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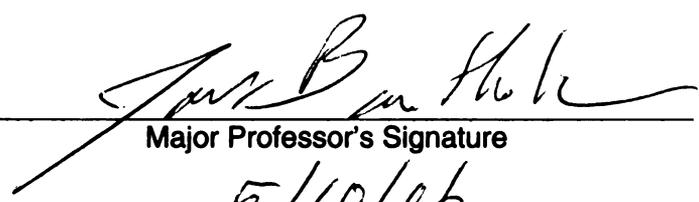
**RESOLVING HIGH CAPACITY GROUNDWATER  
WITHDRAWAL CONFLICTS IN THE GREAT LAKES BASIN**

presented by

Leroy P. Kettren

has been accepted towards fulfillment  
of the requirements for the

Ph.D. degree in Resource Development

  
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**RESOLVING HIGH CAPACITY GROUNDWATER WITHDRAWAL  
CONFLICTS IN THE GREAT LAKES BASIN**

By

Leroy P. Kettren

A DISSERTATION

Submitted to  
Michigan State University  
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## **ABSTRACT**

### **RESOLVING HIGH CAPACITY GROUNDWATER WITHDRAWAL CONFLICTS IN THE GREAT LAKES BASIN**

By

Leroy P. Kettren

High capacity groundwater withdrawal wells have created conflicts between operators of high capacity wells and other water users, including owners of small capacity wells and those with interests in surface water and wetlands. Groundwater withdrawal conflicts and other environmental disputes are often complex and difficult to resolve because they involve not only conflict over scarce resources but also involve the parties' core values and beliefs.

The objective of this study is to develop a management system for resolving well interference conflicts that satisfies the primary goals of conflict resolution. Those goals are to reestablish the water supply to affected wells as soon as possible; to protect high capacity well operators from malicious claims; and to minimize regulatory agency costs in administering the resolution process.

Groundwater laws and administrative rules of 30 Eastern and Midwestern states, the Canadian province of Ontario, and the Delaware and the Susquehanna River Basin Commissions were reviewed to better understand groundwater policy and to identify efficient and equitable management systems for resolving groundwater conflicts.

Based on the review of those state laws and policies, the states of Michigan, Minnesota, Indiana and Iowa were selected for a further detailed analysis of well interference conflicts. These states represent different approaches to regulation and resolution of well conflicts. Records of more than 1300 well interference claims were

collected, tabulated and analyzed. The analysis provided insight into the causes, investigation methods and resolution of well conflicts.

From that analysis, an alternative system to resolve groundwater withdrawal disputes emerged. The management system proposed here includes a mediator to oversee the process, a public education program to prevent conflict situations, and an ADR-based negotiation process to resolve conflicts that occur.

The management system, based on Alternative Dispute resolution (ADR) techniques and monitored by a state agency acting as a neutral third-party mediator, can encourage mediation, well maintenance and foster voluntary negotiations between high capacity well operators and the owners of affected domestic wells. The system is designed to anticipate and prevent conflicts and to reach voluntary, equitable resolution of conflicts that do occur. The agency's role is seen as one that works to prevent conflicts through education and to facilitate efficient, equitable resolutions to conflicts.

The ADR management system was examined using Cost Effectiveness Analysis. The results showed that the most cost-effective means to equitably resolve well interference claims is using the regulatory agency as the neutral mediator.

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# CHAPTER 1

## INTRODUCTION

### Subheadings

Research Question

Background

Objectives

### **Research Question**

Well interference conflicts arise when a high capacity well withdraws enough water to lower the water table and cause adjacent small capacity wells to fail.

Historically these conflicts have been resolved informally by the well owners or through civil litigation. As suburban growth extends into traditionally rural areas, well

interference conflicts are expected to increase. The question posed by this research is:

Can a management system be developed that will resolve well interference conflicts more economically and equitably, rather than continuing the use of approaches that are currently utilized in the eastern and Midwestern states?

### **Background**

The importance of groundwater in Michigan is often overlooked because of the large amount of freshwater available in the surrounding Great Lakes. Yet groundwater is extremely important to the Great Lakes ecosystem and to the economy of Michigan and the other Great Lake states. Increased suburban development and the increased use of groundwater for domestic, industrial, and irrigation will increase the demand for groundwater and will increase the conflicts between groundwater users (Grannemann and others, 2000).

