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THE EFFECT ON PROPERTY VALUES
USING THE HEDONIC METHOD

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STREAM PROTECTION ORDINANCES: THE EFFECT ON PROPERTY VALUES USING THE HEDONIC METHOD

By

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ABSTRACT

STREAM PROTECTION ORDINANCES:
THE EFFECT ON PROPERTY VALUES
USING THE HEDONIC METHOD

By

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Stream buffers have been well documented as measures that improve water quality and provide wildlife and aquatic habitats. Some communities have adopted stream protection ordinances that require stream buffers or restrict riparian land uses to protect water quality. Other communities are hesitant to adopt ordinances because of the unknown effect the ordinances might have on property values. Property values differ due to the combination of their attributes, such as location, lot size, distance to businesses, and age of house. The hedonic pricing method enters property attributes in a multiple regression analysis to obtain an implicit value for just one of the attributes, in this case, a stream protection ordinance. This study involves two townships in the southern Lower Peninsula of Michigan. Results of the study conclude that riparian property values after the ordinances were adopted are significantly greater than non-riparian and riparian properties before the ordinances were adopted, with all other factors remaining constant. These results could alleviate concerns that property owners and local planners have about their property values and suggest to local officials that ordinances can be enacted to protect water quality without decreasing property values.

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CHAPTER 1 - INTRODUCTION

Water pollution is a global, regional, and local environmental problem. Tremendous advances have been made in the past 25 years to clean up aquatic environments by controlling pollution from industries and sewage treatment plants that discharge pollution at point sources through pipes, ditches, or sewers. However, these point sources that contain toxic chemicals and heavy metals account for only 9% of the total surface water pollution in the United States (Miller, 1992). Nonpoint source (NPS) pollution caused when stormwater runoff carries sediment, nutrients, and other contaminants into surface waters, accounts for the majority of the remaining sources of pollution and is considered a significant threat to water quality in rivers, lakes, and streams (United States Environmental Protection Agency [U.S. EPA], 1996). Approximately 40% of surveyed rivers, lakes, and estuaries are not clean enough to meet basic uses such as fishing or swimming as a result of NPS pollution. These pollutants have harmful effects on drinking water supplies, recreation, fisheries, and wildlife (U.S.EPA, 1994).

Certain land use activities associated with economic development have been identified as contributing NPS pollution and degrading water quality. As communities grow and develop, NPS pollution increases due to increased impervious surfaces and alteration of the natural hydrology. This relationship presents to communities everywhere the common struggle between managing growth and protecting the environment. Land use planning is essential for communities to decide the best present and future use of the land by mapping out suitable locations for specific land uses, such as residential, industrial, and waste water treatment plants. Land use planning determines where land will be used, then

zoning regulations control how the land is used. Zoning ordinances can designate areas for certain types of uses and can protect areas from certain types of development. Zoning ordinances are administered at the local government level and can only address areas within the government's jurisdiction. Federal and state regulations set the minimum standards by which local officials must abide.

The Army Corps of Engineers has jurisdiction over navigable waters of the state. Michigan's Department of Environmental Quality and Department of Natural Resources oversee the use and protection of the majority of the water bodies in the state. County drain commissioners have authority to regulate the maintenance and use of designated county and intercounty drains within their counties. Water does not flow according to political boundaries, thus the management of water resources requires cooperation and coordination of all agencies.

BACKGROUND TO THE PROBLEM

Current leaders in land use planning have been promoting better site design criteria to simultaneously reduce NPS pollution, conserve natural areas, save money, and increase property values (Schueler, 1998). One component of better site design is a stream protection ordinance. Communities have initiated stream protection ordinances to control NPS pollution and exerted local control over local resource protection. These ordinances include stream buffer zone requirements, land use setbacks, stormwater management, and other measures to reduce polluted runoff into streams. Many communities have adopted stream protection ordinances on the basis of the proven and well-documented

environmental benefits to water quality. Other benefits include increased flood protection, creation of recreational opportunities, and preservation of wildlife habitats (Schueler, 1998). Individuals that are affected by these ordinances, however, often need more justification than "it's good for the environment." Residents often equate "good for the environment" with "bad for economic growth and progress."

PROBLEM STATEMENT

Changing local land use regulations is a difficult task. Local governments need to evaluate their current rules and procedures to understand how changes would impact the cost of development, local liability, public safety, and many other factors, including property values. Controlled change happens only when these impacts have been thoroughly addressed and understood.

Information about economic impacts is lacking for local governmental planners to use to make decisions about environmental protection. No studies were found that specifically address the implementation of stream buffers on private property or how property values are related to the adoption of an ordinance. Researchers have scientifically determined the environmental benefits of stream protection practices in controlling nonpoint source pollution (Correll, 1999). However, analyses concentrated on the economic effects on property values where stream protection practices are implemented on small tributaries and designated county drains are scarce.

Ordinances that protect streams can result in varied and multiple uses for riparian areas. A riparian buffer is any vegetated area adjacent to a river, lake, or stream. Buffers that are used for recreation, or serve as wildlife corridors, are often called greenways. Parks, open space, and greenways are usually considered positive additions to a community, however, these additions are based on the recreational values, not on the sustainable environmental protection measures that an ordinance provides.

The effect of stream protection ordinances on property values is difficult to study since most of the parameters are intangible, such as perceptions of water quality and aesthetics. The fact is that either "the environment" is important to landowners or it isn't. This study assumes that stream protection is an accepted policy goal of the communities that have adopted the ordinances.

PURPOSE OF STUDY

The purpose of this research is to determine the economic impacts on communities if stream protection ordinances are adopted. Communities are striving to improve water quality and stewardship of natural resources. Public acceptance of these initiatives, however, is often based on economic principles. If communities can gain an understanding of the financial aspects of environmental protection, local officials will be more easily able to determine what measures will be accepted and approved. The development and empirical estimation of a hedonic model will demonstrate the economic influences of a stream protection ordinance. The hedonic pricing method analyzes property values through identifying all the attributes that are contributing to the value of

the property. The method isolates the housing attribute of a riparian parcel sold after a stream protection ordinance was adopted from the attributes to determine its contribution to the property value. The method is an indirectly observed valuation technique where estimates are obtained from observed behavior, i.e., the sale of a house, and values are derived from the inferred relationship between the sale of the house and the housing attributes (Mahan, 1997). The use of the hedonic price method has a distinct advantage of estimating the actual price paid for the stream protection ordinance, reflecting a true market value. This study has attempted to determine whether stream protection ordinances adopted in Michigan communities have had an economic effect on property values and the amount that homebuyers are willing to pay for the protection of the stream.

LOCAL OPINIONS

Many individuals involved with local government, water quality protection, and real estate transactions that were contacted during the collection of the data expressed interest in the issue under investigation. The purpose of the study was often difficult to describe to those not in these fields of work or interest. Conversing with experts and sharing ideas of how to approach the research question proved to be invaluable to the progress of this study.

Conversations with officials in Cannon Township centered on the complexity of the study and the understanding that property values in that Township have a multitude of variables associated with determining a selling price. Additional attributes that are difficult to

measure but important to the characteristic of the Township are the rapid growth of the Township and its unique recreational opportunities, including a ski resort and three heavily populated lakes. The officials did not have the opinion that their overlay protection zones had an effect on property values, but they were interested in being informed of the results.

The adoption of stream protection ordinances benefits townships by reducing the risk of homes flooding, because houses are farther from the stream, which reduces the Townships' obligation to compensate the homeowners for their losses. Often townships are liable for damage when areas are zoned for construction and floods in those areas damage property. With no authority to restrict building in riparian areas, townships are looking for ways to increase authority and leverage enforcement.

The Michigan Department of Environmental Quality is working with many communities around the State of Michigan to develop ordinances to protect local water resources. Employees shared their insight to the difficulties and impediments that Townships face when trying to enact environmental protection regulations.

Real estate agents that were contacted to assist in the selection of variables often stated that environmental protection measures are not heavily publicized nor often brought to their attention. Some expressed skepticism that the overlay zones had an effect on property values, since they believed that most buyers were not aware of the restrictions or benefits of riparian buffers.

SIGNIFICANCE OF STUDY

Rural areas in Michigan and elsewhere are experiencing rapid urbanization, often at the expense of the natural resources in those areas. Stream protection ordinances are designed to protect riparian areas and preserve water quality of streams. Research has produced scientific information about the impacts and consequences of the destruction of riparian areas on water quality (Correll, 1999). Increased awareness of the importance of riparian vegetation has led many communities to make changes in planning and development rules for their communities (Schueler, 1995). Ada Township, a community east of the City of Grand Rapids, Michigan, was featured in a newspaper article in March 2002. A proposed stream protection ordinance, intended to protect water quality, preserve plant and animal habitats, and minimize erosion, was raising concerns among the residents about how their properties would be affected. Residents believed that many of the proposed rules would not be enforced, and that not being able to use all of their property would decrease their land values. The Township officials did not think that the new rules would lower property values, but evidence was not available to support that claim.

Changes in rules that affect the environment usually emphasize the physical and biological impacts that those changes will have on the resource in question. Natural resource management, however, requires the consideration of social and economic impacts as well. Scientific knowledge cannot be shaped into effective resource policy without these considerations (Abdalla and Libby, 1982). This study focuses on the economics of environmental policy change and the role that economics can play in

formulating and implementing those changes. This research documents the economic impact of ordinances on property values in certain townships, but the information may be applicable to other areas and municipalities interested in improving environmental protection measures or implementing stream protection ordinances.

HYPOTHESIS

The hypothesis tested in this study focuses on the role and significance of stream protection ordinances in determining the sale price of a riparian residential property. The hypothesis is stated as follows:

- The presence of a stream protection ordinance has a significant influence on riparian residential property values.

To test this hypothesis, property value is the dependent variable and the adoption of the stream protection ordinance is one of the explanatory variables included as a housing attribute.

ORGANIZATION OF STUDY

A problem-focused literature review is included in Chapter 2, which discusses the literature covering the importance of stream protection measures, economic methods used to value stream protection measures, hedonic pricing analysis of water resources, and the criteria for selecting the characteristics of the selling prices of houses. Chapter 3, Data

Collection and Recording, describes the study areas of Cannon Township, Kent County, and Meridian Township, Ingham County. The methods used to collect and record the necessary information for the study is explained, including the challenges and requirements to access the data. The hedonic price method is presented in Chapter 4, Methods and Procedures. The theoretical model for the hedonic price method and how the method was implemented to achieve the objectives of the study are discussed. A description of the data used in the analysis is also included. The study results are presented in Chapter 5, and Chapter 6 discusses the results and their implications. The final chapter, Conclusions, presents a summary of the study, discusses its application, and suggests topics for further research.

CHAPTER 2 - REVIEW OF RELATED LITERATURE

The research and development of environmental protection has spanned many decades and produced a wealth of information. However, a limited number of water protection valuation studies have used the hedonic pricing method. Those that have used the method usually estimated the recreational or aesthetic values for lakes or high quality rivers. This literature review focuses specifically on studies that have used the hedonic pricing method and other non-market valuation techniques to value water quality as an amenity.

HISTORICAL BACKGROUND OF STREAM PROTECTION

Before urban sprawl, growth boundaries, and cluster development were on the minds of community planners, Aldo Leopold (1949) was writing of the ecological effects of abusing the land. His collection of essays in "A Sand County Almanac" spoke of a land ethic – the idea that the individual is a member of a community of interdependent parts, including soil, water, plants, and animals. Conservation of these natural resources in the past was motivated by economic incentives to reduce soil erosion and sedimentation in streams and rivers by encouraging the farming community to implement erosion control practices. Extending this concept to the rest of the community is difficult because a conservation system based wholly on economic motives does not take into account the fact that most landowners cannot recognize tangible economic values in their land. Today, decisions are still based on economic evidence to be valid, but a higher land ethic is beginning to emerge as demonstrated with the adoption of stream protection ordinances at the local and county level.

Schueler (1994) describes the evolution of environmental protection ordinances as beginning with flooding concerns from increased development that led to stormwater management ordinances. Soil erosion from increased land disturbances increased sedimentation in rivers, lakes, and streams, which led to soil erosion and sedimentation control ordinances. The merging of stormwater management controls with soil erosion and sedimentation controls enabled communities to connect water quantity and water quality issues. Schueler argues that the stream protection approach addressed both these issues and led to an abundance of research on developing criteria for stream protection ordinances. Cannon and Meridian Townships, selected for use in this study, have adopted some of the concepts of the stream protection approach and are working toward improving and preserving water quality in their communities.

Extensive research has demonstrated that Best Management Practices (BMPs), such as soil erosion and sedimentation control measures, stormwater management, and riparian land use regulations, such as filter strips and riparian forest buffers, can reduce NPS pollution (Schueler, 1995). Other environmental benefits of buffers include protecting aquatic ecosystems, providing safe conduit for potentially dangerous floodwaters, treating stormwater runoff, and preventing drainage problems for adjacent homeowners (Schueler, 1995). Some community leaders understand the problems associated with NPS pollution and have adopted and enforced stream protection ordinances to reduce pollution. Others, however, are unsure of the economic effects that these measures will have on property values, thus have not attempted to draft and adopt stream protection

measures. Communities are often hesitant to enforce an ordinance or restriction that could negatively affect property values, since an increase in property values generally results in an increase in property tax revenues for local governments (Miller, 1992). However, studies have concluded that policies at the local level are the most effective means to increase environmental protection (Sanford and Stroud, 2000). Developers worry that restrictions on land development make properties less attractive. Property owners might think of an ordinance as a "taking" of their land. These issues lead to important water resource management questions. What type of protection measures should be implemented? What amount are homeowners willing to pay for water resource protection? What are the economic benefits of protection? This study will attempt to use an economic analysis to determine the effects on property values when communities adopt and enforce stream protection ordinances.

Vermont enacted a progressive land development and land use law over 30 years ago to provide greater control over large developments (Sanford and Stroud, 2000). Act 250 established environmental and planning criteria that were intended to be comprehensive regulations to preserve the state's rural character and renowned natural environment. Sanford and Stroud (2000) evaluated the effectiveness of Act 250 by presenting four case studies of stream buffer use along Vermont streams. Specific criteria were designed to protect riparian buffers zones and preserve water quality in streams. The results of the study found that the law has been applied on a case-by-case basis leading to inconsistent levels of enforcement and possibly ineffective environmental improvements. Regulations concerning stream buffers need to be strengthened to include a more consistent

application of buffers along streams. The goal of the study was to increase understanding and improve the role of comprehensive land use regulations for protective buffers. Management goals could be realized if sufficient support for local zoning and planning rules is gained. The key result in this Vermont study is that stream protection ordinances need to be clear on the location where they are to be enforced and in the land use restrictions that apply in those locations to create a consistent and predictable regulation throughout the state.

Howarth and Norgaard (1992) addressed the sustainability of environmental protection measures by illustrating that the incorporation of environmental values in decision-making will not bring about sustainability unless each generation is committed to transferring sufficient natural resources and capital assets to the next generation to make development sustainable. The adoption of stream protection measures ensures the transfer of natural resources from one house sale to the next, which creates the sustainability for development that is desired for the next generation.

Municipalities can implement strategies to have effective policies with greater compliance. Johnston and McCartney (1991) concluded that clearly written statute objectives and an adequate causal theory underlying the need for the policy enhanced the policy's implementation. Other factors, such as the availability of strong sanctions and incentives, committed and skilled local officials, and support from interest groups were also found to be important to the development of successful policies. Educating the

township officials through demonstrated success of environmental policies will enhance the enforcement and compliance of these policies.

RESEARCH RELATED TO VALUING STREAM PROTECTION

Stream buffers have been extensively studied for their ability to filter pollutants in surface water runoff and protect water quality. Woodard and Rock (1991) presented a study that explained the pollutant reduction capacities of natural buffers in controlling phosphorus and sediment runoff. Federal programs through the USDA Farm Service Agency and the Natural Resources Conservation Service offer funding to landowners to install buffer and filter strips based on the accepted fact that filter strips reduce nonpoint source pollution. Three watersheds in the State of Michigan, the Macatawa Watershed, the Saginaw Bay Watershed, and the River Raisin Watershed, are designated areas for the Conservation Reserve Enhancement Program, which offers incentives to farmers to install filter strips along all streams and drains. The concept of filter strips and buffers reducing nonpoint source pollution from agricultural lands has been transferred to urban and developing lands, to reduce stormwater runoff and residential lawn runoff. Other amenities, such as protected natural features and open space, are generally agreed-upon positive qualities (Schueler, 1995). Many different land uses exist in Cannon and Meridian Townships, and demonstrating the benefits of such ordinances for a broad range of land uses will assist officials in giving these ordinances serious consideration.

The Natural Rivers Program is a national initiative to protect the riparian zone of prized rivers. The restriction of certain land use activities in the zones is assumed to produce

benefits to water quality. A study conducted by the Michigan Department of Natural Resources (MDNR) in 1979 used a multiple regression analysis to determine statistical significance of zoning and other variables on riverfront property prices. General trends in rural property prices for three designated Natural Rivers and three control rivers were established. The study developed one general equation for all classes of river properties and a composite average of price per acre for the analysis. The study concluded that the percent in price increases due to the designation as a Natural River was no different than in the control rivers. The zoning was one of the several significant factors in determining price and without employing a hedonic model, the zoning could not be distinguished among the other variables. Admittedly, this design was unsatisfactory for price prediction purposes (MDNR, 1979). Leefers conducted a similar study in 1997 to again assess the economic impacts of the designation of a Natural River. Leefers's study criticized the previous study for using a model that did not fit the data, and thus discounted the results. The 1997 study used the hedonic pricing method and determined that property values were affected by the Natural River restriction. Two factors were described as economic forces influencing property values. First, the study suggested that property values decline on the designated rivers due to restrictions placed on land use. The designation, therefore, is viewed as an opportunity cost (Leefers, 1997). The second factor described is that the property values may increase due to the improved and preserved water quality presumed with a Natural River designation. The study focuses on this second factor, since market transactions could be used in a hedonic model to determine the non-market value of the Natural River designation. The study hypothesized that if the net effect of the designation were positive, then the non-market values of Natural River designation would be greater

than the lost opportunity costs of land use restrictions. The author concluded that property values increased as a result of the Natural River designation in select rivers in Michigan.

