COUNTY AND REGIONAL INTEGRATION OF THE MICHIGAN WELLHEAD PROTECTION PROGRAM

By

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1.1) General Introduction

Michigan has historically been a state with bountiful natural resources. Many of Michigan's cities have prospered from the consumption and refinement of such things as iron ore, copper and lumber as well as the availability of vast water resources to support these industries. We are discovering in these modern times, though, that these resources are not as limitless as was once believed, and that our actions impact these resources in a way that may take generations to remedy. We have learned that we must be stewards of the land and, through a conscientious effort towards proper management the State's natural resources will continue to provide a sustainable yield.

The protection of ground water resources is a key component to sustaining Michigan's environmental well being. Nearly half of the state's population depends upon ground water as a drinking source. This is why the State of Michigan has developed its Wellhead Protection Program (WHPP) to protect public water supply systems. This program is designed to protect public ground water drinking sources, focusing primarily on the wellhead, which is the surrounding geological area that contributes water to a well or well field.

The Michigan Department of Natural Resources (DNR) recently completed a study titled *Michigan's Environment and Relative Risk*. This report is the result of study and debate by some of the state's leading environmental experts from State and local government, private industry and the scientific community. The most important environmental issues facing the state today are identified and prioritized in this report. This report, submitted to the Governor, is intended to guide government officials in making future policies to address these important issues.

One of the top ranked issues in the report is the need for "a statewide planning system that encourages appropriate land use with consideration for sustainable resources and long term ecosystem health"[1] The report reiterates the actuality that the bounds of natural systems, such as ground water, do not conform to local political boundaries. This report identifies the need for a cooperative effort between communities and various levels of government for the coordinated stewardship of our natural resources.

The State of Michigan has also recently submitted the WHPP to the United States Environmental Protection Agency (EPA) for approval in accordance with the provisions of the 1986 amendments to the federal Safe Drinking Water Act (SDWA). The program will encourage local governments to develop plans and undertake management practices for the maintenance of ground water drinking supplies.

Through this study, I evaluate the development of local wellhead protection plans and outline the administrative and legal measures that can be taken to ensure a coordinated effort by local communities in the management of ground water resources. My study evaluates the necessary responsibilities between various local, county, regional and State agencies for implementing this program in a regionally integrated manner. The WHPP is voluntary for all local units of government and is intended to be locally initiated and managed. Although there are profound advantages to this form of "Grass Roots" planning, there also arise significant complications that need to be addressed. With this paper, I evaluate the critical balance of power needed to ensure that this remains a localized planning effort, but with county and State agencies acting as a coordinators among adjacent municipalities. This balance should maintain the maximum amount of

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1 Michigan Department of Natural Resources, Michigan's Environment and Relative Risk, July of 1992, pg. 22.

authority and responsibility at the local level, while allowing county, regional and State agencies to coordinate the development and implementation of the WHPP as part of a regionally integrated and comprehensive planning effort.

The remaining portions of this introduction will provide a brief overview of the WHPP and the need for a more coordinated management of the State's land and natural resources, such as ground water. The following section will describe the need for a coordination and integration of planning and resource management efforts, such as the WHPP, over multiple jurisdictions and levels of government to allow an ecosystem level approach to land use planning. Section three of this paper will briefly describe the legal basis for water resources and a local government's legal ability to develop plans and regulations. The next section will describe the existing structure of control and coordination between local jurisdictions and other levels of government; as well as identify the integration and coordination which can be done under the existing laws. Section five of this paper will describe some of the existing planning and resource management programs controlled by State and/or county government that relate to water resources. I will provide suggestions on how these programs can be administered differently to meet the need for a more coordinated effort in managing the State's natural resources.

1.2) State of Michigan Wellhead Protection Program

Michigan is presently in the process of refining the WHPP for the state. The primary objective of this program is to protect the quality of ground water sources contributing to a public water supply system. Michigan has prepared this program to meet the requirements of Section 1428 of the 1986 amendments to the federal Safe Drinking Water Act (SDWA). The goal of the program as set forth in the SDWA is as follows:

> "The Governor ... of each state shall ... adopt and submit to the Administrator [of the EPA] a State program to protect wellhead areas

within their jurisdiction from contaminants which may have any adverse effects on the health of persons."[2]

The Michigan WHPP is a voluntary program for local communities to develop their own wellhead protection plans. A wellhead protection plan will generally include the following:

A) Establishment of local goals and objectives

B) Definition of roles and duties

C) Delineation of wellhead protection areas

D) Identification of all potential sources of contamination

E) Management program

i) Underground storage tank regulations

ii) Hazardous materials management

iii) Zoning, subdivision regulations and site plan review

iv) Water quality monitoring

F) Ground Water contingency plan

G) Siting criteria for new wells

H) Public involvement and education[3]

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2 Safe Drinking Water Act, Section 1428(a).

1.3) Michigan's Environment and Relative Risk

In July of 1992, the DNR released a study, *Michigan's Environment and Relative Risk*, which evaluated issues of critical importance to Michigan's environmental quality and stewardship of the natural resources. One of the top issues or problems identified by the study was an "absence of land use planning that considers resources and integrity of ecosystems." The report expands upon this by stating that:

> "In Michigan ... state and local agencies manage the resources under their statutory jurisdiction as individual commodities. ... A multitude of land use authorities and interests express their control and power at the local level. Little attention is paid to coordinating the goals of these various entities to lay the foundation for integrated land use planning. ... In Michigan ad-hoc arrangements of government units cut across natural landscapes, and conflicting jurisdictions confound effective planning."[4]

The study goes on to describe how various divisions of the State government, as well as county and local government units, frequently exercise land use and natural resource management over their particular area of jurisdiction in an often disjointed manner. The study identifies the need in Michigan for a more comprehensive land use policy that not only individually serves the needs of local communities, but also takes into account the larger issues of natural resource management, the large scale ecological systems which extend beyond local and county political boundaries, and that the resources contained within local communities serve values extending far beyond local jurisdictions.

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3 Michigan Departments of Natural Resources and Public Health, State of Michigan Wellhead Protection Program, Lansing, MI, Aug. 1992.

4 Michigan Department of Natural Resources, Michigan's Environment and Relative Risk, July of 1992, pg. 22.

Other issues identified as a high priority which could potentially impact the WHPP were: "Alteration of surface water and ground water hydrology"; "Non-point-source discharges to surface water and ground water"; "Point-source discharge to surface water and ground water" and, "Degradation of the urban environment."[5] The Michigan WHPP should ensure these issues do not compromise the fully effective and successful implementation of this program.

1.4) Reasons for Protecting Ground Water

Michigan's future depends upon natural resources. Michigan's cities and industries have been built upon the state's bountiful natural resources such as iron ore, copper, lumber, land for farming and an abundant supply of fresh water. Water resources are a key component to the long term viability of the state's economy. Ground water is a critical component of our water resources.

According to the Michigan Departments of Health and Natural Resources, ground water is a primary source of drinking water for over 44 percent of the State's population. "An estimated 14,000 public water supply agencies serving nearly 1.7 million people use ground water in Michigan."[6] In addition to this, there are also thousands of private ground water wells. The remaining 56 percent of the state's population uses surface water. These are mainly communities that are adjacent to major lakes or rivers. Detroit city water, for example, is obtained from Lake Huron. It is drawn in at Port Huron and

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5 Michigan Department of Natural Resources, Michigan's Environment and Relative Risk, July of 1992, pp. 14-16.

6 Dean, Lillian F., AICP, Mark A. Wyckoff, AICP, Community Planning & Zoning for Ground Water Protection in Michigan, Michigan Society of Planning Officials, Rochester, MI, May 1991, pg. 1-1.

brought down to the City of Detroit for treatment and distribution. Other communities that are located inland, such as the City of Kalamazoo, depend primarily on ground water resources to meet the public water demand. The glacial deposits in many parts of the state provide a high yield of ground water for public consumption. There are also bedrock formations which provide high yield aquifers, such as the Saginaw sand stone formation underlying central Michigan. For communities located inland, ground water is a very economical source for an abundant supply of quality drinking water. Because of this, pumping water from the ground will generally be more economical than transporting surface water great distances. In addition to this, there are some areas of the state where ground water is the only economical source of water.

Ground water is interlinked with surface water bodies. As water infiltrates through the soil profile and reaches the saturated zone, it contributes to the aquifer. The water within this aquifer moves down gradient. Upon reaching a point where the ground water elevation is above that of the soil's surface, the water will discharge. This discharge will often be to a wetland, lake or stream. Ground water discharging into lakes and streams is referred to as base flow.

An abundance of high quality ground water is essential to Michigan's economy. Agriculture uses ground water to irrigate crops. Industry needs quality water for manufacturing, to support the work force population, and to maintain quality communities for workers.

Contamination of ground water resources is very costly to society. The direct cost of remediating ground water contamination is often very high. Polluted ground water can also have a negative effect on property values, the image of a community, economic

development and the over all quality of life (Michigan Departments of Health and Natural Resources).