Two examples illustrate the use of groundwater in Michigan. In 2004, the Michigan Water Use Reporting Program recorded 619 irrigated golf courses having a capacity to withdraw 100,000 or more gallons of self-supplied water per day. These courses reported a withdrawal of approximately 34 million gallons per day, 58% or nearly 20 million gallons came from groundwater (Michigan Department of Environmental Quality, 2004). Similarly, agricultural irrigation is also common. The amount of water used for agricultural irrigation depends on many factors including the availability of water supplies that do not create conflicts with other local water users (Michigan Department of Environmental Quality, 2004).

The conflict between groundwater users is not unique to Michigan or the Great Lakes Basin. Glennon (2002) cites numerous incidents of groundwater conflicts from widely scattered areas of the United States.

States have adopted a variety of approaches to resolve the well interference conflicts. A preliminary review of state laws and policies shows that the various approaches differ in their efficiency and equitability. This research is designed to investigate the various approaches to well interference conflicts and attempt to design a conflict management system that is economical and equitable for all parties.

## **Objectives**

The research will be conducted through a series of objectives and tasks.

### **Objective 1**

Objective 1 will be to determine how various states, particularly those in the Great Lakes Basin, define and resolve well interference conflicts and will be met through two tasks. Task 1 will be a review of state laws and administrative rules regulating

groundwater withdrawal. The review will be web-based and consider those eastern and Midwestern states that, like Michigan, follow the doctrine of Beneficial Use for water access rights. In particular, the review will examine how the various states define and resolve well interference conflicts. Specifically, the information search for Task 1 will be targeted to identify:

- The state's policy on groundwater rights;
- Extent of groundwater withdrawal regulations, including whether allocation permits are required or if well owners are only required to report quantities of water withdrawn;
- What information is required in permit applications and how this information is used;
- How groundwater conflicts are claimed, investigated and resolved;
- What information is available to state officials to investigate conflicts, the format of such information and its accessibility to the public; and
- Extent of state authority to restrict high capacity withdrawals in conflicts.

Task 2 will involve follow-up contacts with appropriate state agencies to confirm or clarify questions regarding the application of their laws, rules, and policies.

### Objective 2

Objective 2 will be an evaluation of the effectiveness of the various state laws and policies for resolving groundwater withdrawal conflicts. This objective will be accomplished by two tasks.

Task 1 will include the collection of well conflict claims data from selected states. Data will be collected from states that used differing approaches to resolve well

interference conflicts and from those states having a relatively large number of claims. Initial contact with state officials will be by telephone to determine their agency's experiences with conflict regulation and to determine the availability of conflict claim data for a representative year.

Following the initial contact, each state agency will be visited to collect data for each well interference conflict claim filed during the representative year. Data collected for Task 1 will include, but will not be limited to:

- Number of well interference claims made during the year;
- Number of claims rejected as unsubstantiated or frivolous;
- Reasons why the claim was rejected;
- Number of claims in which a high capacity well was found responsible;
- Type of affected well (other high capacity well, domestic well, etc.) well industrial supply well, public water supply well);
- Type of settlement (alternate water supply, new well, permit restriction etc);
- Acceptability of settlement (voluntary settlement, Department order, rejected claim, appeal of Order);
- Cost incurred to implement the various types of settlements;
- Estimated agency costs to investigate and resolve the claims; and
- Type of high capacity wells (agricultural and golf course irrigation excavation and quarry dewatering, municipal, industrial process and other uses).

Task 2 will be a quantitative analysis of the well conflict claim data. The analysis will attempt to identify the number of claims filed per year, the time needed to resolve each claim, the types of investigations performed by state authorities, number of

unsubstantiated claims filed, the reasons for rejecting claims, and the types of settlements achieved. Data collected from well interference claim records from the selected states will be tabulated for analysis. The data analyses will include, but will not be limited to the following:

- Comparison of the number of claims and number of unsubstantiated claims to determine the significance of the problem with frivolous or unsubstantiated claims to well interference;
- Comparison between the numbers of claims in those states with a permit application system, against those states without a pre-installation evaluation process. This comparison will indicate possible benefits from an evaluation of aquifer capacity prior to the installation of additional high capacity wells;
- Comparison of the time to resolve interference conflicts between those states with differing resolution procedures;
- Comparison of states with a conflict negotiation option versus those that resolve conflicts through direct agency intervention. The comparison will consider the acceptability of the conflict solution based on the number of appeals filed. This analysis will indicate a preferred method for reaching an equitable conflict solution; and
- Develop and analyze cost data to determine the average costs involved, to include:
  - agency costs to evaluate permit applications for high capacity wells;
  - agency costs to investigate claims of well interference;
  - agency costs to implement a resolution of the claim;

- high capacity well operator costs to reimburse affected well owners;  
and
- direct and inconvenience costs incurred by affected well owners.