A study presented by Mooney in the Proceedings of the 31st Annual Pacific Northwest Regional Economic Conference in 1997 investigated residential property values in the Pacific Northwest where water resources are highly regarded for their fisheries and aesthetic value. The study used the hedonic method to create a number of linear models, which established the sale price of the house to be a function of the sale date of the house, the size of the lot, the size of the house, the age of the house, the length of the riparian frontage, the area of the lot planted in trees, the quality of the house, and the neighborhood school district. The results of the model indicated that residents were willing to pay more for additional riparian footage, and willing to pay less with additional area of the lot planted in trees. Trees were planted in this area to protect the stream and provide wildlife habitat. The residents wanted to live on the water, but they did not want trees obstructing their view of the water. The methods used in Mooney's study provided guidelines for important variables to include in the hedonic model used for analyzing Cannon and Meridian Townships. The results differ, however, since most ordinances in Michigan do not require trees to be planted in the buffer, but instead contain language that encourages the natural vegetation, grasses and shrubs which don't block the view, to become established and remain undisturbed.

Floodplain management often accomplishes stream protection by limiting development and alteration of the riparian habitat. Holway and Burby (1990) conducted a study on the

National Flood Insurance Program, a federal program that requires local governments to regulate floodplain land uses to reduce the possibility of property loss due to flood damages and the resulting insurance losses. The floodplain elevation regulations are similar to stream protection ordinances in that they both limit development in the riparian area and place restrictions on the land. The study investigated whether floodplain elevation regulations were affecting the value of vacant land in areas that were likely to experience flooding. The study also examined whether floodplain regulations lowered the development expectations of the owners of land in the floodplain. The conclusions were that local governments have a much greater influence on the land value and development potential by utilizing zoning as part of their floodplain program, instead of relying solely on elevation requirements to reduce flood damages. Local governments often need stronger regulations than merely satisfying building elevation standards to save on flood damages and protect the environment.

Zoning regulations can often introduce water and natural resource protection. Planned Unit Developments (PUDs) have the flexibility in the development process to allow for significant land area to be set aside for preservation. Rivers, lakes, and streams can be protected since the designs deviate from the traditional rigid lot standards and incorporate concepts such as cluster development. Waterfront or natural resource overlay zoning creates consistency between zoning areas and levels of protection. The Michigan Township Association has promoted the concepts of waterfront overlay zoning and has offered guidelines of the necessary components to create an effective policy. To create an overlay zone, municipalities should develop uniform standards to use throughout the

zone, adding to the existing zoning district regulation that traverse the overlay district. Criteria that a municipality might consider in developing the boundaries of the overlay zone include: the 100-year floodplain, natural boundaries of wetlands, designated coastal and dune areas, stream corridors including lowlands and select upland segments, water associated bluffs and other areas of steep topography contiguous to a water area, and areas contiguous to shorelines that have been determined to require some form of additional regulatory control or protection. The purpose of the overlay zone is to protect the existing vegetation, shoreline topography, and view (PZC, 2000). Both Cannon and Meridian Townships have followed such guidelines in developing their overlay districts and associated ordinances.

Waterfront properties have always been desirable housing options. The University of Maine has conducted studies relating lake water quality to lake front property values (Michael, et al., 1996). Pompe and Reinhart (1995) studied beach quality and the enhancement of property values. Both studies related the environmental amenities, water and beach quality, to waterfront property values, and concluded that a decrease in the quality of the environmental amenity decreases property values. When lakes are visibly polluted, swimming and recreational activities are restricted. Trash and unkempt beaches detract from the pleasure of having beachfront property. The presence of a stream protection ordinance is not a visible amenity, such as clear lakes and combed beaches, thus its influence on property values is more difficult to measure.

Many studies have shown increases in property values from stream protection measures that include recreational opportunities. The Chesapeake Bay Foundation (1996) concluded that the creation of Penney Park in Philadelphia was responsible for a 33% increase to the value of nearby properties. A greenway, described as a riparian area designed for recreation within a natural buffer, was found to have increased aggregate property values by $5.4 million, resulting in $500,000 of additional tax revenue per year in Boulder, Colorado (Fausold and Lilieholm, 1996). Correll, et al., in 1978, found that housing prices, also in Colorado, were 32% higher if they were located next to a greenway buffer. Nationally, buffers were thought to have a positive or neutral impact on adjacent property values in 32 out of 39 communities surveyed by Schueler (1995). Steiner & Loomis (1996) studied stream restoration projects in California that enhanced buffers, improved habitat conditions, and provided increased recreational opportunities. Homes situated near the seven projects were found to have a 3% to 13% higher property value than homes located near unrestored streams. These studies all indicate that including recreational opportunities with riparian protection usually increases surrounding property values.

CHRONOLOGICAL DEVELOPMENT OF RESEARCH METHOD

Griliches (1967) and Rosen (1974) provided the basic hedonic pricing framework and defined the use of hedonic modeling. Since then, researchers have been calculating the implicit price of a particular attribute's contribution to the total value of a property. Most studies utilizing this method choose a particular attribute that is measurable or tangible to isolate from all of the attributes measured, such as lake clarity or the use of a bike trail.

A study on farmland used hedonic methods to determine the natural and man-made factors that affect the price of farmland at the urban fringe (Chicoine, 1981). The model used property characteristics of distance to urban areas, road type frontage, neighborhood land use, proximity to a water body, soil productivity, and zoning. The proximity to a large body of water or a flowing stream was expected to enhance the value for a residential use, but decrease the value for agricultural use due to the risk of flooding. The results, however, determined that in the agricultural areas, the negative impact was not significant. The selection methods and measurements of property characteristics in determining property values employed in Chicoine's study were considered when selecting the characteristics of the parcels in Cannon and Meridian Townships to include in the study.

SUMMARY OF LITERATURE REVIEW

This chapter reviews key aspects of studies that have used pricing models to value water resources. Table 1 summarizes the water resource studies that have been reviewed that address river and stream protection.

Several points can be drawn from the valuation studies presented in this section. First, a variety of techniques have been used to value stream protection and water quality, including techniques that do not measure benefits, but rather opportunity costs. Second, different techniques tend to capture benefits from different land uses and the value of uses being measured tends to overlap with different techniques. The distinction between

values that are actually being measured is not exactly clear. For example, while the hedonic pricing method primarily measures amenity values, values for recreational use and other perceived uses are also likely being captured. Clear estimates of the total economic value of stream protection ordinances are difficult to make. Measuring the benefits of stream protection ordinances is an imperfect science, although meaningful economic information has been obtained in some settings. The hedonic pricing method is re-emerging in the economic literature to measure the amount that homebuyers are willing to pay for stream protection by controlling other variables that contribute to the selling price.

Table 1 • Summary of Literature Reviewed in Water Resource Valuation

Authors	Dependent Variable	Explanatory Variables Identified in Study	Results
Chesapeake Bay Foundation, 1996 Maryland	Property values	Penney Park	Increased nearby property values by 33%
Chicoine, 1981	Farmland values	Distance to urban area Road frontage Neighboring land use Proximity to water Soil productivity Zoning	
Correll, 1978 Colorado	Housing prices	Greenways	Houses had 32% higher pricing if next to greenway
Fausold and Lilieholm, 1996 Boulder, Colorado	Property values	Greenways	Increase of aggregate property values by $5.4 million
Holway & Burby, 1990	Land values	Floodplain regulations	Need zoning as part of floodplain protection
Leefers, 1997 Michigan Natural Rivers	Sale price per acre	Natural River designation	Some evidence indicates that property values increase more rapidly with designation
Michael, Boyle, & Bouchard. 1996 Maine	Lakefront property values	Lake water quality	A decrease in lake water quality resulted in a decrease of lakefront property values
MDNR, 1979 Michigan Natural Rivers	Sale price	Natural River designation	No significant results
Mooney, 1997 Oregon	Sale price	Riparian buffer strip Sale date Size of lot Size of house Age of house Length of riparian frontage Area of trees planted Quality of house School district	Willing-to-pay $48 for additional foot of water frontage Willing-to-pay $1.44 less for every additional square foot of riparian area planted in trees
Pompe and Reinhart, 1995 Maine	Beachfront property values	Beach quality	A decrease in beach quality decreased beachfront property values
Schueler, 1994 United States	Property values	Buffers	Buffers have positive or neutral impact on adjacent property values
Steiner and Loomis, 1995 California	Sales price and assessed values	Urban stream restoration projects	Restored streams increased property values by 3% to 13%

CHAPTER 3 – DATA COLLECTION AND RECORDING

SITE SELECTION

The initial task to accomplish for this study was to investigate which communities actually had adopted stream protection ordinances. A review of Michigan township ordinances revealed that few municipalities had distinct stream protection ordinances. Cannon Township in Kent County administered the Bear Creek Watershed Project, which resulted in the development of an ordinance to protect the riparian areas in the watershed. The Township also has two tributaries included in the Rogue River Natural Rivers designation and has adopted the Michigan Department of Natural Resources regulations at the local level.

Meridian Township in Ingham County is involved in the Red Cedar River Watershed project and has drafted regulations to protect the riparian areas in the Watershed. Meridian Township is well known as proactive toward conservation of natural resources as demonstrated by the passage in 2000 of the ordinance to protect wetlands.

Maps of the Townships were secured to identify the rivers, streams, and drains that flowed through the Townships, and to determine if an adequate number of riparian parcels existed to be a viable sample for the study.

Cannon and Meridian Township officials understand the importance of local control for the protection of local resources. These municipalities have implemented enhanced

measures to protect their water resources and have spent considerable time and effort to develop comprehensive local environmental review processes.

STUDY AREA DESCRIPTION

Cannon Township is situated in Kent County, Michigan, northeast of the City of Grand Rapids, Michigan. Bear Creek flows through the southern half of the Township. Barkley Creek and Rum Creek, tributaries to the Rogue River, flow through the northwest corner of the Township (Figure 1). The Township has experienced rapid growth around its three major lakes, Bostwick Lake, Silver Lake, and Lake Bella Vista.

Meridian Township is located east of the City of Lansing in Ingham County, Michigan. The Red Cedar River flows through the southern half of the Township and has been the focus of many studies and protection efforts (Figure 2). Wetlands are highly regarded in the Township and were recently delineated to identify areas that required precautionary zoning to protect the ecosystems. After a development boom in the 1970s, steady growth has been occurring over the years as a result of continued urban sprawl from the Lansing area (Figure 3).

Figure 1. Cannon Township

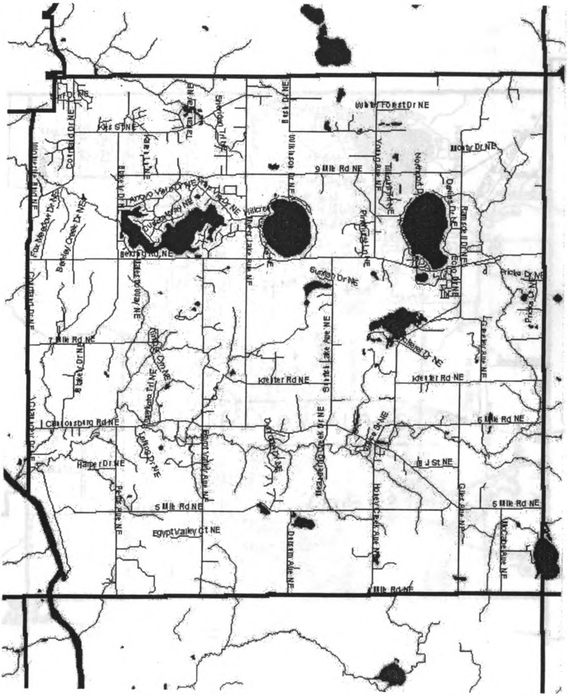


Figure 2. Meridian Township

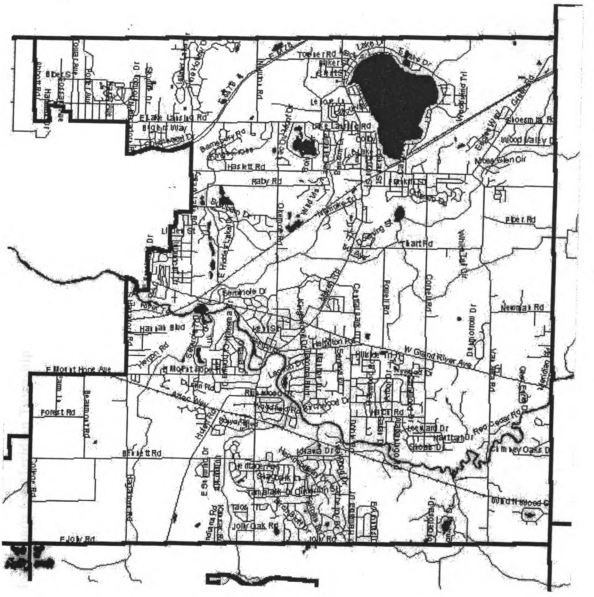
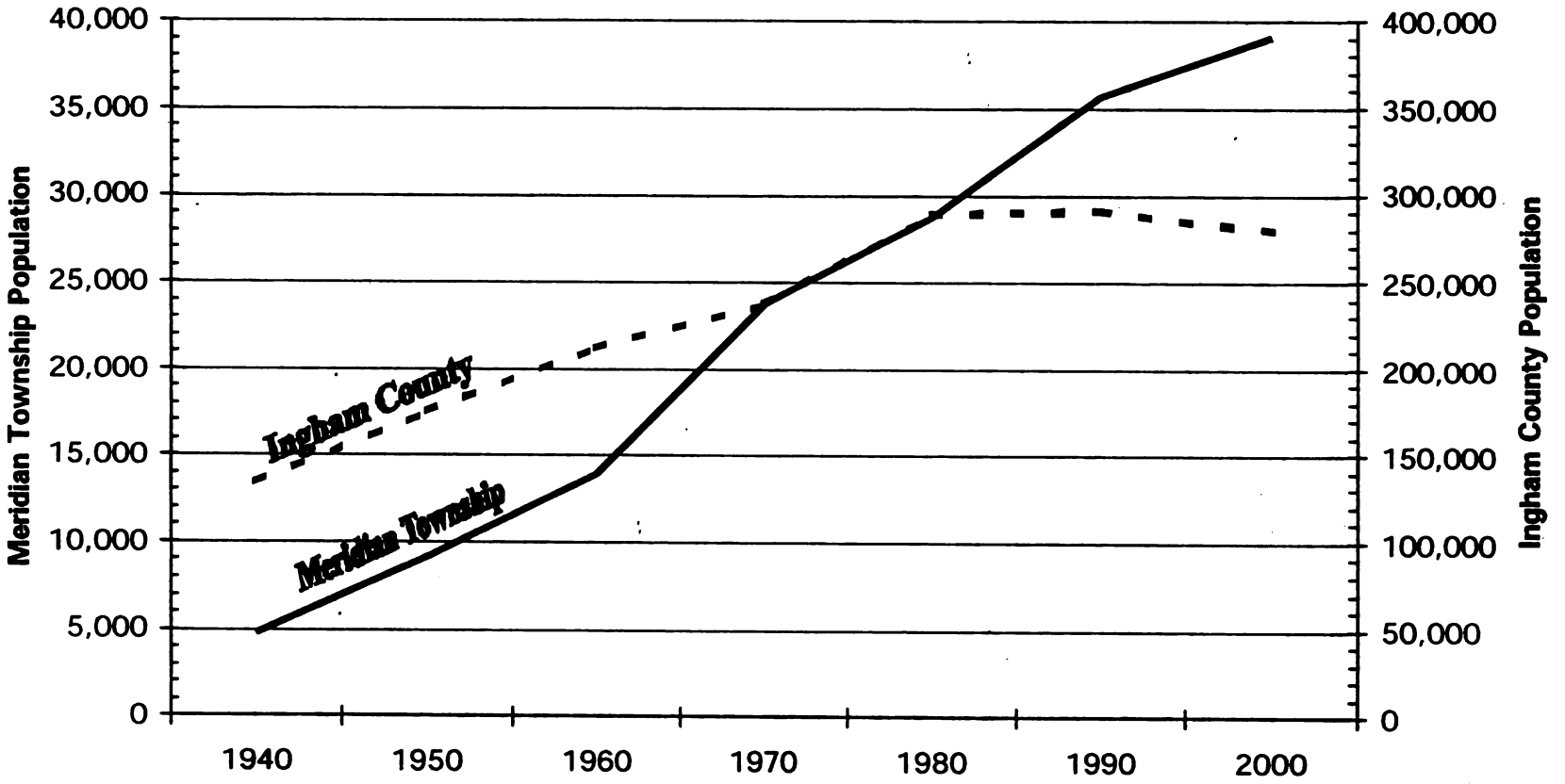


Figure 3. Population Trends for Meridian Township



RESEARCH ENTRY

CANNON TOWNSHIP

The offices of Cannon Township provided copies of the ordinances and preliminary examples of assessment information that would be accessible. Information was available on request and was freely distributed for the required research. The engineering firm representing the Township provided a map of the stormwater management zones for the Township's stormwater ordinance. The Kent County Drain Commissioner's office allowed access to the Sidwell map books, which contained reduced parcel maps of Cannon Township from Kent County's Property and Mapping Department. These maps include locations of all streams and county drains. Scant information was available on Cannon Township's website (www.cannontwp.org). The Michigan Department of Natural Resource's website (www.michigan.gov/dnr) provided information about the Natural Rivers Designation.

MERIDIAN TOWNSHIP

Meridian Township's Code of Ordinances, Zoning Ordinance, and other policies related to water quality protection in the Township were available from the Community Planning and Development Office of the Township. The Township also provided a wetlands map of the Township, illustrating surface water and parcel lines. Information from the Assessor's office was more difficult to obtain. A Freedom of Information Act (FOIA) request was necessary to obtain the information about the housing characteristics and the Township charged for this service. The Ingham County Equalization Department houses

the Sidwell books that contained Meridian Township's riparian parcels. Meridian Township's website (www.meridian.mi.us) provided information about Meridian's 2002 Update of the 1993 Comprehensive Development Plan. Drafts of figures to be included in the plan were available, which included delineations and facts about demographics, housing characteristics, land use, community facilities, and the infrastructure.

