managing wetlands is the Natural Resources and Environmental Protection Act of 1994 (formerly the Goemaere-Anderson Wetlands Protection Act of 1979). This act is administered by the Michigan Department of

Environmental Quality (MDEQ) Land and Water Management Division and protects against wetland loss, provides for public acknowledgment of wetland benefits, establishes a permit program, enforces violations of the act, and authorizes regulation of wetlands by local governments (MDNR, 1988). This act now protects smaller wetlands that have significance too, as they each perform functions that may be important to local communities. This provision, however, states that the area must be essential to the preservation of the natural resources of the state from pollution, impairment, or destruction (Public Act 295, 1992). Other state laws that affect wetlands in Michigan include the Michigan Constitution (Article 4, Section 53), the Soil Erosion and Sedimentation Control Act (P.A. 347 of 1972), the Subdivision Control Act (P.A. 288 of 1968), the Michigan Environmental Protection Act (P.A. 127 of 1970), the Michigan Endangered Species Act (P.A. 203 of 1974), the Flood Plain Regulatory Act (P.A. 167 of 1968), the Inland Lakes and Streams Act (P.A. 346 of 1972), the Shorelands Protection and Management Act (P.A. 245 of 1970), and the Sand Dunes Protection and Management Acts (P.A. 146 and P.A. 147 of 1989).

Although state provisions allow for local regulation it is difficult for small governmental units, such as townships, to develop land use master plans that will prevent piecemeal development of these small wetlands, especially without the funds to determine which wetlands are more important to local ecosystems and public well-being. The state gives municipalities authorization to regulate wetlands in Public Act 203 (section 8 (4)). Municipalities may choose to enact zoning laws for land use control under the County, Township, and City and Village Zoning Enabling Acts and some have adopted local

wetland zoning ordinances (Cwikiel, 1992). However, local wetland regulation has not been without controversy as some view this as over-regulation. Still, local ordinances and regulation can provide the most effective form of wetland protection since they may contain restrictions that are exempt from state or federal law, local officials have easy access to sites for enforcement of the provisions, and local involvement allows for integration of ordinances into development and land use plans. In the past, the state did not regulate wetlands under five acres in size, but since a recent revision discussed earlier (Public Act 295), townships now have more opportunity to preserve small wetlands under state law. The type of wetland protection for each local governmental unit depends on political climate, funding, staff expertise, and public opinion (Cwikiel, 1992). Therefore, each municipality must choose the best protection plan, if any, for themselves. At present, it seems that local zoning options are more popular than stand alone wetland ordinances.

Some of the information needed in the decision making process to create zoning, development, or wetland protection ordinances must originate from field observations. This is due to the fact that different wetlands provide functions at varying degrees. But, part of the information needed deals with public attitudes and preferences pertaining to the functions and perceived values of wetlands. This allows for public voices to be heard so local governing units can avoid assumptions about public perspectives, while also allowing for improved decision making which can lead to better land use plans and future need assessments.

CHAPTER II

PROBLEM STATEMENT

Introduction

Wetland acreage is continuing to decline in Michigan. General guidelines are needed at the township level for wetland assessment to determine which wetlands and functions are most important to the area. Regulations and land use controls that can withstand litigation will aid in the preservation of wetland acreage. However, public attitudes and preferences about wetlands and functions must be included in the decision and law making process.

This research deals with wetland preservation and local land use planning. Determination of public preferences and the willingness-to-pay to preserve wetlands allows for a more representative valuation of wetlands and the gathering of information for land use plans. In determining the need for wetland preservation it is necessary to consider risk assessment, risk communication, and resource valuation. These will be discussed in more detail in this chapter. Investigation of the public preferences and willingness-to-pay to preserve wetlands now, will allow this data to be incorporated with bio-physical data on function performance, therefore allowing for a more objective assessment of the importance of wetland types and development of specific wetland protection criteria.

Risk Assessment

Traditional risk assessment dealt with potential risks to human health, however a new branch of risk assessment dealing with risks posed to the environment and affecting ecosystems has developed (Buie, 1996). This type of risk assessment is referred to as ecological risk assessment and is the type of risk assessment that pertains to this study. As stated by Elyse Rogers (1988) risk assessment is needed in the following situations: 1) when a new risk emerges, 2) when the degree of existing risk changes, or 3) when a new perception of risk occurs. Thinking of risk in its simplest form, one can create a conceptual formula such as RISK = HAZARD / SAFEGUARD (ibid.). This is relevant to wetland preservation in the sense that with each new developed area or impaired wetland, there is the possibility of increasing hazards (e.g. reductions in water quantity) and decreasing safeguards (e.g. flood control). When this occurs the RISK factor increases. One way to reduce potential risk is with safeguards, such as zoning ordinances or preserving beneficial functions of natural resources. It must be pointed out however that risk reduction has its costs. Many times people feel that public benefits from natural features are evaluated to be above dollar value (or valued above the market cost of replacing existing natural functions) since precautionary measures or safeguards seem reasonable in terms of market value (in the monetary sense). For example, the shade that an old oak tree provides on a hot summer day may seem overpriced when considering the cost of replacing a tree of the same size. When actual costs appear, the degree of risk in losing that tree may or may not seem worth the price. Or for instance, as Rogers (1988) states the cost of water and air pollution abatement and control in the US during 1984 was

$43.9 billion. The government was responsible for $8.3 billion of the cost, which undoubtedly came from citizen's tax dollars (ibid.). Pollution control is very expensive, but if it prevents the outbreak of illnesses and deaths around the world, many people feel that human life is worth the cost of risk reduction. Therefore, knowing which wetlands prevent hazards and which increase safeguards would help in the development of management plans that would include land use controls. One method of ecological risk management deals with prioritizing environmental risks (Harwell et al., 1992). A list of environmental risks was compiled and put into matrices. The end result was a priority matrix that can be seen in Table 1. However, Harwell et al. (1992) admitted that the matrix does not match well with public perceptions of environmental risk and this can be seen in Table 2 (Buie, 1996). Proper risk assessment should comply with public perceptions to ensure that environmental management is headed in the right direction.

Risk Communication

When thinking about risk assessment, it is also important to think about risk communication. This comes from the fact that even when proper risk assessment is estimated there can be problems with communicating these risks and probabilities to the public. According to Covello et al. (1987) there are four major problems with risk communication. The first problems are message problems which may deal with lack of scientific understanding creating uncertainties in estimates, or advanced risk analysis which the general public tends to find incomprehensible. The second are source problems which may comprise of mistrust of the assessment team or organization,

Table 1. Summary of ecological risk rankings[a]

Environmental Stress	Extent of stress			Medium			Recovery time		
	Biosphere	Regional	Ecosystem	Air	Water	Terrestrial	Short	Medium	Long
1. Global climate	HHH	HHH	HHH	HHH					X
Habitat alteration	HH	HHH	HHH		HHH	HHH		X	X
Stratospheric ozone	HHH	HHH	HHH	HHH					X
Biological depletion		HH	HHH		HH	HH			X
2. Herbicides/pesticides		M	HH	HH	HH			X	
3. Toxics in surface waters		M	HH		HH			X	
Acid deposition		H	H	H				X	
Airborne toxics	M	HH	HH	HH				X	
4. Nutrients			H		H		X		
BOD			M		M		X		
Turbidity			M		M		X		
5. Oil		L	M		M	L	X		
Groundwater		L	L		L				X
6. Radionuclides			L	L	L			X	
Acid inputs to surface waters			H		H			X	
Thermal pollution			L		L				

[a] From Harwell, *et al.* 1992

Table 1. Summary of Ecological Risk Rankings (Source: Harwell, et al, 1992)

Table 2. Ecological Risk Priorities vs. Public Perception of Environmental Risk
(Source: Harwell, et al, 1992)

Highest Ecological Risks	Public Perception of Environmental Risk
• global climate change	-active hazardous waste sites
• habitat alteration	-abandoned hazardous waste sites
• stratospheric ozone depletion	-water pollution from industrial sources
• biological depletion	-oil spills
	-stratospheric ozone depletion
	-radiation from nuclear power plant accidents
Higher Ecological Risks	-chemicals from industrial accidents
• herbicides and pesticides	-radionuclides in nuclear waste
	-industrial air pollution
High Ecological Risks	-groundwater contamination
• toxins in surface waters	-coastal pollution
• acid deposition	-solid waste
• airborne toxins	-water pollution from agricultural runoff
	-water pollution from sewage plants
	-vehicular air pollution
Medium Ecological Risks	-global climate change
• nutrients	-wetland habitat alteration
• BOD	-acid deposition
• turbidity	-water pollution from urban runoff
	-nonhazardous waste sites
	-release of genetically engineered organisms
Low Ecological Risks	
• oil and petroleum products	
• groundwater contamination	
• radionuclides	
• acid inputs to surface waters	
• solid wastes	
• thermal pollution	

or experts disagreeing about results or methods. The third, channel problems, deal with biased reporting of findings, providing information before a completed assessment, or poor interpretation of risk information. Finally, receiver problems deal with the notion of risk perception such as misinterpretation of risk levels, a resistance to change, disbelief in risk assessment due to a need for absolute certainty in findings, or resistance to reduce risk due to other costs or benefits. Although there is no way to guarantee effective communication, the USEPA established a loose set of guidelines that are still violated in practice (Covello and Allen, 1988). The first rule is most significant to this study since it includes the public as a partner for determining public perceptions of certain risks. This decreases a researcher's need for assumptions and biases throughout the process of determining and communicating risk. Without public input on the subject matter, the assessment may not reflect the true needs and wants of the citizens in the area. Therefore, in any assessment or communication of that assessment the public must be aware and have some input into the process.

Involving the public is important to find general attitudes and preferences, and the public's willingness-to-pay to preserve natural areas. This type of data does exist broadly in Meridian Township's Comprehensive Development Plan (1993), in which personal values of citizens are defined (without quantification). The same is true for Williamstown Township. These are two neighboring townships in mid-Michigan which comprise the study area. Still, the attitudes and values for wetlands and their functions in the area is lacking in the decision making process. In addition there is little published information on public opinions, although studies of government officials are abundant. A study of public

attitudes and preferences toward wetland preservation, along with on site studies and computer generated analytical tools may provide a framework for wetland preservation at the township level throughout Michigan.

Resource Valuation

The broad notion of valuation for implementing public policy deals with three issues. These issues include economic valuation based on market goods and services, resource valuation based on non-market goods, and environmental risk assessment (Schultink, 1996). This study deals with resource valuation as natural features and their functions cannot always be quantified like market goods with prices resulting from supply and demand. Resource valuation was included in the survey to obtain information about the values of non-market goods and services associated with wetlands for use in policy making.

The literature on wetland valuation is diverse. Many publications deal with wetland values in general terms of beneficial functions that wetlands provide. Examples of these are "Wetlands in the Northern Great Plains: A guide to values and management (Berry and Buechler, 1993)," "Wetland Fact Sheets (EPA, 1995)," and "Michigan Wetlands Yours to Protect: A Citizen's Guide to Local Involvement in Wetland Protection (Cwikiel, 1992)." A common way to quantify functions is in terms of developing infrastructure that will replace these functions if they were non-existent (opportunity or replacement costs). The reason for this is that non-market goods are difficult to quantify, and when quantification is completed, there are many questions about

validity and accuracy of outcomes since quantification relies on economic theory and not fact. Valuation techniques may include scaling or weighting approaches, and common denominator approaches that place dollar values on each function and on wetlands in general (Mitsch, and Gosselink, 1993). Each approach has problems and therefore no single approach is recognized by experts or federal agencies. Most people think of value in terms of benefits to society, and therefore values may arise from public perceptions, location of the resource, pressure on the resource, or the abundance or scarcity of resources. However, individual wetlands are unique and may play different roles or possess different functions. For example, a wetland in an urbanizing area may be more important to flood control or storm water retention while a wetland in an agricultural area may have a small effect on flood control, but may be important in nutrient recycling. This makes wetland valuation difficult but no less needed for the development of sound land use plans. References for determining how to quantify wetland values range from the most general type of valuation (discussing functions that benefit society) to complicated mathematical or economic models. The National Research Council (1995) talks about valuation in terms of functional assessment and discusses the need to predict the effects of wetland evaluation while using rank or categorization methods to determine which wetlands warrant more protection. The Corps (1979) manual for valuation aids in permit decisions. This publication gives qualitative guidelines for determining the effectiveness of wetland functions. The FWS (1980) published an evaluation procedure (Habitat Evaluation Procedure, HEP) to evaluate proposed projects on wetland sites using numerical analysis of habitat quality and quantity, and also measures functional capacity.

This process is time consuming and gives a scale for habitat suitability, but is not used by other agencies for wetland regulation. The Federal Highway Administration developed a method for wetland functional assessment using large amounts of quantitative data to develop evaluation algorithms that represent wetland functions (Adamus and Stockwell, 1983). The algorithms are placed into decision trees and ranked as high, moderate, or low to determine a function's value. The Hollands-Magee method uses a numerical index for each function as do many others (Hollands and Magee, 1986). Other similar methods include "Estimating Relative Wetland Values for Regional Planning" (Hruby et al., 1995) and "Public Attitudes and Economic Values for Wetland Preservation in New England" (Stevens et al., 1995). The "Oregon Freshwater Wetland Assessment Methodology," Roth et al. (1993), uses qualitative descriptions of wetland functions and values as the final outcome, but should only be used to obtain basic information. The "Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire," Ammann and Stone (1991), uses a ranking method for wetland functions but gives no overall score or built in rating of high, medium, or low due to beliefs that wetlands should be judged at the local level. "The Wetlands Information Management System," Wolfson et al. (1995), is a computer based program that uses spatial analysis capabilities and calculates a "wetland function index" to be used in the ranking of wetlands according to the user's needs. These techniques are used primarily for planning purposes by people who are not necessarily wetland experts. However, the methods do state that they were designed to be scientifically defensible. Michigan is in need of specific guidelines for categorizing wetlands and their relative values as they relate to the local area of interest.

Wetland valuation is twofold in that it must consist of ecological and economic valuation. This is due to several problems that must be addressed (Mitsch and Gosselink, 1993). These problems include the fact that wetlands are multiple-value systems (they are valuable for different reasons), the most valuable products of wetlands are public amenities that have no commercial value for the private wetland owner, the relationship between wetland area and marginal value is complex, commercial values are finite, whereas wetlands provide values in perpetuity (development is often irreversible), a comparison of economic short-term gains with wetland value in the long term is often not appropriate, and estimates of values are subjective due to personal perspectives and biases of individuals and of the society (Mitsch and Gosselink, 1993).

Ecological valuation is usually based on the HEP. This requires a list of functions to be made assigning each a value of 1. Each factor must then be scaled to represent the maximum value for each functional value. Each scaled factor must then be weighted in proportion to its importance. Finally, the scaled and weighted factors must be added to result in a value index which is arbitrary (Odum, 1979). However, techniques such as HEP (and others based on habitat valuation) do not include all relevant goods and services nor do they incorporate a landscape focus (Mitsch and Gosselink, 1993). Other methods mentioned previously do account for more than habitat evaluation but many methods are still site specific and are not applicable over larger areas.

Economic Valuation

Economic valuation, with respect to resource valuation, tries to place market prices on items that are non-market goods. This is due to the fact that most of us try to reduce values to monetary units since all of us express our preferences in terms of these units when making a purchase. When buying goods, we indicate our willingness-to-pay by exchanging money for goods, therefore reflecting our preferences (Pearce and Turner, 1990). In addition, each value has a different moral standing according to the individual viewpoint and benefits or values are more obvious in quality of life than in any increment of economic output. Therefore, environmental values are less concrete than market values and like ecological valuation, these non-market values tend to be downgraded by the public (Pearce and Turner, 1990).

The main purpose of valuing resources (such as wetlands) is to provide a check on the economic rationality of investing in environmental improvement or preservation. Valuation is most often expressed as the "willingness-to-pay" for the resource rather than be without it (Mitsch and Gosselink, 1993). In economic theory, the price of a good is valued and the optimum quantity of a good determined where the supply and demand curve meet. However, with non-market goods there are problems with valuing goods like wetlands since they are measured by real estate values and not by the free services or functions provided to society (Mitsch and Gosselink, 1993).

Past studies have valued wetlands mostly by commercial goods from wetlands, such as fish, shellfish, feather or fur harvests. The past trend is similar to that of Berry and Buechler (1993) where wetland non-market values are briefly discussed and wetland

products comprise the rest of chapter on wetland values. This trend is changing as increased concern for the environment has forced governments to seek more efficient approaches to environmental preservation and restoration (Turner and Jones, 1990). Market approaches to non-market goods have assisted in improving design and implementation of programs that protect natural resources.

Problems with valuation often deal with the fact that non-market pricing is imprecise. However, only pricing market values of wetlands omits ecosystem and global values of resources that are not confined to any boundaries. Two problems often discussed are: 1) wetland values are found in functions that are defined by man but are hard to see, study, and understand (these functions include flood control, nutrient retention, sediment recycling, open space preservation, etc.) and 2) wetlands may provide different functions with different efficiencies (Berry and Buechler, 1993). The second problem can be dealt with using tests of functional capacity, but this goes beyond the realm of this study.

As stated by Mitsch and Gosselink (1993) and Pearce and Turner (1990) economists recognize four aspects of value. The first, use value, stems from identifiable direct benefits to users such as hunting, fishing, hiking or boating. Second, social values are those that benefit large groups instead of individuals, such as flood protection, nutrient retention, improved water quality or increased water quantity. Next, option value derives from the value a resource will provide in the future, this is usually a perceived future benefit. Finally, existence value deals with the fact that a resource is worth something

because it exists, and may have adverse effects if non-existent. An example may include preserving a wetland for sustaining habitat which in turn may conserve biological diversity.

There are methods available for assigning economic values to benefits resulting from wetland functions that cannot be exchanged in an open market. These methods may include willingness-to-pay methods (also known as contingent analysis or valuation), replacement cost analysis, opportunity cost analysis, travel cost analysis, and conjoint analysis (Smith et al., 1995). For the purpose of this study willingness-to-pay is most relevant as it is included in the survey instrument.

Willingness-to-pay

The willingness-to-pay method is used in the absence of an open market. The researcher must create a hypothetical market for the non-market good or service and include a group of subjects to answer questions about goods in that hypothetical market. Subjects may be survey respondents or experimental subjects. The values generated through use of the hypothetical market are treated as estimates of the value of the non-market good, contingent upon the existence of that market. The technique applied in the willingness-to-pay method uses direct questions, iterative bidding, or other experimental techniques (Pearce and Turner, 1990).

While there is a wide variety of direct-question techniques, all of them involve some variation of the following kind of question: "How much would you be willing to pay in order to obtain or retain some non-market good (or willing to accept in order to permit some level of provision of the good)?" Direct question techniques are widely used

because they are well-adapted to mail surveys, thus permitting inexpensive data collection. (Reynolds, 1992). This technique was used for the study.

Iterative bidding techniques are used in interviews. This involves the "yes or no" type of question. The interviewer varies the amount of money to be paid or received until the highest amount the respondent is willing to pay, or the lowest amount the respondent is willing to accept is identified. The identified amount is an estimate used on a total value curve or plot.

The willingness-to-pay concept results in an automatic monetary estimate or indicator of preferences. The basic idea is that individuals' preferences should be the basis of value or benefit measurement. However, while one can safely assume that people will not pay for what they do not want, one can never be sure that willingness-to-pay as measured by market prices accurately measures the whole benefit to individuals or society. The reason for this is that there may be individuals willing to pay more than others or individuals willing to pay more than the market price, since personal preferences show one's willingness-to-pay (Pearce and Turner, 1990). Therefore, willingness-to-pay must be aggregated to obtain a total willingness-to-pay, yielding a value more socially desirable. It must be noted that an individual's willingness-to-pay for a certain benefit from a wetland (or a wetland function) may depend on his or her understanding of ecology, wetlands in general, and wetland functions (Mitsch and Gosselink, 1993). The less one understands wetlands and their functions, the less he or she will be willing to pay to preserve wetlands and their individual functions.