1.5) Safe Drinking Water Act

One of the primary objectives of the Federal Safe Drinking Water Act (SDWA) is to protect the quality of ground water sources contributing to a public water supply system. Michigan has prepared the Wellhead Protection Program to meet the requirements of Section 1428 of the 1986 amendments to the SDWA. The goal of the program as set forth in the SDWA is to protect wellhead areas from contaminants which may have adverse health effects on persons using the public well for drinking water supply. The Act goes on to require that the State program include all of the following:

A) specification of the roles and duties of State and local government entities as well as water supply systems;

B) determination of well head protection areas;

C) identification of all anthropogenetic sources of contaminants within each well head protection area;

D) provision of technical, financial and educational assistance to local governments;

E) contingency plans for the provision of alternative drinking water supplies; and

F) identification and protection of areas for future public water supply wells.

The Act identifies, as summarized above, that the program will "specify the duties of State agencies, [and] local governmental agencies..."[7]. This act does nothing to acknowledge that ecosystems do not often follow local political boundaries and that in order to have a truly effective program that properly manages natural resources, there needs to be a coordinated effort by all groups involved. Although local, county and regional government planning will differ from state to state, based upon the established regional planning framework, I feel the Act should acknowledge the fact that this needs to be a coordinated and integrated effort. Based upon the wording of the Act, it appears that the intent of Congress is for this to be a locally implemented program.

1.6) Wellhead Protection Area

The SDWA defines a wellhead protection area as follows:

> "...the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field."[8]

The act then goes on to say that the State program shall determine the extent of the wellhead protection area using such factors as the radius of influence around a well, the depth of draw down, the rate of travel for various contaminants, and other factors. The Michigan program has detailed procedures for delineating a wellhead protection area (based upon additional guidance from the Environmental Protection Agency). The State is using a ten year zone of transport to identify the wellhead protection area; in other words the area around the well, bounded by a perimeter, at which point water will take ten years to reach the well.

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7 Safe Drinking Water Act, Section 1428(a)(1).

8 Safe Drinking Water Act, Section 1428(e).

There are numerous pieces of information needed to delineate a wellhead protection area. The phenomenon of ground water is explained by Fetter as follows:

> "Precipitation that falls in the land surface enters into a number of different pathways of the hydrologic cycle. ... If the surface soil is porous, some of the water will seep into the ground by a process termed infiltration. ... Excess soil moisture is pulled downward by gravity. At some depth, the soil or rock is saturated. [The interconnected void spaces or pours between the soil or rock particles is filled with water.] The top of the saturated zone is the water table, and below the water table is ground water. Ground water flows through the rock and soil layers of the earth until it discharges as a spring or as seepage into a stream, lake, or ocean."[9]

The ground water will have a natural gradient and direction of flow that will often follow the topography of the land's surface (but there are exceptions to this). Once a well is installed and pumping begins, the draw of water will cause a cone of depression to form around the well. This cone of depression is referred to as the zone of influence (Figure 1).

The zone of contribution is "the area surrounding a pumping well that encompasses all areas or features that supply ground water recharge to the well."[10] The limit of this zone down gradient of the well is determined as the point at which the gradient of the water table within the cone of depression is equal to zero forming an artificial ground water divide (the distance at which the force of the water being drawn by the well pumping is equal to the natural counter force of gravity drawing the water down gradient). Beyond this point, water will naturally flow down gradient away from the well.

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9 Fetter, C. W., Applied Hydrogeology, 2nd edition, Macmillan Publishing Co., New York, NY, 1988, pp. 4,5.

10 Michigan Department of Natural Resources and Michigan Department of Public Health, State of Michigan Wellhead Protection Program, Lansing, MI, August, 1992, pg. 27.

The limit of this zone up gradient from the well will extend upward until reaching the ground water divide, or a ground water barrier.

The ten year zone of transport is determined from within this zone of contribution. This is the distance within which water will reach the well within ten years. This can be calculated using an analytical flow model or more precise lithological data can be collected to delineate a more accurate area. The analytical flow models assume that the aquifer media are isotopic and homogeneous. In reality, the geology of an aquifer is going to be much more complex (especially in many parts of Michigan that have glacially formed landscapes with varied materials). Therefore if lithological data are available, they will provide a much more accurate delineation using water table gradients and permeability of the various media to determine the distance of transport.

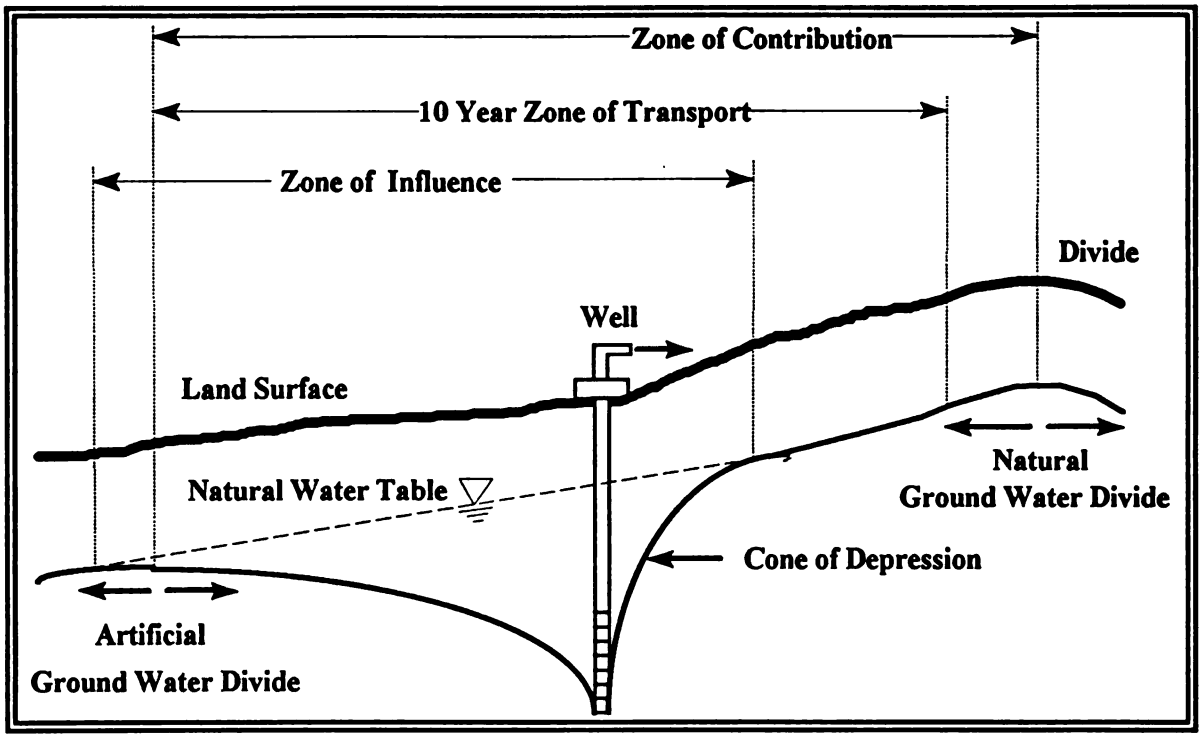

Figure 1. Illustration of terminology used for wellhead protection area delineation. Modified from U.S. Environmental Protection Agency "Guidelines for Delineation of Wellhead Protection Areas" (EPA 440/6-87-010, Washington D.C., 1987, pg. 2-21). Drawing not to scale.

2) Importance of Inter Community Coordination with Wellhead Protection Programs

2.1) Ecosystems and Political Boundaries

Political boundaries do not necessarily coincide with ecosystem boundaries. A situation where political and ecosystem boundaries match is uncommon due to a number of practicalities. First of all, ecosystems do not have well-defined boundaries. Secondly, depending on the natural resource of interest and the scope or scale of management interest, the size and location of the resource area will vary. So therefore we must

establish an organizational framework that is able to manage a resource at the appropriate scale and level.

Ecosystem boundaries are in themselves obscure. In reality it is difficult to accurately delineate an ecosystem boundary. In the natural landscape, ecosystems intermingle with transitions from one to the other. Examples of this would be with the transition from an aquatic to an upland ecosystem. There will be a gradual transition from one to the other, indicated in such measurements as soil saturation or the amount of oxygen in the soil which will gradually transition from one level to the other over a short or possibly long distance. With ground water, boundaries are generally set at major bodies of water and ground water divides. While it is easy to identify where a boundary lies with a water body such as a river, it is very difficult to accurately delineate a ground water divide. With many hydrogeological studies, these divides are arbitrarily set at the same location as the surface terrain or drainage divide. Because geologic formations are often complex, there may be some error involved. Therefore it is difficult to delineate an ecosystem boundary as accurately as a parcel of land or jurisdictional boundary.