SOURCES OF DATA

STREAM PROTECTION ORDINANCES

CANNON TOWNSHIP

Copies of the Cannon Township ordinances that pertained to stream protection were obtained from the Township office. In 1993, Cannon Township's Master Plan identified areas of conservation that the Township desired to be preserved and protected. The areas included the Cannonsburg State Game Area and portions of the Bear Creek Watershed. Bear Creek flows through the southern half of the Township, before joining the Grand River in the Township's far southwest corner. In 1996, the Township adopted an ordinance that required a 20-foot to 50-foot buffer on Bear Creek and all tributaries in the Bear Creek Watershed. The Township also enacted rules to parallel the protection measures placed by the State of Michigan under the Natural Rivers Act for two tributaries, Barkley Creek and Rum Creek, of the Rogue River that flow through the Township.

The ordinance created an overlay zone that delineated the buffer widths adjacent to the streams. Cannon Township recognized that irregular protection of rivers and streams resulted from inconsistencies of zoning, therefore, the boundaries of the stream protection ordinances were defined on the Township zoning maps and the Master Plan.

MERIDIAN TOWNSHIP

Meridian Township adopted Section 82-16 into their Code of Ordinances in 1977, creating a Conservancy District within the Township. The purpose of the Conservancy District was "to protect the natural, human, and economic resources of the Township, and to promote the public health, safety, and general welfare; by application of special regulations for the use of land which may be subject to periodic inundation at predictable intervals which may be subject to soil erosion, or which may be particularly suited to provide for the impoundment of waters for the purpose of stormwater control or groundwater recharge." The ordinance was drafted as a flood protection measure to reduce the risk of damages caused by floods and to protect those areas where flooding should naturally occur. The Conservancy District consisted of three overlay zones: groundwater recharge areas, floodway areas, and floodway fringe areas. The groundwater recharge areas were determined on a case-by-case basis by a professional hydrologist. The floodway and floodway fringe areas coincided with the boundaries for floodways and floodway fringe areas as shown on the Flood Insurance Rate Map (panel 0010B, 0013B, and 0015B dated August 9, 2000), and by the Flood Insurance Study, as published by the Federal Emergency Management Agency.

An Environmental Protection Policy, created in 1991 by the Meridian Township Board, reinforced the Township's commitment to protecting the natural resources of the Township by designating sufficient financial and staff resources to oversee construction and land use changes that would affect the environment and ensure that all pertinent permitting and assessment requirements were satisfied before any changes took place. The observation and evaluation of activities had to be documented in a plan to be approved by the Township Board.

Section 83-1.11 in the Township Code of Ordinances, adopted September 2, 1991, addresses riparian areas of water features in the Township to minimize erosion, stabilize streambanks, protect water quality, and preserve fish and wildlife habitat. Structure and grading setbacks and natural vegetation strips are required on the edges of wetlands, the Red Cedar River, open county drains or creeks, and lakes. Natural vegetation strips must be maintained on the Red Cedar River 25 feet as measured from the abutting ordinary high water mark. Open county drains or creeks must also have a natural vegetation strip maintained for 25 feet as measured from the top of the abutting bank. Additional protection measures for the riparian areas include preserving existing soil, organic matter, and natural ground cover; prohibiting the application of pesticides, fertilizers, and other chemicals; limiting vegetation pruning and removal activities; minimizing pathways to access the water features; and maintaining a live root system to provide for streambank stabilization and erosion control.

Appendices 1 and 2 contain the policies and ordinances of the Townships that were reviewed. Figure 4 compares the time frame in which all of these policies and ordinances were adopted.

RIPARIAN PARCELS

A map of Cannon Township's stormwater management zones depicted all of the streams and drains in the Township (Figure 5). The riparian parcels were identified on that map. Those identified parcels were matched with parcel numbers using the Sidwell parcel mapping books in the Kent County Drain Commissioner's Office. The riparian parcels were then identified on the sales ratio report.

Meridian Township's wetlands map illustrated the riparian parcels. The wetlands map was created from aerial photographs, existing topographic maps, the Ingham County Soil Survey, the U.S. Fisheries and Wildlife National Wetland Inventory Map, and the Michigan Department of Natural Resource's MIRIS maps to serve as guidance in the administration of their Wetland Ordinance. The riparian parcels were identified and matched with parcel numbers using the Sidwell books from the Ingham County Equalization Office. An example of one section of the wetlands map is displayed in Figure 6.

HOUSING TRANSACTIONS

The Cannon Township Assessor provided the sales ratio reports for April 1, 1996 to March 31, 1998. The Kent County Equalization Department generated additional sales

Figure 4. Timeline of Stream Protection Development

	Cannon Township 07/16/1981 - MDNR enacts Rogue River Natural River Zoning rules. Establishes delineation of zoning district, 300-foot setbacks and 50-foot natural vegetation buffer.				
		Cannon Township 12/01/1993 - Stated goals and objectives for water resources in Comprehensive Plan with Conservation Area depicted on Future Land Use maps. Included Bear Creek Watershed riparian zone.			
			Cannon Township 01/08/1996 - Created Bear Creek Watershed Protection Overlay District. Included Bear Creek, Stout Creek, Armstrong Creek and any other flowing tributary. Requires natural vegetation strip and setback.		
			Cannon Township 01/08/1996 - Created Rogue River Natural River Overlay District. Included Barkley Creek, Rum Creek, and any land within 300-feet of the edge of the waters. Requires 50-foot natural vegetation strip, allows recreation.		
				Cannon Township 10/01/2001 Created stormwater ordinance, delineating management zones for levels of protection.	
Meridian Township 01/01/1977 - Created Conservancy District describing floodway areas and floodway fringe areas. Required natural vegetation to be retained and protected where feasible.					
		Meridian Township 07/17/1991 - Established Environmental Protection Policy, which required plans for all activities that would change the environmental or natural features of the Township.			
		Meridian Township 07/23/1991 - Amendment to the ordinance 83-1.11 Setbacks from Water Features. Required 50-foot setback from the Red Cedar River for any structure or grading activities. Natural vegetation must be maintained for 25 feet on Red Cedar and open county drains and creeks.			
1975	**1980** **1985**	**1990**	**1995**	**2000**	

Figure 5. Cannon Township Stormwater Management Zones

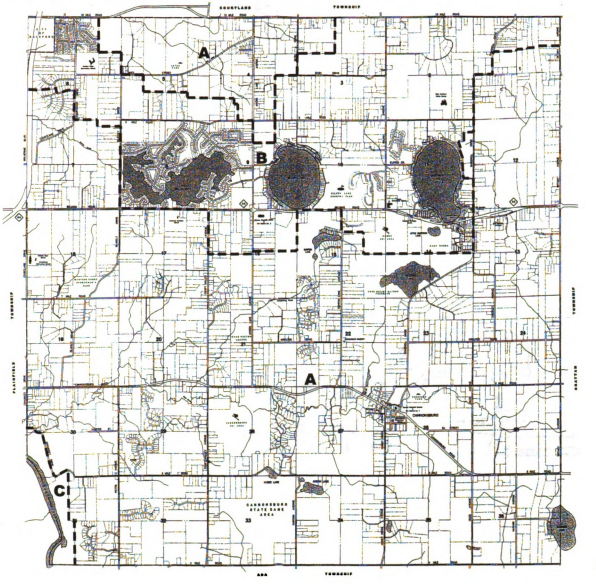
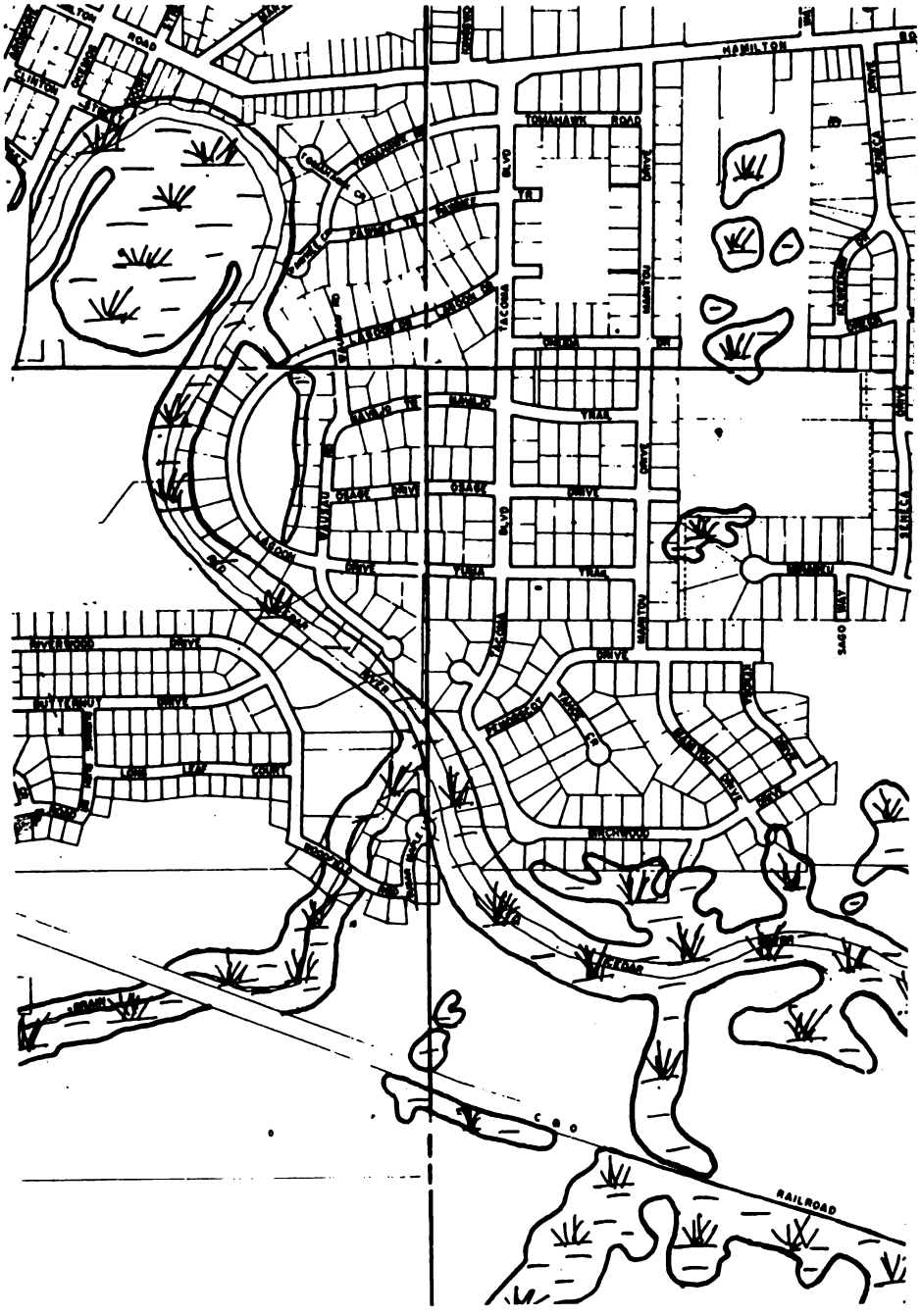


Figure 6. Example of Meridian Township Wetlands Delineation Map



ratio reports for January 1, 1990 to March 22, 2002. The Department was initially concerned about the confidentiality of the reports and questioned who would be the end user of this information, but then determined that no privacy rights had been compromised. Property sales within the Townships provided an indication of market activity and interest in these properties. Sales data from "regular" sales, under a warranty deed or land contract, were selected, since these are more likely to reflect true market values. Parcels with missing data were not included. A total number of 4,688 housing transactions occurred in Cannon Township from January 1, 1990 to March 22, 2002, which represented the potential sampling set for use in the hedonic price model.

From this total number of sales, the resulting number with regular sales and complete information for that time period was 270 parcels. The greatest increase in the number of sales has occurred in the past five years, as the agricultural land in the Township is quickly becoming subdivisions.

The sale prices were adjusted by the Consumer Price Index for housing in the Michigan residential housing market (www.economagic.com). Index numbers estimate the percent change in price on a typical property over time. The index used equaled 100 in 1982. An index of 127.4, for example, indicates a 27.4% increase in price since 1982. A Consumer Price Index that calculated the index as 100 in 2002, if available, could be used to adjust the prices to current rates.

The following paragraphs describe the data collected from Cannon Township in further detail and ways in which the data were recoded to enter into the statistical analysis.

All parcels have a unique 12-digit number (41-11-24-356-036, for example) by which they are identified for use by County Equalization Departments, realtors, and others. A variable was created containing this number. This variable was not used in the analysis, but was necessary for the assignments of the housing attributes.

The selling price of the parcel sold was listed as net price on the sales ratio report. A continuous variable was created using the actual sale price of the parcel. Another variable was created to adjust for inflation and annual growth rates for the area. A price index was applied to each sale according to the date sold, and an adjusted price was entered as a continuous variable, equalizing all selling prices to 1982 dollars.

The size of the parcel was listed in the sales ratio report. A continuous variable was created and listed the size of the lot, down to hundredths of an acre.

The year the house was built was included in the Assessor's Report from the Township. A continuous variable was created from this variable which listed the age of the house, as of 2002.

The total living area was listed on the Assessor's Report. This continuous variable is expressed in square feet of the living area of the house.

The business or village centers in the Township include Lake Bella Vista and Cannonsburg. Lake Bella Vista is a new shopping and business district that has been developed over the past ten years for the influx of residents occupying the new homes around the lakes in the Township. Cannonsburg, however, is a historic town, which has kept its rural atmosphere and protected its historical integrity. Both of these centers are important to the Township. A continuous variable was created that listed the distance, in quarter-mile increments, from a parcel to the nearest village, being either Lake Bella Vista or Cannonsburg.

Maps provided by the three school districts represented in the Township illustrated the areas that are within the boundaries of each school district. The few areas in the Forest Hills School District include portions in the southwest quadrant of Section 32, portions of the southern half of Section 33, and a portion of the west half of Section 34. The Lowell School District includes parcels in the southern portion of Sections 25 and 26, portions of the east half of Section 34, and all of Sections 35 and 36. The remaining area in the Township, representing the majority of the Township, is in the Rockford School District. The parcels were first identified by school district, and then indicator variables were created for each school district to indicate if the parcel was in or out of that school district. Homebuyers are often looking for houses in a particular school district, thus this variable could have an effect on property values, depending on the reputation of the school.

An indicator variable was created to identify the parcel as being either riparian (1) or non-riparian (0). This variable was used to create another variable, which incorporated the adoption of the stream protection ordinance.

The date of the sale was recorded from the sales ratio reports. The variable was used to apply the price index for that date to equalize the selling prices.

The date of sale information was also used to create another indicator variable, which indicated whether the parcel sold before (0) or after (1) the ordinance was passed. Four indicator variables were then created to code the data as: riparian before the ordinance (1) or other (0); non-riparian before the ordinance (1) or other (0); riparian after the ordinance (1) or other (0); and non-riparian after the ordinance (1) or other (0).

Meridian Township's Assessor's office provided the sales data, once the FOIA was completed. Home sales information was collected from September 1, 1988 to September 1, 1994, which was a sufficiently long time period to establish some trends, both before and after, of the economic effects of the ordinance. The same Consumer Price Index was used to equalize all selling prices to 1982 dollars. The database from the Assessor's Office for that time period included 1,286 single-family property transfers in the neighborhoods that were identified to include in this study. Meridian Township's housing explosion occurred in the 1970s. The average age of homes in Meridian Township is much greater than for Cannon Township. The number of transactions that reflected regular sales with complete information totaled 219 parcels. Only the recorded

deeds that contained property classifications by assessment officials as residential were used. The data were further screened by identifying the "arms' length" sales that were recorded from a willing seller to a willing buyer, who were neither related nor professionally associated (business partners) with each other. The result was a total of 163 of sales that were used in the study.

Additional data in the requested report from Meridian Township, besides the selling price of the parcels, included the neighborhood code, the parcel number, the address, the occupancy, the year in which the house was built, the average story height of the house, the class categories, the area of living space, the size of parcel, the state equalized value for 2001 and 2002, the last sale price, and the last sale date. Meridian Township's Comprehensive Development Plan is posted on their website and provided additional information about housing characteristics, such as ranges of housing values by neighborhood, location of parks, school district boundaries, condition of the house, floodplain delineations, types of housing, existing land use, and farmland preservation sites. The land use map shows the center of the Township, where Marsh Road and Grand River Avenue intersect, as the main commercial area within the Township. Other variables were created from this existing data and the following paragraphs describe the data used from that collected in further detail and the how the data were recoded to enter into the statistical analysis.

The unique number assigned to each parcel was entered into the database as a variable. This variable was not used in the analysis, but was necessary to assign the correct housing attributes to the correct parcel.

The selling price of the parcel sold was listed as last sale price on the Township report. A continuous variable was created using this actual sale price of the parcel. Another variable was created to adjust for inflation. A price index was applied to each sale according to the date sold and an adjusted price was entered as a continuous variable, equalizing all selling prices to 1982 dollars.

The size of the parcel was listed in the Township report. A continuous variable was created and listed the size of the lot, down to hundredths of an acre.

The year the house was built was included in the Township report. A continuous variable was created from this variable which listed the age of the house, as of 2002.

The total living area was listed on the Township report as square feet. A continuous variable was created to express the living area of the house, in square feet.

The center of the Township contains the main commercial area, where Grand River Avenue and Marsh Road intersect. A continuous variable was created that listed the distance, in quarter-mile increments, from a parcel to the center of that commercial area.