CHAPTER III

STUDY GOALS AND OBJECTIVES

Objectives

The aim of this research is to compare wetland valuation based on perceived functions by socio-economic characteristics (represented by proxy variables such as property values, population density, income, education level, and predominant land use) in Meridian and Williamstown Township. Since Meridian Township is more urbanized and Williamstown Township is still largely agricultural, these townships can be compared and the potential differences in preferences and the willingness-to-pay for wetland preservation can be examined.

The primary objectives of this study are first, to provide current data on public attitudes and preferences toward wetland preservation, and second to determine whether socio-economic population characteristics in Meridian (an urbanizing) and Williamstown (a predominately agricultural) Townships, effect personal preferences on the preservation of wetlands. The researchable rationale is: Assessment of personal attitudes and preferences regarding wetlands and wetland functions and values will improve the rationale behind and guidelines for wetland preservation in the aforementioned townships as well as Michigan.

The secondary objective is to explore more specific public preferences on wetland functions, wetland preservation, and the willingness-to-pay to preserve wetlands and their functions. The dependent variables include public attitudes and preferences toward

wetland preservation and the willingness-to-pay to sustain wetland functions. The independent variables are socio-economic characteristics that will be used to compare the results of the survey for each township and these variables include property values, population density, income, education level, and predominate land use. These variables have been obtained using survey methods, township data, census data, and other primary sources.

The results of this research will benefit the people in the community by raising awareness, providing new information to planners and decision makers, and helping to protect wetland species and ecosystems. Local units of government may use the results of the public preferences and willingness-to-pay to preserve wetlands to create land use plans and ordinances (where applicable) that may protect critical wetland acreage in the area. More specifically, the results can be used to develop or modify wetland and zoning ordinances which guide future development, while preserving important wetland functions. The Michigan Township Association, Michigan Department of Natural Resources and the Michigan Department of Environmental Quality may benefit from improved wetland preservation and planning at local levels. Natural resource industries that depend on wildlife, fisheries, tourism, and the like will benefit from this study as wetlands, natural areas, biological diversity, and wildlife species are protected. Wetland protection strategies may also help reduce the need for drain construction and maintenance, storm water management, and water quality initiatives. The contrasts between the two townships may help explain why different communities chose whether or not to preserve and protect certain natural resources, therefore aiding in the understanding of public

behavior. This study may also result in the exploration of public attitudes and preferences in other types of communities with differing predominant land uses.

Definitions

Wetlands are unique ecosystems that serve as the transitional zone between upland and aquatic habitats (Cowardin et al., 1979). There are many different types of wetlands and Michigan contains diverse wetland types. The predominant wetlands in the study area are open water, forested, scrub/shrub, and emergent wetlands. Percentages of these distributions will be discussed later in this chapter. Definitions of wetlands have stressed separate emphases for wetland scientists, and wetland managers and regulators. The scientific definition adopted by the FWS in 1979 first appeared in *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). As written this definition states:

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water...Wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes, 2) the substrate is predominantly undrained hydric soil, and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The three criteria are inter-related and must all be present for an area to be considered a wetland. Data on these criteria can usually be found through soil type and species lists developed by the US Army Corps of Engineers (Corps), the EPA, the US Natural Resources Conservation Service (NRCS), and the US Fish and Wildlife Service (FWS). Wetland hydrology data are usually the most difficult to obtain but can be found by reviewing hydrological data, aerial photographs, or simply by direct field observations.

Although the cited FWS definition above is probably one of the most widely used and accepted definitions, that of the Corps is more appropriate for management and regulation purposes (Mitsch et al., 1993).

The USEPA and the Corps use the legal definition of a wetland, a definition which is more reliable under litigation (Mitsch and Gosselink, 1993).

> The term wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The USEPA and the Corps developed this definition for implementation of permitting laws required by the 1977 Clean Water Act, Section 404. Vegetation cover is the only factor in determining if wetland conditions exist because this definition is used for rapid identification of a wetland, identification of wetland boundaries, and determination of regulatory jurisdiction.

Michigan has also created a wetland definition contained in the Natural Resources and Wetlands Protection Act. This is due to responsibilities dealing with permitting and state regulation. The Wetland Protection Act definition was defined by the Michigan Department of Natural Resources (MDNR) and is now administered by the MDEQ, which originated from state governmental reform (Cwikiel, 1992).

> Wetlands are land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog , swamp, or marsh.

This definition resembles that of the USEPA and the Corps, with slightly different wording. The largest difference is that Michigan's state definition goes one step beyond that of the USEPA and Corps to include aquatic life as well as hydrophytic vegetation.

This allows for greater preservation of wetland areas without weakening the regulatory power of the definition in court. This does slow some management strategies as more information is needed to determine if an area should indeed be classified as a wetland.

For the purpose of the survey, wetlands were defined as any lake, stream, swamp, pond, or area with frequently damp soils. This was done to keep from leading respondents with knowledge that may influence individual opinions about wetlands.

Study Area

The study area consists of two neighboring townships (Meridian and Williamstown) in Ingham County, mid-Michigan. A map of the study area with land cover/use can be seen in Figure 1. These areas were chosen because of differences in development pressures that may affect wetland preservation needs and conflicts. The classes of wetlands in the area include aquatic, open water, forested, scrub/shrub, and emergent wetlands. Distributions of the types of wetlands in the area can be seen in pie chart form in Figure 2. For the purpose of this study, only forested, scrub/shrub, and emergent wetlands were included. Definitions for each of these wetland types can be seen in Appendix B. A map of these wetland types in the study area can be found in Figure 3. According to the FWS these types of wetlands fall into a system called the Palustrine System (Cowardin et al., 1979). Palustrine wetlands include marshes, bogs, or swamps. A list of each system, subsystem, and class can be found in Figure 4.

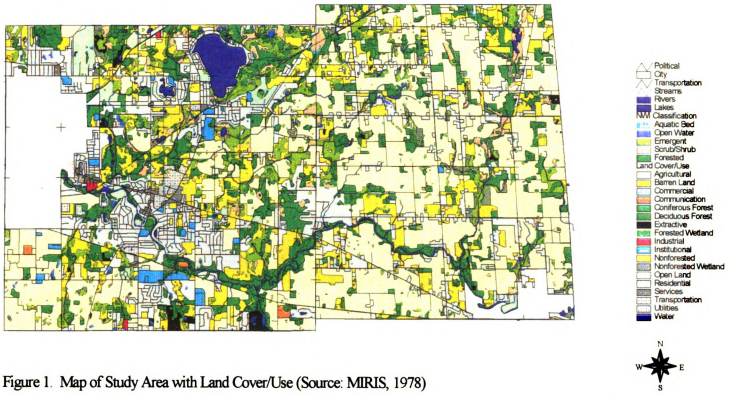


Figure 1. Map of Study Area with Land Cover/Use (Source: MIRIS, 1978)

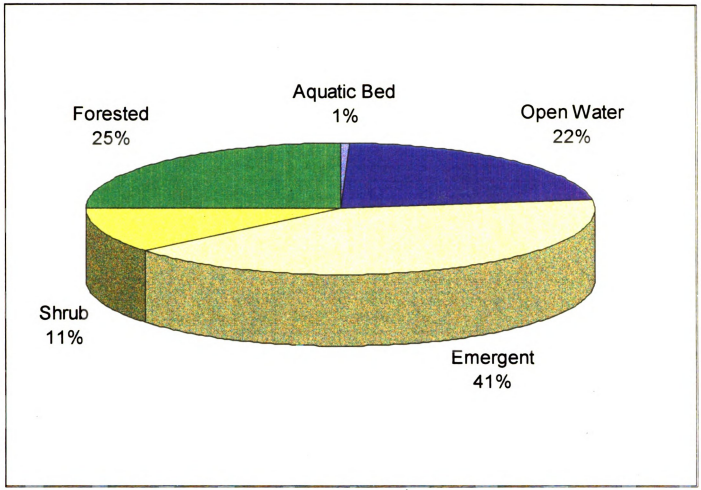


Figure 2. Distribution of Wetland Types: Meridian and Williamstown Townships (Source: FWS, 1993)

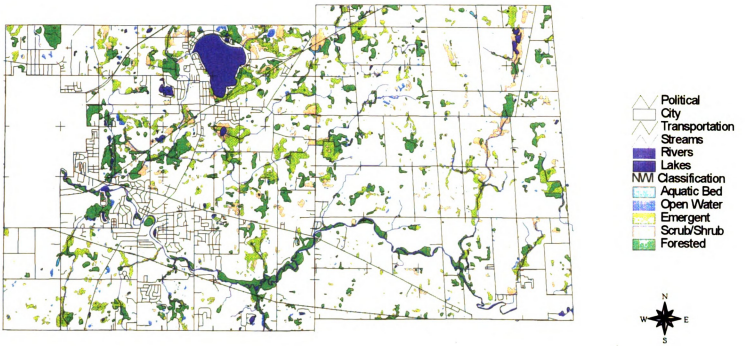


Figure 3. Wetlands in the Study Area (Source: FWS, 1993)

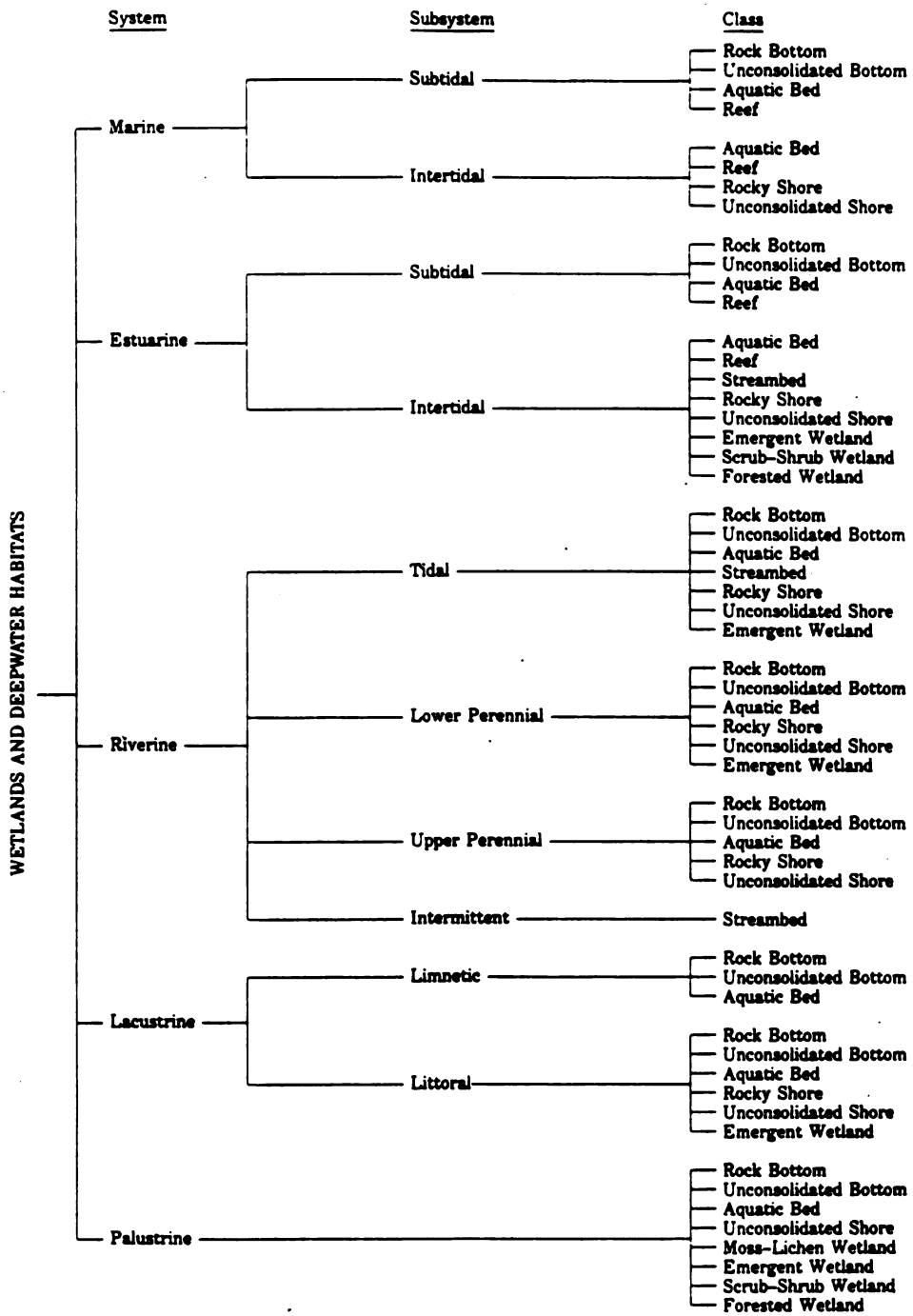


Figure 4. Classification Hierarchy Used in the Cowardin Wetland Classification System (From Cowardin et al. 1979).

The FWS defines a Palustrine System as:

> All nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5‰. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: 1) area less than 8 hectares (ha) or 20 acres; 2) active wave-formed or bedrock shoreline features lacking; 3) water depth in the deepest part of basin less than 2 m at low water; and 4) salinity due to ocean-derived salts less than 0.5‰.

An example of a Palustrine System can be seen in Figure 5. Forested wetlands must contain trees or woody vegetation at least 6 m tall. Subtidal waterways are the only water regimes not included in this class. Forested wetlands are most common along rivers or mountains. In fact, the Red Cedar River flows through both townships. Scrub/shrub wetlands include trees or woody vegetation less than 6 m in height. The vegetation usually consists of shrubs, young trees, and trees or shrubs that have been stunted due to waterlogging. These wetlands may be in the succession stage into forested wetlands or may be stable in and of themselves. Again, subtidal regimes are not included in this class. Emergent wetlands are dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichen. These plants are usually perennials and present for most of the growing season. Emergent wetlands may be stable environments, but with dramatic climate changes they may become open water wetlands in some years (Cowardin et al., 1979). The subtidal regimes are not present in this class either.

Meridian Township is experiencing rapid growth in population which creates development pressures. Urbanization and increases in population creates a larger demand for residential and commercial development. Meridian Township also has a higher average income and higher average property values than Williamstown Township. This

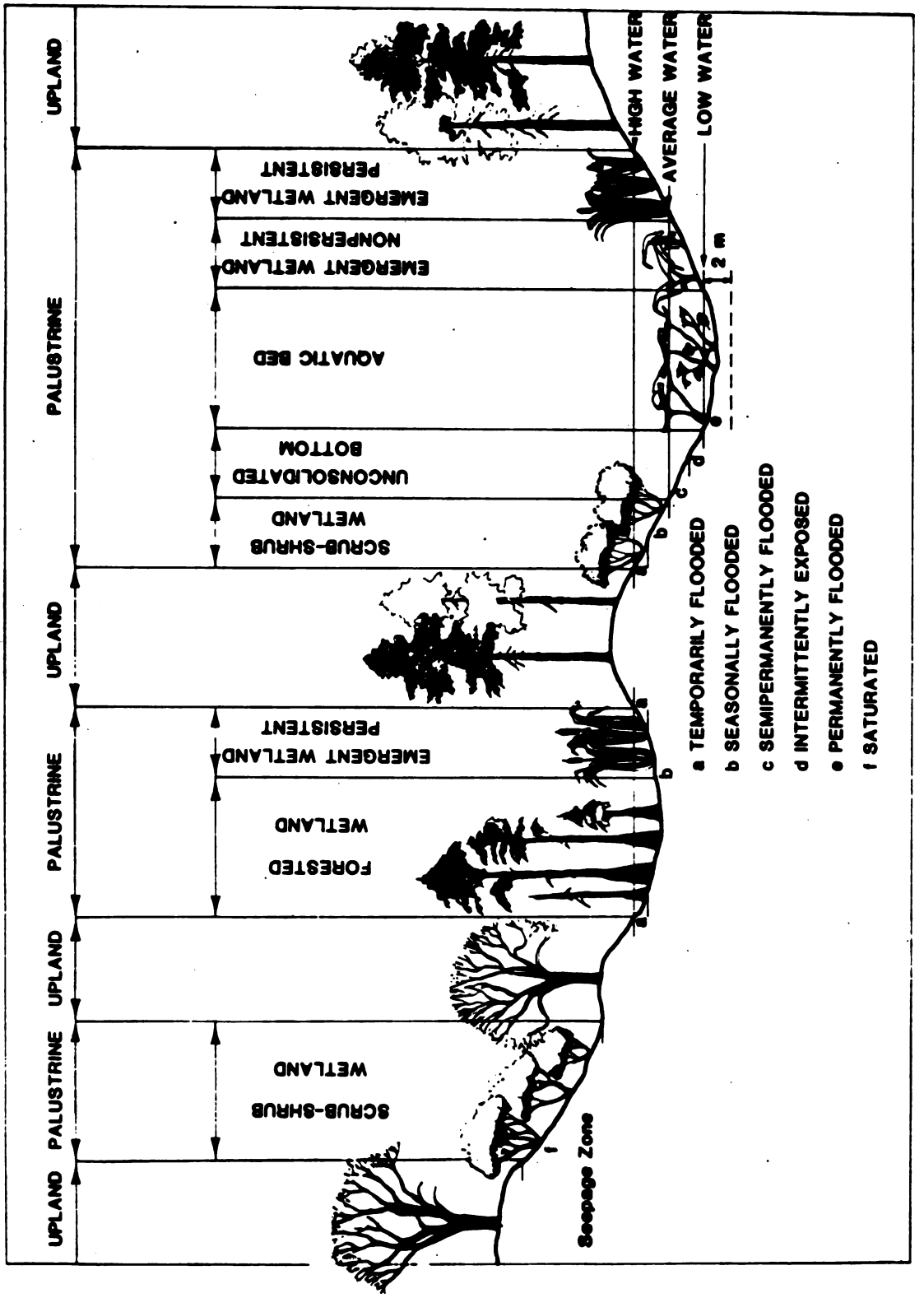


Fig. 5. Distinguishing features and examples of habitats in the Palustrine System.

places increasing pressure on Meridian township officials. In fact Meridian has developed a wetland ordinance along with a wetland commission to aid in the protection of these natural areas. Meridian Township's wetland ordinance, known as the Wetland Protection and Restoration Ordinance, was first adopted in 1991 and amended in 1994. A copy of this ordinance can be seen in Appendix A. This ordinance regulates wetlands from one-quarter acre to five acres, and those wetlands not regulated by the state. Appendix C reveals an inventory of wetlands in the area by one mile sections (Charter Township of Meridian, 1993).

Williamstown Township is quite different. This township is still largely agricultural and rural. Development is increasing in this township, but not at the same rate as Meridian. Williamstown Township's population has increased almost 8% while Meridian's population has increased 24% from 1980 to 1990 (Tri-County Regional Planning commission, 1992). In both townships, Planning Commission Members are voluntary appointed citizens. Meridian Township does have professional planners on staff, while Williamstown Township does not have a formal staff. Williamstown Township has not yet created a wetland ordinance for the protection of wetland areas. There has not been as much conflict over the wetland issue and development pressures are not as severe.

CHAPTER IV

RESEARCH METHOD

Study Design

Obtaining data on personal preferences and the willingness-to-pay to preserve wetlands requires a representative survey. In this case, a mail survey of 400 township residents was conducted. The survey instrument is included in Appendix D. The first step in the survey process was to determine perceptions on the functions that wetlands perform in the study area. A list of functions were compiled using "A Wetlands Information Management System (WIMS) for Facilitating Wetland Evaluation" (Wolfson, et al., 1995). This publication was used because it focuses on similar wetlands in the Sycamore Creek Watershed located in Michigan. The second step was to work closely with a survey expert, Joel Lichty, to minimize potential bias of the survey. Recipients of the mail survey were selected from a cross reference of property owner and registered voter lists. These lists were obtained from the respective township offices.