In attempting to delineate these ecosystem boundaries, using the surface drainage basin is one of the more practical means:

> "Integrated land use management requires that the spatial scale of governmental influence encapsulates the boundaries of the ecosystem of concern. Generally, ecosystems boundaries can be delineated by the boundaries of a watershed. ... In Michigan, ad hoc arrangements of governmental units cut across the natural landscape and conflicting jurisdictions confound effective planning. Furthermore, land use

constraints are often perceived by private land owners as constitutional "taking" without due compensation."[11]

The size, shape and location of the ecosystem will vary depending upon the resource being managed and the scale at which it is being managed. It would be very hard to establish one organization for the management of a comprehensive set of ecosystems. In the natural environment there are a variety of natural systems with internal cycles that interact with each other over a wide range of spatial areas and time frames. Each major component of the environment consists of a number of cycles: there is the short, local cycle; the medium, regional cycle; and a longer, global cycle.

With the hydrologic cycle, there are a wide range of shorter, internal cycles within the larger. A very short cycle would be the evaporation and precipitation of water over the same major body of water, or precipitation over a forest followed by evapotransporation back into the atmosphere. A longer cycle could be that of evaporation over the sea, precipitation on land, infiltration to the ground water, base flow to surface water and movement back to the sea. Therefore environmental cycles are very complex in that they consist of numerous internal cycles as well as interactions with other systems.

The scale and level of management for an ecosystem depend also on the component of the environment that is to be managed. The area for management of surface water pollution may vary from that of ground water pollution or air pollution. Both have local, regional and global levels; but depending upon the desired results, the level of management may vary.

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11 Public Sector Consultants, Absence of Integrated Land Use Planning that Considers Resources and the Integrity of Ecosystems: White Paper on Michigan's Environment and Relative Risk, Lansing, MI, 1992, pg. 4.

Therefore, a management framework needs to be established which allows us to effectively manage selected resources at the necessary level and scope. A good measurement of the scope of the Michigan Wellhead Protection Program is the use of the ten year time of travel for delineating the management boundary (while there are aspects of the program that extend beyond this).

2.2) Potential Incompatibility Between Communities

Resource management incompatibility between communities is a real possibility in Michigan. As stated in the study, *Michigan's Environment and Relative Risk*, there exists an "absence of land use planning that considers resources and integration of ecosystems"; that "agencies manage the resources under their statutory jurisdiction as individual commodities [and] ... land use authorities ... express their control and power at the local level [with] little attention ... paid to coordinating the goals of these various entities to lay the foundation for integrated land use planning."[12]

Various divisions of State government, as well as county and local government units often exercise land use and natural resource management over their particular area of jurisdiction, in an often disjointed manner. The study identifies the need in Michigan for a more comprehensive land use policy that not only individually serves the needs of local communities, but also takes into account the larger issues of: natural resource management, the large scale ecological systems that extend beyond local and county political boundaries and, that the resources contained within local communities serve values extending far beyond local jurisdictions.

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12 Michigan Department of Natural Resources, Michigan's Environment and Relative Risk, Lansing, MI, July of 1992, pg. 22.

While this study identifies the need for a more coordinated and comprehensive land use policy, it is also important not to discount the substantial importance of local level planning and public participation. Home rule and the sanctity of a local municipality's right to plan for its own future have been the long-standing and compelling tradition in Michigan. And while it is obvious that there will need to be some changes to this doctrine in the near future, the Wellhead Protection Program is being implemented now in this present political environment. This is why this paper is focusing on improving coordination with local units of government and modifying existing resource management and planning duties now being carried out at higher levels of government.

The Michigan Wellhead Protection Program is designed to be implemented at the local community level. This strong grass-roots effort is instrumental in ensuring that a plan is developed which reflects the true desires of the local community; but the lack of involvement by county level agencies may hinder a county or regionally integrated ground water protection effort.

The American Society of Civil Engineers has identified problems with the management of water resources and its interrelationship with land use.

> "...those administering federal programs have talked of 'water and related land resources.' In reality, however, the interrelationship has received inadequate consideration, largely because of organizational conflicts. For example, the Corps of Engineers and other federal water resource agencies have maintained that land use regulation is a local responsibility, and so they have not intruded into this area of control. At the same time, however, local land use planning and decision making must incorporate many aspects of water resources, even though management of these resources may be at a higher level of government. Accordingly,

intergovernmental cooperation is essential in dealing with water-land use interrelations."[13]

There is a lack of a coordinated effort between higher level agencies and local units of government to manage the land use and water resource relationship. Because the Wellhead Protection Program is a locally implemented program, it will be effective in increasing the interrelated management of land use and ground water resources under the State's current planning framework. Implementing this program at the local level places more of the ground water management power with the same unit of government that controls land use policy. The need for coordinated management extends beyond just an integration of local government and higher level agencies. There also is the need for horizontal management between separate local units of government across geographical areas; all of which are interlinked with a variety of ecosystems.

Ground water resources cross political boundaries. The ten year time of transport may extend beyond a local jurisdictional area; such is the case in Oxford Village, in Oakland County, where the municipality's wellhead protection area extends out of the village limits into Oxford Township and even into the adjacent county of Macomb. In situations such as this, a community is faced with the position of managing a resource that extends beyond jurisdictional lines and into areas where the community does not have the police power authority.

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13 American Society of Civil Engineers, Urban Planning Guide, American Society of Civil Engineers, New York, NY, 1986, pg. 308.

3) Water Law as it Applies to Ground Water Protection

3.1) Riparian Rights

Michigan is under riparian rights doctrine. This is the system of water rights associated with land ownership which is prevalent in the eastern United States. This doctrine has its base in English common law and is used for surface waters. According to Grad (1985), a property owner's right to use water arises from the ownership of land which borders that body of water. There are two fundamental principles of allocation. First is the natural flow principle: that a land owner may not use the water so as to diminish the quantity or quality of another riparian owner's right to do the same. Secondly, and more applicable to present day, is the reasonable use approach. This states that "each riparian owner may make reasonable use of the waters with due regard of the needs of other riparian owners. Reasonable use, therefore, involves ... balancing the needs of different users at a given time and place."[14] The reasonable use principle is applied in a number of cases to the requirement that a riparian owner may not, in addition to unreasonable alteration of flow, degrade the quality of the water, see: Parker v. American Woolen Co. (195 Mass. 591, 81 N.E. 468, 1907).

Although the riparian rights doctrine has been applied to only surface waters (and may not be practical for ground water), some interesting parallels can be made for the purpose of discussion. First of all, simple land ownership includes the land, everything below the surface to the center of the earth and above into the sky for infinity. These ownership rights are of course an idealistic situation which has been limited over time by such things as rights for aircraft to pass over the top of properties, but nonetheless, in

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14 Frank P. Grad, Environmental Law, Third Edition, Matthew Bender, New York, NY, 1985, pg. 26.

most situations, these rights will include the right to use ground water that is passes through the land. This is where the similarity ends though. Because in actuality, surface waters, which are associated with land ownership, are controlled as quasi-public interest through what is known as the public trust doctrine, which was explained as follows in the U.S. Supreme Court decision in Illinois Central Railroad Co. v. Illinois, 146 U.S. 387 (1892):

> "The trust devolving upon the state for the public, and which can only be discharged by the management and control of property in which the public has interest, cannot be relinquished by a transfer of property. The control of the state for the purpose of the trust can never be lost, except as to such parcels as are used in promoting the interests of the public therein, or can be disposed of without any substantial impairment of the public interest in the lands and waters remaining."

The right to use ground water, which is associated with land ownership, is more closely related to mineral rights. For the purpose of discussion I would like to propose that perhaps this is not the best way to view the right of a land owner to use ground water. It is now a known scientific fact that ground water is generally not stationary, but moves through the earth under the same basic laws of physics, kinetic energy, and is interlinked with the hydrologic cycle (see Sections 1.4 and 1.6). "While ground water and surface water are generally thought of as separate systems, they are highly interdependent components of the hydrologic cycle."[15] I feel it should therefore be treated in much the same way as surface waters.

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15 U.S. Environmental Protection Agency, A Review of Methods for Assessing Nonpoint Source Contaminated Ground-Water Discharge to Surface Water, Washington D.C., (EPA 570/9-91-010), Apr. 1991, pg. 1.

3.2) Tort Liability

Laws have been passed which prohibit the discharge of pollutants into the environment. At the Federal level, these laws include the Resource Conservation and Recovery Act (RCRA), the Federal Water Pollution Control Act (FWPCA), the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act (TSCA), as well as others. In the State of Michigan, there is a second level of regulation which provides additional standards such as the Michigan Water Resources Commission Act (P.A. 245 of 1929), the Michigan Hazardous Waste Management Act (P.A. 64 of 1979), the Underground Storage Tank Regulatory Act (P.A. 423 of 1984) and the Pesticide Control Act (P.A. 171 of 1976). The Michigan Water Resources Commission Act states that: "It shall be unlawful for any person directly or indirectly to discharge into the waters of the state any substance which is or may become injurious to the public health safety or welfare..."[16] These laws all place the burden of responsibility on the handler of hazardous materials to carry out best management practices and prevent a pollution incident from occurring.