A map included in Meridian Township's Land Use study illustrated the areas that are within the boundaries of each school district. The few areas in the Williamston Community School District include portions in the southeast quadrant of Section 25, portions of the east half of Section 35, and a majority of Section 36. The East Lansing Public School District includes parcels in the eastern portion of the Township, including portions of the Sections 5, 6, 8, and 31. The Haslett Public School District encompasses much of the northern half of the Township, including all of Sections 1, 2, 3, 4, 9, 10, 11, 12, and portions of Sections 13, 14, and 15. The remaining area in the Township, representing the majority of the Township, is in the Okemos Public School District. The parcels were first identified by school district, and then indicator variables were created for each school district to indicate if the parcel was in or out of that school district. Homebuyers are often looking for houses in a particular school district, thus this variable could have an effect on property values, depending on the reputation of the school.

An indicator variable was created to identify the parcel as being either riparian (1) or non-riparian (0).

The date of the sale was listed from the Township report. The variable was recoded to state just the year of the sale in order to sort and display the data in a more usable format.

The sale date and riparian variables were used to create another indicator variable, which indicated whether the parcel sold before (0) or after (1) the ordinance was passed. As with Cannon Township, four additional indicator variables were then created to code the

data as: riparian before the ordinance (1) or other (0); non-riparian before the ordinance (1) or other (0); riparian after the ordinance (1) or other (0); and non-riparian after the ordinance (1) or other (0).

Data selection was based on the availability of property value information. The attributes of the properties are the explanatory variables in the study. The explanatory variable of most concern is the presence of the stream protection ordinance. The issue of which variables to include and their units of measurement was taken into consideration in the development of the model. Sheppard (1997), for example, states that few models use the location of a residential property as a variable, thus omitting a central principal of urban economics that the price of land will vary according to location. This study uses location variables of whether the parcel is riparian, the type of neighborhood, the school district, and the proximity to shopping and business centers, thus including this important variable. The regression model was developed incorporating factors that the economic literature indicated were important in explaining price variation in the price of a property. The model used indicator variables, assigned as either 1 or 0, to estimate the effects of qualitative characteristics, such as whether the parcel is riparian.

ADDITIONAL INFORMATION

Zoning codes, which indicate what type of land use is permitted on a parcel of land, were available for both Townships. Since only residential codes were used in this study, this variable was determined to be insignificant to the results, thus was not used.

In Meridian Township, all houses are rated according to the quality of building materials used in their construction. The ratings are coded from A to D, with A being the highest rating, normally indicating brick construction and other high quality materials. No comparable information was available for Cannon Township, thus for the sake of consistence in the results, the information was not used.

Meridian Township's Comprehensive Land Use Plan (www.meridian.mi.us/frame2.htm) posts several maps on the website, depicting a variety of information about the Township. The maps illustrating the school district boundaries and the business center were used to create the variables of Haslett School district, Okemos School district, and distance to economic activity.

SUMMARY OF DATA COLLECTED

The data collected were used to quantify the variables that describe the property characteristics that define to property values in Michigan townships. The study is most interested in the selling price and riparian parcels, before and after the adoption of the stream protection ordinance. Table 2 defines the data collected.

Table 2 • Number of Properties in the Sample

	Before Ordinance		**After ordinance**	
Township	Cannon	Meridian	Cannon	Meridian
Riparian property	24 (9%)	28 (17%)	64 (24%)	42 (26%)
Non-riparian property	26 (10%)	24 (15%)	155 (57%)	69 (42%)
Total	50	52	219	112

Cannon Township = 269 parcels
Meridian Township = 164 parcels

CHAPTER 4 – METHODS AND PROCEDURES

This chapter presents the hedonic pricing method and the multiple regression procedures followed to determine if stream protection ordinances have an effect on property values. The research methodology of the hedonic price model is introduced and its practical use is explained.

The functional form of the hedonic price model is described. The instruments and materials used to analyze the data are explained, including the process to convert and transfer the data. The statistical procedures, using SPSS, Version 7.5, are explained and the methodological assumptions associated with the model are discussed.

DESCRIPTION OF RESEARCH METHODOLOGY

The definition of hedonic is "pleasurable, as in amenities" (Morris, ed. 1969), thus a hedonic method strives to put a value on an amenity. The amenity in this study is a stream protection ordinance. The strength of ordinances and enforcement efforts vary among governments, which poses difficulties in putting an economic value on the ordinance. The hedonic pricing method uses a price observed for a market good, such as the sale of a home, to establish an implicit price for the non-market good, in this case, a stream protection ordinance (Mahan, 1997). The existence of a riparian buffer as a result of a stream protection ordinance is an environmental amenity that differentiates properties. The hedonic pricing method considers residential property as a composite

good encompassing many separate component characteristics, including environmental amenities of stream buffers. Sherwin Rosen provided the framework for the hedonic pricing method in an article in the Journal of Political Economy in 1974. The method relies on variations in residential property values to reveal implicit prices for each of the property attributes, while holding all other attributes constant. These implicit prices can then be used directly to assess the value of marginal changes in all of the attributes, including the environmental attributes, one of which is the presence of a stream protection ordinance.

Realtors have used this method for many years to compare and analyze the housing market. Many models have been developed for many uses in the housing industry. The available literature reports mostly on measures of tangible environmental amenities, such as proximity to hazardous waste sites. The studies did, however, provide guidelines for the framework of the model.

A study by Ridker (1967) was a precursor to the use of the hedonic pricing method. The study focused on the relationship between property values and environmental attributes. The results of the study found that property values varied systematically with air quality levels when median housing prices were regressed against the property characteristics, using various measures of air pollution as one of the variables. This model was used in following studies that were interested in water quality.

HEDONIC PRICING MODEL

DEPENDENT VARIABLE

The dependent variable in the study is the property value, expressed as the selling price of a home and land, each adjusted to 1982 prices by the Consumer Price Index for housing.

EXPLANATORY VARIABLES

The information available was compared to the parameters of the theoretical model to determine what data to collect for this study. Table 3 lists the parameters of the theoretical model and the variables included in the Cannon and Meridian Township data sets. Other data were available, but were considered to be insignificant in influencing housing prices.

RELATIONSHIP OF VARIABLES

Certain characteristics of the property will influence the selling price in different ways. As the measure of the attribute increases, the selling price will either increase (a positive relationship) or decrease (a negative relationship). For example, when the acreage of the lot increases, normally the price would increase as well. The statistical analysis will determine the nature of the relationship of the attribute to the selling price. The relationships of the variables are predicted in Table 4.

Table 3 • Comparison of Variables to Theoretical Model

Parameters In Theoretical Model	Cannon Township	Meridian Township
Property value of parcel	Selling price adjusted to same year	Selling price adjusted to same year
Property characteristics	Size of lot Age of house Total living area of house	Size of lot Age of house Total living area of house Exterior condition of the house Classification of building materials
Neighborhood characteristics	Rockford Public School District Forest Hills Public School District Lowell Public School District	Haslett Public School District Okemos Public School District East Lansing Public School District Williamston Public Schools
Accessibility characteristics	Distance to economic activity	Distance to economic activity
Level of environmental characteristics	Riparian before the ordinance Non-riparian before the ordinance Riparian after the ordinance Non-riparian after the ordinance	Riparian before the ordinance Non-riparian before the ordinance Riparian after the ordinance Non-riparian after the ordinance

Table 4 • Expected Relationships of Variables

Attribute	Expected relationship to dependent variable (selling price)
Stream Protection Ordinance	Positive
Acreage of lot	Positive
Square footage of living area	Positive
Age of house	Negative
Riparian before ordinance	Negative
Non-riparian before ordinance	Negative
Riparian after ordinance	Positive
Non-riparian after ordinance	Negative
Distance from economic activity	Negative
Preferable school district	Positive

CHAPTER 5 - RESULTS

This chapter presents results of the hedonic analysis, covering the estimated price function and the marginal willingness-to-pay. Models were estimated on the relationship between the housing transaction price and other housing attributes.

STATISTICAL PROCEDURES

The SPSS Version 7.5 statistical computer program was used to analyze the data using multiple regression analyses. The "Frequencies" function was run to verify the number of cases being entered into the model, and the statistical summaries, such as the means, standard deviations, minimum values, and maximum values were calculated. The variables were selected for the regression model. The adjusted price variable was the dependent variable and the other variables were the explanatory variables. The statistical characteristics of the variables were calculated and are presented in Table 5. The goodness-of-fit statistics were represented in R, R^2, adjusted R^2, and the Standard Error of the Estimate. Additional statistics investigated with the regression were the significant F changes and the Durbin-Watson test for collinearity. The statistical significance of the stream protection ordinance and other factors on property values was determined. Multiple regression analysis is a multi-variate statistical technique that describes how the dependent variable (property value) is related to the explanatory variables (other property characteristics), which creates the hedonic model.

Table 5. Statistical Information about the Variables

Cannon Variables	Valid Cannon	Valid Meridian	Mean Cannon	Mean Meridian	Minimum Cannon	Minimum Meridian	Maximum Cannon	Maximum Meridian
Acreage	260	208	3.5823	0.72	0.06	0.2	31	2.92
Age of house	254	202	18.79	36.11	2	1	152	149
Square footage of living area	255	202	1974.44	2132.97	440	840	4966	5456
Distance to nearest activity	269	224	1.994	1.79	0.5	0.75	3.5	3.5
Forest hills Schools	269	N/A	0.01	N/A	0	N/A	1	N/A
Lowell Schools	269	N/A	0.01	N/A	0	N/A	1	N/A
Rockford Schools	269	N/A	0.98	N/A	0	N/A	1	N/A
Haslett School District	N/A	224	N/A	0.24	N/A	0	N/A	1
Okemos School District	N/A	224	N/A	0.76	N/A	0	N/A	1
Non-riparian after ordinance	269	165	0.58	0.41	0	0	1	1
Non-riparian before	269	165	0.10	0.16	0	0	1	1
Riparian after ordinance	269	165	0.24	0.25	0	0	1	1
Riparian before ordinance	269	165	0.09	0.18	0	0	1	1
Selling price	269	157	$ 141,000	$ 162,042	$ 23,500	$ 20,000	$ 465,000	$ 455,000
Adjusted price 1982	269	157	$ 224,734	$ 110,954	$ 32,624	$ 17,212	$ 755,960	$ 315,753

This study used separate models for Cannon Township and Meridian Township, which allowed the analysis to compare two different types of communities that have different factors influencing sale prices. Sample sizes for the two models differed due to the amount of available data from the two townships.

RESULTS OF REGRESSION

The results of the regressions for the functional form are presented with the coefficient of multiple determination (R^2) and the significance of the coefficients in Table 6. Included in the summary are the number of observations (N), R^2, and the Durbin-Watson statistic.

Table 6 • Results Of Regression Analysis

Variable Name	Cannon Township Coefficient (significance)	Meridian Township Coefficient (significance)
Number of Observations R Square Durbin-Watson	N = 269 0.179 1.260	N = 163 .576 2.158
Constant	71695.86 (0.064)***	48111.051 (.090)***
Acreage of lot	1241.639 (0.179)	4368.880 (0.516)
Age of house	18.827 (.912)	-296.236 (0.180)
Square footage of living area	16.330 (.003)*	39.071 (.000)*
Distance to economic activity	-18147.9 (.000)*	-7811.697 (.325)
Lowell School District	15422.01 (.755)	N/A
Rockford School District	23311.32 (.520)	N/A
Forest Hills School District	Excluded	N/A
Haslett School District	N/A	Excluded
Okemos School District	N/A	1805.910 (.907)
Non-riparian before ordinance	-31834.9 (0.064)***	-15560.6 (.031)**
Riparian before ordinance	-34882.2 (0.028)**	-2215.656 (.771)
Non-riparian after ordinance	Excluded	Excluded
Riparian after ordinance	15676.13 (0.140)	17608.232 (.011)**

* Significant at the 0.01 level
** Significant at the 0.05 level
*** Significant to the 0.10 level

The model for Cannon Township explained 17.9% of the selling price variation and the model was statistically significant. The variables of square footage of living area and

distance to economic activity were significant at the 0.01 level. The variables of riparian before ordinance was significant at the 0.05 level. The non-riparian before ordinance variable was significant at the 0.10 level. The Durbin-Watson statistic was below the acceptable range, which could indicate slightly positive autocorrelations of the variables.

The model for Meridian Township explained 57.6% of the selling price variation and was also statistically significant. The analysis indicates that the variable of square footage of living area was significant at the 0.01 level. The non-riparian before ordinance and riparian after variables were significant at the 0.05 level. The Durbin-Watson statistic was in the acceptable range, indicating the independence of the observations.

The results were used to estimate the equation to predict the dependent variable from an independent variable. The constant in the equation is represented by where the line intersects 0 on the Y-axis. The constant in the equation for the Cannon Township model is 71,695.86, and was significant at the 0.10 level. The constant in the equation for the Meridian Township model is 48111.05, which also was significant at the 0.10 level.

A negative coefficients of an attribute implies that the predicted value of the dependent variable will decrease when the value of that attribute increases, and vise-versa. In the Cannon Township model, the attributes of the distance to nearest activity, non-riparian before ordinance, and riparian before ordinance all had negative coefficients.

The attributes in the Meridian Township model with negative coefficients were the age of the house, distance to economic activity, non-riparian before ordinance, and riparian before ordinance.

CHAPTER 6 – DISCUSSION OF RESULTS

The statistically estimated function that relates property values to the property characteristics measured the portion of the property value that is attributable to each of the attributes listed. The results were analyzed to determine if the influence of just the stream protection ordinance has an effect on property values.

ANALYSIS

Multiple regression analysis can be used for a variety of analytical purposes (SPSS, 1997). One purpose is to use the results to make strict statistical predictions. Another purpose is to create models that are more precise by reducing the number of predictor variables through conducting multiple regressions. A third purpose is to test the hypothesis concerning the relative importance of certain variables.

In this study, multiple regression was used to estimate the importance of variables in relation to one another. The means of the variables presented in Table 5 suggest that the characteristics of the data are similar between the two Townships, thus enabling parallel conclusion to be drawn. The R^2 (coefficient of multiple determination) of the model for Cannon Township was 0.179, indicating that 17.9% of the observed variability in the adjusted price is explained by the variables in the model. Many other factors are known to influence selling prices in Cannon Township. The rapid growth in the Township and the high value of recreational property currently have a strong influence on the Township's property values. The results of this study, which illustrate that property value

increased after the ordinance was adopted, should encourage residents to embrace the environmental protection measures that the Township officials are pursuing. Perhaps when the housing market becomes more stable in its growth rate, the stream protection ordinance will begin to have more of an influence on the price as residents begin to realize that the growth has degraded and reduced the natural features of the Township that once defined the rural atmosphere of the area.

The R^2 of the model for Meridian Township was 0.576, indicating that 57.6% of the observed variability in the adjusted price is explained by the variables in the model. Meridian Township is more developed than Cannon Township and the recognition of natural resources as valuable assets is quite high. The stream protection ordinance has been in existence for a longer period of time in Meridian Township and prices may now be reflecting the acceptance of the ordinance and the willingness-to-pay for riparian protection on the part of the homeowners. The residents of Cannon Township, as the residents have in Meridian Township, might come to realize that riparian properties are valuable, and protecting these areas through riparian restrictions is necessary to maintain environmental quality.

The multiple regression equation represents the line that best fits the data by minimizing the squares of the distance between the line and the points. The R^2 value of the Cannon Township model indicates that many other factors, which were not included in the model, are influencing the sale prices of the houses. However, the coefficients for the variables concerning riparian before the ordinance and non-riparian before the ordinance were

statistically significant at the 0.05 and 0.10 levels, respectively, which suggests that conditions before the ordinance was adopted were different than the conditions after the ordinance was adopted.

The signs of the coefficients for the variables in both Townships are similar and as expected, except for the age of the house variable in Cannon Township. With the increasing amount of development occurring in the area, newer homes would be expected to capture higher prices. The age of the house would be expected to influence property values inversely, since older homes are generally less attractive to buyers. The opposite is shown in the model, however, with a positive coefficient interpreted as older homes resulting in higher prices. Cannon Township is a rural area, with historic villages and old farmhouses dotting the countryside. The negative coefficients could represent homeowners' desires of living in a rural atmosphere and be interpreted that they are willing to pay more for the historical significance of the property. Neither of these variables, however, was statistically significant in the models.

The expected positive coefficients for acreage of lot and square footage of living area indicate a larger home, thus a higher price. The negative coefficients for distance to economic activity in both Townships indicates that houses closer to the commercial areas have higher selling prices. The negative signs for non-riparian before ordinance, and riparian before ordinance indicate that each of these conditions in both Townships decrease the selling price of the house as compared to a riparian or non-riparian parcel sold after the ordinance. The values and signs of the school districts are puzzling. The

variable may be meaningless though, since the districts allow school-of-choice, which allows a resident to apply for attendance at any school in the region, not just the district in which one resides.

Cannon Township's model explained some of the selling price in the variables selected. The coefficients that were significant in the results of the model are interpreted in following predictions:

1. For every square foot increase in living area, sale prices would increase by $16.33 on average with all other factors remaining constant.

2. For every half-mile increase in distance from the economic activity in the Township, sale prices would decrease on average $18,147.90 with all other factors remaining constant.

3. A riparian parcel sold before the ordinance would have sold for $34,882.20 less than a non-riparian parcel sold after the ordinance, with all other factors remaining constant.

4. A non-riparian parcel sold before the ordinance would have sold for $31,834.90 less than a riparian sold after the ordinance with all other factors remaining constant.

Meridian Township's model explained the majority of the selling price in the variables selected. The coefficients that were significant in the results of the model are interpreted as follows,:

1. For every square foot increase in living area, sale prices increase by $39.07 on average with all other factors remaining constant.

2. A non-riparian parcel sold before the ordinance would have sold for $15,560.60 less than a non-riparian parcel sold after the ordinance, with all other factors remaining constant.

3. A riparian parcel sold after the ordinance will sell for $17,608.23 more than a non-riparian parcel sold after the ordinance, with all other factors remaining constant.

The excluded variable in both models represent the non-riparian parcels after the ordinance was adopted, which becomes the base case from which the other results are compared. The signs of both the riparian and non-riparian parcels before the ordinance were negative. Most would find that curious, since a riparian parcel would be expected to have a higher value than a non-riparian parcel regardless of the presence of an ordinance. This finding indicates that unknown factors are contributing to the changes in the expected values and additional investigations would be required to determine those factors.