The survey (Appendix D) consisted of five main parts, including questions about community, qualitative wetland issues, wetland functions, quantitative wetland issues, and general background information about the respondent. Respondents answers were anonymous, and all information was treated with the strictest confidence. No information can be traced to a specific respondent.

Respondents were first asked to answer general questions about wetlands. Opinions about wetland functions were solicited with respect to water quality, water

quantity, flood prevention, ground water recharge, sediment control, and nutrient recycling. Other opinions solicited dealing with bio-diversity included wildlife, plant, and aquatic diversity, and habitat for threatened and endangered species. The final questions related to recreation, including fishing, hunting, boating, hiking/walking, camping, swimming, and picnicking, and aesthetics such as nature observation and nature photography.

Using a survey allowed some functions to be relatively valued using the notions of economic valuation discussed in Chapter 2. Respondents were asked to rate the importance of these functions and, in general, how much they would be willing to sacrifice financially to ensure the protection of wetlands in their township. By surveying personal preferences and attitudes towards wetlands in general, wetland preservation and protection needs can be predicted for Meridian and Williamstown Townships. Personal preferences are determined from the analyses conducted.

These results are discussed in Chapter V. Functions were given a numeric ranking from 1 (not important) to 5 (very important), while also being assigned a range of dollar values representing willingness-to-pay "less than $50 a year" or willingness-to-pay "more than $50 a year." The survey also contained questions to help assess public perceptions about who should be paying for wetland preservation, how much of the township budget should be allocated to wetland preservation, individuals' relative willingness-to-pay for wetland preservation in general, the relative importance of wetlands to the area, how future moneys should be raised by township officials for wetland preservation or

mitigation, and whether people feel their township is doing enough to protect wetlands. All of these data were averaged for each township and the results compared.

The independent variables were also important to the investigation. As stated, these variables are socio-economic characteristics that were used to compare the results of the survey in each township. These variables include property values, population density, income, level of education, and predominant land use. Three of these variables, property values, income, and level of education were obtained directly from the survey. The rest of the variables were obtained from census data, township records, and land use maps. These variables were then used to compare the differences in survey results to help explain the different results (predicted), if any, in the way each township values wetland preservation.

Data analysis was conducted using Statistical Products and Service Solutions, SPSS, (formerly known as Statistical Package for the Social Sciences) a computer program developed by SPSS Inc. to display results. Frequency tests were run for each variable, first including both townships and then individually. Frequency tests help determine how many persons gave a certain response, the percentages, and means of each response. Correlation tests were run for all variables to determine whether relationships between the variables existed and the statistical significance level of the relationships. Independent t-tests were run for all of the variables (using township as the dependent variable) to determine if there were statistically significant differences in the responses between townships. After viewing the results, conclusions were drawn and the appropriate graphs were produced to help explain these results.

Potential Error Sources

Answers to the questionnaire are empirical, relying solely on the current knowledge and perceptions of the respondent. Therefore, some uncertainty or error will exist, and in several instances questions were skipped by respondents because they did not know the answer or did not feel they knew enough about current township involvement in wetland preservation. Also, several respondents may have shied away from questions dealing with money or willingness-to-pay possibly to avoid tax liabilities, even though these were hypothetical situations. This study assumed that the survey design did obtain the best available information for each township, even though respondents' knowledge of wetlands, ecology, and wetland functions was not determined. This was not necessary since the study was based on public opinions, attitudes and preferences toward wetland preservation, and not the respondents' previous knowledge base.

A pre-test of the questionnaire was not conducted. The pre-test was deemed unnecessary since there were several reviews of the survey instrument and the data to be obtained dealt with individual opinions that cannot be exactly duplicated.

Statistical error may include recording error, measurement error, and Type I or Type 2 error around hypothesis testing. Recording error has to do with the transposition of survey answers into the computer program. Human error can always be present, but entries were entered carefully and proofed before any statistical analysis was performed. After the first statistical test was run, two errors in data entry were found and corrected. Therefore, it is the author's opinion that recording error is non-existent.

Measurement error can deal with how well the questions obtained the desired output. Since a pre-test was not conducted, this is difficult to determine. Questions about how well the survey obtained desired results have been raised. These questions have occurred in the willingness-to-pay section of the survey since questions reveal relative willingness-to-pay instead of a precise quantification of this. Other questions have been raised about how valid results are since predictions called for more variation between the two townships. Since the survey was reviewed by an expert, approved by the university, and followed the general guidelines for this type of survey, the author feels its accuracy is adequate to draw the necessary conclusions.

Measurement error can also deal with measurement of statistics. Type I and Type II statistical errors have to do with hypothesis testing. A Type I error occurs when a researcher rejects a null hypothesis that is true. A Type II error occurs when a researcher fails to reject a null hypothesis that is false (Norusis, 1995). Since the data being examined was qualitative, null hypotheses were more vague than if quantitative data were being used to test means and significance. In most cases the null hypotheses stated: The two townships have the same mean for the variable being examined. This simplified analysis and allowed for more accurate interpretations of null hypotheses. The major concern in this area has to do with the experimental design, which may allow for some misrepresentation of preferences and raise questions of whether the data actually allow for accurate hypothesis testing. The author is confident in the accurate interpretation of the null hypotheses from the results obtained from the various statistical tests.

Error can be introduced to a study in many ways, but it is the researchers duty to try to keep this error to a minimum. The author feels this was done to the best of her ability to improve accuracy and reduce suspicions about the results that follow.

CHAPTER V

RESULTS

Introduction

This chapter presents and discusses portions of the survey results related to public preferences regarding wetlands and their functions, and the willingness-to-pay to preserve these functions. The results presented depict respondents preferences during October, 1996. Presented are data, findings, and the response rate from this survey.

Analysis of wetland preservation is done relative to the two townships inclusively, as well as individually. Wetland preservation is analyzed relative to each section of the survey including general findings, wetland function results, and the relative willingness-to-pay. Responses are then discussed by township differentiation, and the significance of the study findings.

General Findings

Before proceeding with the results it is necessary to describe the determination of the strength or weakness of a relationship as found in correlation tests and the statistical significant levels for these and other statistical tests. A correlation test results in a probability of whether variables are related and how statistically significant this relationship is determined to be using a two-tailed significance level. The probability is explained in terms of a correlation coefficient which allows a researcher to determine whether there is a positive or negative relationship between variables and how strong or

weak of a relationship exists. There are no set rules for determining the strength or weakness of a relationship, but the correlation coefficient can be from .0000 to .9999. The author determined each interval of strength using weak (.0000 to .2999), moderately weak (.3000 to .5555), moderately strong (.5556 to .7999), and strong (.8000 to .9999). Since there are no guidelines these intervals are arbitrary, but help explain the findings.

The significance levels found in various statistical tests help determine the confidence that a particular relationship or difference in findings exists. For example, tests showing significant levels less than .001 mean that the researcher is 99% confident with the results, less than .002 means that a researcher is 98% confident, and so on. This allows the researcher to determine the accuracy of the findings. These concepts are used throughout the results.

Surveys were returned by mail in early October, 1996. The anticipated response rate was 25 to 30%, however in actuality the response rate was higher at 36.25%. Therefore, participation was better than anticipated with 145 returned surveys, 73 from Meridian Township and 70 from Williamstown Township and 2 non responses to that particular question. Due to the no response to the township of residence question included in the survey, some respondents were not included in individual township data or when using t-tests. The reasoning behind their exclusion is the township of residence cannot be determined and therefore the researcher and SPSS cannot record or include their particular responses. These responses, however are included in the overall findings. Therefore, totals for individual township data add to 143 instead of the total of 145.

Participants varied by gender, education level, income, employment, and property value. There were 84 male (41 in Meridian and 42 in Williamstown Townships) and 59 female respondents (30 in Meridian and 28 in Williamstown Townships), with 2 cases that were entered as "no response" since the respondents chose not to answer that particular question. The higher response rate of males may be due in part to the cross referencing of property owner lists and voter registration lists. Cases of property owner lists often only list males as the owner even if that male is married and shares the property title with a spouse or relative. In cases where both were listed, and both appeared as voters, envelopes were addressed to both parties indicated.

Education levels revealed 3 respondents had less than a high school diploma, 8 respondents had a high school diploma, 40 respondents had completed an Associate's degree or had completed some college, 42 respondents had received a Bachelor's degree, 27 respondents had received a Master's degree, 22 respondents had received a Doctoral degree, and there were 3 responses coded as no response (1 in Meridian and 2 in Williamstown Townships). When the two townships are compared to one another using a t-test the results show that there exists a statistically significant difference between education levels. Meridian Township has a higher mean average education level than Williamstown Township (at the confidence level of 99% and a standard error of mean difference equal to .199).

Using the "Explore" function in SPSS, the mean household income for respondents in Meridian and Williamstown Townships is determined to be from "$50,000 to $74,000" a year. Figures 6 and 7 depict absolute frequencies of household incomes for

Figure 6. Household Income for Respondents in the Study Area

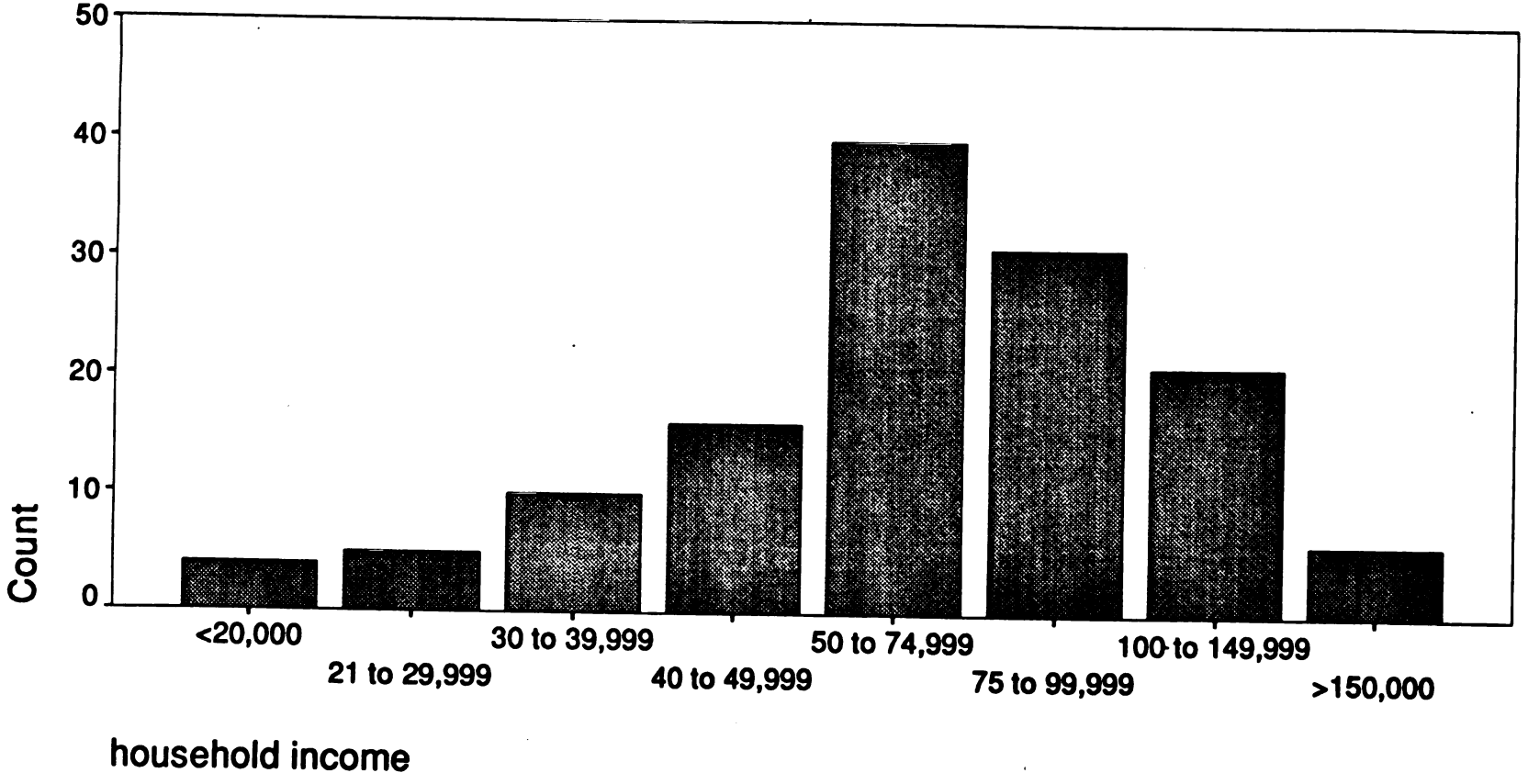
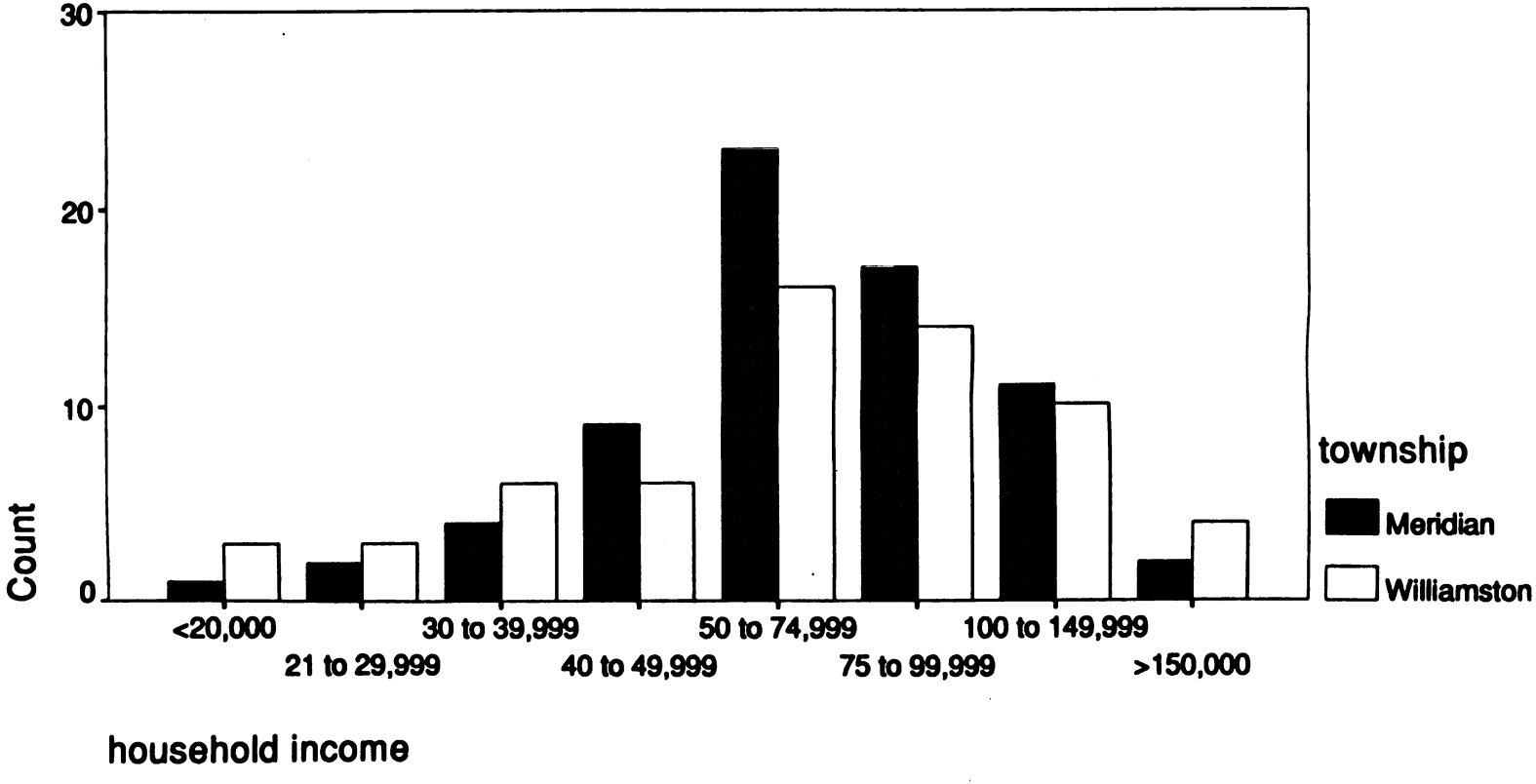


Figure 7. Household Income of Respondents by Township of Residence



the study area and the two townships. A correlation test showed that education level and household income are positively related, with a significance level of less than .001 (a 99% confidence level) and a correlation coefficient of .3698. This probability means that the two variables have a moderately weak relationship, keeping in mind that these numbers represent household, not individual income. This helps to explain the fact that a t-test showed no statistically significant difference between the townships in mean household income per year. This finding is surprising since one would expect Williamstown respondents to have a lower household income since their education level is lower.

Employment was examined through the employment situation (i.e. full time) and by type. The majority of respondents are employed full time in overall and individual township findings. Figures 8 and 9 show respondents employment situation by study area and townships. Figures 10 and 11 depict respondents employment type overall and by township. T-tests show no statistically significant difference between townships in employment situation or employment type. It was not surprising to find the majority of workers to be educational or professional workers given the proximity of these two townships to Michigan State University and various state agencies. It was disappointing to find only one respondent employed as a farmer since Williamstown Township acreage is predominantly agricultural. Although it must be noted that the residents are not predominantly employed in the agricultural sector.