There are criteria for determining what a hazardous material is and at what concentrations it becomes such. The Environmental Protection Agency (EPA) identifies hazardous materials as having any one or more of the following characteristics: ignitability, corrosivity, reactivity or toxicity. Ignitability refers to posing a fire hazard based upon flash point and oxidization criteria set by the EPA. Corrosive materials have a pH less than 2.0 or greater than 12.5, or corrode steel at a rate of at least .25 inches per year. Material which exhibits the characteristic of reactivity is unstable, reacts with water,

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16 The Michigan Water Resources Commission Act 245 of 1929, as amended, Section 6(a).

generates toxic gases or fumes, or is readily capable of detonating.[17] Toxicity refers to the materials which may release toxicants posing a hazard to human health.[18]

The extent to which these materials are regulated under the associated state and Federal laws depends upon quantities being handled. Under RCRA, facilities that generate less than 1,000 kg of hazardous materials per month are excluded from the notification and manifesting requirements of the Act (this does not apply to acutely hazardous wastes listed under 40 CFR 261.33). Similarly, in Michigan, the Fire Prevention Code (P.A. 207 of 1941, as amended) requires secondary containment for storage tanks larger than 1,000 gallons used for combustible liquids. Despite these thresholds, individuals are still required to ensure that hazardous materials are handled and disposed of properly.

While there are materials that are inherently harmful to humans, other materials which are essential for human well being, can also pose a health threat if exposed in high concentrations or large doses. Chemicals such as Zinc, Fluoride, Manganese and Potassium are just a few elements that are essential to human life, but if ingested at excessively high concentrations, can be injurious to health. (see Figure 2)

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17 Panos Kokoropulos, Hazardous Waste Management, Air Force Institute of Technology, Wright-Patterson Air Force Base, OH, 1990, pg. 10.

18 Frank P. Grad, Environmental Law, Third Edition, Matthew Bender, New York, NY, 1985, pg. 640.

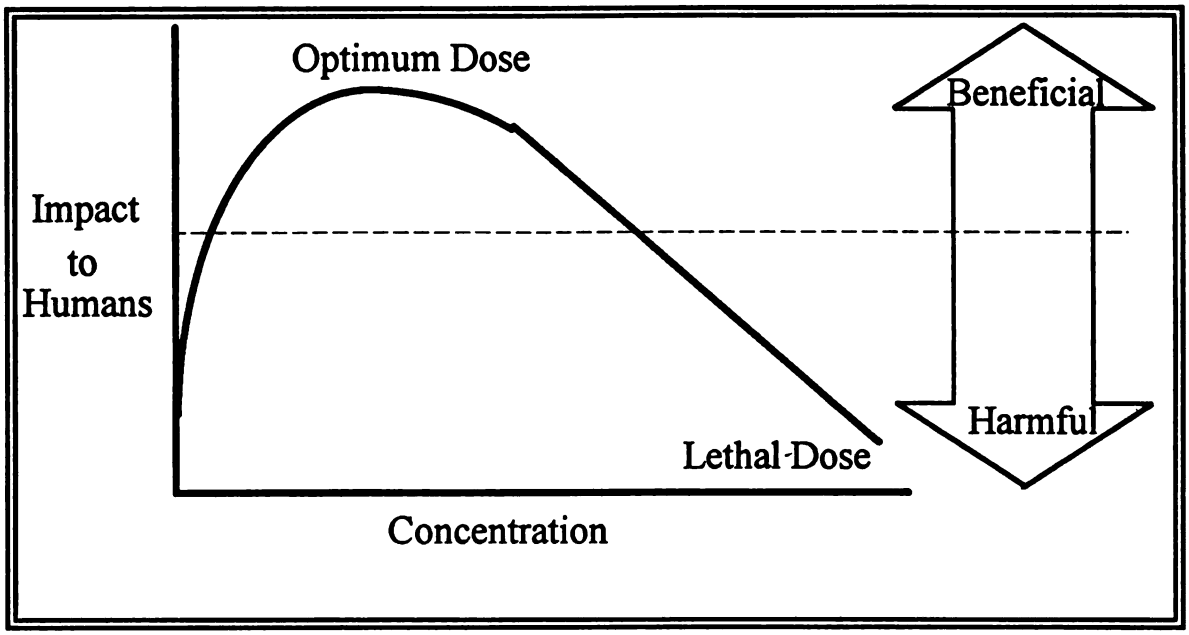

Figure 2. Dose-response curve. Curve showing the influence that a chemical substance will have on the human biosystem at varying concentrations. Modified from geochemistry lecture by David Long, Ph.D., Department of Geological Sciences, Michigan State University.

If an individual is careless with hazardous materials, based upon the many laws which regulate the use, handling and disposal of these substances, he or she may be held liable for any damages resulting from the incident. For the courts to find an individual responsible and liable for polluting ground water, and the damages suffered as a result, there needs to be proven, beyond a doubt, that a chain of events links the polluter and the individual harmed by the pollution. First, the court must establish that the polluter had a duty to uphold. In this case, that duty is to exercise best management practices for the handling and disposal of hazardous materials as required by numerous state and Federal regulations. Secondly, it must be shown that the polluter was in breach of his/her duties by not taking all reasonable precautions in avoiding polluting the ground water. After establishing a breach of duty on the part of the polluter, there next needs to be an injury

sustained by the recipient of the polluted ground water. This could take the form of illness in individuals drinking the water or a municipality undertaking enormous cost in the cleanup or having to relocate the well field. While this chain of events may be somewhat easy to establish, the final and most crucial step has been very difficult to prove: proximate cause. To establish proximate cause in a ground water pollution case, it must be proven that the specific act of the polluter caused the injury sustained.

The Texas Court of Appeals heard an appeal of a case involving a cattle farmer's claim that the pollution caused by an aircraft manufacturer caused the death of his cattle and thereby his suffering of monetary damages. The details of this case involved some uncertainties with regard to proximate cause of the injury. The court stated that, "[i]n such cases it is held that where there is no basis for determining how much of the of the damages suffered resulted from the wrongful acts of the defendant, and how much resulted from other cases, a judgment would be based on mere conjecture, and could not be upheld" (Globe Aircraft Corp. v. Thompson, 203 S.W. 2d 865, 1947).

This case serves as an example that to determine proximate cause, one must be able to prove the chain of events that show the injury resulting from polluted water was in fact caused by the negligent act of a handler of hazardous materials. Given the level of detail of hydrogeologic analysis done to delineate a wellhead protection area, one could predict, with a certain degree of accuracy, the travel time and dispersion of a contaminant entering the ground. The geology of most areas, especially glaciated areas such as Michigan, leaves some room for dispute over the scientific data, but having this information could help the local community litigate against uses in adjacent communities, given that contamination does occur at some future date.

In a later decision, the Texas Supreme Court heard a case that involved two separate companies who on the same day, both discharged pollutants into a pond, on an adjacent property, being used for farming fish. The court in this case held that:

> "Where the tortious acts of two or more wrongdoers join to produce an indivisible injury, that is, and injury which from its nature cannot be apportioned with reasonable certainty to the individual wrongdoers, all of the wrongdoers will be held jointly and severally liable for the entire damages and the injured party may proceed to judgment against any one separately or against all in one suit" (Landers v. East Texas Salt Water Disposal Co., 151 Tex. 251, 248 S.W. 2d 731, 1952).

This seems to indicate that multiple polluters can be held liable for creating a pollution problem.

These cases may be interpreted to show that a property owner can be held liable for damages to an adjacent community's water source if the appropriate negligence and proximate cause can be established. By having a wellhead protection plan that indicates general direction and speed of ground water flow, it will be easier to establish this. But can a community, which allows a use that ends up polluting, to locate in an adjacent community's wellhead protection area, also be held liable for this? In a strict legal sense, it probably can not. This is because a lawful use of land is not a polluter per-se, but becomes one by accident.

The State, though, has acknowledged a link between land use and ground water contamination:

> "The following land use categories were considered by the DNR to pose a very high threat of ground water contamination: petroleum product manufacturing (including coal); junk yards and salvage yards; vehicle maintenance services, including public and private garages; chemical paint

> and allied products manufacturing; laundries and dry cleaners; and electronic and other equipment, including plating and chemical coating."[19]
>
> "Kalamazoo County Well fields are also threatened by nearby land use practices. At present, there are 90 known environmental contamination sites in Kalamazoo County. A wellhead protection program would marshal all available government resources towards the challenge of reducing future threats to municipal water supply systems. *** City of Gaylord officials are also concerned about land uses which threaten public drinking water supplies. *** The particular land use activities which pose potential threats to public drinking water supplies vary among communities. The ease with which ground water can be contaminated as well as the extent of the area which contributes water to the aquifer also vary."[20]

It appears that a link has been documented by environmental authorities between certain land uses and pollution of the environment. Certain noxious and hazardous uses will inevitably cause pollution. This link may be conclusive enough to justify prohibiting certain hazardous land uses in environmentally sensitive areas. Actually, this type of practice has been a long standing part of zoning. Many of the older writings on the need for zoning have as an objective the removal of residential areas from the noxious and polluted industrial areas.