The adjusted price in this study was determined by dividing the selling price by a factor of inflation related to 1982. This adjustment could be partially responsible for the unexpected results of the parcels before and after the ordinance. Using an alternate conversion of the data could address this issue. An indicator variable could be established for each year of sale. The model could use the earliest year in the data as the base case to create highly significant variables in the model that would get larger as time goes on. This time adjustment could account for the unknown variables related to the riparian and non-riparian parcels either before or after the ordinance.

The stream protection ordinance was modeled using indicator variables for riparian and non-riparian parcels and before and after the ordinance was adopted. The coefficient of the indicator variable, if statistically significant, provided an estimate of the price increase or decrease associated with the ordinance, with all other factors being constant. The fact remains, however, that not all components of housing prices are, nor possibly could be, included in this study. The addition of variables relating to the physical characteristics of the properties and the neighborhoods could greatly improve the model, however. The interpretation of the results, therefore, is carefully presented and should be accepted conceptually, rather than empirically.

Although the results of these models do not support a strong linear relationship of the variables, the significance of the coefficients suggests that these variables are important to the determination of the selling price. The basic variables that are essential information for a homebuyer and usually the first questions that homebuyer have about a piece of

property are included in the model, creating a usable framework if the study were to be expanded.

Leefers (1996) attempted to estimate price trends for the AuSable River in northern Michigan to compare sale prices of riparian lands before and after the Natural Rivers designation. He reported that the regression results were not statistically significant and concluded that no evidence was able to support or refute any effect of the designation on property values. The sample size of his study, however, was very small. The results reported for Cannon and Meridian Townships were based on a slightly larger sample size and indicate that prices are statistically different for riparian parcels after the ordinances. Studies that continue to provide information and improve models for estimating environmental protection need to be conducted to keep these issues in the spotlight for planners and officials to use in making land use decisions.

METHODOLOGICAL ASSUMPTIONS

The use of a multiple regression or ordinary least squares model has assumptions associated with its use. The model assumes that all of the relevant explanatory variables are in the model, and the price is linearly related to the variables. Another assumption is that the variables are controllable and measured without error and with no exact linear relationship between any two of the variables (MDNR Resources, 1979).

The hedonic pricing method is formed on the assumption that the value of the environmental attribute of interest is partially realized in property values (Rosen, 1974).

Two additional assumptions are required to apply the model. The first assumption is that the residential area used to model the relationship between property values and environmental attributes can be treated as a single market for housing services, thus no segmentation is required. The homogeneous nature of Meridian Township precluded the need for market segmentation within the model. Cannon Township could be segmented into markets similar to the boundaries of the stormwater management zones, which divides the Township into the high-density area of the lakes, the rural residential area in the central portion, and the urban developed area in the southwest. For this study, however, Cannon Township was considered to be one market.

The second assumption is that the housing market is in equilibrium, thus home buyers made utility-maximizing choices given housing pricing for alternative locations, and these prices brought buyers and sellers together to clear the market for the existing stock of homes in the market area (www.wrsc.usace.army.mil). The assumption that the housing market is in equilibrium excludes the possibilities of a bias in the study. If the market were not composed of free buyers and sellers, where the prices adjust immediately to changes in supply and demand, then a biased would be introduced (Hite, 1998).

The model also assumes that buyers have full knowledge of all of the property characteristics. This is not always the case. Homebuyers hire inspectors to assess the physical characteristics of a home. Real estate agents are hired to ensure the legality of the sale, but might not always contact township officials about land use restrictions or

intangible amenities that have special rules or ordinances. Most buyers and sellers are probably not aware of environmental restrictions placed on their properties through stream protection ordinances, nor are they likely aware of the benefits that stream buffers have on water quality. The validity of these assumptions could compromise the validity of the results.

UNCONTROLLABLE FACTORS

Property records are typically very reliable and are filed in an efficient manner for investigation. Filters can be applied to clean the data and ensure that "outliers," values that do not fit the criteria, are eliminated. The availability of the data, however, is often limited in what is collected for an area in terms of importance to the selling price of a house. Valiant efforts can be made to collect, analyze, manipulate, and calculate additional variables, but unknowns will always be present. Property markets are relatively efficient in responding to information and are thus good indicators of value. Unknown influences on the markets, however, can often lead to unpredictable upturns or downturns, which ultimately effect housing sales.

EVALUATION OF METHODOLOGY

The success of the results of a study often depends on the reliability and validity of the data used in the study. The reliability of the data used in this study appears to be very high since the information collected was from county and township offices for tax purposes and under close scrutiny of the tax paying homeowner. To reduce uncertainties

of the quality of the data, the actual selling price of the home was used, rather than the assessed price. The use of the selling price eliminates the subjectivity of an assessor, and reflects the truer market value of the house. The validity of the data is satisfactory, since assumptions must be made about whether all of the defining characteristics have been included in the model. Property values are influenced by many other factors that might not be quantifiable or attainable.

Property sales information is available to the general public, thus the data were fairly easily obtained, once the most informative source was found. Property sales can be related to other secondary sources of data to obtain descriptive variables for the analysis. The model is versatile in that it can be adapted to consider several possible interactions between market goods and environmental quality.

LIMITATIONS AND WEAKNESSES

The advantages of using the hedonic price methods are that the estimated values in the results of the model are based on actual choices, the price that the buyer was willing to pay, and the price that the seller was willing to accept. A basic assumption in the application of hedonic modeling to housing transactions is that the individuals participating in real estate markets have full information about all the characteristics of a given property (Hite, 1998). Property markets are relatively efficient in responding to information, when full information is available, and are good indications of value. Stream protection ordinances are an attribute along with the size of the lot and the neighborhood school district. The knowledge base of the typical homebuyer does not include the

implications of a stream protection ordinance as it would the reputation of a school, for example. This difference in the awareness of the value of attributes could influence the results since the attribute would not be realized in the property price.

The regression analysis may be complicated by the relationship between values and attributes not being linear if the values increase at an increasing or decreasing rate when the attributes change. Many of the attributes are closely linked to one another, which may make the values change in similar ways. Understating the significance of some of the variables in this case may be the result. Different functional forms and model specifications for the analysis were considered to address the bias.

The scope of environmental benefits that can be measured in this study is limited to those that are related to housing prices. The hedonic method will only capture people's willingness to pay for perceived differences in environmental attributes and their direct consequences. If homebuyers are not aware of the linkages between environmental attributes and the benefits to them or their property, the value will not be reflected in housing prices. The method assumes that homebuyers have the opportunity to select the combination of features they prefer, given their income. However, the housing market may be affected by outside influences, such as taxes, interest rates, or other factors. Large amount of data must be gathered and manipulated. The time and expense to carry out an application depends on the availability and accessibility of data (www.cbl.cees.edu). The hedonic method does not tell the researcher why the attributes are affected or why results

go one way or another. Further qualitative study would be required, such as interviews, to get perceptions and reasons for choices made.

ESTIMATION ISSUES

The hedonic price function is estimating the value of the stream protection ordinance as a reflection of both the value of the land and the value of the house on that land. Stream protection ordinances normally only directly affect riparian land and not structures on the land. Difficulties are encountered with that approach since land and the structures are almost always sold together, therefore the entire land and house transaction prices were used and the house characteristics were accounted for in the hedonic price equation.

The estimation issues for the explanatory values fall into several categories. Determining what characteristic will be included as the explanatory variables is the most important issue. Factors that constitute to selling price will be different for every community. Investigating what was important to Cannon Township and Meridian Township was at times subjective. The amount of variables to collect was limited by time and available information. Unlimited quantities of time, information, and money, could greatly increase the accuracy of identifying the pertinent variables for the study.

CHAPTER 7 – CONCLUSIONS

The purpose of this study was to contribute to the understanding of the economic impacts of stream protection ordinances. The hypothesis was presented in Chapter 1 of this study regarding the impact that stream protection ordinances have on property values. The hypothesis was:

- Stream protection ordinances have a significant influence on riparian residential property values.

The results of the study support this hypothesis, although the regression results do not suggest strong linear relationships. The results for both Cannon Township and Meridian Township analyses were statistically significant.

Cannon Township riparian parcels were found to be higher in value after the ordinance was adopted by $15, 676.13. A surprising similar amount, $17,608.23, was determined to be the differential price in Meridian Township for riparian parcels after the ordinance was adopted. This willingness to pay for riparian parcels after a stream protection measure has been put in place is a hopeful indication that homebuyers are becoming aware of the importance of protection riparian areas for water quality and that they are willing to pay for the aesthetic and ecological benefits.

SIGNIFICANCE OF STUDY

As community leaders increase their knowledge of methods to improve environmental quality, those affected by the decisions become more accepting of the methods. Stream protection ordinances are gaining in acceptance, and developers, real estate agents, and homebuyers will be more aware of these regulations and protection strategies in the future. This study will strengthen the arguments for the adoption of stream protection measures and inspire developing communities to implement these measures before streams have been impacted by development. The results of this study could be the evidence that Township officials, such as those in Ada Township mentioned in Chapter 1, could present to their residents to promote the adoption of the ordinance.

This study addresses the roles that economics and science have in the formation of natural resource policies. Continued research on the pollution reducing benefits of buffers will lead to stronger ordinances. Supporting that research with studied economic impacts to the community and the individual will facilitate the cooperation of those necessary to get the ordinances passed. Policy makers and local communities must understand possible effects of ordinances on property values. Private and public good are served when ordinances positively affect property values. However, if property values are affected negatively by an environmental protection measure, local officials must decide if the public good should prevail over the private loss.

An assumption of the model, stated earlier, was that of knowledgeable buyers and sellers securing the housing transaction (Hite, 1998). If stream protection ordinances were shown to negatively impact property values, a possible benefit to property values could still result from this assumption. A knowledgeable buyer might value stream protection ordinance, but pay less for a home because of the restriction. The sale of that home influences other properties to have lower values. The effect is that those buyers not valuing stream protection ordinances and the environmental benefits they provide would be enjoying other attributes that they do value at lower prices than otherwise possible.

Although homeowners might enjoy the aesthetics of a riparian buffer, they might not know why or how it exists. Buyers could be willing to pay more for the scenery, not knowing that a stream protection ordinance exists, which in essence is paying for the ordinance. If buyers are not aware of the ordinance, the assumption that it affects property values should not be made. However, when issues are important to homeowners, such as the township planning to build a sewage treatment plant in the neighborhood, word spreads around the neighborhood and property values are affected. If buyers are not aware of the ordinance, then maybe it's because the ordinance is not an issue in that community, thus property values are not affected.

FUTURE RESEARCH CONSIDERATIONS

A similar study as this could be conducted in communities that have floodplain ordinances that delineate the floodplain and restrict land use activities in that area. The date of sale of the parcel could be compared to the date of the completion of the Flood

Rate Insurance Map and the model could determine if the delineation had an effect on property values. Parcels could be identified in the 2-, 10-, 25-, 100-, and 500-year floodplains and entered into the database. Questions to be asked include: Does the risk of being in a floodplain override the impact that the floodplain ordinance might have? Is the property worth paying more for since insurance is available? Is the property worth paying less for since it gets flooded? What influence does the floodplain delineation have on properties outside of the floodplains?

The selection of the variables and the hedonic analysis could be integrated with a Geographic Information System (GIS). Models can be extremely accurate using GIS techniques. Factors that contribute to the selling price of a house can be specified and econometric methods can be used to estimate equations. Measurements of neighborhood and spatial information are easily obtained with GIS.

Many communities often have bits and pieces of water resource protection strewn throughout their codes of ordinances and zoning ordinances, but not a comprehensive stream protection strategy. A study that evaluated these different levels of stream protection and incorporated those levels as a variable in this model could predict the effect on property values by the strength of the stream protection measures.

More study areas could be added to this analysis to gain a broader perspective of the results. Few communities, however, have enforceable stream protection ordinances at this time. Cannon Township passed a stormwater ordinance in October 2001 that delineated

the Township into zones according to the degree of environmental protection required to protect water quality (Figure 5). Zone A is the most restrictive zone, where the headwaters of two high quality trout streams exist. Zone B is a slightly impacted area, where development is occurring and site plans have certain criteria for stormwater management. Zone C is the urbanized area, where streams are already impacted, and development rules contain urban BMPs for water quality. Data could be collected in a few years and entered into this hedonic model to determine if the stormwater management zones, and their associated restrictions and development criteria, had an effect on property values.

Additional variables with numeric values, rather than indicator values, would improve the fit of the model and increase its precision. Many sources are available to collect certain facts and figures about areas, such a regional planning commissions and real estate boards. These sources should be more fully investigated to ensure that all factors feasible to contributing to the selling price have at least been considered.

SUMMARY

Stream protection ordinances play an important role in the quality of local water resources. The services that stream buffers provide, such as wildlife habitat, water quality protections, recreation, and aesthetics, are collective-good characteristics, meaning that they benefit greater society at large (Mahan, 1997). Non-market valuation techniques were used to estimate the economic value of stream protection attributes that represent collective goods to improve water protection and land use efforts. This study used the

hedonic price method to estimate the impact of stream protection ordinances on property values in two townships in southern Michigan.

The study analyzed property values in relation to housing attributes. The study found that in Cannon Township the values of riparian properties after the ordinance were more than riparian and non-riparian properties prior to the ordinance being adopted, equalizing prices to 1982 and with all other variables remaining constant. The same was true in Meridian Township. The hedonic pricing method allows the quantification of the stream protection ordinance's contribution to property values. The results showed an effect on property values, thus a stronger argument for the adoption of the ordinance can be made.

The study of Act 250 in Vermont (Sanford and Stroud, 2000) stressed the importance of consistent and realistic application of stream buffers to truly improve water quality. The adoption of the comprehensive land use law is commendable, but the application must be directed to all activities equally and uniformly to be effective and enforces at a local level for the regulations to become a legitimate consideration of managing growth.

The findings of this study revealed that many different attributes of a piece of property contribute to its selling price, a stream protection ordinance being one of them. Local officials must have economic and scientific support for deciding whether to adopt a protection ordinance for the natural resources in their community. The preliminary evidence presented in this study provides the economic support that a stream protection ordinance can increase property values in certain communities.

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APPENDIX 1

Cannon Township Ordinances

CHAPTER 18

BEAR CREEK WATERSHED PROTECTION OVERLAY DISTRICT

SECTION 18.01 PURPOSE. The purpose of this chapter is to establish regulations to preserve and enhance the integrity of Bear Creek, Armstrong Creek, Stout Creek and associated tributaries which make up the Bear Creek Watershed. These creeks and streams are a valuable natural resource of Cannon Township as they contribute to the Township's rural character, provide scenic views and serve as a habitat for fish and wildlife. The regulations are designed to prevent soil erosion along creek banks, prevent sedimentation from entering the creeks, preserve and enhance vegetation along the creeks, and ensure adequate setbacks for buildings, structures and septic systems.

This is an overlay district and is intended to supplement the regulations of any underlying zone.

SECTION 18.02 APPLICABLE REQUIREMENTS AND DISTRICT BOUNDARIES.

(a) The requirements of this chapter are in addition to and shall supplement those imposed on the same lands by any underlying zoning provisions of this ordinance or other ordinances of Cannon Township. These regulations supersede all conflicting regulations of the underlying zoning districts to the extent of any such conflict.

(b) The boundaries of the Bear Creek Watershed Protection Zone shall include all lands which are within 100 feet beyond the ordinary high water mark on each side of those creeks and tributaries shown on the Official Cannon Township Zoning Map and as described below:

(1) Bear Creek
(2) Stout Creek
(3) Armstrong Creek
(4) Flowing tributaries (even if intermittently flowing) of any of the creeks described in (1), (2) and (3) above.

SECTION 18.03 DISTRICT REGULATIONS.

(a) Natural Vegetation Strip

(1) To minimize erosion, stabilize the creek bank, protect water quality, keep nutrients out of the water, maintain water temperature at natural levels, preserve fish and wildlife habitat, screen manmade structures, and also to preserve aesthetic values of the creek area, there shall be a natural vegetation strip on all banks within 25 feet of the ordinary high water mark; provided, however, that artificially maintained vegetation strips along creek banks within 25 feet of the ordinary high water mark that are in existence at the

time of adoption of this ordinance may continue, but if such artificially maintained vegetation strips thereafter return to a natural state, then they shall not again be artificially maintained.

(2) Natural ground cover shall be preserved to the fullest extent feasible and where removed it shall be replaced with vegetation that is equally effective in retarding runoff, preventing erosion and preserving natural beauty.

(3) Within the natural vegetation strip, trees and shrubs may be selectively pruned or removed for harvest of merchantable timber, so as to achieve a filtered view of the creek from the principal structure and for reasonable private access to the creek. These pruning and removal activities shall insure that a live root system stays intact to provide for streambank stabilization and erosion control and to insure that any path to the creek or tributary is no greater than 10 feet in width, and that it will meander down to the ordinary high water mark in a manner which protects the soil and vegetation from erosion. Clear cutting within the natural vegetation strip is prohibited.

(4) Dead, diseased, unsafe or fallen trees and noxious plants and shrubs, including poison ivy, poison sumac and poison oak, and other plants regarded as a common nuisance under Section 2, Public Act 359 of 1941, as amended, may be removed.

(5) Planting of perennial native species in the natural vegetation strip is encouraged, especially where exposed soil and steep slopes exist and in reforestation efforts.

(b) Minimum Setback from Creek

(1) A principal building shall be set back at least 100 feet from the ordinary high water mark of any of the creeks or tributaries regulated by this Chapter except as permitted below:

(i) A principal building to be erected on a vacant legal non-conforming lot of record may be closer than 100 feet to the ordinary high water mark if it is demonstrated to the Zoning Administrator that compliance with this setback requirement would prohibit the construction of the principal structure. The reduction in the setback shall be the minimum necessary to construct the principal structure. The Zoning Administrator may refer such decision to the Planning Commission.