Property values were also examined. By analyzing t-test results there were no statistically significant differences in property values between the two townships (See Figure 12). A correlation test revealed that property values are related to the employment situation (with a correlation coefficient of .3158), employment type (with a correlation

Figure 8. Employment Situations for Respondents in the Study Area

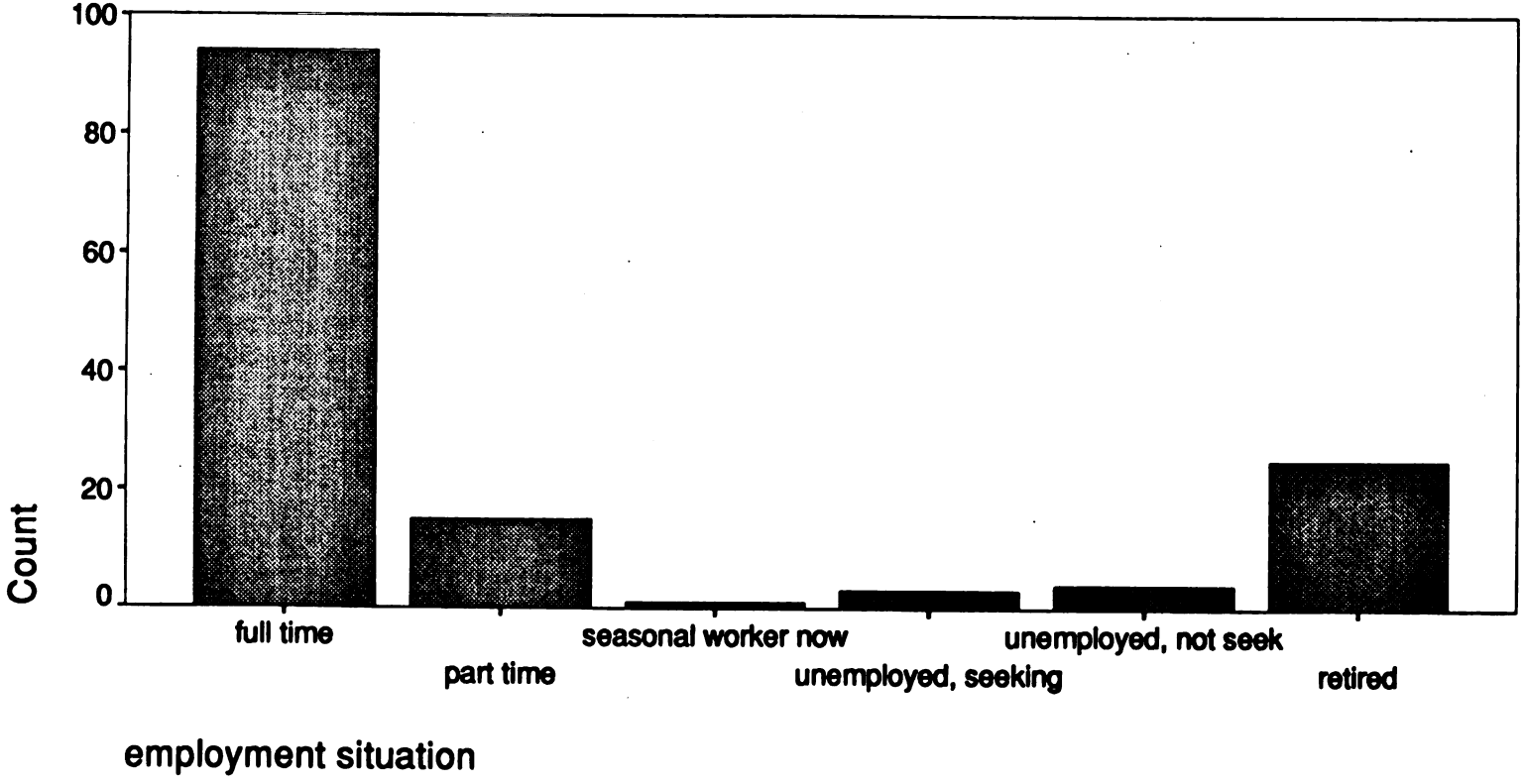


Figure 9. Employment Situation for Respondents by Township

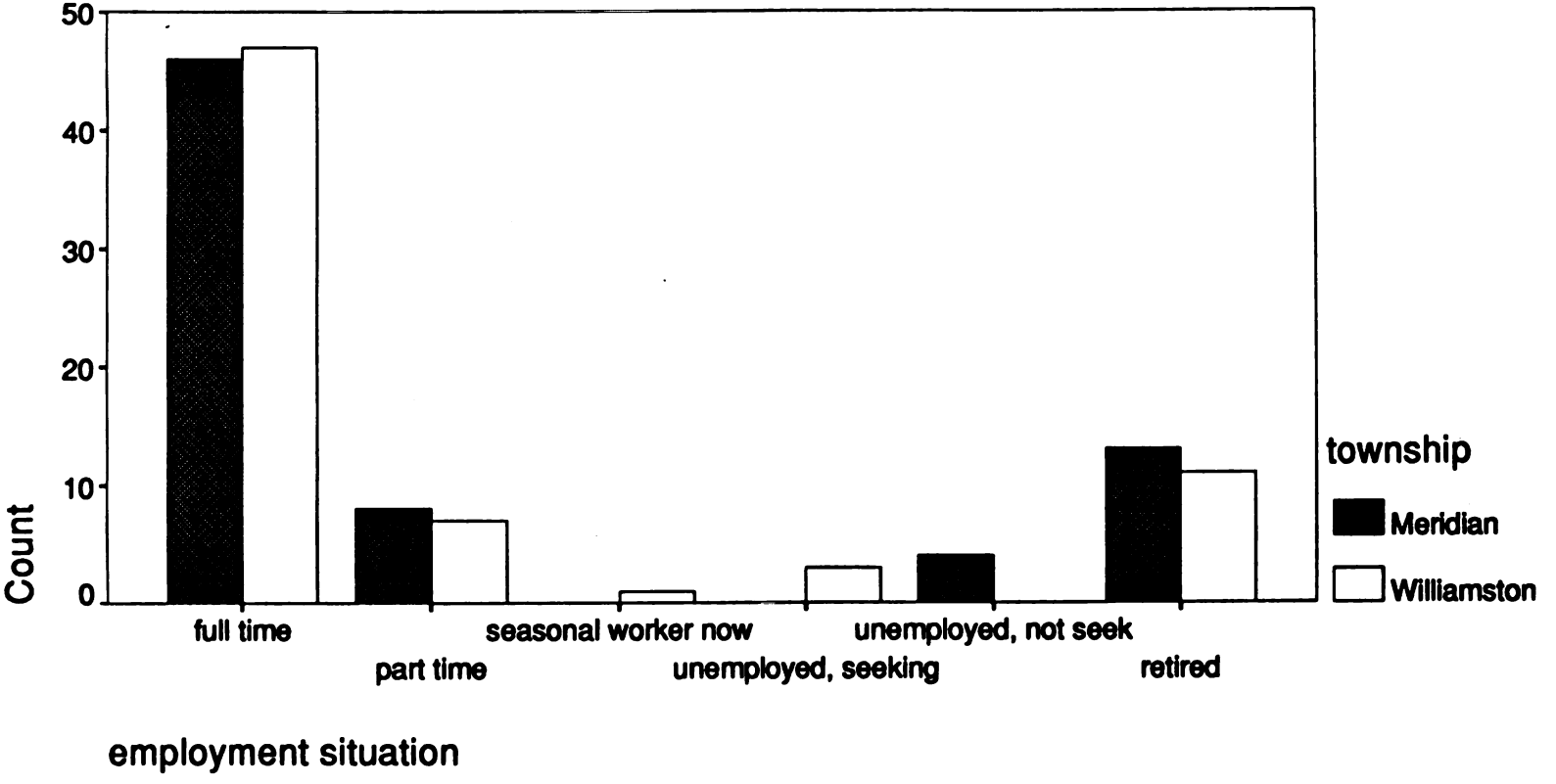


Figure 10. Employment Types for Respondents in the Study Area

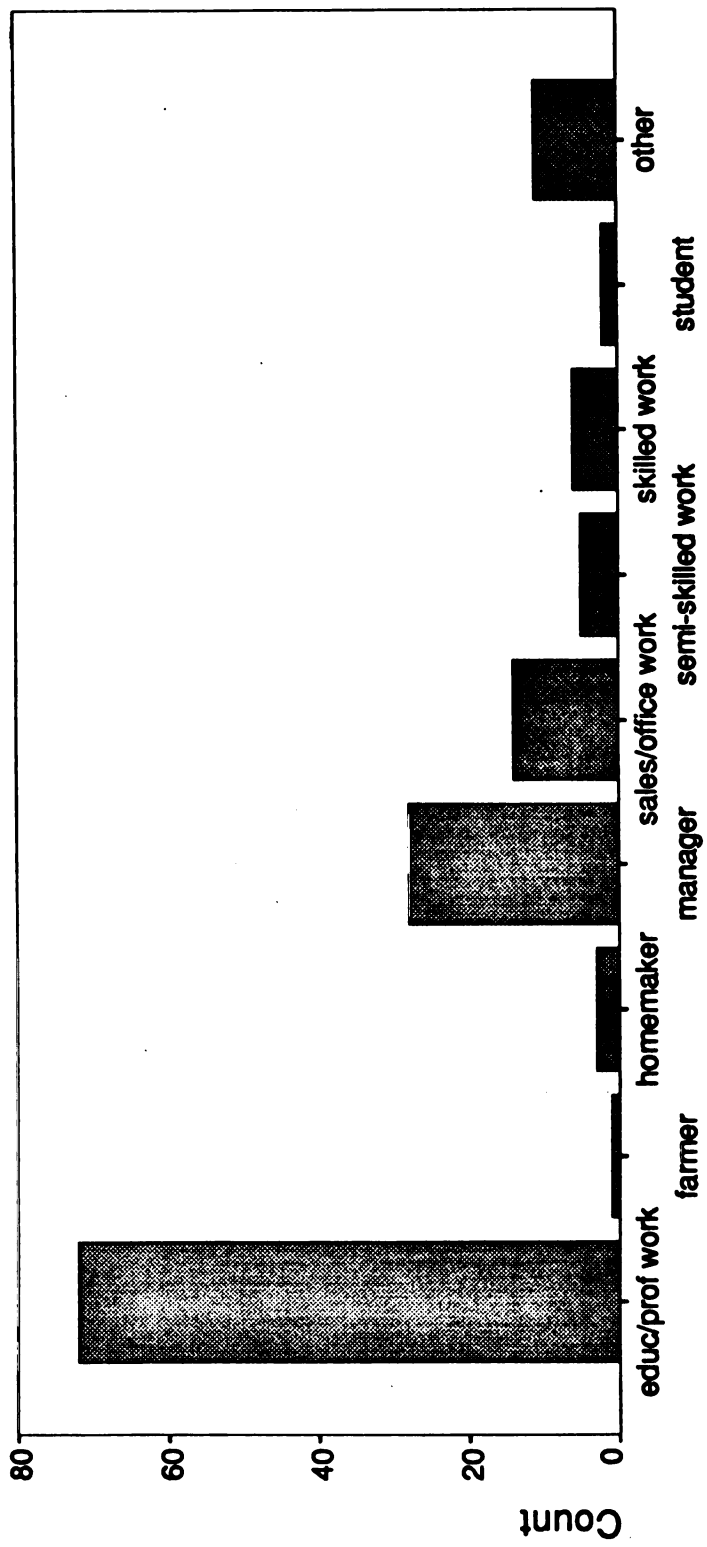


Figure 11. Employment Type for Respondents by Township

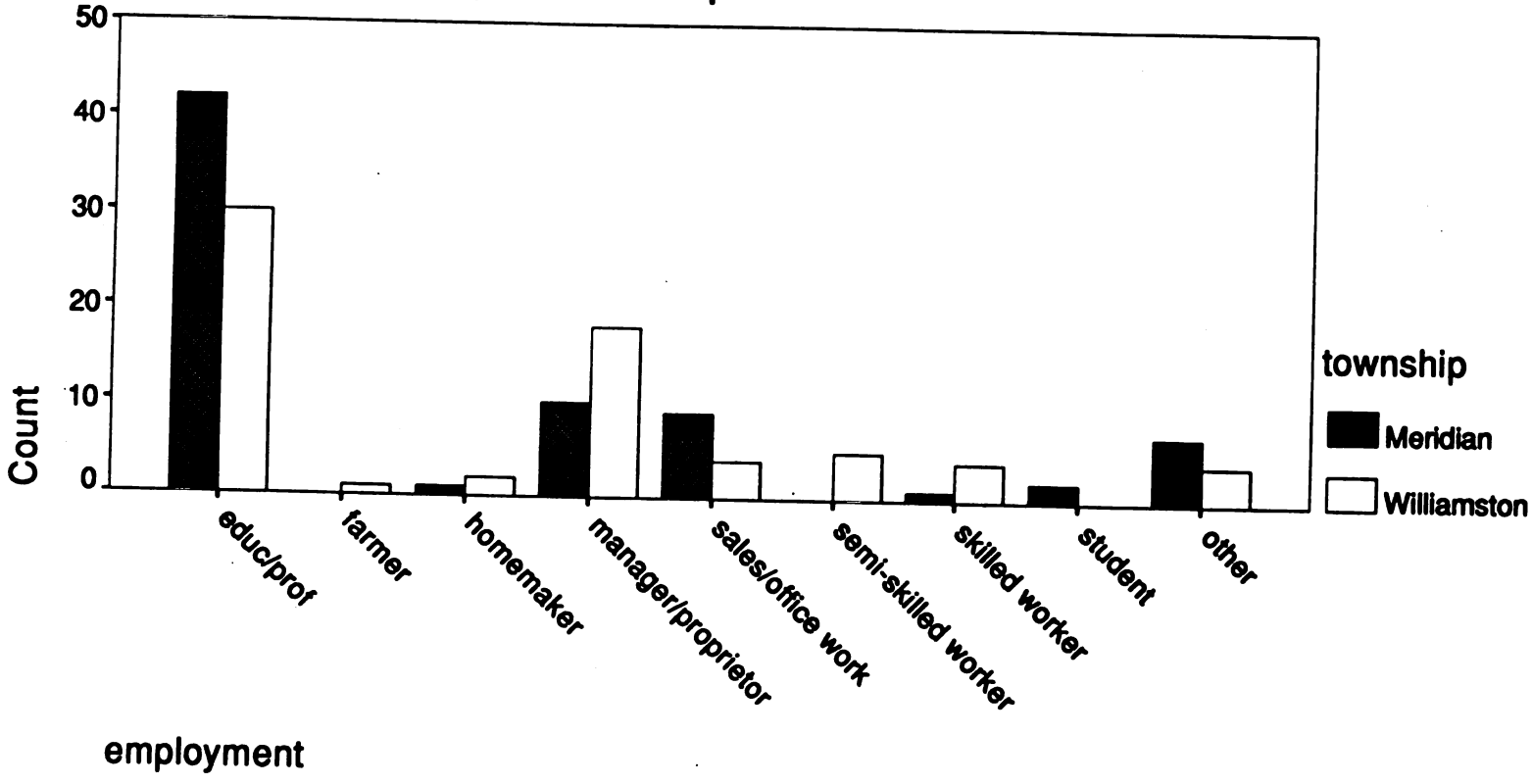
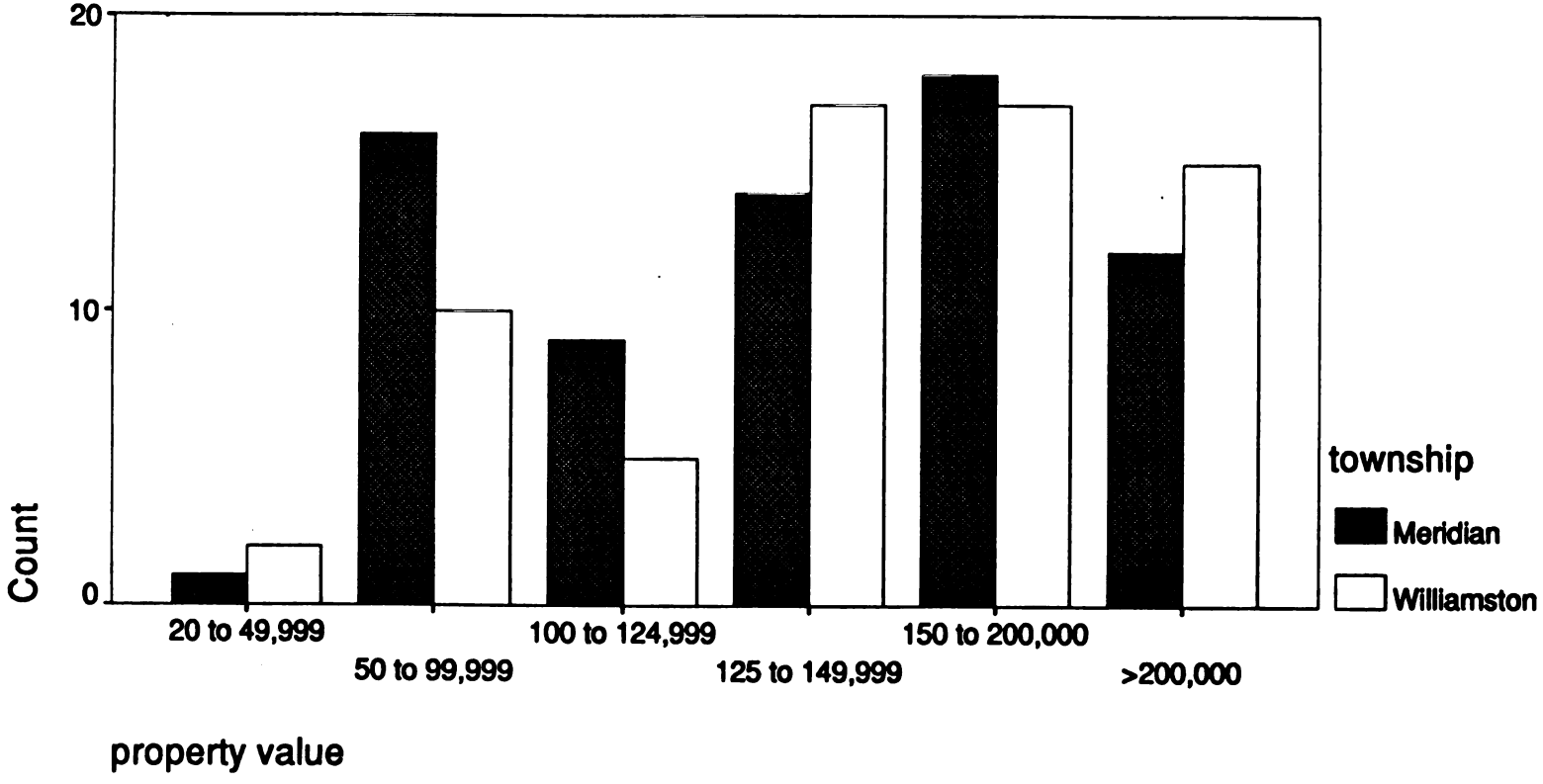


Figure 12. Property Values for Respondents by Township



coefficient of .2468) and income (with a correlation coefficient of .5699). These are all positive relationships but they are moderately weak, weak, and moderately strong, respectively.

General questions about wetlands are discussed in Part II of the survey. None of respondent's answers to these questions revealed significant differences through t-tests. It is important, however, to examine these general findings. The most frequent response to the following statements was "strongly disagree": 1) Wetlands tarnish the beauty of an area, 2) Wetlands pose problems for human health, and 3) Wetlands are lands that could be put to better use. This shows that many of the respondents feel favorably about wetlands in the area. Most people "agreed" to the following statements: 1) Wetlands are mosquito hatching grounds, 2) Wetlands are aesthetically pleasing, 3) Wetlands are important to maintaining ecosystem health, 4) Wetlands help in flood control, 5) Wetlands help in providing clean drinking water, 6) Wetlands are important in maintaining open spaces, 7) Wetlands have economic value, and 8) Although wetlands greater than five acres are protected by the state, some small wetlands may perform functions that warrant their protection by the township. Most respondents "strongly agreed" with the statement "Wetlands provide wildlife habitat". When asked if wetlands are important to the township most people thought wetlands were "very important" followed by "important". When asked if the township was doing enough to protect wetlands 60% of respondents said "yes". In Meridian Township 56.1% of respondents feel the township is doing enough while in Williamstown Township 62.9% feel this way. Although Williamstown Township does not have a wetland ordinance at this time, it is not surprising that most

citizens feel the township is doing enough since it is not under the same development pressures that Meridian Township currently faces. Several respondents commented that responsibility should be a joint effort between all forms of government.

General questions about the funding of wetland protection were also addressed. The most frequent response was "1 to 5%" of township budget expenditures should be allocated to wetland preservation. There was no statistically significant difference between the responses by township. Most people feel the township should raise money for wetland protection by charging a fee to new developers or by collecting fees from wetland use applications/permit programs. However, without the proper zoning and wetland ordinances these fees would be difficult to collect legally. If citizens alone were responsible for general wetland protection, respondents would be willing to pay "$11 to $30 a year" for this preservation. Again there were no significant differences found between townships. These dollar amounts show that respondents value wetlands at $11 to $30 a year as discussed in Chapter II in sections entitled Resource Valuation, Economic Valuation, and Willingness-to-pay.