While the intention of the State is not to have wellhead protection areas which exclude legitimate and appropriate uses, it does believe that performance standards and greater scrutiny are necessary for potential contaminators.

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19 Public Sector Consultants, Nonpoint Source Discharges to Surface Water and Ground water: White Paper on Michigan's Environment and Relative Risk, Lansing, MI, 1992, pg. 1.

20 Michigan Department of Natural Resources and Michigan Department of Public Health, State of Michigan Wellhead Protection Program, Lansing, MI, August, 1992, pg. 4.

The local unit of government is bound, though, to ensure that any potentially hazardous use is conducted in a manner following sound, legal requirements, and if the community fails to do so it should be held liable. This includes site plan review, building inspection and continual monitoring of a potentially hazardous use. Hazardous land uses should, in general, be subject to a special use permit and assurances for proper facility design and hazardous material management.

3.3) Police Power

A local community has the authority to regulate under the police power for the protection of citizens' health, safety and welfare. A city has this right under the Michigan Home Rule Cities Act (P.A. 279 of 1909). A city or village also has the power to regulate the use of land through the City or Village Zoning Act (P.A. 207 of 1921) which states:

> "The legislative body of a city or village may regulate and restrict the use of land and structures; to meet the needs of the state's residents for food, fiber, energy and other natural resources, place of residence, recreation industry, trade, services, and other uses of the land; ... to facilitate adequate and efficient provision for ... ***water*** ... and to promote public health, safety and welfare, and for those purposes may divide a city or village into districts of the number, shape, and area considered best suited to carry out this section."[21](emphasis added)

A township has similar authority under the Michigan Township Rural Zoning Act (P.A. 184 of 1943). These various zoning acts require that the zoning ordinance be based upon a plan designed to promote the public health, safety and welfare. These various types of local governments are also given the authority to make and adopt a plan under a variety of planning acts for each.

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21 Michigan City or Village Zoning Act 207 of 1921, Section 1. (1)

What these various acts provide for is that a local jurisdiction may develop a land use plan and regulate development to protect the public health, safety and welfare. The statement that these regulations must be based upon a plan is important to point out. An ordinance that is not, may be found to be arbitrary. There are a number of important steps that need to be followed to develop a plan and ordinance which protects the public health, safety and welfare.

With the Wellhead Protection Program, the local jurisdiction will proceed through a number of steps. First, the local legislature will identify goals and objectives for the protection of the local ground water drinking supply. On the basis of these goals and objectives, data will be gathered not only on the ground water supply, but also land use, sources of contamination and the public use and impact on water supply and quality. Based upon these, a plan is developed for the protection of the wellhead area and drinking water supply. This plan will present alternative solutions to managing the natural resource. These will include regulatory procedures as well as other programs such as public education and awareness. From this plan, the local legislative body can adopt regulations which are rationally connected with the protection of the public health, safety and welfare.

4) Inter Community Coordination

4.1) County and Regional Integration of Wellhead Protection

Counties may also develop a zoning ordinance for portions of land within the county that are outside the limits of cities and villages and outside of townships with their own zoning ordinances, in accordance with the Michigan County Rural Zoning Enabling Act (P.A. 183 of 1943). Many parts of the state, where there is large population and the strongest need to protect ground water public drinking sources, will have mostly, if not

all, land in incorporated cities, villages and zoned townships, such as Oakland County. In areas such as these, counties may have less control over local planning and land use decisions. For incorporated parts of a county, the County Planning Act states that "Any plan describing the recommended development of an incorporated area shall not be recognized as official plan or part of the official plan for that area unless adopted by the municipality"[22]. This greatly limits any power a county may have over incorporated areas. This is not to say that a county government can't play a major role in coordinating local wellhead protection programs.

Many county planning functions serve as central sources of information for local communities. This is the case with Oakland County where the Planning Department collects information, places it in a Geographic Information System, and makes the data available to local communities. One example of this is with the Michigan Sites of Environmental Contamination Priority Lists (Michigan Environmental Response Act, PA 307 of 1982). The Planning Department receives reports from the DNR and produces relatively accurate maps (U.S.G.S. 7 1/2 minute quadrangle maps) showing the locations of these sites within the county. This same type of information collection and distribution can be done for wellhead protection areas.

Other counties, such as Monroe County, serve a much more involved role in local community planning by aiding local communities in developing master plans. In rural areas, township master plans and zoning ordinances must be submitted to the county for approval. The Township Planning Act states that: "The plan or parts thereof shall be referred to the county planning commission ... for its approval."[23] This is a significant

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22 Michigan County Planning Act 282 of 1945, Section 5.

23 Michigan Township Planning Act 168 of 1959, Section 8. (1).

means for the controlling of land use in un-incorporated areas surrounding a municipality with a wellhead protection plan. When reviewing a township plan, the county should specifically look at proposed land uses within critical ground water recharge areas.

There is a complication which needs to be pointed out in situations where a county that is very involved in developing plans for townships. In these situations a county is both the developer of the plan and the approving authority of the plan. There is no required review of a county's work by the regional planning agency or the State. The absence of this check and balance could be a potential problem. I believe this absence of a check and balance for plans developed by incorporated places is also a serious problem.

Regional level planning in Michigan has no real authority over local planning and zoning. The Michigan Regional Planning Act (P.A. 281 of 1945) set forth the procedures for forming a regional planning agency by local units of government. Participation by local units of government is voluntary as is the payment of fees for planning services rendered. Local adoption of any plans developed by a regional planning agency is also entirely voluntary.

Regional planning agencies, though, has informally obtained strong power in many parts of the state. One of their greatest sources of power is information. Regional agencies develop studies and reports on area growth trends and issues. These reports are read by officials in local and State agencies, utility companies and private sector corporations. Regional agencies could collect local wellhead protection plans and publish, as part of an annual report on water resources, a regional map showing the location of all managed wellhead protection areas in the region.

4.2) Local Powers vs. State and/or County Authority

The Wellhead Protection Program is voluntary for all local units of government and is intended to be a locally initiated and managed. Although there are profound advantages to this form of "Grass Roots" planning, there also arise significant complications that need to be addressed. There is a critical balance of power needed to ensure that this program remains a localized planning effort, with county agencies acting as coordinators between adjacent municipalities. This balance should maintain the maximum amount of authority and responsibility at the local level, while allowing county, regional and State agencies to coordinate the development and implementation of the WHPP as part of a regionally integrated and comprehensive planning effort.

The WHPP's strong emphasis is on the current local planning framework in Michigan, which is based upon a strong home rule. I have cited in this paper reasons why Michigan needs a more coordinated and comprehensive land use policy. Michigan has a very strong tradition of home rule and this has minimized the amount of planning activities that take place at the State level. Michigan will need to make major changes in the way we manage our land and resources the near future. For the purpose of this study, though, we must address the immediate needs of the WHPP which is being implemented now in the present political environment.

There are a number of compelling reasons why it is logical to have the WHPP implemented at the local level. First of all, the program places the decision making power at the local level. This serves to empower local officials to develop policies which are best suited for their community. By having this power at the local level, the program is likely to be adopted and implemented with more enthusiasm by the local government and

citizens. This is because it will be their plan that they developed. This "pride of ownership" over a plan will generally have much more positive results in implementation.

Secondly, local units of government have strongly established ties with the local citizenry. This is through the day to day interaction that local officials (elected, appointed and administrative) have with the citizens. Local communities will also have strong ties with other local organizations such as the chamber of commerce, schools, churches, other non-profit community organizations and local business. There are also established and regularly scheduled meeting times for the Council/Board and the Planning Commission that are open to the public for involvement. These ties are all vital to developing a successful local Wellhead Protection Plan. These ties provide a means for collecting public comments and concerns over managing ground water resources. Because one of the main thrusts of the program is to educate the public on drinking water and protecting our ground water resources, these links to the community are imperative.

Most importantly, though, the program places the authority and decision making power for ground water protection at the same level of government as the power to plan for and regulate land use. This is critical. The same planning commission which is conducting and adopting (recommending to Board/Council) the wellhead protection plan and all of the management programs, which may include overlay zoning, is the same local legislative body that is responsible for developing and enforcing the Zoning Ordinance as well as the community's Master Plan.

An example of a program which is held more tightly by higher levels of government is the National Flood Insurance Program. This program is managed under the Federal Emergency Management Agency (FEMA) which has delegated some authority to the State level. In order for a community to qualify for Federally subsidized flood

insurance, it must participate in the program by adopting flood plain regulations which meet FEMA standards. These regulations are reviewed and approved by the DNR Land and Water Management Division. Because this program is mandated, for those who wish to qualify for Federally subsidized flood insurance, an ordinance is developed at the local level to meet the required standards and submitted for approval. Many communities will adopt ordinances "blindly" from generic requirements without assessing the true needs of the community for protecting rivers, lakes and shorelines. If a community has the initiative to do so, it could conduct a study of the flood plain and shoreline areas and adopt an ordinance that not only meets the requirements of FEMA, but also addresses a myriad of other local problems associated with flood plain areas that are not characteristic of all other communities.