(ii) For lots which have a steep bank abutting the creek, a principal building may be set back a minimum of 50 feet from the top of the bank. For purposes of this chapter a steep bank shall be defined as being at least 10 feet high (measured vertically from the ordinary high water mark to the top of the bank) with a slope of at least 33 percent (determined by dividing the vertical height of the slope by the horizontal distance of the slope).

(c) Septic disposal fields and tanks shall be at least 100 feet away from the ordinary high water mark and shall be in conformance with the standards of the Kent County Health Department.

SECTION 18.04 EXISTING USES AND STRUCTURES. Those land uses, buildings and structures which existed before the effective date of this Chapter and which do not conform to the requirements of this Chapter shall be non-conforming and subject to the applicable non-conforming use provisions of this Ordinance. If a natural vegetation strip as regulated herein exists on a lot as of the effective date of this Ordinance, it shall be subject to the regulations of this Chapter, but any regulations which are more restrictive than these shall prevail over this Chapter.

CHAPTER 19

ROGUE RIVER NATURAL RIVER OVERLAY DISTRICT

SECTION 19.01. DEFINITIONS. The following definitions apply to this Section:

(a) "Bluff" means the top of a steep bank rising sharply from the water's edge of a river or stream.

(b) "Zoning Administrator" means the agency or individual appointed by the appropriate governmental subdivision to administer provisions of Act No. 230 of the Public Acts of 1972, including issuance of zoning permits.

(c) "Cutting edge of the river" means the outside edge of a river or stream where water velocity has increased to the point where it may cause soil or stream bank erosion.

(d) "Filtered view of the river" means maintenance or establishment of woody vegetation of sufficient density to screen developments from the river, to provide for stream bank stabilization and erosion control, to serve as an aid to infiltration of surface runoff, and to provide cover to shade the waters. The vegetation need not be so dense as to completely block the river view. It means no clear cutting.

(e) "Natural river district" means the Rogue River Natural River District as described in Section 19.02.

(f) "Ordinary high water mark" means the line between upland and bottomland which persists through successive changes in water level, below which the presence and action of the water is so common or recurrent that the character of the land is marked distinctly from the upland and is apparent in the soil itself.

(g) "River's edge" means the ordinary high water mark as used in Act No. 346 of the Public Acts of 1972, being 281.951 et seq. of the Michigan Compiled Laws and defined in Section 19.01(f).

(h) "Reforestation" means renewal of vegetative cover by seeding, planting or transplanting.

(i) "Soil erosion and sedimentation control enforcement agency" means the local agency appointed by the appropriate governmental subdivision to enforce the provisions of Act No. 347 of the Public Acts of 1972, being 282.101 et seq. of the Michigan Compiled Laws.

SECTION 19.02. BOUNDARIES; RULES OF CONSTRUCTION; DISPLAY AND FILING OF ZONING MAP; EFFECT OF ZONING PROVISIONS.

(a) The boundaries of the Rogue River Natural River District shall be as hereinafter described and as depicted in the Rogue River Natural River District as shown on the official Cannon Township Zoning Map. The Rogue River Natural River District comprises that area described as follows:

(1) Barkley Creek from Blakely Drive downstream to the west boundary line of Section 6 of Cannon Township.

(2) Rum Creek from 10 Mile Road in Section 4, downstream to the north boundary line of Section 5 of Cannon Township.

(3) The lands lying within 300 feet of the edge of the waters numerated in subdivisions (1) and (2).

(b) The provisions of this chapter do not repeal, abrogate, or impair any existing easements, covenants, or deed restrictions applicable to lands within the natural river district, except that where this chapter imposes greater restrictions than found on such easements, covenants, or deeds, the provisions of this chapter shall prevail.

(c) This chapter does not permit actions prohibited by other statutes or ordinances, including other sections of this zoning ordinance, applicable to the natural river district, therefore:

(1) All earth changing activities, other than normal landscaping or maintenance, undertaken within 500 feet of a lake or stream, are subject to provisions of Act No. 347 of the Public Acts of 1972, being 282.101 et seq. of the Michigan Compiled Laws.

(2) All dredge and fill activities and construction of permanent structures lying below the ordinary high water mark are subject to provisions of Act No. 346 of the Public Acts of 1972, being 281.951 et seq. of the Michigan Compiled Law.

(d) Where uncertainty exists with respect to the boundaries indicated on the Rogue River Natural River Zoning Map, the following rules shall apply:

(1) Boundaries indicated as approximately following streets or highways shall be construed to be the centerlines of the streets or highways.

(2) Boundaries indicated as approximately following lot lines shall be construed as following such lot lines.

(3) Boundaries indicated as approximately following such city, township, or county boundary lines shall be construed as following such city, township, or county boundary lines.

(4) Boundaries indicated as approximately following railroad lines shall be construed to be midway between the main tracks.

(5) Boundaries indicated as approximately parallel to the centerlines of streets or highways shall be construed as being parallel thereto and at such distance therefrom as indicated on the official Rogue River Natural River Zoning Map. If no distance is given, the dimension shall be determined by the use of the scale shown on the official Rogue River Natural River Zoning Map.

(6) Boundaries following the shoreline of a river, stream, lake, or other body of water shall be construed to follow such shoreline and, in the event of change in the shoreline, shall be construed as moving with the actual shoreline; boundaries indicated as approximately following the thread of streams, canals, or other bodies of water shall be construed to follow such threads.

SECTION 19.03. PERMITTED USES.

(a) The following uses shall be permitted by the owner upon the owner's property within the Natural River District, subject to limitations and requirements outlined in the zoning ordinance, and other applicable statutes:

(1) Private camping and other recreational activities not requiring installation of permanent structures within 150 feet of the designated mainstream and 100 feet of the designated tributaries.

(2) Operation of motorized watercraft subject to limitations of local ordinances established under authority of Act No. 303 of the Public Acts of 1967, being 281.1101 et seq. of the Michigan Compiled Laws.

(3) Fishing and hunting in compliance with existing laws and rules.

(4) Reforestation and other accepted forest management practices, subject to the limitations outlined in Section 19.04.

(5) Normal agricultural activities, if those activities meet the requirements of this Chapter, and when the Bureau of Environmental Protection of the Department of Natural Resources determines that such activities do not contribute to stream degradation.

(6) Operation of licensed motor vehicles on dedicated public roads or access roads to private single-family dwellings.

(7) Off-road operation of emergency and public utility maintenance vehicles.

(b) The following uses are permitted upon approval of the Zoning Administrator:

(1) One single-family dwelling and appurtenances on a lot not less than 200 front feet wide, subject to the following limitations:

(i) On the designated tributaries, the setback shall be 100 feet from the river's edge.

(ii) Setback shall be not less than 15 feet from side lot lines and not less than 25 feet from the right-of-way of a public road.

(iii) New structures shall not be located on land that is subject to flooding.

(iv) New structures shall not be closer than 50 feet from the top of the bluff on the cutting edges of the river and tributaries.

(2) Plats, if the minimum setback and lot width requirements specified in subsection (1) are met.

(3) Private boat docks not to exceed six feet in width or 20 feet in length, with not more than four feet of the dock extending over the water, if designed, constructed, and maintained with indigenous natural materials.

(4) Mining and extractive industries more than 300 feet from the ordinary high-water mark, if constructed and operated pursuant to applicable laws and rules of the state and local ordinances.

(5) Utility lines to service private single-family dwellings.

(6) Surface gas and utility lines on lands, or interests in real property continuously owned by a utility from and after January 1, 1971, subject to review and approval by the planning commission.

(7) Disposal of fields and septic tanks located at least 100 feet from the water's edge and in conformance with the State and County Health Codes, and the provisions of this Chapter.

(8) Land alteration (grading, dredging or filling) of the land surface, unless the high groundwater table is within six feet of the land surface, if the activities meet all provisions of Act No. 347 of the Public Acts of 1972, and Act No. 346 of the Public Acts of 1972, being 282.101 et seq of the Michigan Compiled Laws, and approval is granted by the local soil erosion and sedimentation control enforcement agency and the Department of Natural Resources.

(9) Signs and outdoor advertising devices if otherwise permitted in the Zone District must be:

(i) Related to permitted uses.

(ii) Not more than one square foot in area for residential uses and not more than four square feet in area for any other uses.

(iii) Not illuminated by any neon light or flashing device.

(iv) Not attached to any tree or shrub.

(10) Other uses for which an applicant is granted a permit by the Zoning Administrator.

SECTION 19.04. NATURAL VEGETATION STRIP. A restricted cutting belt 25 feet wide on each side of the designated tributaries will be maintained. Trees and shrubs may be pruned for a filtered view of the river upon approval by the Zoning Administrator, but clear cutting in the natural vegetation strip is prohibited. The natural vegetation strip is also subject to the following provisions:

(a) Dead, diseased, unsafe, or fallen trees and noxious plants and shrubs, including poison ivy, poison sumac, and poison oak, may be removed.

(b) Selective removal or trimming of trees for timber harvest, landscaping, or public utility facilities is permitted upon approval of the Zoning Administrator.

SECTION 19.05. SPECIAL EXCEPTION PERMITS.

(a) Special exception permits may be granted to allow a use in the Natural River District that is not specifically permitted by Section 19.03, where implementation of that use does not contravene the purposes of this Chapter.

(b) Application for a special exception permit shall be made on a form provided by the Zoning Administrator and shall be submitted to the Zoning Administrator for approval.

(c) Upon reviewing an application for a special exception permit, the Zoning Administrator, at any time prior to rendering a decision thereon, shall require the applicant to furnish any of the following information as is deemed necessary by the Zoning Administrator for determining the suitability of the particular site for the proposed use:

(1) A detailed description of the proposed activity or use.

(2) A surface view plan giving accurate dimensions on either a scale drawing or a rough sketch showing elevations or contours of the ground, including existing earth fills; generalized vegetative cover; size; location and spatial arrangement of all proposed and existing structures on the site; and the location and elevations of streets, access roads, and water supply and sanitary facilities.

(3) Photographs showing existing land uses and vegetation upstream and downstream from the proposed use.

(4) Valley cross sections showing the natural stream channel, stream banks, and high watermarks and flood marks, if known, with indication of locations of proposed developments.

(5) Any other information deemed relevant by the Zoning Administrator and necessary to carry out the intent and provisions of this Chapter.

(d) Before considering applications, the Zoning Administrator shall give notice by certified mail to all property owners and residents within 500 feet of the proposed use as shown on the current tax assessment rolls, to the County Soil Erosion and Sedimentation Control enforcement agency, Soil Conservation Service, and Regional Office and Natural Rivers Section of the Department of Natural Resources, and to any other interested party who requests that they be notified of such requests in the Natural River District.

(e) In reviewing an application, the Zoning Administrator shall consider all of the following:

(1) All relevant factors specified in these rules in light of the spirit and intent of the purposes specified in Section 19.01.

(2) The economic effect of the subject property weighed in light of the applicant's entire contiguous holdings and not merely the portion within the Natural River District. If the subject portion is the remainder of a larger holding, this fact and a description of the title history shall be included in the hearing evidence.

(3) Increase in flood levels and flood damages that may be occasioned by the proposed use at the site and upstream and downstream from the site, water quality consequences, and other factors relevant within the terms of this Chapter.

(4) Cumulative effect upon the Natural River District from potential development of holdings in a legal position similar to the applicant's, if the applicant's request is approved by the Zoning Administrator.

(5) Reasonable alternatives available to the applicant.

(f) In weighing the applicant's request, consideration of public health, safety, and welfare shall prevail, unless private injury is proved by substantial preponderance of the evidence to be so great as to override the public interest.

(g) A requested use shall not be granted where the Zoning Administrator determines that the requested use poses substantial hazard to life or property rights, either public or private.

(h) The Zoning Administrator may require public hearings to be held regarding the application. The Zoning Administrator shall decide an application within 30 days after receiving the application, except that where public hearings are held or additional information is required pursuant to Subsection (c), he shall render a decision within thirty (30) days following the hearings or upon receipt of the last requested information.

(i) The Zoning Administrator shall attach such conditions to the granting of a special exception as are necessary to further the purposes of these rules.

SECTION 19.06. SUBSTANDARD LOTS OF RECORD.

(a) The Zoning Administrator may grant a zoning permit for erecting a structure permitted by this Chapter on a lot of record if the lot is of insufficient width, depth, or area, or there exists physical limitations on an existing lot or parcel, or a lot described in a deed or land contract executed and delivered prior to the effective date of this Chapter, which precludes a proposed structure from complying with the terms of this Chapter. The Zoning Administrator shall insure that all structures are located to best meet the objectives and purposes of these rules, the adopted Rogue River Natural River Plan, and the Natural River Act of 1970.

(b) The Zoning Administrator shall determine if a proposed structure on a lot of record, or a lot described in a deed or land contract executed and delivered prior to the effective date of this Chapter, cannot conform to those standards listed in Section 19.03 and is, therefore, ineligible for consideration for use under Section 19.03(b)(1).

(c) Application for a permit on all lots of record shall be filed in writing with the Zoning Administrator.

(d) In considering a request for use of a substandard lot of record, the Zoning Administrator shall grant a zoning permit only upon a showing that the following standards are met:

(1) Will not be contrary to the public interest.

(2) Will not permit establishment of a use not otherwise permitted by these rules.

(3) Relates only to the property under the control of the applicant, and any practical difficulties are not the result of actions taken by the applicant.

(4) Will pose no substantial hazard to life or public or private property rights, and that the spirit of the rules shall be observed, public safety secured, and substantial justice done.

(5) Will not, if granted, result in an increase of flood levels or risk of flood damage to other lands, and will be developed in accord with Department of Natural Resources requirements under Act 167 of the Public Acts of 1968, and Act 291 of the Public Acts of 1954, as amended.

(6) Will not significantly impair existing water quality, vegetative cover, fisheries, or wildlife habitat, or increase risk of erosion.

(7) Will be the minimum dimensional reduction necessary to achieve a reasonable use of the land after evaluation of alternative dimensional arrangements and permitted land uses available to the applicant given the peculiar characteristics of the lot and circumstances surrounding the request. Alternatives shall be examined in light of the applicant's entire contiguous holdings, and not merely a single lot or the portion within the natural river area. Where dimensional requirements may be more nearly met through lot combination of contiguous holdings, the Building Inspector may so require.

(8) Will be granted with the condition that no fill is placed within the natural vegetation strip, and that approval of both the appropriate County Health Department, and Soil Erosion and Sedimentation Control enforcement agency is secured.

(9) Will, if granted, contain any conditions necessary to insure proper development as closely in accord with the intent and requirements of this Ordinance as is reasonable to require.

APPENDIX 2

Meridian Township Ordinances

SECTION 82-16 CONSERVANCY DISTRICT

82-16.1 Purpose: It is the purpose of the Conservancy District to protect the natural, human and economic resources of the Township, and to promote the public health, safety and general welfare; by application of special regulations for the use of land which may be subject to periodic inundation at predictable intervals which may be subject to soil erosion, or which may be particularly suited to provide for the impoundment of waters for the purpose of storm water control or groundwater recharge. Said regulations, while permitting reasonable economic use and considering the physical limitations of such land, will help to protect the public health, public safety and general welfare, and will reduce the financial burdens imposed upon the community which may result from the improper use of land. All lands included in said district shall be subject to the terms imposed herein in addition to the terms imposed by any other district in which said lands may be located.

82-16.2 Definitions:

a. **BULKHEADING:** The protection of fill material from erosion through the use of a retaining wall.

b. **CUT:** Portion of land surface or area from which earth has been removed or will be removed by excavation; the depth below original ground surface to excavated surface.

c. **DEBRIS BASIN:** A barrier or dam built across a waterway or other suitable locations to retain rock, sand, gravel, or silt or other materials.

d. **DEVELOPMENT:** Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operation.

e. **EROSION:** The wearing away of the land surface by the action of wind, water or gravity.

f. **FLOOD INSURANCE RATE MAP:** That map or maps prepared by Federal Emergency Management Agency which classifies the floodplain into various zones for purposes of determining flood insurance rates within the Township, a copy of which is available for examination at the Department of Community Planning and Development of the Charter Township of Meridian.

g. **FLOOD INSURANCE STUDY:** A study prepared by the Federal Emergency Management Agency which examines, evaluates and determines flood hazards, and if appropriate, corresponding water surface elevations for the Charter Township of Meridian.

h. **FLOODPROOFING:** Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

i. **FLOODWAY:** The channel of the watercourse and those portions of the adjoining flood plains which carry and discharge the intermediate regional flood, as determined by the Federal Emergency Management Agency and as indicated on the Flood Insurance Rate Map.

j. **FLOODWAY FRINGE:** That portion of the intermediate regional flood plain located outside of the floodway which may generally be considered as the backwater area of the intermediate regional flood.

k. **GRADING:** Any stripping, cutting, filling, stockpiling, or any combination thereof, and shall include the land in its cut or filled condition.

l. **GRADING PERMIT:** A permit issued to authorize grading under the Charter Township of Meridian Building Code.

m. **INTERMEDIATE REGIONAL FLOOD:** A flood which is representative of large floods known to have occurred generally in the area and is reasonably characteristic of what can be expected to occur in a particular stream. The intermediate regional flood generally has a one percent (1%) chance of being equaled or exceeded in any given year.

n. **INTERMEDIATE REGIONAL FLOODPLAIN:** The area inundated by the intermediate regional flood. This is the flood plain area which shall be regulated by the standards and criteria of this ordinance, as indicated on the Flood Insurance Rate Map and as indicated in the Flood Insurance Study.

o. **MULCHING:** The application of plant or other suitable materials on the soil surface to conserve moisture, hold soil in place, and aid in establishing plant cover.

p. **OBSTRUCTION:** Any dam, wall, wharf, embankment, levee, dike, pile, abutment, projection, excavation, bridge, conduit, culvert, building, wire, fence, rock, gravel, refuse, fill, structure or matter in, along, across, or projecting into any channel, water course, or regional flood hazard area which may impede, retard or change the direction of the flow of water or that is placed where the flow of water might carry the same downstream to damage of life or property.

q. **SEDIMENTS:** Solid material, both mineral and organic that is in suspension, if being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

r. **SEDIMENT POOL:** The reservoir space allotted to the accumulation of submerged sediment during the life of the debris basin.

s. **SOIL:** All unconsolidated mineral and organic material of whatever origin that overlies bedrock which can be readily excavated.

t. **SUBSTANTIAL IMPROVEMENT:** Any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either, (a) before the improvement or repair is started, or (b) if the structure has been damaged, and is being restored, before the damage occurred. For purposes of this definition "substantial improvement" is considered to occur when the first alterations of any structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not include:

1. Any project for improvement of a structure to comply with existing state or Township health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions; or (2) any alteration of a structure listed on the National Register of Historic Places or the State of Michigan Register of Historic Places.

u. **TEMPORARY PROTECTION:** Stabilization of erosive or sediment producing areas.

v. **VEGETATIVE PROTECTION:** Stabilization of erosive or sediment producing areas by covering the soil with:

1. Permanent seeding, producing long-term vegetative cover,

2. Short-term seeding, producing temporary vegetative cover, or

3. Sodding, producing areas covered with a turf of perennial sod-forming grass.

w. **WATERCOURSE:** Any natural or artificial watercourse, stream, river, creek, ditch, channel, canal, conduit, culvert, drain, waterway, gully, ravine or wash in which water flows in a definite direction or course, either continuously or intermittently, and which has a definite channel, bed and banks, and shall include any area adjacent thereto subject to inundation by reason of overflow or flood water.