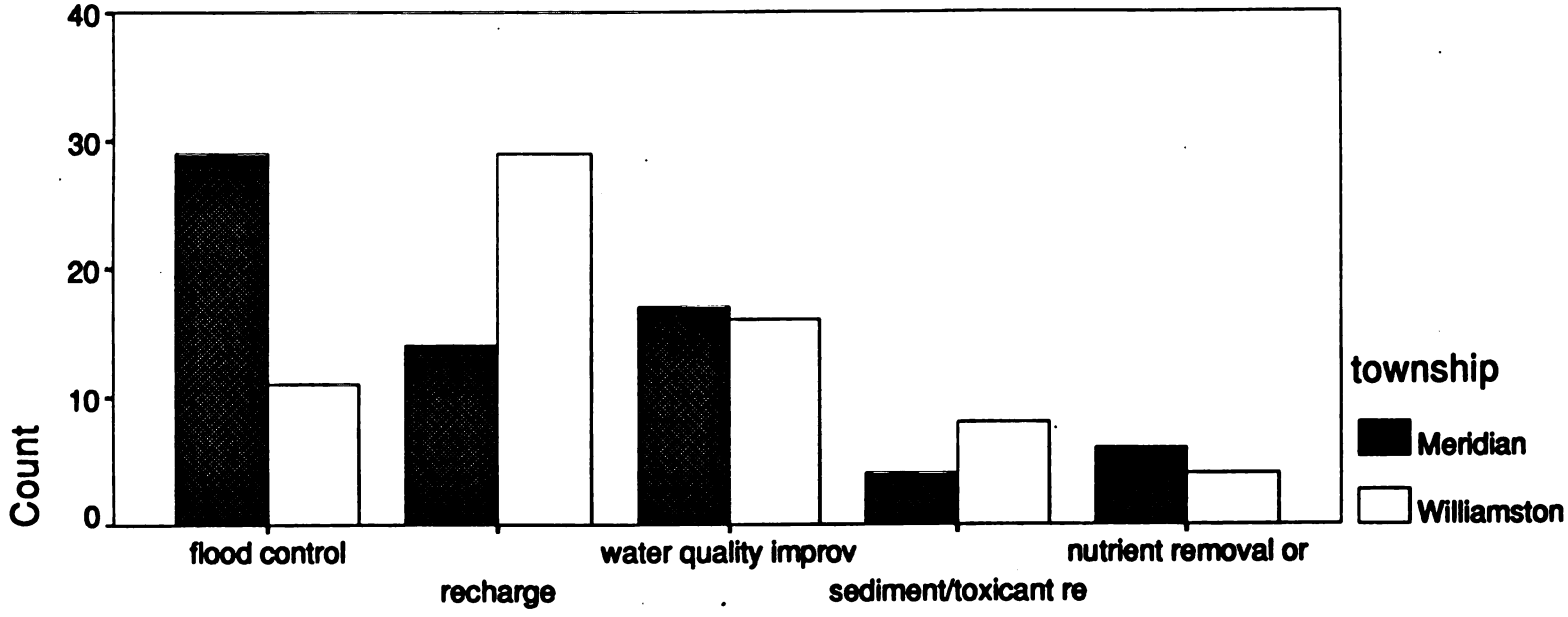
Wetland Functions

Part III of the survey relates to wetland functions. Functions were broken down into three types: 1) functions related to water quality and quantity, 2) functions related to biodiversity, and 3) functions related to recreation and aesthetics. After each function type, respondents were asked to indicate which they felt was most important to their township.

Wetlands perform a variety of functions dealing with water quality and quantity. The functions examined include flood control, groundwater supply or recharge, water quality improvement, sediment/toxicant retention, and nutrient removal or transformation. T-tests show that there are no significant differences between townships for these variables, but frequency distributions warrant discussion. The most frequent response to all of these functions was "important" when looking at the townships inclusively and individually. Overall, respondents chose recharge as the most important of these functions dealing with water. Williamstown Township had similar results. However, Meridian Township respondents felt that flood control was the most important wetland function dealing with water in their township (See Figure 13). Development pressures tend to have a large impact on flood control as the construction of drains becomes necessary. When natural features that once controlled flooding are reduced in number there is a larger need for drain construction and maintenance by township planners. This may explain the slight difference in preferences of function related to water quality and quantity between the two townships even though the difference was not found to be statistically significant. Correlation tests reveal that for each of these dependent variables there is a weak negative relationship with income. This would mean that as income increases, positive opinions about wetland functions would decrease. This does not imply that people with larger amounts of money feel that natural wetland functions are not important, it may simply mean that they are more financially capable of dealing with these issues or paying the higher costs associated with loss of wetland function. Two dependent variables, water quality improvement and sediment/toxicant retention, were found to be related to property

Figure 13. Respondent's Opinions of the Most Important Wetland Functions

(regarding water quality/quantity)

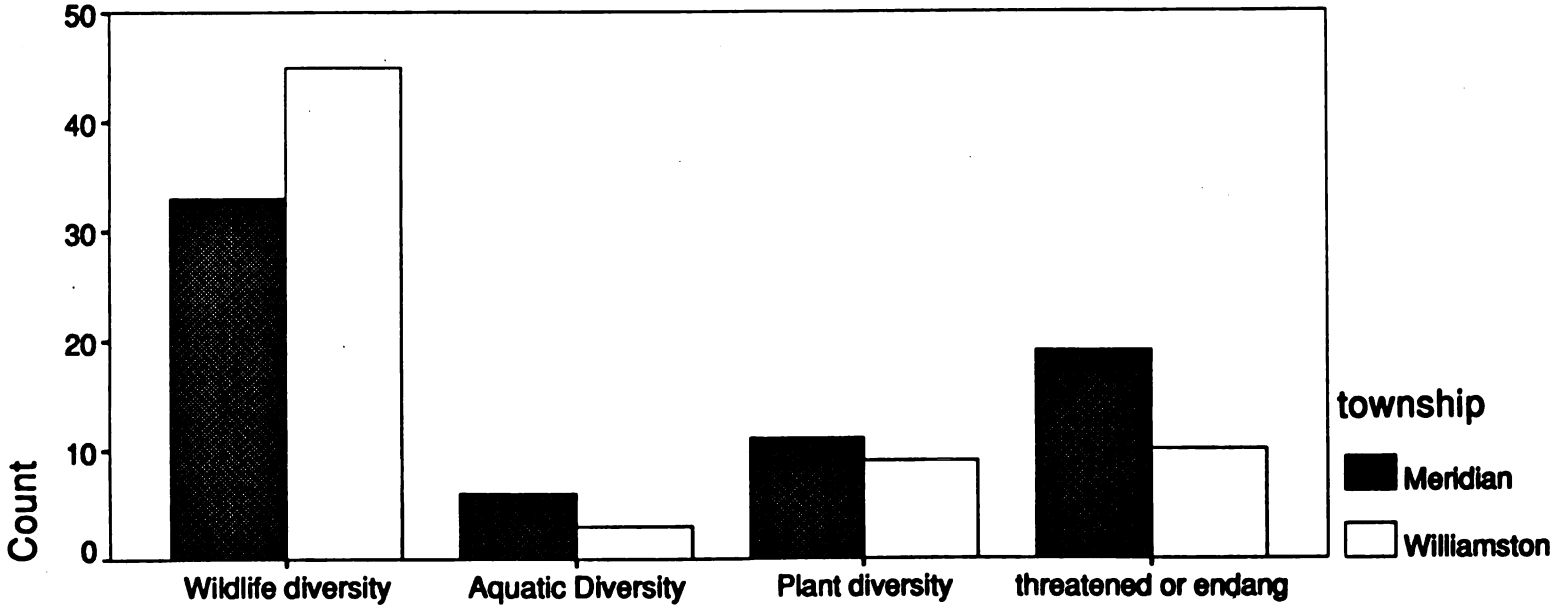


values as an independent variable. Again, these are negative and weak relationships, but as property values increase, opinions about the importance of these functions decrease.

Wetland functions dealing with biodiversity include maintaining wildlife diversity, aquatic diversity, plant diversity, and threatened or endangered species. Wetlands may help preserve habitats for these species and therefore deserve discussion. In overall findings wildlife diversity was rated as "very important", and the others were rated as "important." In addition, the function of wetlands related to biodiversity with the highest frequency was indeed wildlife diversity. In Meridian township the highest frequency of responses to these variables were all "very important". The most important function regarding biodiversity was wildlife diversity in both townships (See Figure 14). However, the most frequent response in Williamstown Township to each of the functions was "important", except for wildlife diversity which again was "very important". Correlation tests between independent and dependent variables showed no statistically significant relationship between variables. T-tests did show that there was statistically significant differences in response rates between townships for the most important function dealing with biodiversity, even though most frequencies peaked with wildlife diversity (See Figure 14). It was determined that Meridian Township's mean response was 2.2319 and Williamstown Township's mean response 1.7612, a mean difference of .4707. The significance level for this test is .029 (a confidence level of 97.1%) with a standard error of difference at .213. The statistically significant difference stems from the fact that Meridian Township respondents had more variation in response to what was most important to their

Figure 14. Respondent's Opinions of the Most Important Wetland Functions

(regarding biodiversity)



township, while Williamstown Township leaned largely toward wildlife diversity as the most important wetland function dealing with biodiversity.

The final function type deals with recreation and aesthetics. General aesthetic questions were addressed in the "General Findings" section of this chapter. The variables in this category include fishing, hunting, boating, hiking/nature walking, camping, swimming, picnicking, nature observation, and nature photography. The overall most frequent response to the importance of fishing is "important". Williamstown Township follows this trend, but Meridian has equal frequencies for "important" and "of little importance." None of the independent variables had a significant relationship to fishing, and a t-test found no statistically significant difference in the mean response to the importance of fishing.

Hunting provided interesting findings. The most frequent responses to the importance of hunting were "important" and "of little importance" (See Figure 15). The mean of these responses yields that hunting is "moderately important" when looking at the townships inclusively. However, the most frequent response to the importance of hunting was "of little importance" in Meridian and "important" in Williamstown Townships (See Figure 16). A t-test reveals that there is a statistically significant difference between mean values in the townships. The mean for Meridian Township is 2.3380 and Williamstown Township is 3.3913, a mean difference of -1.0533. The negative number shows that Meridian Township has a lower opinion of the importance of hunting when compared to Williamstown Township. The significance level is less than .001 (a confidence level of 99%) with a stand error of difference at .191. Correlation tests show that hunting is related to education levels and predominant land use. Both dependent variables have

Figure 15. Respondent's Opinions of Hunting in the Study Area

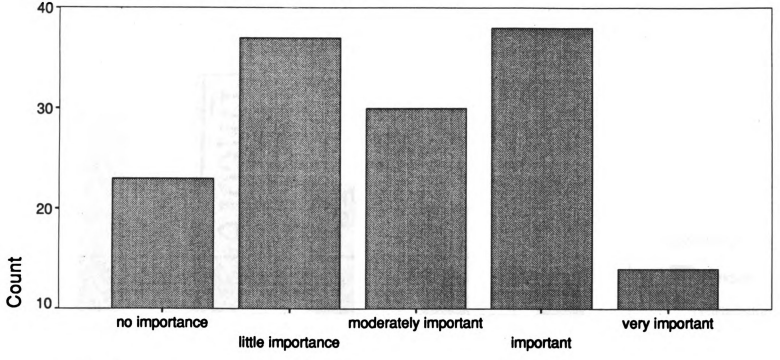
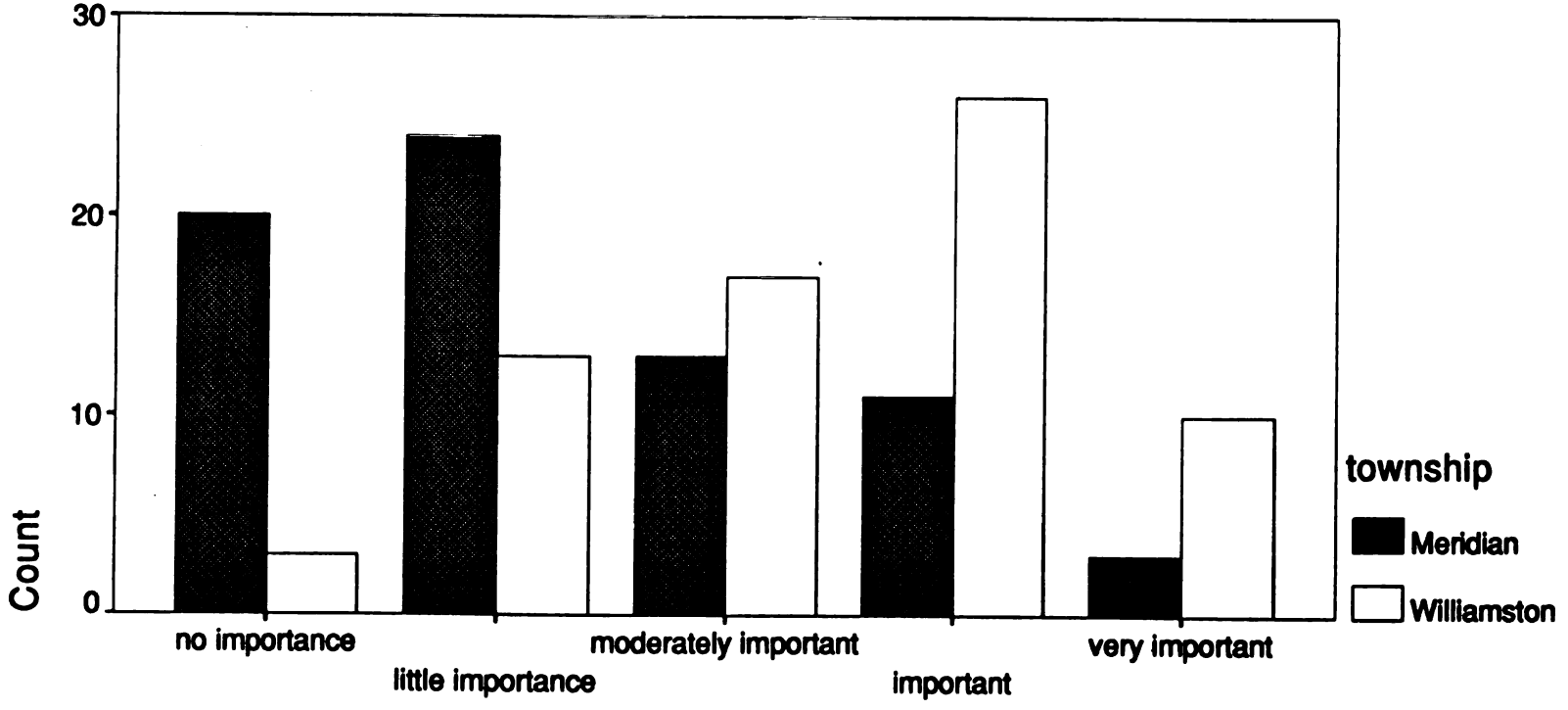


Figure 16. Respondent's Opinions of Hunting by Township



confidence levels of 99%. Education level is related to hunting with a negative, moderately weak relationship. The correlation coefficient of this relationship is .4020. This means as education levels rise, positive opinions on the importance of hunting to the township residents decrease. The correlation coefficient is not negative due to question formatting. Since Meridian Township has a higher mean education level, it can again be concluded that these respondents will have a less favorable opinion of the importance of hunting. Hunting is also related to the predominant land use. This is a positive, yet moderately weak relationship with a significance level of less than .01 (99% confidence level) and a correlation coefficient of .4248. This means that the more rural an area the more important hunting is to residents of that area. Therefore, Williamstown Township respondents feel that hunting is more important than Meridian Township. This may be due to the fact that land is more available for wildlife and hunting, hunting may be somewhat more traditional in rural areas, and there may be more of a need for hunting in rural areas to feed residents or keep wildlife population counts in balance.

Boating, hiking and nature walking, camping, swimming, picnicking, observing nature, and photographing nature showed no statistically significant differences between townships or no statistically significant relationships with any of the independent variables (income, education, property value, population density, or predominant land use). Overall and individually, boating was "moderately important" in the two townships. Overall and individually, hiking and nature walking was "moderately important" to respondents in the townships. Providing an area for camping as a wetland function was "of little importance" to respondents in both townships. Swimming was of "little importance" to respondents in

both townships. Overall, picnicking was rated "moderately important" in the two townships, and although there was not a statistically significant difference in the means, Meridian Township seems to think picnic areas are slightly more important to their township than Williamstown Township (See Figure 17). This may again be explained by the development pressures existing in Meridian Township and the desire to preserve some areas as parks and recreations areas. Both townships feel that nature observation is "important" to their township. This may be due to the desire to preserve natural features for future generations. It may also be due in part to respondents simply enjoying the view that natural areas and wetlands provide. Nature photography was found to be "moderately important" to both townships.

The most important recreation or aesthetic function is the final topic of discussion. In this category the most frequent response to the most important wetland function dealing with recreation/aesthetics was nature observation, with 60.7 percent of respondents choosing this function (See Figure 18). Correlation tests showed no relationship between this variable and any of the independent variables. However, there was a statistically significant difference in means for this variable. The significance is .017 (a confidence level of 98.3%) and the standard error of difference is .439. This can be explained by the higher variance of responses in Williamstown Township.

Relative Willingness-to-Pay

The importance of each wetland function discussed above allows general conclusions to be made about public preferences and attitudes toward each of the