While it is very important that programs such as the Flood Insurance Program are controlled at a higher level of government, this example illustrates that a locally initiated study will often better address unique individual needs.

The WHPP is an even greater example of managing a resource which will have an infinite number of localized idiosyncrasies; many of which may be better studied and accommodated for by the local ordinance than a program "mandated from above." If ground water did not pass through political boundaries, then local management would be sufficient. But it does, and therefore there is also a need to have some degree of management at a level that can address these inter jurisdictional resources. These two varying reasons to have the resource managed at various levels of government are why there needs to be a coordinated management that balances local vs. county, regional and State control.

4.3) Local Responsibilities Between Adjacent Communities

In Michigan, communities have home rule which allows them to undertake any action for which they have been delegated the authority, provided this action does not violate State or Federal Law. Therefore a local unit of government is responsible for following the laws set by the State or Federal government. But what responsibilities do local communities have to each other? One community is not mandated to adhere to any laws which an adjacent community passes (without some form of cooperative agreement). Through the interstate commerce clause of the Federal Constitution, the Federal Government maintains control over activities that are seen to be of importance over more than one state, and actions which could be taken by one state affecting another. With wellhead protection, the State has chosen to delegate authority to the local unit of government.

There are some existing laws that can be used for groups of municipalities and/or townships to group together and form a cooperative agreement to perform studies and manage resources. The Intermunicipality Committees Act (P.A. 200 of 1957) provides that "the governing bodies of two or more municipalities, by resolution, may establish and organize an inter municipal committee ... for the purpose of studying area governmental problems of municipal interest or concern, including such matters as ... water ... and formulate recommendations for review and action thereon by the member governing bodies."[24] This could be used by a group of local governments that share the same ground water resources to combine and formulate an integrated plan to protect the common aquifer. This would first require a delineation of the ecosystem, i.e., the common aquifer, and an identification of those communities which share this resource.

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[24] Michigan Intermunicipality Committees Act (Act 200 of 1957), Section 2.

The Local River Management Act (P.A. 253 of 1964) was passed for the purpose of "enabling local units of governments to cooperate in planning and carry out a coordinated water management program..."[25] This act allows three or more local units of government which lie within the same surface watershed to enter into a cooperative agreement and form a council made up of representatives from each community. The primary function of the watershed council is to "conduct ... studies of the water resources of the watershed, including investigations of water uses, water quality and the reliability of the water resource."[26] Under these two Acts, local communities can (and do) voluntarily cooperate and forge a coordinated effort towards management of ground water resources.

5) Presently Existing Management Programs

5.1) State

5.1.1) State Level Planning

An important part of managing water resources is management of land use. There are a number of planning activities that State agencies are actively involved in which have a pronounced effect on the land use and development patterns of Michigan. Examples of these are transportation planning and economic development.

Some of the background research done for Michigan's Environment and Relative Risk found that:

> "Land use, by and large, determine the future. The land in Michigan has a fundamental role in sustaining our society for the long haul. Despite this overwhelming importance, Michigan lacks a statewide

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25 The Michigan Local River Management Act (Act 253 of 1964).

26 The Michigan Local River Management Act (Act 253 of 1964) Section 6.(a).

> planning system that encourages appropriate land uses with consideration for sustainable resources and long-term ecosystem health."[27]

State agencies such as the Michigan Department of Transportation (MDOT) are actively undertaking massive programs that are a central part of the land development patterns of this State. The decision to construct a highway and the selection of a roadway route have significant effects on the landscape.

> "First, transportation is a critical factor in making parcels available for development. A central characteristic of most urban networks is that they serve major activity centers which are a focus for transportation services and are junctions or terminal points for the congested high traffic volume corridors. This relationship produces the high densities of land use in metropolitan areas, and, inturn, the high values of land observed in these centers.
>
> ***
>
> A second factor in the transportation and land use relationship is that transportation facilities occupy land. Between 25% and 45% of the land in central cities (approximately 3 % nation wide) is devoted to highways, streets, and parking lots."[28]

This illustrates the effects that transportation planning can have on land use patterns and the landscape in general. The improvement of access to individual parcels of land will have a significant effect on the type and intensity of land use. Industry and commercial development are attracted to areas such as expressway interchanges and highway junctions, airports, sea ports and rail stations. More intensive commercial development will generally result in an increase in the amount of impermeable land cover

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27 Public Sector Consultants, Absence of Integrated Land Use Planning that Considers Resources and the Integrity of Ecosystems: White Paper on Michigan's Environment and Relative Risk, Lansing, MI, 1992, pg. 1.

28 American Society of Civil Engineers, Urban Planning Guide, American Society of Civil Engineers, New York, NY, 1986, pg. 122.

due to buildings and large parking lots. According to the American Society of Civil Engineers, the runoff coefficient for a business area is between 0.50 to 0.95 while the runoff coefficient for a single family residential area is between 0.30 to 0.50, depending upon density, soil permeability, and storm intensity. This will therefore affect the amount of ground water reaching the aquifer. A reduction in the amount of infiltration will decrease ground water recharge. As was also stated by the above quote, the roadways themselves cover a large area of land. While roadways are factored into the runoff coefficients, these also serve to increase the amount of impermeable area.

One of the primary areas of emphasis in the Wellhead Protection Program is to protect public ground water drinking sources from contamination. The more intense land uses, identified above as being partially dependent upon transportation networks, will also have the potential to introduce higher levels of contaminants to the environment (see Section 3.2). The greater surface area of roadways and parking lots will result in an increase in the amount of polluted runoff resulting from such things as roadway deicing chemicals and vehicular by-products such as oil and other mechanical fluids. The resulting increased industrial activities will also have the potential to introduce more contaminants to the environment as a part of manufacturing and transporting activities.

Through a more coordinated effort at the State level between various agencies, the long term impact of activities on the natural and human environment can better be evaluated. There should be a more centralized effort at the State level focused on the exchange of information that can be used to better assess decisions. The problem identified in the study, *Michigan's Environment and Relative Risk*, should be solved partially by having a mechanism for the input of information, such as the location of wellhead protection areas, into a more holistic approach to planning. Major activities, such as the routing of major highways, should be reviewed by a multi-agency task force

that looks at items related to the environment and land use and provides the lead agency with input on selecting the best alternative. Major actions should at least be coordinated among the various agencies the ensure integrated resource management.

Many of the new requirements of the Inter Surface Transportation Efficiency Act (ISTEA) will direct state efforts towards addressing some of these issues. This Act requires each state to develop a long-range transportation plan and a transportation improvement program for the state that considers some of the issues raised herein. ISTEA also provides transportation enhancement funds specifically for the improvement of conditions such as mitigation of water pollution due to highway runoff. The objectives of ISTEA are focusing on the broader relationships that transportation networks have on the surrounding landscape.

The National Environmental Policy Act (NEPA) states that:

> "Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impacts allowed."[29]

One of the intentions of this statement was to require this type of coordination between Federal agencies to ensure the avoidance or minimization of impacts to resources under another agency's jurisdiction. The agency that is the proponent of the action will often not be aware of the existence of, or have the expertise to evaluate the impact to a proximate resource. I believe the intent of NEPA was to require an evaluation of impacts and coordination with other agencies (Federal, state and local) at a point in the planning process where this information could be taken into account when deciding between

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29 National Environmental Protection Act, (42 U.S.C.A. Section 4321 to 4370c), Section 4332(C).

alternatives. On the basis of my personal experience and observations, implementation of NEPA is often conducted at a point in time where agency commitment to the project design is extensive enough (but not exceeding a point where it could be construed as an irretrievable commitment of resources, i.e., construction has not begun) but to a point where if potential significant impacts are realized, this impact is endured or the project is delayed or not initiated. The implementation of NEPA as a final requirement prior to project construction or initiation causes problems with successful coordination with other agencies, such as those involved with ground water protection.

The State needs to have a better integration among the various departments, regional agencies and local governments. I feel that the planning function in the Governor's Executive Office should take a more active role in developing and directing multi-departmental working groups which provide a more interdisciplinary approach to planning. This can be done through bringing together planners and others responsible for resource management.

5.1.2) Permits

As I identified above in section 3.1, ground water and surface waters are generally interlinked as parts of the hydrologic cycle. Therefore actions affecting surface waters have the potential of significantly affecting ground water resources. This is the reason for the need to coordinate a variety of programs affecting surface waters with the Wellhead Protection Program. There needs to be a comprehensive approach to water resource management in the State.