82-16.3 Warning and Disclaimer of Liability: The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes, and for promotion of the public health, safety, and welfare, and is based on engineering and scientific methods of study. Larger floods may occur on rare occasions. Flood heights may be increased by man-made or natural causes, such as ice jams and bridge openings restricted by debris. Approval of the use of land or premises under this Chapter shall not be considered approval, guarantee, or warranty of safety or suitability. This ordinance does not imply that areas outside the floodplain districts or land uses permitted within such districts will be free from flooding or flood damages. This ordinance shall not create liability on the part of the Charter Township of Meridian or any officer or employee thereof for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

82-16.4 Conservancy District Areas: The Conservancy District shall be considered to overlay existing zoning districts and shall constitute additional terms over and above those imposed by the underlying zoning districts. The Conservancy District within the jurisdiction of this ordinance is hereby divided into three areas: ground water recharge areas, floodway areas, and floodway fringe areas. The location and boundaries of groundwater recharge areas shall be determined on a case by case basis by the Director of Public Works & Engineering or any other professional retained by the Township who is competent in the field of water resources or hydrology. The location and boundaries of the floodway and floodway fringe areas shall coincide with those locations and boundaries for floodways and floodway fringe areas as shown on the Flood Insurance Rate Map (panels 0010B, 0013B, and 0015B dated August 9, 2000), and by the Flood Insurance Study, as published by the Federal Emergency Management Agency.

82-16.5 General Provisions of the Floodway and Floodway Fringe Areas of the Conservancy District: The restrictions listed in the following section constitute those general provisions which shall govern development, construction, improvement, and relocation within the floodway and floodway fringe areas of the Conservancy District.

a. All persons proposing development within the floodway and floodway fringe areas shall obtain approved permits from those government agencies having jurisdiction over floodplain development. No building permit or occupancy permit shall be issued until all such aforementioned permits have been obtained and have been reviewed by the Department of Community Planning & Development of the Charter Township of Meridian.

b. Developers of new, substantially improved, or relocated structures within the floodway and floodway fringe areas shall submit to the Department of Community Planning & Development a written document indicating:

   1. The elevation of the lowest floor including basements in the structure, including basement.

   2. The elevation to which a structure has been floodproofed, if floodproofing methods have been employed.

      Details of specifications proposed and as built drawings shall be kept on record and will be available for public inspection and for use in determining flood insurance risk premium rates.

c. Persons wishing to develop in areas designated as "A" zones on the Flood Insurance Rate Map (that "A" having no number or other letter(s) affixed to the designation) shall obtain intermediate regional floodplain elevations from federal, state, or other sources. Such elevations shall be subject to review by the Township.

d. When floodproofing measures are employed, a registered engineer or architect shall certify that the methods used are adequate to withstand the flood depths, pressures, velocities, impact and uplift forces and any other factors associated with the intermediate regional floodplain elevation.

e. All new construction and substantial improvements made to existing structures, including mobile homes, shall be firmly anchored to prevent flotation and lateral movement, and shall be constructed with flood resistant materials and methods.

f. If new and replaced utility and sanitary facilities must be located below elevation of the intermediate regional floodplain they shall be constructed so as to be watertight, to resist hydrostatic and hydrodynamic loads and to be resistant to the effects of buoyancy. All measures to flood proof utility and sanitary facilities are subject to the approval of the Director of Public Works & Engineering.

g. On site waste disposal systems such as septic tanks and leach fields shall be located to avoid impairment by flood waters associated with the intermediate regional flood level.

h. The application or discharge of persistent toxic compounds whose direct or indirect effects through residuals have a half-life greater than six months, onto or within those areas defined as floodway or floodway fringe areas is strictly forbidden.

i. Service facilities such as electrical and heating equipment shall be constructed at or above the intermediate regional flood protection elevation for the particular area or floodproofed.

j. Fill or other materials shall be protected against erosion by rip- rap, vegetative cover or bulkheading.

k. Should any watercourse relocation or alteration be proposed, notification of said change in the watercourse shall be sent by the developer to all adjacent communities, to the State of Michigan Department of Environmental Quality, and to the Federal Emergency Management Agency. With the altered or relocated portion of any watercourse the carrying capacity shall be maintained.

l. Additional regulations pertaining to activities and construction within fifty (50) feet of the Red Cedar River and county drains are specified in Section 83-1.11.

m. All subdivision proposals and proposals for new development shall be designed and located to be consistent with the need to minimize flood damage. In addition, all subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.

82-16.6 Permitted Uses by Right in the Floodway Area of the Conservancy District: The following uses having a low flood damage potential and present no, or minimal obstruction to flood flows shall be permitted within the floodway district to the extent that they are not prohibited by any other ordinance and provided they do not require structures, fill, or storage of materials or equipment. No use shall in any manner, affect the capacity of the channels or floodways of any tributary to the main stream, drainage ditch, or any other drainage facility or system. Approval from the State of Michigan Department of Environmental Quality is needed for construction activity taking place in the floodway and floodway fringe areas of the Conservancy District.

a. Recreation Uses: Parks, playgrounds, playfields, bridle paths, nature trails, natural wildlife preserves, outdoor tennis courts, archery ranges, boat launching ramps, target ranges, trap and skeet ranges, game farms, fish hatcheries, and similar uses. Land owned by the developer of multiple housing or of a planned unit development in the floodway area of the Conservancy District may be used to provide the necessary open space required under the provisions of this Title.

b. Golf Courses and Driving Ranges: In accordance with the requirements of Section 82-2 of this Title.

c. Agricultural Uses: General farming, pasture, grazing, outdoor plant nurseries, horticulture, viticulture, truck farming, and wild crop farming.

d. Uses incidental to single family dwellings: Lawns, gardens, and play areas.

e. Parking Areas: Provided said parking areas are unpaved and are incidental to those uses permitted in the subsections listed above.

f. Uses not permitted: Permitted uses in underlying zoning districts shall not be construed as being permitted uses in the floodway area of the Conservancy District unless those uses are indicated as being permitted in the subsections listed above.

82-16.7 Uses Permitted by Special Use Permit in the Floodway Area of the Conservancy District: Provided such uses shall not in the opinion of the Planning Commission be adverse to the purpose of this section or damaging to the public health, safety, or welfare, or impose a financial burden upon the community or shall in any manner affect the capacity of the channels or floodways of any tributary to the main stream, drainage ditch, or any other drainage facility or system, the following uses may be permitted by issuance of a special use permit in accordance with Chapter 81 of this Title and any other requirements stipulated herein:

a. Railroads, streets, bridges, utility transmission lines, and pipelines.

b. Marinas, boat rentals, docks, piers, wharves.

c. Extraction of sand, gravel, and other materials.

d. Structures for recreational uses such as shelter houses, out buildings or wildlife sanctuaries.

e. Parking areas.

f. Other uses similar in nature to uses described in Section 82-16.6 which are consistent with the provisions of this Title.

82-16.8 Requirements for Special Use Permits for Uses in the Floodway Area of the Conservancy District: In addition to the requirements of Chapter 81 of this Title, the application for a special use permit in the Floodway Area of the Conservancy District shall submit the following:

a. A letter of approval from the State of Michigan Department of Environmental Quality.

b. A location map including existing topographic data at two (2) foot interval contours at a scale of one (1) inch representing 100 feet.

c. A map showing proposed grading and drainage plans including the location of all public drainage easements, the limits, extent, and elevations of the proposed fill, excavation and occupation.

d. A statement from the Ingham County Drain Commissioner indicating that he has reviewed and approved the proposal.

e. A statement from the Ingham County Health Department indicating that they have reviewed and approved the proposal.

f. A statement from the Director of Public Works & Engineering concerning feasibility of the proposal and his approval.

g. Any other information requested by the Planning Commission.

82-16.9 Standards for Special Use Permits within the Floodway: The Planning Commission shall review the particular circumstances and facts of each proposed use in terms of the following standards as well as those in Section 81-3.2

a. Structures shall not be designed for human habitation and shall have a low flood damage potential.

b. Structures, if permitted, shall be constructed and placed on the building site so as to offer the minimum obstruction to the flow of floodwaters and whenever possible shall be constructed with the longitudinal axis parallel to the direction of floodflow.

c. No special use permit shall be issued for the development of new structures, the substantial improvement or relocation of old structures, or development of any kind within the floodway area when such development, construction, improvement or relocation would cause any increase in flood level associated with the intermediate regional flood.

82-16.10 Permitted Uses by Right in the Floodway Fringe Area of the Conservancy District: The following uses having a low flood damage potential and present no, or minimal obstruction to flood flows shall be permitted within the floodway fringe district to the extent that they are not prohibited by any other ordinance and provided they do not require structures, fill, or storage of materials or equipment. Approval from the State of Michigan Department of Environmental Quality is needed for construction activity taking place in the floodway fringe.

a. **Recreation Uses:** Parks, playgrounds, playfields, bridle paths, nature trails, natural wildlife preserves, outdoor tennis courts, archery ranges, boat launching ramps, target ranges, trap and skeet ranges, game farms, fish hatcheries, and similar uses. Land owned by the developer of multiple housing or of a planned unit development in the floodway area of the Conservancy District may be used to provide the necessary open space required under the provisions of this Title, provided the open space requirement of the specific section of this Title is met.

b. **Golf Courses and Driving Ranges:** In accordance with the requirements of Section 82-2 of this Title.

c. **Agricultural Uses:** General farming, pasture, grazing, outdoor plant nurseries, horticulture, viticulture, truck farming, and wild crop farming.

d. Uses incidental to single family dwellings, lawns, gardens, play areas, and parking areas.

e. **Uses not permitted:** Permitted uses in underlying zoning districts shall not be construed as being permitted uses in the floodway area of the Conservancy District unless those uses are indicated as being permitted in the sub-sections listed above.

82-16.11 Uses Permitted by Special Use Permit in the Floodway Fringe Area of the Conservancy District: Provided such uses shall not in the opinion of the Planning Commission be adverse to the purpose of this section or damaging to the public health. safety, or welfare, or impose a financial burden upon the community the following uses may be permitted by issuance of a special use permit in accordance with Chapter 81 of this Title and any other requirements stipulated herein:

a. Railroads, streets. bridges, utility transmission lines, and pipelines.

b. Marinas, boat rentals, docks, piers, wharves.

c. Extraction of sand, gravel, and other materials.

d. Structures for recreational uses such as shelter houses, out buildings or wildlife sanctuaries.

e. Those uses indicated as being permitted uses or as being permissible with a special use permit in those zoning districts which underlie the Conservancy District.

f. Dumping or backfilling with any material in any manner. In the case where floodway fringe areas have no groundwater recharge or impoundment potential, filling may occur through compensating excavation and shaping of floodway fringe in such a way as to maintain or improve the flow or natural impoundment capacity of the floodway fringe. In no case shall the flow or impoundment capacity of the floodway fringe be reduced.

g. Other uses similar in nature to uses described in Section 82-16.10 which are consistent with the provisions of this Title.

82-16.12 Requirements for Special Use Permits for Uses in the Floodway Fringe Area of the Conservancy District: In addition to the requirements of Chapter 81 of this Title, the applicant for a special use permit in the Conservancy District shall meet the following requirements.

a. The applicant for a special use permit shall be required to submit that information listed as necessary in Section 82-16.8.

82-16.13 Standards for Special Use Permits within the Floodway Fringe: The Planning Commission shall review the particular circumstances and facts of each proposed use in terms of the following standards as well as those in Section 81-3.2.

a. All new residential structures and residential structures requiring substantial improvement shall have the lowest floor (including basement) elevated to one (1) foot above the level of the intermediate regional floodplain.

b. All new non-residential structures and non-residential structures requiring substantial improvements shall have the lowest floor (including basement) elevated to one (1) foot above the level of the intermediate regional floodplain or shall be floodproofed to one (1) foot above the level of the intermediate regional floodplain.

82-16.14 Mobile Homes and Mobile Home Parks and Subdivisions Located In Floodplain Areas: When a mobile home, mobile home park or mobile home subdivision is to be developed or substantially redeveloped or reconstructed and is located either totally or partially within the floodway fringe areas of the Conservancy District, the following regulations shall apply in addition to those listed in Sections 82-9 and Chapter 104:

a. No mobile homes shall be placed in the floodway fringe area of the Conservancy District except within mobile home parks or mobile home subdivisions which were existing prior to February 1977. In no case shall a mobile home be placed in the floodway.

b. Mobile homes placed within the floodway fringe area shall be anchored to resist flotation, collapse, or lateral movement in the following manner:

1. Over-the-top ties to ground anchors shall be provided at each of the four corners of the mobile home with two additional ties per side at intermediate locations, however, mobile homes of less than 50 feet long shall be required to have only one additional tie per side.

2. Frame ties shall be provided at each corner of the home with five additional ties per side at intermediate points along the mobile home; however, mobile homes of less than 50 feet long shall be required to have only four additional ties per side.

3. All equipment used to tie down the mobile home shall be capable of carrying a force of 4,800 lbs.

4. Any additions to the mobile homes located within the floodway fringe shall be anchored in a similar manner.

c. For new mobile home parks and mobile home subdivisions, and for expansions to existing mobile home parks and mobile home subdivisions, and for repair, reconstruction, or improvement of the streets, utilities and pads, in said mobile home parks and mobile home subdivisions, any of which take place in the floodway fringe area, the following restriction shall apply.

1. Stands or lots shall be elevated on compacted fill or on pilings so that the lowest floor of the mobile home shall be elevated to at least one (1) foot above the intermediate regional flood protection elevation.

2. Adequate surface drainage shall be provided along with ample access for a hauler.

3. If the stands are elevated on pilings, lots shall be large enough to permit steps. Pilings shall be placed in stable soil and shall be no more than ten (10) feet apart. Any pilings which are located more than six (6) feet above the ground level shall be reinforced.

d. Any mobile home which is to be located, reconstructed, or repaired, on an individual lot not associated with a mobile home park or mobile home subdivision and which is located either totally or in part in the floodway fringe area shall meet those requirements for elevation, drainage, and piling design set forth in Section 82- 16.14 (c).

e. All mobile home parks and mobile home subdivisions located within the floodway area shall develop an evacuation plan indicating alternate vehicular access and escape routes and shall submit copies of said plan to the Emergency Response Teams for both Lansing and Ingham County and to any other disaster relief agency deemed appropriate.

82-16.15 Standards for Variance by the Zoning Board of Appeals from the Strict Interpretation of the Regulations set Forth in Section 82-16 of this Title:

a. No variance shall be granted for the development of new structures, the substantial improvement or relocation of old structures, or development of any kind within the floodway area when such development, construction, improvement, or relocation would cause any increase in flood levels associated with the intermediate regional flood.

b. The following four criteria must be met in addition to those stipulated in Section 81-3.5F before a variance can be granted:

1. A sufficient cause for granting the variance must be shown.

2. A determination that failure to grant the variance would result in exceptional hardship to the applicant.

3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with this Title.

4. A determination that the variance is the minimum necessary to afford relief.

c. Upon application for a variance for construction below the elevation of the intermediate regional flood, the Township shall notify the applicant for variance in writing that:

1. Issuance of a variance to construct a structure below the elevation of the intermediate regional flood will result in increased premium rates for flood insurance commensurate with the increased risk resulting from the reduced lowest flood elevation and that,

2. Such construction below the elevation of the intermediate regional flood increases risk to life and property.

3. Record of such notification shall be maintained along with records of all variance actions dealing with floodplain development.

82-16.17 Uses Permitted by Special Use Permit in the Ground Water Recharge Area of the Conservancy District: Provided such cases shall not in the opinion of the Planning Commission be adverse to the purpose of this section or damaging to the public health, safety or welfare, or impose a financial burden upon the community, the following uses may be permitted by issuance of a special use permit in accordance with Section 81-3.2 of this Title and any other requirements stipulated herein:

a. Railroads, streets, bridges, utility transmissionlines, and pipelines.

b. Marinas, boat rentals, docks, piers, wharves.

c. Extraction of sand, gravel, and other materials.

d. Structures for recreational uses such as shelter houses, out buildings or wildlife sanctuaries.

e. Those uses indicated as being permitted uses or as being permissible with a special use permit in those zoning districts which underlie the Conservancy District.

f. Other uses similar in nature to uses described in Section 82-16.14 which are consistent with the provisions of this Title.

82-16.18 Requirements for Special Use Permits for Uses in the Ground Water Recharge Area of the Conservancy District: In addition to the requirements of Section 81-3.2 of this Title, the applicant for a special use permit in the Conservancy District shall submit the following:

a. A location map including existing topographic data at two (2) foot interval contours.

b. A map showing proposed grading and drainage plans including the location of all public drainage easements, the limits and extent of the proposed fill, excavation and occupation.

c. A statement from the Ingham County Drain Commissioner indicating that he has reviewed and approved plans.

d. A statement from the Ingham County Health Department indicating that they have reviewed and approved plans.

e. A statement from the Township Engineer concerning feasibility of the plans and his approval.

f. Any other information requested by the Planning Commission.