Figure 17. Respondent's Opinions of Picnicking by Township

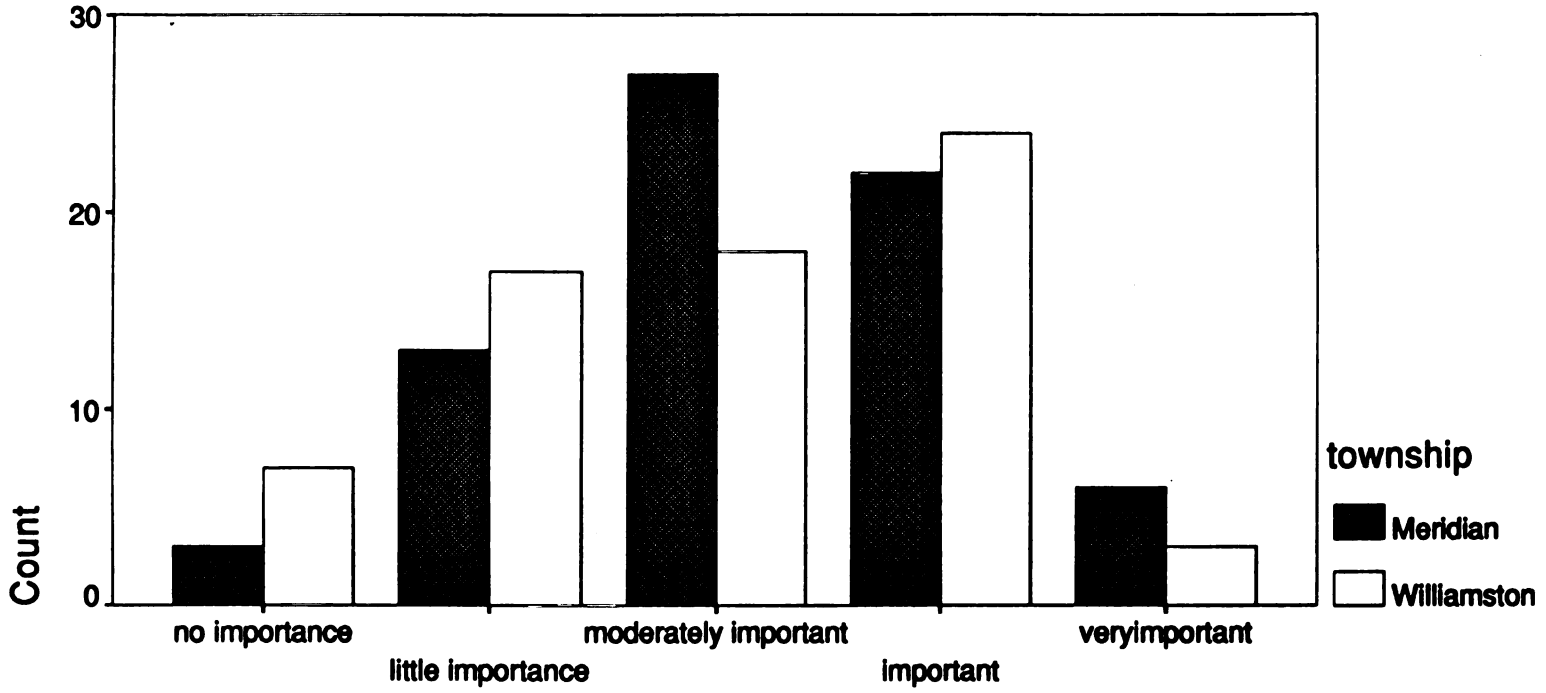
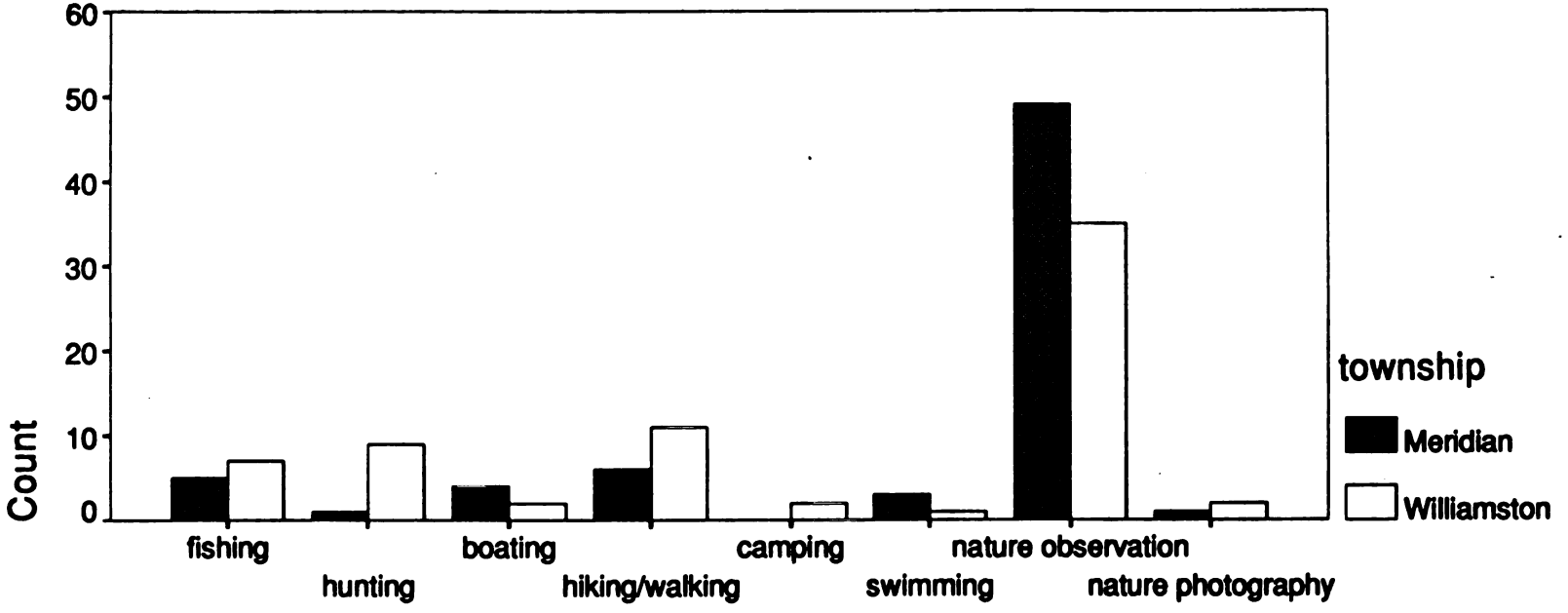


Figure 18. Respondent's Opinions of the Most Important Functions by Township

(regarding recreation and aethetics)



functions. The relative willingness-to-pay for these functions give indications of how respondents value wetland functions. The survey sets a hypothetical situation, in which respondents are asked how much they would be willing to pay for services if wetlands were non-existent in the township. These services include drain construction, drain maintenance, public health, additional drinking water treatment, additional waste water treatment, habitat preservation, water availability, sediment or toxicant removal from water, nutrient removal from water, endangered species preservation, open space preservation, travel to similar natural areas, travel to similar recreational areas, and augmentation of well water supplies with water purchased from other sources (such as the Lansing Board of Water and Light).

Overall and individual frequencies and means show that respondents are willing to pay "less than $50 per year" for each of the services listed. Therefore, t-tests show no statistically significant differences for any of the variables noted above. These findings are not surprising since respondents were only willing to pay "$11 to $30 a year" to protect community wetlands. A pre-test may have shown that these questions needed to be reworked so more representative dollar figures could have been presented to respondents. It must also be noted that 5 respondents chose not to answer these questions. This could be due to a fear of a tax increase to pay for these services, or the way the question was presented. In future studies more representative questions and answer categories should be used. The researcher found this question to be of little significance to the study. It should be mentioned, however, that income (an independent variable) was related to respondents willingness-to-pay for water availability and willingness-to-pay to travel to

similar natural areas. These relationships are weak (with correlation coefficients of .2308 and .2444, respectively), but they are positive relationships revealing that as income increases so does the respondents willingness-to-pay for water availability and travel to similar natural areas.

It was surprising not to find more relationships between independent and dependent variables. It was also surprising to find that township perspectives are similar even though the characteristics of the area and the respondents have differentiation. It would be interesting to see if actual differences exist between non-neighboring townships or townships with more extreme land use differences. Population density did not seem to significantly effect the variables, however it is interrelated with predominant land use types.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Introduction

To date, information on public preferences and attitudes regarding wetland preservation in Michigan has been limited. Available information has been presented in regards to wetland preservation in general, accompanied by information on preservation of wetland functions and the relative willingness-to-pay to preserve these wetland functions. The objective of this study was to provide current data on public preferences and attitudes toward wetland preservation, and second to determine whether socio-economic population characteristics in Meridian (an urbanizing) and Williamstown (a predominately agricultural) Townships, effect personal preferences on the preservation of wetlands. Through a mail survey of township residents, data was acquired and presented holistically and individually by township. It is difficult to assess the accuracy of this data since responses were based on public opinions that change over time. However, the willingness-to-pay to preserve wetland functions did not yield expected results and therefore may have a low confidence level.

This chapter presents the major findings of the analyses of the completed survey for Meridian and Williamstown Townships in mid-Michigan. Results were obtained in early October, 1996 and are indicative of wetland preservation preferences for this time. Also presented in this chapter are recommendations for further study.

Major Findings

The major findings of this study are presented as follows:

1. In general, respondents tend to have a positive image and opinion of wetlands. This is important because in the past, wetlands were thought of as wastelands that should be drained and filled.

2. Most respondents agree that wetlands and their functions are important to the community, and that wetlands possess economic value.

3. Respondents seem most concerned about biodiversity and preserving species habitat when examining wetland functions holistically.

4. Respondents felt that their township adequately protected wetlands and their functions, and township boards should be held responsible for wetland preservation with 1 to 5% of the township budgets allocated to this goal.

5. Citizens would be willing to pay a range of $11 to $30 a year to protect wetlands, in general, but would be willing to pay "less than $50 a year" for each function wetlands provide, or "less than $50 a year" to replace these functions if lost.

6. Major statistically significant differences in preference between townships were not found, even though the two townships have different mean education levels, different population densities, and different predominant land uses. However, statistically significant differences were found in education level, importance of biodiversity, importance of hunting, and most important wetland function dealing with recreation/aesthetics..

7. Water recharge and flood control preferences were the most important when dealing with wetland functions regarding water quality and quantity.

8. Respondents felt the most important wetland functions are associated with biodiversity and with the preserving of wildlife.

9. Respondents felt the most important function associated with recreation or aesthetics was nature observation.

10. The independent variables (or socio-economic characteristics) that had significant effects on dependent variables (the wetland functions) include income, education, property values, and land use.

11. Income was the most important independent variable and effected wetland functions including flood control, groundwater recharge, water quality improvement, sediment/toxicant retention, and nutrient removal or transformation.

Income effected the willingness-to-pay for water availability and travel to similar natural areas.

12. Education level had a moderately weak influence on the preferences of hunting as a wetland function regarding recreation since the correlation coefficient is .4020.

13. Property values had small effects on preferences dealing with water quality improvements and sediment/toxicant retention as wetland functions regarding water quality and quantity (with correlation coefficients of .2627 and .2625, respectfully, the relationships are weak).

14. Predominant land use had a moderately weak effect (with a probability of .4248) on preferences dealing with hunting as a wetland function regarding recreation.

15. Assessment of the willingness-to-pay for preservation of wetland quality could be improved with a different type of question. This assessment was ineffective in this study.

Recommendations for Further Study

Future studies will be needed to keep up with changing opinions and public preferences. A study similar to this one using extreme differences in socio-economic characteristics (and non-neighboring townships) may provide more understanding into the factors and reasoning behind public preferences regarding wetland preservation. However, a more complete contingent valuation study will be necessary for determining the public's willingness-to-pay to preserve wetlands and their functions. Tests can be performed to evaluate the public's knowledge of wetland preservation issues, and measures can be taken to improve their knowledge, where necessary. This will allow the public to be involved in determining future needs for wetland preservation and land use planning. Improving public information will also allow for more informed decision making. Finally, public preferences can be incorporated into weighting schemes for

wetland assessment to ensure the public's attitudes are heard and incorporated into land use planning and zoning ordinances and practices.

APPENDICES

APPENDIX A

WETLAND ORDINANCE (MERIDIAN TOWNSHIP)

APPENDIX A

CHAPTER 105

WETLAND PROTECTION

Section 105-1 Findings

The Township Board of the Charter Township of Meridian finds that wetlands are indispensable and fragile natural resources that provide many public benefits, including maintenance of water quality through nutrient cycling and sediment trapping as well as flood and storm water runoff control through temporary water storage, slow release, and groundwater recharge. In addition, wetlands provide open space; passive outdoor recreation opportunities; fish and wildlife habitat for many forms of wildlife, including migratory waterfowl, and rare, threatened or endangered wildlife and plant species; and pollution treatment by serving as biological and chemical oxidation basins.

Preservation of the remaining Township wetlands in a natural condition shall be and is necessary to maintain hydrological, economic, recreational, and aesthetic natural resource values for existing and future residents of the Charter Township of Meridian, and therefore the Township Board declares a policy of no net loss of wetlands. Furthermore, the Township Board declares a long-term goal of net gain of wetlands to be accomplished through review of degraded or destroyed wetlands in the Township, and, through cooperative work with landowners, using incentives and voluntary agreements to restore wetlands.

Pursuant to Article 4, Section 52 of the Constitution of the State of Michigan, the conservation and development of natural resources of the state is a matter of paramount public concern in the interest of the health, safety, and general welfare of the people. Therefore, with authority from Section 8 (4) of the Goemaere-Anderson Wetland Protection Act (Act 203, Public Acts of 1979, as amended), the Township Board finds that this Chapter is essential to the long term health, safety, economic, and general welfare of the people of the Charter Township of Meridian, and, to the furtherance of the policies set forth in the Michigan Environmental Protection Act (Act 127, Public Acts of 1970) and the Goemaere-Anderson Wetland Protection Act (Act 203, Public Acts of 1979, as amended).

Section 105-2 Purpose

The purposes of this ordinance are to provide for:

a. The protection, preservation, replacement, proper maintenance, restoration, and use in accordance with the character, adaptability, and stability of the Township's wetlands, in order to prevent their pollution or contamination; minimize their disturbance and disturbance to the natural habitat therein; and prevent damage from erosion, siltation, and flooding.

Adopted 8-6-91
Rev. 6-7-94

b. The encouragement of proper and reasonable economic use of wetlands, the discouragement and limitation of improper use, the reduction of financial burdens improper uses impose on the community, the maintenance of harmonious and compatible land use balance within the Township, and the prevention of nuisance conditions that arise with the indiscriminate development of wetlands.

c. The coordination with, and support for, the enforcement of applicable federal, state, and county statutes, ordinances, and regulations, including but not limited to:

   1. Goemaere-Anderson Wetland Protection Act (Act 203, Public Acts of 1979, as amended), enforced by the Michigan Department of Natural Resources; and

   2. Soil Erosion and Sedimentation Control Act (Act 347, Public Acts of 1972, as amended), enforced by the Ingham County Drain Commissioner.

d. Compliance with the Michigan Environmental Protection Act (Act 127, Public Acts of 1970), which imposes a duty on government agencies and private individuals and organizations to prevent or minimize the pollution, impairment or destruction of the natural resources that is likely to be caused by their activities.

e. The establishment of standards and procedures for the review and regulation of the use of wetlands.

f. The issuance of wetland use permits for approved activities.

g. A procedure for appealing decisions.

h. The establishment of enforcement procedures and penalties for the violation of this Chapter.

i. Assurance that the right to reasonable use of private property is maintained.

Section 105-3 Definition of Terms

The following definitions shall apply to the words and terms used in this Chapter:

a. "Aggrieved Person" is any land owner whose property is located within 500 feet of the property affected by the permitted activity or any other person determined by the Township Board to be aggrieved.

b. "Aquatic Life" means vertebrates or invertebrates that are dependent on wetlands for some vital portion of their life cycle including any of the following: breeding, spawning, nesting, rearing of young, feeding, and resting or protection.

c. "Deposit" means to fill, place or dump.

d. "Director of Planning and Development Control" shall mean the Director of Planning and Development Control for Meridian Township or his/her designee.

e. "Fill material" means soil, rocks, sand, pilings, waste of any kind, or any other material which displaces soil or water, reduces water retention potential or reduces ability for wetland vegetation growth.

f. "Lot" means a designated parcel, tract, building site or other interest in land established by plat, subdivision, conveyance, condominium master deed, or as otherwise permitted by law, to be used, developed or built upon as a unit.

g. "Minor drainage" includes ditching and tiling for the removal of excess soil moisture incidental to the planting, cultivating, protecting, or harvesting of crops or improving the productivity of land in established use for agriculture, horticulture, silviculture, or lumbering.

h. "Mitigation of wetlands" shall mean: (1) methods for eliminating or reducing potential impact to regulated wetlands; or (2) creation of new wetlands of the same or similar function to offset unavoidable loss of existing wetlands to meet the Township goal of no net loss of wetlands.

i. "Person" means an individual, sole proprietorship, partnership, corporation, association, municipality, this state, and instrumentality or agency of this state, the federal government, or an instrumentality or agency of the federal government, or other legal entity.

j. "Remove" means to dig, dredge, suck, pump, bulldoze, drag line, or blast.

k. "Restoration" means to return from a disturbed or totally altered condition to a previously existing natural or altered condition by some action of man.

l. "Structure" shall mean any assembly of materials above or below the surface of the land or water, including but not limited to, buildings, bulkheads, piers, docks, landings, dams, waterway obstructions, paving and roadways, poles, towers, cables, pipelines, drainage tiles, and other underground installations.

m. "Township Board" shall mean the legislative body of Meridian Township, Ingham County, Michigan.

n. "Township Wetland Consultant" shall mean a person(s) professionally knowledgeable in wetland delineation and resource value assessment, wetland protection, wetland restoration and wetland mitigation, appointed pursuant to Section 3.4 of the Township Personnel Policy to carry out certain duties hereunder. Any firm or individual appointed on a contract basis shall be selected competitively under the Township Purchasing Policy.

o. "Township Wetland Inventory Map" refers to the Meridian Township Wetland Inventory Map created to comply with Section 8a(1) of the Goemaere-Anderson Act. The Township Wetland Inventory map is based on the National Wetland Map of the U. S. Fish and Wildlife Service; the Michigan Resource Information System Mapping (MIRIS) of the Michigan Department of Natural Resources; the soils maps of the Soil Conservation Service, aerial photography, and on-site inspections.

p. "Wetland" means land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life and is commonly referred to as a bog, swamp, or marsh.

q. "Wetland Board" shall mean the Wetland Board of the Charter Township of Meridian or any other body designated by the Township Board to assume the Wetland Board's duties.

r. "Wetland Vegetation" means plants that exhibit adaptations to allow germination and growth with at least their root systems in the water or saturated soils under normal conditions.

Section 105-4 Lands to Which This Chapter Applies;

a. This Chapter shall apply to:

1. All wetlands, as defined in this Chapter, that are equal to or greater than one-quarter (.25) acre and equal to or less than five (5) acres in area except those wetlands for which the Michigan Department of Natural Resources (MDNR) has determined to exercise State regulation under MCL 281.702 (g) (iii).

2. Notwithstanding the above, it shall be unlawful under this Chapter to conduct any activity or use within a MDNR regulated wetland without full compliance with the requirements of the Goemaere-Anderson Wetland Protection Act. A copy of all applications for Wetland Permits filed with the MDNR and for which permits are not governed by this Chapter, shall be submitted to the Township for review and comment by the Township Wetland Consultant. A copy of the comments filed by the Township Wetland Consultant shall be forwarded to the Board.

Section 105-5 Township Wetland Inventory Map

The Township Wetland Inventory Map is a guide to the location of wetlands in Meridian Township. The Map shall be used in the administration of this Ordinance and Chapter 84 of the Code of Ordinances.

a. The Township Wetland Inventory Map, together with all explanatory matter thereon and attached thereto, as may be amended through the Wetland Verification and Delineation process, is hereby adopted by reference and declared to be part of this Chapter. The Township Wetland Inventory Map shall be on file in the Department of Development Control.

Adopted 8-6-91
Rev. 6-7-94

b. The Township Wetland Inventory Map shall serve as a general guide for the location of protected wetlands.

c. The Township Wetland Inventory Map does not create any legally enforceable presumptions regarding whether property that is or is not included on the inventory map is or is not in fact a wetland.

d. Map Amendment Process

1. Any change to the Township Wetland Inventory Map, approved by the Director of Planning and Development Control through verification or delineation, shall be added to the Township Wetland Inventory Map on an annual basis.

2. The Township shall insure that each record owner of property on the property tax roll shall be notified of any amendment to the Township Wetland Inventory Map on an annual basis. The notice shall include the following information:

a. the maps have been amended

b. the location to review the maps

c. the owner's property may be designated as a wetland on the inventory map

d. the Township has an ordinance regulating wetland

e. the inventory map does not necessarily include all of the wetland within the Township that may be subject to the wetland ordinance

Section 105-6 Wetland Verification and Delineation

The Township Wetland Inventory Map shall be validated through the Wetland Verification Process and the Wetland Delineation Process. The Wetland Verification Process, as set forth herein, shall be used to verify wetlands on properties where wetland is shown on the Wetland Inventory Map. The Wetland Delineation Process, as set forth herein, shall be used to establish the actual boundaries of wetlands in the Township. The identification of the precise boundaries of wetlands on a project site shall be the responsibility of the applicant.

a. Wetland Verification Process

1. The Township or property owners of wetlands may initiate a verification of the areas shown on the Township Wetland Inventory Map as wetland. The verification shall be limited to a finding of wetland or no wetland by the Township Wetland Consultant. The finding shall be based on, but not limited to, aerial photography, topographical maps, and field inspection.

2. In the event that there is a finding of no wetland on the property, then no further action by the applicant would be required and the finding shall be incorporated into the Wetland Inventory Map during the Map Amendment Process.

3. In the event that there is a finding of wetland, then the establishment of the precise boundary through a wetland delineation shall be required to amend the Township Wetland Inventory Map or process a wetland use permit application.

4. The applicant shall pay fees for the Wetland Verification Process as established by resolution of the Township Board. The fee shall be refunded if there is a finding of no wetland.

b. Wetland Delineation Process

Prior to the issuance of any permit or land development approval for a property which is shown to include a wetland on the Township Wetland Inventory Map, the applicant may be required to provide a wetland delineation to the Township. The Director of Planning and Development Control shall decide whether a delineation is required, based on the proximity and relationship of the project to the wetland.

1. To establish actual wetland boundaries on a property, an applicant shall provide a survey or dimensional site plan, drawn at an appropriate scale, showing property lines, buildings and any points of reference along with the determined wetland boundaries, according to one of the following:

   A. Wetland delineation by the Michigan Department of Natural Resources (MDNR).

   B. Wetland delineation by the applicant's wetland consultant subject to review and approval by the Township Wetland Consultant .