> "Building institutions, especially at the state level, is critical to the comprehensive management and protection of ground water. Many states have made major strides in increasing their capabilities to protect ground water, despite the difficulties implicit in this complex problem. While many states have expanded substantial efforts to build and coordinate their state

> programs and have comprehensive programs that are in development or under operation, these efforts are still insufficient to ensure protection for a resource that demands a comprehensive approach."[30]

The State of Michigan is initiating an effort in the right direction by developing a wellhead protection program that not only involves local governments in ground water protection, but places them as the focus of the program. But for this program to be successful, the efforts of local units of government must be integrated with the State's comprehensive management of not only water resources, but land, water and other resources as a whole. To properly manage water resources, there needs to be an integrated management with all resources. The use of land, the removal of vegetation, the alteration of surface water bodies, all have an effect on the hydrologic cycle, which has an effect on ground water resources.

An example of another State activity which affects the hydrologic cycle is water way/wetland dredge and fill permits. The State of Michigan has been delegated authority for the Clean Water Act Section 404 dredge and fill permitting from the Federal government. This allows the DNR to regulate the dredge and fill of bottom lands. Bottom lands refer to lakes, rivers, streams, wetlands and flood plains. The State implements this through two Acts: Michigan's Inland Lakes and Streams Act (P.A. 346 of 1972, as amended) and Michigan's Goemaere-Anderson Wetland Protection Act (P.A. 203 of 1979, as amended). These acts allow the DNR to regulate much of the activity that will have a direct impact on inland waterways (the Federal government retains control over the Great Lakes, Lake St. Clair, the Detroit and St. Clair Rivers). As I pointed out previously, surface waters are interlinked with ground water. Therefore management and

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30 U.S. Environmental Protection Agency, Ground Water Protection Strategy, Washington D.C., Aug. 1984, pg. 29.

permitting for the dredge and fill of surface waters should be coordinated with the protection of ground water. This is one of the reasons why the State should remain involved with a local government wellhead protection plan.

Part of the criteria set forth by the recent amendments to the Wetland Protection Act is the required evaluation of wetland ecosystem values in determining whether a local community may regulate a specific wetland under 2 acres in size. One of these criteria is *documented* linkage with ground water resources. This is an example of where these two programs should be linked. Using the hydrogeologic analysis done with pump tests as part of wellhead delineation, recharge boundaries, such as a wetland or other surface boundaries can be delineated and the importance of that wetland documented.

The White Papers (background papers) which were developed as research topics for the *Michigan's Relative Environmental Risk* identified that there are even coordination problems within single agencies:

> "Within the MDNR, the several divisions all develop their own objectives and manage separate databases. There is very little linkage between these divisions such that common resource goals, resource data, and science are integrated into the management process. This places the resource at risk. Forest, wildlife, water, air, and the other resources that the MDNR is charged to protect are used to generate operating funds to support the various programs within the agency."[31]

This shows not only the urgent need to coordinate programs to ensure management of the State's resources is not contrary to overall best management, but also the need to share information.

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31 Public Sector Consultants, Absence of Integrated Land Use Planning that Considers Resources and the Integrity of Ecosystems: White Paper on Michigan's Environment and Relative Risk, Lansing, MI, 1992, pg. 11.

Another example of the need to coordinate local wellhead protection plans at the State level is with subdivision approvals. Final plat approval for all subdivisions is authorized by the Michigan Department of Treasury. DNR review is only required at the preliminary plat stage if the proposed subdivision contains or abuts a lake, river, stream or flood plain (section 116 P.A. 288 of 1967). If the area of the subdivision only provides ground water recharge to a wellhead protection area, without abutting a water body, it does not require review by the DNR, and review by the Michigan Department of Health is generally delegated to the county health office. While a subdivision development over a wellhead protection area may not pose a significant threat to ground water resources, a maximum allowed density with septic systems of 12,000 square foot lots in sandy soils may not be desirable. There needs to be a State and county level coordination of these types of issues.

5.1.3) Environmental Restoration and UST's

Another area that is currently being coordinated at the State level is the prioritization of Act 307 sites (Michigan Sites of Environmental Contamination Priority Lists) within wellhead protection areas. This program is best designed for coordination with the WHPP.

When a contaminated site is discovered, a risk assessment is developed which determines the relative hazard posed to the public health, safety, welfare, or to the environment. The assessment provides a numerical score representing the relative risk of each site. The numerical score of each site is reviewed annually for re-prioritization. If a wellhead protection area is found to contain contaminated sites or leaking underground storage tanks, the remediation of these sites is placed at a higher priority than those sites which do not pose an immediate threat to humans. Funding prioritization is based upon

the scoring which considers potential human exposure to hazardous substances and damage to natural resources. Because of the potential for increased population exposure, risk assessments for contaminated sites located within a wellhead protection area will indicate a much higher threat to the human environment. The intent of the DNR is to coordinate these two programs very closely.

5.2) County

5.2.1) County Level Planning

As I pointed out in section 4.1, one important aspect of county and regional government's role in area wide planning is the exchange of data and information. Through collecting information about local wellhead protection plans, or possibly even taking part in the process, a county planning department can develop a database of ground water information and make it available to other local units of government or other county departments such as the county road commission.

In section 5.1.1 I discussed some of the interrelationships between transportation systems, land use and water resources. The need for transportation planners and engineers to consider ground water resources is vital. As roadways are improved, access to and from the city will also improve. People are able to commute further in the same amount of time thereby enabling the proliferation of urban sprawl. County planning, both for land development and transportation network planning, needs to consider the holistic aspect of the landscape in decision making. The guardianship of critical natural resource areas, such as wellhead protection areas, needs to consider the amount and type of development that can be sustained before there is a potential to seriously impact the resource. Roadway improvements that increase capacity will also increase commercial and industrial development. This can be seen presently in south-central Oakland County where

commercial development has exploded in anticipation of construction of the Haggerty Road project. At the same time, there are areas within West Bloomfield, just east of Haggerty Road, where the roads have remained gravel, and the surrounding parcels of land have remained undeveloped.

The provision of other infrastructure improvements, in addition to roads, will also increase the desirability of an area to be more intensely developed. One potential trade off in ground water protection could be with the installation of sanitary sewer systems. While the replacement of septic systems with sanitary sewer in developed areas will normally increase local water quality, it will also lead to more intensive development. Many communities will plan for development densities at a much higher level if sanitary sewer is provided (e.g., 2 residential units per acre, 4 units per acre if sanitary sewer is available). While the local sanitary impacts of this increased density are more than offset by the sewer system, the other impacts associated with the much higher density and the commercial development are not. There will be an increase in impermeable area, decreasing ground water recharge. There will also be an increase in polluted storm water runoff. If additional commercial or industrial development follows, there will also be an introduction of a greater quantity and variety of hazardous materials that have the potential to impact ground water resources.

When a county makes decisions regarding the increased capacity of infrastructure, the desired level of development for that particular area needs to be considered. It may be advantageous to maintain ecologically important areas of the county in a more rural state through minimizing the amount of infrastructure improvements.

When a county reviews a township's master plan or zoning ordinance for approval under the Michigan County Rural Zoning Enabling Act, (P.A. 183 of 1943) it should

ensure that in situations were an adjacent municipality's wellhead protection area extends beyond local political boundaries into the township in question, that this be properly addressed in the master plan and zoning ordinance. For townships adjacent to municipalities with wellhead protection plans, the wellhead protection area must be shown as a constraint to development in the township master plan. Industrial development in these areas should be discouraged. While sanitary sewer may be desirable, other improvements may be more suitable elsewhere in the community and land use should be managed to minimize the amount of non-residential development.

5.2.2) Subdivision Approvals

As I identified above, the location and density of subdivisions with septic systems are something that should be taken into account for the protection of fragile ground water recharge areas or wellhead protection areas. The authority to review and approve subdivision plats is in most cases delegated from the State Department of Health to the county health departments.

> "Diffuse (nonpoint) pollution is increasingly recognized as the primary source of surface water degradation. Ground water has also been shown to be vulnerable to nonpoint source pollution. ... In an 1988 survey, the Michigan Department of Natural Resources (DNR) found the major rural sources of nonpoint source pollution were septic systems, stream bank erosion, and agricultural practices. ... [M]ore than 50 land use categories were identified as posing a medium-high risk of ground water contamination including golf courses, unsewered residential development ...[and] roads..."[32]

Oakland County has developed a policy for the siting and density of septic systems.

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32 Public Sector Consultants, Nonpoint Source Discharges to Surface Water and Ground water: White Paper on Michigan's Environment and Relative Risk, Lansing, MI, 1992, pg. 1.

> "Many residents in Oakland County receive their potable water supplies for household use in areas where the aquifers are not fully protected. In order to maximize the protection given to such areas, criteria needs to be established as they relate to the subsurface disposal of sewage effluent from on-site systems.
>
> Controlling the density factor (i.e., number of home sites) is of primary importance in controlling the amount of sewage effluent disposal by ground water absorption in the environmentally sensitive areas. An environmentally sensitive area is defined as an area which the potable ground water aquifer is not protected by a suitable aquaclude. A suitable aquaclude to protect an aquifer is an impervious barrier with a minimum thickness of seven feet."[33]

I believe this type of methodology should be used for sensitive areas such as wellhead protection areas. Local wellhead protection plans need to be coordinated at the county level to ensure that health departments can evaluate this as part of their decision to allow a density of septic sewers to be constructed.