82-16.19 Standards for Special Use Permits within the Ground Water Recharge Area: The Planning Commission shall review the particular circumstances and facts of each proposed use in terms of the following standards as well as those in Section 81-3.2F.

a. Any fill proposed to be deposited in a ground water recharge area must be shown to have some beneficial purpose and the amount thereof not greater than is necessary to achieve that purpose.

b. Fill or other material shall be protected against erosion by rip- rap, vegetative cover or bulkheading.

c. Reduction of surface water infiltration shall be kept to a minimum.

82-16.20 Plans for Control of Soil Erosion: Any development in Meridian Charter Township shall comply with the Standards and Specifications for Soil Erosion and Sediment Control as adopted by the Ingham County Soil Conservation District on April 21 1970.

a. **COMPLIANCE:** No site plan, except for single family residential structures which must meet standards approved for the plat, shall be approved unless it includes soil erosion and sediment control measures in accordance with the technical standards of the Ingham County Soil Conservation District. No certificate for occupancy of any building may be granted unless and until all needed erosion control measures have been completed or substantially provided for in accordance with this Title and the Standards and Specifications of the Ingham County Soil Conservation District. The developer shall bear the full responsibility for the installation and construction of all required erosion control measures according in the provisions of this Title and to the standards and specifications of the Ingham Soil Conservation District.

b. **DATA REQUIRED:** The developer must submit to the Department of Development Control of Meridian Township and to Ingham County the following for the entire tract of land, whether or not the tract will be developed in stages:

1. A boundary line survey of the site on which the work is to be performed.

2. Description of the features, existing and proposed, surrounding the site of importance to the proposed development.

3. General topographic and soil conditions on the site available from the Township Planning Department or the Ingham County Soil Conservation District.

4. Location and description of existing and future man-made features of importance to the proposed development.

5. Plans and specifications of soil erosion and sedimentation control measures in accordance with standards and specifications of the Ingham County Soil Conservation District.

6. A timing schedule indicating the anticipated starting and completion dates of the development sequence and the time of exposure of each area prior to the completion of effective erosion and sediment control measures.

c. **GRADING PERMIT:** A grading permit valid for no more than six months unless extended by new application as provided for in the Township Building Code shall be required for each development. This permit may not be issued without the approval of both the Planning Director and the Building Inspector.

d. **GENERAL DESIGN PRINCIPLES:** Practical combinations of the following general principles will provide effective sediment control when properly planned and applied:

1. The development plan shall be fitted to the topography and soils so as to create the least erosion potential.

2. Permanent vegetation and improvements such as streets, storm sewers or other features of the development, capable of carrying storm runoff in a safe manner, shall be scheduled for installation to the greatest extent possible before removing the vegetative cover from an area.

3. Where feasible, natural vegetation shall be retained and protected.

4. Where inadequate vegetation exists, temporary or permanent vegetation shall be established.

5. The smallest practical area of land shall be exposed at any one time during development.

6. When land is exposed during development, the exposure shall be kept to the shortest practical period of time.

7. Critical areas exposed during construction shall be protected with temporary vegetation and/or mulching.

8. Sediment basins (debris basins, desilting basins, or silt traps) shall be installed and maintained to remove sediment from run-off waters from land undergoing development.

9. Provisions shall be made to effectively accommodate the increasing run-off caused by changed soil and surface conditions during and after development.

10. The permanent final vegetation and structures shall be installed as soon as practical in the development.

e. DEVELOPMENT STANDARDS: All development plans, specifications and timing schedules including extensions of previously approved plans, shall include provisions for erosion and sediment control in accordance with the standards and specifications established by the Ingham County Soil Conservation District.

1. Technical standards for the design and installation of erosion and sediment control measures are on file at the Ingham Soil Conservation District office in Mason, Michigan, and with the Township Planning Director.

f. MAINTENANCE: Individuals or developers carrying out soil erosion and sediment control measures under this Title, and all subsequent owners of property on which such measures have been installed, shall adequately maintain all permanent erosion control measures, devices and plantings in effective working condition.

82-16.21 Conflict Between this Section and the Remainder of this Title: In the event of conflict between those regulations stipulated in Section 82.16 and the remainder of this Title, those regulations found in Section 82.16 shall take precedence over the remainder of this Title.

82-16.22 Relationship of this Chapter to State and Federal Law: Nothing in this Chapter shall be deemed to exempt a developer from the requirements of any State or Federal statute or regulation applicable to the proposed activity; nor shall any permit or approval issued to a developer from a State or Federal agency be deemed to exempt the developer from the requirements of the Chapter.

ENVIRONMENTAL PROTECTION POLICY

WHEREAS, protection of the environment and conservation of natural resources are of the utmost importance not only to the residents of this planet, this nation, and this state, but also of particular concern to the citizens of Meridian Township and to the Township Board of Meridian Township; and

WHEREAS, this Township Board feels that an awareness of and a sensitivity to environmental constraints is absolutely vital to the preservation of our environmental resources; and

WHEREAS, this Township Board recognizes that proper evaluation of proposed changes to the environment and natural resources of Meridian Township is a necessity for the protection of those elements of the environment and natural resources deemed critical to a viable natural environment; and

WHEREAS, this Township Board concludes that the existing body of regulatory legislation from Federal law, State law, and Township ordinances would allow for the proper evaluation of those proposed changes to the environment and natural resources of Meridian Township.

NOW, THEREFORE, BE IT RESOLVED THAT:

(1) The Township Board of the Charter Township of Meridian will commit sufficient financial and staff resources to ensure that any proposed change to either the environment or the natural resources of Meridian Township will have first been taken through the required regulatory process to obtain those permits required by the appropriate Township, State, or Federal regulations. Examples of, but not to be construed as an exhaustive list of, those regulated activities requiring the issuance of permits are those activities requiring permits under the Environmental Protection Act of the United States, the Goemare-Anderson Act, the Inland Lakes and Streams Act, the Soil Erosion and Sedimentation Control Act, and the Plat Act of the State of Michigan, and the Code of Ordinances of the Charter Township of Meridian.

(2) To ensure that the Charter Township of Meridian will commit adequate resources, the Township Superintendent is directed to submit for Township board approval a plan whose activities shall achieve the following objectives:

a. To the extent possible, the observation of all activities within the Charter Township of Meridian that will change the environment of or the natural resources of the Charter Township of Meridian. To ensure said proper-

and timely observation, said plan should include any supplemental steps necessary to provide Township staff with the appropriate means to properly carry out the goals of this policy.

b. The timely reporting of such activities to the proper Township authority for evaluation by said authority as to whether or not said activity requires the appropriate statutory or ordinance permits.

c. The timely determination by the proper Township authority as to whether or not said permits have indeed been acquired.

d. The taking of those steps necessary to ensure compliance with, or the acquisition of, the applicable permits. Said steps shall include the filing with the appropriate courts for those legal instruments to cause the cessation of those activities operating without the appropriate permits, or in non-compliance with those permits required under State or Federal statute or Township ordinance.

ADOPTED: July 16/17, 1991

83-1.8 Relocation of Existing Buildings and Structures on Parcels or Lots in the Township: No existing building or other structure within or from outside of Meridian Charter Township shall be relocated upon any parcel or lot located in Meridian Charter Township, unless the building design and construction are compatible with the general architectural design and construction of buildings or other structures presently located in the immediate area of the zoning district and construction are in conformity with the Building Code of Meridian Charter Township and unless the building or structure can be located upon the parcel or lot and conform to the other requirements of the zoning district in which the parcel or lot is located, as determined by the Building Inspector. This shall not be deemed to restrict houses of modular construction which meet the standards of the Uniform Building Code, as amended and adopted by Meridian Charter Township, and which are constructed away from the site and brought to the site to be erected.

83-1.9 Access to Commercial, Research Park and Industrial Districts: Access to commercial, research and industrial districts shall not be permitted through residential district zones, except by means of those principal and minor arterials indicated in Section 82-8.1 or by Special Use Permit in accordance with Chapter 81.

83-1.10 Lots Along Railroad Rights-of-Way: Any lot created or recorded after May 9, 1988, that is adjacent to or along a railroad right-of-way, shall not be used for any residential purpose unless it has a depth of at least 250 feet. In no case shall any dwelling unit be located closer than 175 feet from a railroad right-of-way.

83-1.11 Setbacks From Water Features: Recognizing the special conditions and relationships in transition areas between water features and developed areas, minimum setbacks are hereby established to prevent degradation of the water features of the Township, provide protection during high water episodes in flood prone areas, and preserve the aesthetic values of water features. This regulation is based on the police power, for the protection of the public health, safety and welfare, including the authority granted in the Township Rural Zoning Act, P.A. 184 of 1943, as amended.

a. **Structure and Grading Setbacks:** All structures and grading activities shall be setback from the edge of a water feature as follows:

   1. Wetlands regulated by the Township, the State, or by federal law equal to or greater than two (2.00) acres in area: forty (40) feet. The Township may require the permit applicant to have the precise boundary of the wetland in question delineated in accordance with Chapter 105 of the Charter Township of Meridian Code of Ordinances.

   2. Wetlands regulated by the Township, the State, or by federal law equal to or greater than one-quarter (0.25) acre in area but less than two (2.00) acres in area: twenty (20) feet. The Township may require the applicant to have the precise boundary of the wetland in question delineated in accordance with Chapter 105 of the Charter Township of Meridian Code of Ordinances.

   3. The Red Cedar River: fifty (50) feet as measured from the ordinary high water mark on the side of the River where the structure is to be located or grading activity is to occur.

4. Open county drains or creeks: fifty (50) feet as measured from the top of the bank on the side of the drain where the structure is to be located or grading activity is to occur.

5. Lakes equal to or greater than two (2.00) acres in area: forty (40) feet as measured from the ordinary high water mark.

6. Lakes equal to or greater than one-quarter (0.25) acre in area but less than two (2.00) acres in area: twenty (20) feet as measured from the ordinary high water mark.

b. **Natural Vegetation Strip:** To minimize erosion, stabilize streambanks and wetland edges, protect water quality, and preserve fish and wildlife habitat, a natural vegetation strip shall be maintained from the edge of a water feature as follows:

1. Wetlands regulated by the Township, the State, or by federal law: twenty (20) feet. The Township may require the permit applicant to have the precise boundary of the wetland in question delineated in accordance with Chapter 105 of the Charter Township of Meridian Code of Ordinances.

2. The Red Cedar River: twenty-five (25) feet as measured from the abutting ordinary high water mark.

3. Open county drains or creeks: twenty-five (25) feet as measured from the top of the abutting bank.

4. Lakes: twenty (20) feet as measured from the ordinary high water mark.

5. Existing soil and organic matter shall not be altered or disturbed within the natural vegetation strip.

6. Natural ground cover shall be preserved to the fullest extent feasible, and where removed shall be replaced with other naturally occurring vegetation that is equally effective in retarding runoff and preventing erosion.

7. A lawn shall not be considered a natural vegetation strip.

8. Application of organic or synthetic pesticides, fertilizers, or other chemicals shall not be permitted in the natural vegetation strip.

9. Planting of perennial native species in the natural vegetation strip is encouraged, especially where exposed soil and steep slopes exist and in reforestation efforts.

10. Within the natural vegetation strip, trees, shrubs, and ground cover may be selectively pruned or removed to provide reasonable private access or views to water features, to remove potentially hazardous or nuisance exotic vegetation, and to improve or protect wildlife habitat. Said pruning and removal activities are subject to the following:

(a) No more than ten (10) percent of the length of the strip shall be clear cut or mowed to the depth of the strip.

(b) Pathways accessing water features shall not exceed ten (10) feet in width.

(c) A live root system shall be maintained to provide for streambank stabilization and erosion control.

c. **Exceptions:** The following exceptions shall apply to Section 83-1.11. All uses that fall within such exceptions must comply with all other requirements and standards of this Title and all other applicable regulations and laws.

1. Subsection 83-1.11(a), Structure and Grading Setbacks, shall not apply to the following:

(a) Plats that have received Township preliminary or final approval prior to September 2, 1991.

(b) Site plans and condominium plans that have received final approval prior to September 2, 1991.

(c) Unplatted lots under two (2.00) acres in area, created prior to September 2, 1991, on which an occupiable building is located for which a building permit was issued prior to September 2, 1991.

2. For plats that have received Township preliminary or final approval between September 2, 1991 and the effective date of this Section, for site plans and condominium plans that have received final approval between September 2, 1991 and the effective date of this Section, and for unplatted lots under two (2.00) acres in area, created between September 2, 1991 and the effective date of this Section, on which an occupiable building is located for which a building permit was issued between September 2, 1991 and the effective date of this Section, the requirements of Subsection 83-1.11(a), Structure and Grading Setbacks, shall be modified to provide that when a forty (40) foot setback is required, decks, porches, and patios may project a maximum of ten (10) feet into the required setback.

3. The limitations as to grading activities in Subsection 83-1.11(a), Structure and Grading Setbacks, and Subsection 83-1.11(b), Natural Vegetation Strip, shall not apply to the following:

(a) Plats that have received preliminary or final approval prior to the effective date of this Section, including littoral rights running with platted lots.

(b) Site plans and condominium plans that receive final approval prior to the effective date of this Section.

(c) Unplatted lots under two (2.00) acres in area, created prior to the effective date of this Section, on which an occupiable building is located for which a building permit was issued prior to the effective date of this Section, including littoral rights running with unplatted lots.

4. The limitations as to grading activities in Subsection 83-1.11(a), Structure and Grading Setbacks, and Subsection 83-1.11(b), Natural Vegetation Strip, shall not apply to grading activities required by the Township Engineer under the Township's land development ordinances and regulations.

5. Bridges, docks, piers, sea walls, or wharves, incidental to the permitted uses of the zoning district in which a protected water feature is located are exempt from the water feature setback.

6. Structures that do not require a permit from the Township incidental to the permitted uses of the zoning district in which the protected water feature is located are exempt from the water feature setback.

7. County Drain Commission normal activities including, but not limited to, drain cleaning, dredging, and depositing and grading of dredge spoils are exempt from the water feature setback. The adverse effect on the natural vegetation strip shall be minimized.

8. Landscaping and lawn maintenance incidental to the principal use are permitted in the water feature setback, excluding the natural vegetation strip.

9. Other activities are exempt from the water feature setback to the extent the Township is prohibited from regulating by its ordinances or other laws.

10. Subsections 83-1.11(a) and 83-1.11(b) shall not apply to any driveway, pathway, or sidewalk less than or equal to 12 feet in width and/or utilities that have been granted a permit to pass through a Michigan Department of Environmental Quality (MDEQ) or Township regulated wetland. The exception shall apply only to the areas of the setback and natural vegetation strip which the driveway, pathway, sidewalk and/or utilities must pass through as it enters and/or exits the wetland. All conditions of the MDEQ or Township permit shall be met.

Section 83-1.12 Buildings Greater than 25,000 square feet in gross floor area:

Notwithstanding any other provision of this Title, any building or group of buildings on a lot with a combined floor area greater than 25,000 square feet shall require a special use permit in accordance with Chapter 81, regardless of the use(s) or the zoning district in which the building(s) are located. as provided by Section 86-9 of this Title.

SECTION 83-2 SUPPLEMENTARY USE REGULATIONS

Section 83-2.1 Uses of Structures for Temporary Dwelling: No structure shall be used for dwelling purposes that does not meet the minimum standards as defined in this Title and in the Township Building Code. In addition no temporary structure may be occupied for temporary dwelling purposes for any length of time unless by issuance by the Building Inspector of a special occupancy permit which may be valid for a period not to exceed six (6) months. No permit may be transferrable.

83-2.2 Accessory Building: Authorized accessory buildings may be erected as part of the principal building or may be connected to it by a roofed-over porch, patio or breezeway, or similar structures, or they may be completely detached. If attached to the principal building, an accessory building shall be made structurally a part of it, and shall comply in all respects with the requirements applicable to the principal building. An accessory building not attached and not made a part of the principal building as provided in the preceding statement shall not be nearer than ten (10) feet from any other separate structure on the same lot.

83-2.3 Accessory Uses, Outdoor Storage of Commercial Vehicles: No outdoor storage or overnight parking of commercial vehicles over one ton capacity shall be permitted in any residential district. Space in a garage or parking ramp accessory to a multiple family dwelling may be used for parking purposes by persons other than occupants of that dwelling only if adequate parking is maintained for that dwelling in accordance with this title; and, only when approved by the Planning Commission in accordance with the provisions of Chapter 81, Special Use Permit. In Rural Residential Districts vehicles associated with a permitted agricultural use are exempted from these restrictions.

83-2.4 Excavation of Topsoil: Topsoil shall not be stripped, excavated, or otherwise removed from any premises for sale or for use other than on the premises on which the topsoil was originally located except that in accordance with all other requirements of this Title construction grading, excavation or sod farming may be done by special use permit in accordance with Chapter 86.

83-2.5 Excavation of Soils and Minerals Other Than Top Soil: The excavation of peat, muck, sand, gravel, clay, shale or other natural mineral deposit, including the quarrying of rock materials, but except crude oil, may be authorized in any district by the Planning Commission by the issuance of a special permit upon the completion of procedures and with the imposition of the conditions and safe-guards outline in Chapter 86. A special permit may include authorization for the erection, installation and use of necessary buildings, apparatus, and appertances incidental to the excavation operation.

83-2.6 Fences, Walls, Screens: The following regulations shall apply to all fences, walls, screens or similar devices of structural or plant materials:

a. No fence, wall or screen of any material other than plant materials shall be erected higher than six (6) feet from the average grade elevation on the property.

b. No fence, wall or screen, or any planting shall obstruct visibility at street intersections between the heights of three (3) feet and ten (10) feet, within the triangular area formed by the intersection of the street right-of-way lines and a line connecting the two points along those right-of-way lines which are thirty (30) feet from the point of intersection of the two right-of-way lines, measured above the elevation of the centerline of the road.