2. Where a wetland delineation is required by this Chapter, the Township Wetland Consultant shall establish wetland boundaries following receipt of the above required information and after conducting a field investigation.

3. The applicant shall pay fees for the Wetland Delineation Process as established by resolution of the Township Board.

Section 105-7 Activities Not Requiring A Permit

The following uses shall be allowed in a wetland without a permit subject to other laws of this state and the owner's regulation:

a. Fishing, trapping or hunting.

b. Swimming or boating.

c. Hiking.

d. Grazing of animals.

e. Farming, horticulture, silviculture, lumbering, and ranching activities, including plowing, irrigation, irrigation ditching, seeding, cultivating, minor drainage, harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices. Wetland altered under this subdivision shall not be used for a purpose other than a purpose described in this subsection without a permit from the Township.

f. Maintenance or operation of serviceable structures in existence on October 1, 1980 or constructed pursuant to the Goemaere-Anderson Wetland Protection Act.

g. Construction or maintenance of farm or stock ponds.

h. Maintenance, operation, or improvement which includes straightening, widening or deepening of the following which is necessary for the production or harvesting of agricultural products:

(i) An existing private agricultural drain.

(ii) That portion of a drain legally established pursuant to the drain code of 1956, Act No. 40 of the Public Acts of 1956; as amended, being section 280.1 to 280.630 of the Michigan Compiled Laws, which has been constructed or improved for drainage purposes.

(iii) A drain constructed pursuant to other provisions of the Goemaere-Anderson Wetland Protection Act.

i. Construction or maintenance of farm roads, forest roads, or temporary roads for moving mining or forestry equipment, if the roads are constructed and maintained in a manner to assure that adverse effect on the wetland will be otherwise minimized.

j. Drainage necessary for the production and harvesting of agricultural products if the wetland is owned by a person who is engaged in commercial farming and the land is to be used for the production and harvesting of agricultural products. Except as otherwise provided in the Goemaere-Anderson Wetland Protection Act, wetland improved under this subdivision after October 1, 1980, shall not be used for nonfarming purposes without a permit from the MDNR. This subdivision shall not apply to a wetland which is contiguous to a lake or stream, or to a tributary of a lake or stream, or to a wetland which the MDNR has determined by clear and convincing evidence to be a wetland which is necessary to be preserved for the public interest, in which case a permit shall be required.

k. Maintenance or improvement of public streets, highways or roads, within the right of way and in such a manner as to assure that any adverse effect on the wetland will be otherwise minimized. Maintenance or improvement does not include adding extra lanes; increasing the right-of-way; or deviating from the existing location of the street, highway, or road.

l. Maintenance, repair, or operation of gas or oil pipelines and construction of gas or oil pipelines having a diameter of 6 inches or less, if the pipelines are constructed, maintained, or repaired in a manner to assure that any adverse effect on the wetland will be otherwise minimized.

m. Maintenance, repair, or operation of electric transmission and distribution power lines and construction of distribution power lines if the distribution power lines are constructed, maintained, or repaired in a manner to assure that any adverse effect on the wetland will be otherwise minimized.

n. Operation or maintenance, including reconstruction of recently damaged parts, of serviceable dikes and levees in existence on October 1, 1980, or constructed pursuant to the Goemaere-Anderson Wetland Protection Act.

o. Construction of iron and copper mining tailings basins and water storage areas.

Section 105-8 Activities Requiring a Wetland Use Permit

It shall be unlawful for any person to conduct any activity, listed below, within a wetland without first obtaining a wetland use permit in accordance with the requirements of this Chapter. Activities governed by this Section include but are not limited to the following:

a. Depositing or permitting fill material to be deposited in a wetland.

b. Grading in a wetland.

c. Dredging, removing, or permitting the removal of soil or minerals from a wetland.

d. Draining, or causing to be drained through artificial means, excluding storm runoff, any water into or from a wetland.

e. Constructing, operating, or maintaining any use or development in a wetland that requires a building permit under the Building Code.

Section 105-9 Existing Nonconforming Lots, Uses and Structures

Building sites or lots, uses and structures lawfully existing on September 2, 1991, shall be subject to the requirements of this Chapter, except as follows:

a. Any activity, structure, or use lawfully existing prior to September 2, 1991, but not in conformity with the provisions of this Chapter, may be continued, maintained and operated.

b. Any structure lawfully existing prior to September 2, 1991, damaged by fire, explosion, act of God, or other causes beyond the control of the owner, may be restored, rebuilt, or repaired without obtaining a wetland use permit, provided construction on the structure commences within two years from the date the structure was damaged.

Section 105-10 Application Requirements for Wetland Use Permits

Application for approval, appeal, and issuance of wetland use permits shall be concurrent with the application for approval, appeal, and issuance of other necessary Township approvals. The applicant for a wetland use permit shall submit the following to the Director of Planning and Development Control:

a. An application completed in full, on a form provided by the Township, and including such other information as required by the Director of Planning and Development Control.

b. A wetland delineation prepared by the applicant's wetland consultant including, but not necessarily limited to the following information: dominant vegetation in the tree, sapling, shrub, and herb layers; presence or lack of accepted wetland hydrology indicators; analysis of soil including a description of the soil profile to at least 20 inches and comparison to Ingham County Soil Survey and maps of the wetland(s) mapped. Mapped data shall be represented in a manner that allows comparison to the Meridian Township Wetland Inventory Map.

c. Soil drainage and stormwater management plans.

d. A mitigation plan, if the proposed activity will result in the loss of wetland resources.

e. The applicant may elect to have the application processed under one of the following procedures:

   1. The wetland application shall be reviewed immediately, either prior to or concurrent with the review of the proposed land use review with the understanding that the land use review may not be completed at the time a decision is rendered on the wetland application. Election of this alternative may require a reopening of the wetland application if the land use approval is inconsistent with the wetland approval.

   2. The wetland application shall be reviewed and acted upon concurrent with the review of the land use proposal submitted by the applicant and the 90 day review period limitation specified in Section 105-11 is hereby extended accordingly.

f. Copies of wetland permit applications filed with the MDNR and forwarded to the Township in accordance with Section 6 (3) of the Goemaere-Anderson Wetland Protection Act shall become part of the application for a Meridian Township wetland use permit.

Section 105-11 Method of Review of Wetland Use Permit Application

a. The Director of Planning and Development Control shall insure that all required information including a wetland delineation and payment of a fee has been submitted. If an application is not complete, the applicant may be granted additional time to complete the application provided that the applicant agrees that the additional time shall not be charged against the Township's 90-day time limit for making a decision. The receipt of the application shall constitute permission from the owner to conduct an on-site investigation.

b. Upon receipt of an application, the Director of Planning and Development Control shall:

1. Transmit one copy of the application to the Department of Natural Resources.

2. Cause to be published a notice of the application and the date and time for submission of written public comments in a newspaper of general circulation in the Township.

3. Post the subject property with a sign that shall be no less than ten (10) square feet in size.

4. Transmit one copy of the application and supporting materials to the Township Wetland Consultant to confirm the boundaries of the wetland and to review the proposal in light of the purpose and review standards of Section 105-13 of this Chapter and other applicable sections of this Chapter.

c. The Township Wetland Consultant shall prepare and transmit a report and recommendation to the Director of Planning and Development Control documenting the review required by Section 105-11(b)(4).

d. The following process shall apply to wetland use permit decisions by the Director of Planning and Development Control:

1. For wetland use permit applications submitted in conjunction with activities that do not require approval by the Planning Commission and/or Township Board, the Director of Planning and Development Control shall approve, approve with conditions or deny the application within 90 days after receipt of an application.

2. The Director of Planning and Development Control shall transmit application materials and the report and recommendation prepared by the Township Wetland Consultant to the Wetland Board. The Wetland Board may review the materials and transmit comments for consideration to the Director of Planning and Development Control.

3. Persons wishing to comment on the application must submit their comments in writing to the Director of Planning and Development Control prior to the date and time set in the notice. Persons wishing to receive notice of the Director of Planning and Development Control's decision must submit a written request to the Director of Planning and Development Control.

4. The Director of Planning and Development Control's decision shall be made only after reviewing the report and recommendation from the Township Wetland Consultant, written public comments, and any comments submitted by the Planning Commission or Wetland Board.

5. When a wetland use permit is approved, approved with conditions, or denied by the Director of Planning and Development Control, written notice shall be sent to the applicant, and to all persons who have requested notice of the Director of Planning and Development Control's decision. The denial of a permit shall be accompanied by a written reason of denial.

6. A permit approved by the Director of Planning and Development Control shall not be issued or effective until ten (10) calendar days following the date of the approval and compliance with Section 105-15(c).

e. The following process shall apply to appeals of decisions made by the Director of Planning and Development Control or Planning Commission:

1. Any person who is aggrieved by the approval, approval with conditions, or denial of a wetland use permit by the Director of Planning and Development Control or Planning Commission, as applicable, may appeal the decision to the Township Board by filing a written statement containing the specific reasons for the appeal with the Township Clerk within ten (10) calendar days following the date of the decision. The timely filing of an appeal shall have the effect of staying the permit pending the outcome of the appeal.

2. In the event that the person(s) filing the appeal is not an owner of property within 500 feet of the property affected, the Township Board shall determine whether the person(s) is an aggrieved person.

3. The Township Board shall hold a hearing on the appeal which shall be open to public comment and shall include opportunity for the appealing party to present their appeal.

Adopted 8-6-91
Rev. 6-7-94

4. Notice of the time and place for consideration of an appeal shall be placed in a newspaper of general circulation in the Township not less than five (5) days prior to the date of the hearing. A notice shall also be sent by mail or personal delivery to the owners of the property considered in the appeal, and to all owners listed on the most recent tax roll of real property within 500 feet of the boundary of the property in question. Said notice to be sent not less than five (5) days prior to the hearing.

5. The Township Board shall affirm, affirm with conditions, or reverse, the decision of the Planning Commission or Director of Planning and Development Control. The Board's decision shall be based on written findings.

g. The following process shall apply to wetland use permit decisions by the Township Board and Planning Commission:

1. Wetland use permit applications submitted in conjunction with a related land development activity shall be decided by the same entity that decides the related land development activity consistent with the Goemaere-Anderson Wetland Protection Act. The Planning Commission shall decide any wetland use permits in conjunction with special use permit applications and shall require that the delineation and wetland use permit application requests be submitted prior to the special use permit hearing. The Director of Planning and Development Control shall transmit application materials and the report and recommendation prepared by the Township Wetland Consultant to the Township Board, Planning Commission, and Wetland Board. The Wetland Board may review the materials and provide comments for consideration by the Township Board or Planning Commission, as applicable.

2. After review and study of the application materials, the Township Wetland Consultant's report and recommendation, and optional comments from the Wetland Board, the Township Board or Planning Commission, as applicable, may hold one public hearing after publication in a newspaper of general circulation in the Township not less than five (5) days nor more than fifteen (15) days prior to the date of the hearing. Such notice shall indicate the place, time and subject of the hearing and the place and time the proposed wetland use permit may be examined. The wetland use permit hearing may be held in conjunction with a review of the related land use request.

3. In the event of a public hearing, notice shall be sent by mail or personal delivery to the owners of property for which approval is being considered, and to all owners of property, as listed on the most recent tax roll, within 500 feet of the boundary of the property in question. Notification need not be given to more than one (1) occupant of a structure, except that if a structure contains more than one (1) dwelling unit or spatial area owned or leased by different persons, one (1) occupant of each unit shall receive notice. In the case of a single structure containing more than four (4)

dwelling units, notice may be given to the manager or owner of the structure who shall be requested to post the notice at the primary entrance to the structure. A notice containing the time, date, place and purpose of the hearing shall be posted on the subject property at least eight (8) days prior to the hearing. The posting sign shall be no less than ten (10) square feet in size.

4. After completing the review and holding one public hearing, if so required, the Township Board or Planning Commission shall approve, approve with conditions or deny the application within 90 days after receipt of an application, in accordance with this Chapter.

5. Written notice shall be sent to the applicant upon approval, approval with conditions or denial of a wetland use permit by the Township Board. The denial of a permit shall be accompanied by a written reason for denial.

6. A permit approved by the Township Board or Planning Commission shall not be issued or effective until ten (10) calendar days following the date of the approval and compliance with Section 105-15(c) of this Chapter.

Section 105-12 Criteria for Wetlands Under Two (2) Acres in Size

a. Where an applicant proposes to perform a regulated activity in a wetland less than two (2) acres in size, the Director of Planning and Development Control shall be so advised in writing. The Director of Planning and Development Control shall forward the location and other information concerning the wetland to the Township Wetland Consultant, who shall issue a preliminary finding as to whether one or more of the following criteria are likely to apply to the wetland:

1. The site supports state or federal endangered or threatened plants, fish, or wildlife appearing on a list specified in section 6 of the Endangered Species Act of 1974, Act No. 203 of Public Acts of 1974, being Section 299.226 of the Michigan Compiled Laws and/or subsequent amendments.

2. The site represents what is identified as a locally rare or unique ecosystem.

3. The site supports plants or animals of an identified local importance.

4. The site provides groundwater recharge documented by a public agency.

5. The site provides flood and storm control by the hydrologic absorption and storage capacity of the wetland.

6. The site provides wildlife habitat by providing breeding, nesting, or feeding grounds or cover for forms of wildlife, waterfowl, including migratory waterfowl and rare, threatened, or endangered wildlife species.

7. The site provides protection of subsurface water resources and provision of valuable watersheds and recharging groundwater supplies.

8. The site provides pollution treatment by serving as a biological and chemical oxidation basin.

9. The site provides erosion control by serving as a sedimentation area and filtering basin, absorbing silt and organic matter.

10. The site provides sources of nutrients in water food cycles and nursery grounds and sanctuaries for fish.

b. The Township Wetland Consultant's report shall be forwarded to the Township Board, which shall determine whether a wetland use permit application meeting the requirements of Section 105-10 of this Chapter shall be required, based on a finding that the wetland is essential to the preservation of the natural resources of the Township. Said determination shall be based on a finding that one or more of the criteria set forth in (a) above are met.

c. If the Township Board determines that the wetland is not essential to the preservation of the natural resources of the Township, the Township Board's decision shall be so noted on the Township Wetland Inventory Map, at the time it is amended. The requested activity shall be approved subject to all other applicable laws and regulations.

d. When a wetland under two (2) acres in size has been determined to be essential to the natural resources of the Township and the Township has found that one or more of the criteria set forth in 105-12(a) exist at the site, the Township shall notify the applicant in writing stating the reasons for determining the wetland to be essential to the preservation of the natural resources.

e. After determining that a wetland less than two (2) acres in size is essential to the preservation of the natural resources of the Township, the wetland use permit application shall be reviewed according to the standards in Section 105-13.

Section 105-13 Review Standards for Wetland Use Permits

The criteria to evaluate wetland use permits under this Chapter and to determine whether a permit is granted are as follows:

a. A permit for any activity listed in Section 105-8 shall not be approved unless the proposed activity is in the public interest and is otherwise lawful in all respects. Public input shall be evaluated in approving, approving with conditions, or denying the application. The reasonable use of the property involved in accordance with applicable local ordinances and State law shall also be considered.

b. In determining whether the activity is in the public interest, the benefit which reasonably may be expected to accrue from the proposal shall be balanced against the reasonably foreseeable detriments of the activity. The decision shall reflect the national, state, and local concern for the protection of natural resources from pollution, impairment, and destruction. The following general criteria shall be considered:

1. The relative extent of the public and private need for the proposed activity.

2. The availability of feasible and prudent alternative locations and methods to accomplish the expected benefits from the activity.

3. The extent and permanence of the beneficial or detrimental effects which the proposed activity may have on the public and private uses to which the area is suited. including the benefits the wetlands provide.

4. The probable impact of each proposal in relation to the cumulative effect created by other existing and anticipated activities in the watershed.

5. The probable impact on recognized historic, cultural, scenic, ecological, or recreational values and on the public health or safety, or fish or wildlife.

6. Economic value, both public and private, of the proposed land change to the general Township area.

7. The findings of necessity for the proposed activity which have been made by other agencies.

8. Amount of wetland remaining in general area and proximity to a waterway.

c. A wetland use permit shall not be issued unless it is shown that an unacceptable disruption will not result to the aquatic resources. In determining whether a disruption to the aquatic resources is unacceptable, the benefits outlined in Section 105-1 and the criteria set forth in Section 105-13 b shall be considered. A permit shall not be issued unless the applicant also shows either of the following:

1. The proposed activity is primarily dependent upon being located in the wetland, or

2. A feasible and prudent alternative does not exist.

d. Failure to submit a complete application may be reason for denial of a wetland use permit.

Section 105-14 Consideration of Wetland Mitigation Proposals

To ensure no net loss of wetlands in the Township, mitigation shall be required in instances where there are losses of wetland resources. The Township Wetland Consultant shall review an applicant's mitigation plan and transmit a recommendation to the Director of Planning and Development Control. The Director of Planning and Development Control, Planning Commission, or Township Board, as applicable, shall review the applicant's mitigation plan and consider the Township Wetland Consultant's recommendation as part of the wetland use permit review process. A mitigation plan, if required, shall be approved as part of the wetland use permit decision by either the Director of Planning and Development Control or the Township Board, as applicable. Mitigation shall not be considered a substitute for making all prudent attempts to avoid wetland impacts.

a. Prior to considering a proposal for wetland mitigation it must be shown that it is practical to replace the wetland resource values which will be unavoidably impacted including: flood prevention; wildlife habitat, groundwater resource protection and recharge; pollution treatment; erosion control; nutrient sources; aesthetics; recreation; open space and any other values identified.

b. If determined by the Township Wetland Consultant that the above is met, the following criteria shall be considered when reviewing an applicant's mitigation proposal:

   1. Mitigation shall be provided on-site where practical and beneficial to the wetland resources. If mitigation on-site is not practical and beneficial, then mitigation in the immediate vicinity, within the same watershed, of the permitted activity may be considered. Only if all of these options are impractical shall mitigation be considered elsewhere.

   2. Any proposal shall assure that there will be no net loss to the wetland resource values.

   3. The mitigation plan must comply will all applicable federal, state, and local laws.

   4. A plan to monitor preserved and replacement wetlands over a minimum of five years has been specified.

c. Wetland mitigation and monitoring plans shall become conditions to the wetland use permit and shall be the responsibility of the applicant.

d. Financial assurances that mitigation is accomplished as specified by the permit condition may be required by the Director of Planning and Development Control, Planning Commission, or Township Board, as applicable.

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Rev. 6-7-94

e. Any mitigation activity shall be completed before initiation of other permitted activities, unless a phased concurrent schedule can be agreed upon between the Director of Planning and Development Control, Planning Commission, or Township Board, as applicable, and the applicant.

f. Wetland mitigation plans that create less than two (2) acre wetlands shall meet one of the conditions listed in Section 105-12(a).

Section 105-15 Wetland Use Permit Conditions of Issuance

a. The Director of Planning and Development Control, Planning Commission, or Township Board, as applicable, shall attach any reasonable conditions considered necessary to insure that the intent of this Chapter will be fulfilled, to minimize or mitigate damage or impairment to, encroachment in, or interference with natural resources and processes within the protected wetland or to otherwise improve or maintain the water quality.

b. The Director of Planning and Development Control, Planning Commission, or Township Board shall fix a reasonable time for the undertaking and completion of all activities and structures, as applicable.

c. Following the approval of the wetland use permit application, a permit shall be issued upon determination that all other requirements of the ordinance and law have been met, including site plan, plat or land use approvals, as applicable, and including issuance of required permits by Ingham County or the Michigan Department of Natural Resources under Act 203 of the Public Acts of 1979, as amended.

d. The Director of Planning and Development Control, Planning Commission, or Township Board, as applicable, upon issuance of a wetland use permit, may require the applicant to file with the Township Treasurer cash, certified check, or an irrevocable bank letter of credit in an amount the Director of Planning and Development Control, Planning Commission or Township Board, as applicable, determines is necessary to insure compliance with the wetland use permit approval conditions and this Chapter.

e. At no time shall the Director of Planning and Development Control, Planning Commission, or Township Board, as applicable, issue a wetland use permit that allows a more extensive alteration of the wetland than permitted by state or federal law.

f. Wetland use permits for seasonal operations need not be renewed annually unless otherwise stated in the permit.

g. Any change that increases the size or scope of the operation and that affects the criteria considered in approving the permit as determined by the Director of Planning and Development Control, Planning Commission, or Township Board, as applicable, shall require the filing of a new wetland use permit application.