5.3) Federal

While the scope of this paper has focused on the integration of wellhead protection through local, county, regional and State agencies, there are a couple of areas related to the Federal Government which should be identified.

The most direct means for having wellhead protection areas integrated into Federal level planning is through the National Environmental Policy Act. Environmental impact analysis process should include an evaluation of potential impacts to a wellhead protection area. The only means for this to be done will be through the lead agency's coordination and consultation with state and local officials. During the initial scoping phase of the

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33 Environmental Health Services, Oakland County Health Division, Ground water Protection, Density Control, Oakland County, MI, 1989, pg. 2.

environmental impact analysis process, the lead agency will need to inform all other Federal, state and local agencies, that may have jurisdiction over the area or resource in question, of the proposed action. When scoping is conducted, information on wellhead protection plans can be provided to the agency by the DNR, the county and the local unit of government.

Many areas that have a significant amount of Federal activity will have Federal agencies involved with local councils of governments. This is done through the Inter-agency Coordination Program where Federal agencies are active with the local council of governments. Through this group, information is exchanged and the council acts as a clearing house for plans and proposals. Groups such as these are often used to coordinate Environmental Impact Statements. Locally developed wellhead protection plans could be distributed through these groups.

6) Watershed Planning

While it is not the focus of this study, establishing stronger regional planning that focuses on entire watersheds would be another approach towards ground water management and many of the other issues raised in the Environmental Relative Risk study. This method would depart from the existing framework of planning in Michigan, which emphasizes strong local planning. This differing approach would require agencies with strong regional control and greater power over the activities of local governments having the potential to impact water resources.

This would involve a system of land use planning that focuses on a holistic view of the features and functions of various aspects of the landscape, and maintaining the functional relationships within an entire drainage basin. Physiographic constraints and opportunities to development would be identified. This would be used to define the

spatial units of land suitability and establish appropriate land uses and intensities within each. Carrying capacities for each unit of the landscape would be established based upon the hydrologic impact that various types of development would have, and the extent to which this could be mitigated. Areas of environmental importance would also be identified.

This evaluation of land suitability for development, in combination with socio-economic factors, could be used to determine land use, density and water management requirements as part of community planning and individual development design. Land use planning and capital improvements such as roadways and utilities would be based upon the natural carrying capacity of the landscape. These efforts would not be governed strictly by a continuation of the direction of sprawling development and functional relationships of land use based solely on the economics of highest and best use.

This process would most likely involve a very generalized regional land use and natural resource management plan that focuses on each major watershed area, and would identify areas most suitable for industrial, commercial and residential development, agriculture production, and very low density rural residential. Local units of government would then be required to develop much more detailed master plans that follow the general guidelines of the regional plan. The state would also set standards for what needs to be contained in each local master plan.

Implementing this form of planning would require action by the State to create agencies with comprehensive jurisdiction over land, natural resources and the economic development aspects of the various areas of the state. This would most likely be in the form of a major modification to the roles, responsibilities and authorities of regional planning agencies. As I said earlier, defining an area for the management of a

comprehensive set of ecosystems is difficult to do. In terms of practicality, the surface watershed area for major river systems is one of the more easily delineated areas; as well as one of the most effective levels of ecosystem management. Regional planning would need to focus land use planning and resource management on the various watersheds within the region.

In order to properly manage both the natural resources as well as economic development, regional planning agencies would need to have a combination of powers presently distributed amongst different levels of government. I believe this could be best done by developing a State Planning Act that combines all of the local and county planning and zoning enabling acts, the Regional Planning Act and the Local River Management Act. The regional planning agency would serve as an intermediary between State and local government. It would conduct studies much like present regional planning agencies and would serve a similar coordinating role to that of watershed councils. This agency should also have the same power over all forms of local government as a county presently has over rural townships, in terms of review and approval for all local master plans and zoning ordinances.

Implementing this form of planning in Michigan will require major revisions to the way planning is currently done in the state. There are numerous issues and obstacles with this differing approach that would need to be resolved. As the focus of my research has been on working within the existing planning framework in Michigan, further discussion on this type of state planning reform is beyond the scope of this paper.

7) Conclusion

There is a need in Michigan for a more comprehensive land use policy that not only individually serves the needs of local communities, but also takes into account the

necessity for coordinated natural resource management that is responsive to the needs of large scale ecological systems. With the current planning framework in Michigan, various divisions of State government, as well as county and local government exercise land use and natural resource management over their particular area of jurisdiction, in an often disjointed manner. The primary objective of the Wellhead Protection Program is to protect the quality of ground water sources contributing to a public water supply system.

With this study, I focused on the existing framework of planning and resource management in Michigan. My study evaluated and outlined the administrative and legal measures that can be taken to ensure a coordinated effort by local communities, as well as other agencies, towards a more effective management of ground water resources.

There is a critical balance of power needed to ensure that the WHPP remains a localized planning effort, but with county and State agencies acting as a coordinator between adjacent municipalities. This balance should maintain a reasonable amount of authority and responsibility at the local level, while allowing county, regional and State agencies to coordinate the development and implementation of the WHPP as part of a regionally integrated and comprehensive planning effort.

There are a number of important reasons for having the WHPP implemented at the local level. First of all, the program places the decision making power at the local level thereby empowering local officials to develop policies which are individually suited for their community. Secondly, local units of government have strongly established ties with the local citizenry and business community, which is important to implementation. Finally, local implementation places the authority and decision making power for ground water protection at the same level of government as the power to plan for and regulate land use as well as developing and enforcing the zoning ordinance and community master plan.

This local implementation, though, needs to be balanced through involvement by higher levels of government. Not only do county, regional and State governments need to ensure inter-jurisdictional coordination across the regional landscape, but these higher levels of government must also affirm local wellhead protection plans as part of the programs they conduct and manage. The following are my recommendations on how this can be done within the current planning framework in Michigan:

1) **County Planning:** County planning departments need to collect and distribute information on wellhead protection areas in the form of reports and/or maps. When reviewing a township plan and zoning ordinance, as required by the Rural Township Zoning Act, the county needs to specifically look at proposed land uses and zoning standards within critical ground water recharge areas.

2) **Regional Coordination:** Regional agencies should collect local wellhead protection plans and publish, as part of an annual report on water resources, a regional map showing the location of all managed wellhead protection areas in the region.

3) **Intercommunity Coordination:** Communities should be encouraged to forge a coordinated effort towards management of ground water resources, such as with watershed councils, as provided for under the Intermunicipality Committees Act (P.A. 200 of 1957) and the Local River Management Act (P.A. 253 of 1964).

4) **State Level Planning:** The State needs to have a better integration of resource management programs, such as the WHPP, between the various departments, regional agencies and local governments. The Governor's Executive Office should take a more active role in developing and directing multi-departmental working groups that provide a more interdisciplinary approach to

planning. This would create a more centralized effort at the State level focused on the exchange of information, such as the location of wellhead protection areas, into a more holistic approach to planning. Activities, such as the routing of major highways or the development of state transportation plans as required under ISTEA, need be reviewed by this multi agency task force which analyzes items related to the environment and land use, and provides the lead agency with feedback.

5) **State Coordination:** Programs within each department at the State level also need to be more closely coordinated. Stronger linkages need to be established between various departments and divisions at the state level, such that common resource goals, information and programs are integrated and coordinate for the overall best management of resources. Examples of this would be: 1) the management and permitting for dredge and fill of surface waters being coordinated with the protection of ground water; 2) final plat approval for any subdivision by the Michigan Department of Treasury being coordinated with the DNR if it is located within a wellhead protection area.

6) **Health Department:** The Michigan Department of Health should develop performance standards for land uses in wellhead protection areas such as the maximum safe sanitary septic tank density. Local wellhead protection plans need to be coordinated at the county health department level.

7) **Environmental Impact Analysis Process:** Finally, environmental impact analysis should include an evaluation of potential impacts resulting directly or indirectly from government actions to wellhead protection areas. This must to be done through lead agency's coordination and consultation with State and local

officials. Information on wellhead protection plans can be provided by the DNR, the county and the local unit of government.

Michigan's future depends upon our natural resources. Water is a key component to the long term viability of our State's economy, and ground water is a critical component to our water resources.

Although there are strong advantages to implementing Wellhead Protection Plans at the local level, there are also significant complications that need to be addressed. This paper identified the need for a critical balance of power necessary to ensure that this program remains a localized planning effort, but with county, regional and State agencies acting as part of a coordinated effort. This balance should strive to maintain a reasonable amount of authority and responsibility at the local level, while allowing county, regional and State agencies to coordinate the development and implementation of the WHPP as part of a state-wide integrated resource planning effort.

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