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Rev. 6-7-94

h. Any temporary, seasonal, or permanent operation that is discontinued for two (2) years or two (2) seasons shall be presumed to have been abandoned and the wetland use permit automatically voided.

i. Any permit granted under this Chapter may be revoked or suspended by the Township Board, after notice and an opportunity for a hearing, for any of the following causes:

1. A violation of a condition of the permit.

2. Misrepresentation or failure to fully disclose relevant facts in the application.

3. A change in a condition that requires a temporary or permanent change in the activity.

j. An applicant who has received a wetland use permit under this Chapter shall comply with the following in connection with any construction or other activity on the property for which the wetland use permit has been issued:

1. Maintain soil erosion control structures and measures, including but not limited to, silt fences, straw bale berms, and sediment traps. The permittee shall provide for periodic inspections throughout the duration of the project.

2. Maintain clear delineation of the protected wetlands (so marked by the Township Wetland Consultant during the on-site inspection) so that such locations are visible to all construction workers.

3. Post on the site, prior to commencement of work on the site and continuing throughout the duration of the project, a copy of the approved wetland use permit containing the conditions of issuance, in a conspicuous manner such that the wording of said permit is available for public inspection.

k. The wetland use permit shall remain effective for a time period coincidental with any other land use permit reviewed and approved concurrent with the wetland use permit. If applied for prior to the expiration date and concurrent with the expiring land use permit, the applicant may be granted an extension that corresponds to additional time granted for the underlying land use permit. Extensions shall be approved by the same person or body that made the original decision. The maximum number of extensions shall coincide with the maximum number allowed for the underlying land use permit.

l. Where there is no other activity or permit involved, the wetland use permit shall remain effective for one (1) year. A maximum of a one (1) year extension may be approved.

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Rev. 6-7-94

Section 105-16 Wetland Board

The Township Board hereby creates a Wetland Board whose membership, appointment and duties shall be as follows:

a. The Wetland Board shall consist of five (5) residents of the Township appointed by the Township Board; four of whom shall have knowledge and experience in the areas of botany, soils, geology, hydrology, or natural resources. The initial terms of appointment shall be as follows: 2 individuals for 3 years, 2 individuals for 2 years, and 1 individual for 1 year. Thereafter, appointments shall be for a term of three years.

b. The Wetland Board shall establish rules of procedure.

c. The duties of the Wetland Board shall include the following:

1. May advise the Township Board, Planning Commission, and Director of Planning and Development Control, on wetland use permits, appeals of wetland use permits, and mitigation plans.

2. Serve in an advisory role in setting policy guidelines on wetland issues in the Township.

3. Identify conflicts with wetland protection by present Township ordinances, Township operating procedures, and Township activities.

4. Identify and propose solutions to problems associated with wetland management.

5. Provide recommendations to the Director of Planning and Development Control on map administration.

6. Coordinate with the Michigan Department of Natural Resources in keeping up-to-date on issues affecting wetland protection.

7. Recommend a program to protect and acquire important wetlands through tax incentives, donation, development rights, easements, land exchange, purchase, and other means. Assist landowners who are interested in the voluntary protection of wetlands through one of these methods.

8. Promote wetland education at all levels. Develop education programs for the public and for Township schools. The program should promote the values of wetlands and awareness of the hazards and threats to wetlands. The program should be particularly targeted to landowners with wetlands and emphasize how best to protect wetland values on their property.

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Rev. 6-7-94

9. Coordinate a voluntary wetland stewardship program. Develop an adopt-a-wetland program for interested citizens to participate more directly in preservation of specific wetlands.

10. Review degraded or destroyed wetlands in the Township for possible rehabilitation or restoration.

Section 105-17 Request for Revaluation of Affected Property

The owner of any property for which a wetland use permit was applied for under this Chapter and was denied, upon appeal, by the Township Board may request a revaluation of the affected property by the Township Board of Review for assessment purposes to determine its fair market value under the use restriction. A landowner who is aggrieved by a determination, action, or inaction under this chapter may protest and appeal that determination, action or inaction pursuant to the General Property Tax Act, Act No. 206 of the Public Acts of 1893, being Section 211.1 to 211.157 of the Michigan Compiled Laws.

Section 105-18 Fees

Applications for wetland use permits, wetland verifications and delineations under this Chapter shall be accompanied by an application fee in an amount specified by resolution of the Township Board.

Section 105-19 Penalties and Enforcement

a. Penalties. In addition to the rights and remedies herein provided to the Township, any person violating any of the provisions of this Chapter shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in an amount not exceeding Five Hundred Dollars ($500.00), or be imprisoned in the county jail for a period not exceeding ninety (90) days, or both fined and imprisoned. Each violation of this act shall be a separate offense and in the event of a continuing violation, each day during which the violation exists shall be deemed to be separate and distinct offense. Each day such violation is continued or permitted to continue shall constitute a separate offense and shall be punishable as such hereunder.

b. Stop Work Orders. Whenever any work is performed contrary to the provisions of this Chapter, the Township Superintendent or his agent shall order the work to cease by notice in writing served on any persons engaged in the doing or causing such work to be performed, and any such persons shall, upon receipt of the order, forthwith stop such work until authorized by the Township Superintendent or his agent to proceed.

c. Civil Remedies. Any use of land or premises in violation of any provision of this Chapter is declared to be a nuisance per se. Whenever any work is being done contrary to the provisions of this Chapter, the Township may commence judicial proceedings for injunction, mandamus, or other appropriate relief to prevent, enjoin, abate, correct, restore, or remove

any violation of this Chapter. The rights and remedies herein provided are civil in nature and in addition to any criminal remedies under this Chapter or provided by state law.

d. Appearance Tickets. In all arrests and prosecutions for violation of this Chapter, appearance tickets and the appropriate procedures set for in Act 147, Michigan Public Acts of 1968, as amended, may be used.

e. The Director of Planning and Development Control or his agent, officer or employee shall have authority under this Ordinance to enter upon privately owned land for the purpose of performing the Township's duties under this ordinance and may take or cause to be made such examinations, surveys or samplings as are deemed necessary.

f. Law enforcement officials or other officials having the police power shall have authority to assist the office of Planning and Development Control in the enforcement of this ordinance.

g. In the event of a violation of this ordinance, the Township Board shall have the power to order wetland restoration for the damaged or destroyed wetland area by the owner of the property affected or the person or agent responsible for the violation. If the owner or person responsible does not complete the restoration measures within an ordered period of time, the Township Board may order the affected wetland restored to its prior condition and/or create or restore other wetlands for the purpose of offsetting losses sustained as a result of the violation. The owner or person responsible for the original violation shall be responsible to the Township for the full cost of all such remedial activity.

Section 105-20 Notice to the Michigan Department of Natural Resources

1. The Township shall notify the Michigan Department of Natural Resources of the adoption of this Chapter. The Township shall cooperate with the Department of Natural Resources in the enforcement of Act 203 as to wetlands under the Department of Natural Resources' jurisdiction as defined under this Chapter.

2. The Township shall notify the Department of Natural Resources of its decisions on all applications processed by the Township.

Section 105-21 Abrogation and Conflict of Authority

Nothing in this Chapter shall be interpreted to conflict with present or future state statutes in the same subject matter; conflicting provisions of this Chapter shall be abrogated to, but only to, the extent of the conflict. Moreover, the provisions of this Chapter shall be construed, if possible, to be consistent with and in addition to relevant state regulations and statutes. If any part of this Chapter is found to be invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision. Such holding shall not affect the validity of the remaining portions thereof, and the remainder of the Chapter shall remain in force.

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APPENDIX B

DEFINITIONS OF FORESTED, SCRUB/SHRUB, AND EMERGENT WETLANDS

APPENDIX B

Wetland definitions are taken from the National Wetlands Inventory.

Forested Wetlands (FO)

Woody vegetation greater than 6 meters (20 feet) tall. All water regimes. They normally possess an overstory of trees, and understory of young trees or shrubs, and a herbaceous layer. The "broad-leaved deciduous" subclass is commonly dominated by species such as red maple, American elm, ashes, black gum, tupelo gum, and swamp white oak.

For scrub/shrub and forested classes, the determination of the subclass is based on that subclass type which represents more than 50% of the aerial canopy coverage during the leaves-on period.

Scrub/Shrub (SS)

Woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings) or trees that are small or stunted because of environmental conditions. They may represent a successional stage leading to Forested Wetlands, or they may be relatively stable communities. In the Palustrine System, the "broad-leaved deciduous" subclass typically includes alders, willows, buttonbrush, red osier dogwood, honeycup, spirea, bog birch, and young trees of species such as red maple or black spruce. All water regimes are included.

Emergent (EM)

Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. All emergent wetlands visible on aerial photos will be considered to be persistent and mapped as Palustrine or Estuarine unless field or collateral information indicates otherwise. Reference to Cowardin et al. (1979) should be made when distinguishing between what constitutes persistent vs. nonpersistent emergents. All water regimes are included.

APPENDIX C

MERIDIAN WETLAND ACREAGE BY ONE MILE SECTIONS

APPENDIX C

WETLANDS INVENTORY

Section Number	Acres of Wetland (Total)	Percent of Total	Acres Regulated by MDNR[1]	Percent of Total
1	252.78	4.65	241.51	4.79
2	479.59	8.83	475.22	9.42
3	343.20	6.32	343.20	6.80
4	155.67	2.87	120.99	2.40
5	100.34	1.85	85.86	1.70
6	214.86	3.96	200.86	3.98
8	98.50	1.81	87.24	1.73
9	146.31	2.69	133.43	2.64
10	155.43	2.86	153.82	3.05
11	238.51	4.39	230.25	4.56
12	182.29	3.36	175.74	3.48
13	221.40	4.08	206.92	4.10
14	216.69	3.99	212.09	4.20
15	233.71	4.30	220.84	4.38
16	274.56	5.06	267.66	5.30
17	88.73	1.63	87.12	1.73
20	165.52	3.05	162.07	3.21
21	131.54	2.42	127.17	2.52
22	53.29	0.98	29.85	0.59
23	197.89	3.64	183.42	3.64
24	142.61	2.63	118.70	2.35
25	208.92	3.85	196.74	3.90
26	134.08	2.47	124.20	2.46
27	90.70	1.67	84.95	1.68
28	78.97	1.45	72.99	1.45
29	185.27	3.41	168.51	3.34
32	173.94	3.20	138.42	2.74
33	90.01	1.66	75.06	1.49
34	77.06	1.42	58.55	1.16
35	180.24	3.32	169.89	3.37
36	118.16	2.18	92.29	1.83
TOTAL	5,430.77[2]	100.00%	5,045.56	100.00%

1 MDNR = Michigan Department of Natural Resources

2 This figure differs from the wetlands figure in Table 23 because this figure includes Lake Lansing and other surface waters.

Source: J & L Consulting Services, March 1991 Survey

APPENDIX D

SURVEY INSTRUMENT

APPENDIX D

Dear Resident:

The Department of Resource Development at Michigan State University is conducting an independent survey on wetland conservation needs. As a graduate student working on this project, I am asking 15 minutes of your time to fill out this questionnaire. There will be no cost to you, simply return it in the stamped envelope enclosed. Your answers will help local officials and others in making more informed decisions about wetland and open space preservation needs based on public preferences and the importance of wetlands to the community. Funding assistance has been provided by the Michigan Agricultural Experiment Station.

IMPORTANT DIRECTIONS

- This survey should be completed by a person in the household who is of legal voting age. If you should have any questions about the questionnaire, please contact Shannon Ruby at 381-0603 (afternoons and evenings).

- Do not write your name on the questionnaire. Your answers will be anonymous, and all information will be treated with the strictest confidence. Responses will be used to complete some statistical analyses to determine how people in your township and neighboring townships feel about wetland preservation needs. No one in your community will know which answers came from which address. In addition, all participants will remain anonymous in any reporting of research findings.

- Please fill out the questionnaire by yourself. I want YOUR personal opinion of the issues raised.

- Please answer all of the questions. Your opinions are important to meet the research objectives.

- For the purpose of this study wetlands are defined as any lake, stream, swamp, pond, or area with frequently damp soils.

- When you have completed the questionnaire, place the questionnaire in the addressed, stamped return envelope enclosed, and seal the envelope. Do not write your name or return address on the envelope. To make sure that your answers are confidential, there are no identifying marks on the envelope. The numbers on the return envelopes will be used to send a follow up letter to non-respondents, but will be discarded after the return date.

- **PLEASE HAVE COMPLETED SURVEY POSTMARKED BY OCTOBER 10, 1996**

The questionnaire has five sections and should take about fifteen minutes to complete. You indicate your voluntary agreement to participate by completing and returning this questionnaire. Thank you for your time and cooperation in advance.

Part I. COMMUNITY

1. Are you a resident of Meridian or Williamstown Township? (Circle 1 or 2)
   1—Meridian Township
   2—Williamstown Township

2. Are you a full time resident of the Township? (Circle 1 or 2)
   1—Yes
   2—No

3. Do you live near a wetland? (Circle 1 or 2)
   1—Yes
   2—No

Part II. QUALITATIVE WETLAND STUDY.

4. Please circle the answer that best describes how you feel about wetlands. (Circle one number for each statement.)

	No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree
Wetlands tarnish the beauty of an area.	1	2	3	4	5
Wetlands pose problems for human health.	1	2	3	4	5
Wetlands are mosquito hatching grounds.	1	2	3	4	5
Wetlands are lands that could be put to better use.	1	2	3	4	5
Wetlands are aesthetically pleasing.	1	2	3	4	5
Wetlands are important to maintaining ecosystem health.	1	2	3	4	5
Wetlands help in flood control.	1	2	3	4	5
Wetlands provide wildlife habitat	1	2	3	4	5
Wetlands help in providing clean drinking water.	1	2	3	4	5
Wetlands are important in maintaining open spaces.	1	2	3	4	5
Wetlands have economic value.	1	2	3	4	5
Although wetlands greater than five acres are protected by the state, some small wetlands may perform functions that warrant their protection by the township.	1	2	3	4	5

5. In your opinion, how important are wetlands to your township? (Circle one)
   1—Of No Importance
   2—Of Little Importance
   3—Moderately Important
   4—Important
   5—Very Important

6. Do you think your township is doing enough to protect wetlands? (Circle 1 or 2)
   1—Yes
   2—No

7. Who should have the responsibility of managing wetlands? (Circle one)
   1—Federal Government
   2—State Government
   3—County Government
   4—Township Board or Local Municipality

Part III. WETLAND FUNCTIONS

8. Wetlands can perform a variety of functions dealing with amount and quality of our water supply. How important do you think each of these functions is as a reason to preserve wetlands in your township? (Circle one answer for each function)

	Of No Importance	Of Little Importance	Moderately Important	Important	Very Important
1. Flood Control	1	2	3	4	5
2. Groundwater Supply (Recharge)	1	2	3	4	5
3. Water Quality Improvement	1	2	3	4	5
4. Sediment/ Toxicant Retention	1	2	3	4	5
5. Nutrient Removal or Transformation	1	2	3	4	5

9. Of the above, which do you feel is most important to your township? (Circle one)
   1 2 3 4 5

10. Wetlands can perform a variety of functions dealing with biodiversity. How important do you feel each of these functions is as a reason to preserve wetlands in your township? (Circle one for each function)

	Of No Importance	Of Little Importance	Moderately Important	Important	Very Important
1. Wildlife Diversity	1	2	3	4	5
2. Aquatic Diversity	1	2	3	4	5
3. Plant Diversity	1	2	3	4	5
4. Threatened or Endangered Species	1	2	3	4	5

11. Of the above, which do you feel is most important? (Circle one)

1 2 3 4

12. Wetlands can perform a variety of functions dealing with recreation and aesthetics. How important do you feel each of these functions is as a reason to preserve wetlands in your township? (Circle one for each activity)

	Of No Importance	Of Little Importance	Moderately Important	Important	Very Important
1. Fishing	1	2	3	4	5
2. Hunting	1	2	3	4	5
3. Boating	1	2	3	4	5
4. Hiking/ Walking	1	2	3	4	5
5. Camping	1	2	3	4	5
6. Swimming	1	2	3	4	5
7. Picnicking	1	2	3	4	5
8. Nature Observation	1	2	3	4	5
9. Nature Photography	1	2	3	4	5

13. Of the above, which would you consider most important? (Circle one)

1 2 3 4 5 6 7 8 9

Part IV. QUANTITATIVE WETLAND STUDY

14. If the township alone were responsible for protecting wetlands, what percentage of the township budget do you feel should be allocated to wetland protection? (Circle one)

1— Less than 1%
2— 1 to 5%
3— 6 to 10%
4— 11 to 25%
5— More than 25%

15. If needed, how would you prefer your township raise money for wetland protection? (Circle one)

1—Increase in property taxes
2—Fee for new developments
3—Collect a fee from every household
4—Use existing funds and/or cut existing programs
5—Voluntary contributions
6—Fee for those with wetlands on their property
7—Fees derived from wetland use applications/permit programs

16. If citizens alone were responsible for protecting community wetlands, how much money each year would you be willing to spend? (Circle One)

1--None
2--$1 to 10
3--$11 to 30
4--$31 to 50
5--$51 to 100
6--$100+

If wetlands were non-existent in your township, how much would you be willing to pay each year for the following services? (Circle 1 or 2 for each of the services)

	Less than $50.00 per year	More than $50.00 per year
Drain construction	1	2
Drain maintenance	1	2
Public health	1	2
Additional drinking water treatment	1	2
Additional waste water treatment	1	2
Habitat preservation	1	2
Water availability	1	2
Sediment/Toxicant removal	1	2
Nutrient removal from water	1	2
Endangered species preservation	1	2
Open space preservation	1	2
Travel to similar natural areas	1	2
Travel to similar recreational areas	1	2
Augment well water supply with water purchased from the Lansing Board of Water and Light	1	2

Part V. BACKGROUND

18. Are you: (Circle one)
    1—male
    2—female

20. Please circle which best describes your household income. (Circle one)
    1—Below $20,000
    2—$20,000 to 29,000
    3—$30,000 to 39,000
    4—$40,000 to 49,000
    5—$50,000 to 74,999
    6—$75,000 to 99,999
    7—$100,000 to 149,000
    8—$150,000 +

21. Highest level of education. (Circle one)
    1—Less than high school
    2—High school graduate
    3—Some college or Associates Degree
    4—Bachelor's Degree
    5—Master's Degree
    6—Ph.D. or equivalent

22. Most recent employment (Circle one)
    1—Educational or professional worker
    2—Farmer
    3—Homemaker
    4—Manager or Proprietor
    5—Sales or Office Worker
    6—Semi-skilled worker
    7—Skilled worker, Craftsman or Foreman
    8—Student
    9—Other

23. Employment Situation. (Circle one)
    1—Employed full time
    2—Employed part time
    3—Seasonal worker now employed
    4—Unemployed, seeking work
    5—Unemployed, not seeking work
    6—Retired

24. What category best describes the value of your property? (Circle one)

1—Below $20,000
2—$20,000 to 50,999
3—$51,000 to 99,999
4—$100,000 to 125,999
5—$126,000 to 150,999
6—$151,000 to 200,000
7—Greater than $200,000

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