### Objective 3

Objective 3 will be the development of a proposed management system based on the principles of ADR that will efficiently and equitably resolve the well interference claims. Objective 3 will be met with two tasks.

Task 1 will be a review of the literature concerning environmental conflict resolution techniques. The review will identify characteristics of environmental conflicts and the various approaches that have been used to solve them. In particular the review will attempt to identify techniques that are applicable to groundwater withdrawal conflicts. The techniques will be designed to address significant problems identified during the review of claim data.

Task 2 will be to synthesize the knowledge gained from the review of state approaches to groundwater withdrawal regulation, well interference conflict resolution methods, and environmental conflict resolution techniques and to prepare a proposed management system. The techniques will be designed to address significant problems identified during the review of claim data. The techniques for Task 2 will address three significant issues:

- Reduce the number of unsubstantiated claims or claims resulting from failure of the affected well system itself and not due to high capacity pumpage;

- Improve efficiency in the investigation process by more efficient documentation of the impact of high capacity pumpage as the cause of a drop in water level; and
- Encourage negotiated settlements based on reasonable offers of compensation.

Each of the above issues contributes directly to the goal of resolving well interference conflicts while reducing agency costs.

#### Objective 4

Objective 4 will be the evaluation of the effectiveness of the proposed ADR-based management system using Cost Effectiveness Analysis (CEA). CEA is one method of using cost data in the decision-making process. It is similar to cost benefit analysis, cost-utility and cost-feasibility methods (Levin, 1983, p 12).

CEA is similar to cost benefit analysis in that project outcomes are compared and ranked in dollar terms. CEA differs significantly from Cost Benefit Analysis in that CEA ranks outcomes that cannot easily be measured in dollars (Nas, 1996, p 2). For this reason, CEA is commonly used to evaluate educational or health care projects. Below are the tasks that will be used. Task 1 will be data evaluation:

- Quantify the costs to prevent well conflicts utilizing well permit requirements. This includes estimated costs to prepare well permit applications and agency costs to evaluate the applications.
- Costs for each approach to conflict investigation and resolution will be prepared. Costs will be based on actual costs provided by agency officials. If assumptions are required, they will be explained.

- Anticipated costs for implementing the proposed techniques will be estimated from data provided by state agency officials or licensed well drillers or other reliable sources. Where costs estimates are made, they will be explained.

In Task 2, the proposed management system will be evaluated based on the efficiency with which it achieves the primary goals of interference conflict resolution. The techniques will be judged effective if they provide for an equitable resolution to the conflict situation and minimizes costs for implementing the program.

The validity of the proposed management system will be demonstrated when the Cost Effectiveness Analysis shows that the proposed management system is more cost effective than approaches currently being used by eastern and Midwestern states.

## **CHAPTER 2**

### **BACKGROUND**

#### Subheadings

Statement of the Problem

Environmental Conflicts

Description of Well Interference

Theoretical Perspective and Status of State Laws

Limitation of Study

Significance of Study

Regulating Well Interference Conflicts

#### **Statement of the Problem**

High capacity groundwater withdrawal wells have created conflicts between operators of high capacity wells and other water users including owners of small capacity wells and those with interests in surface water and wetlands. As suburban growth extends into traditionally rural areas, competition for groundwater supplies will increase as increased domestic use competes with irrigation and quarry dewatering. In addition, growth will bring new uses for groundwater for irrigation of golf courses and new municipal water supplies (Grannemann and others, 2000).

In general, high capacity groundwater withdrawals are used for the following purposes:

- Irrigation for agriculture and golf courses;
- Quarry dewatering;
- Dewatering for major construction projects; and
- Municipal well fields.

In any well conflict situation, there are three major reasons for reaching a successful resolution as rapidly as possible:

1. Small capacity wells are usually for domestic purposes. Because landowners may be without water, there is an urgent need to reestablish a reliable water supply either through restoration of water to the well, well replacement or providing an alternate water supply.
2. It is important to establish with reasonable certainty that a high capacity well is responsible for the failure of the affected well to protect commercial high capacity well owners from unsubstantiated or frivolous claims.
3. Efficient and equitable regulatory actions are necessary to reduce costs to regulatory agencies. In the current climate of restricted state budgets, reducing costs for regulatory agencies is extremely important.

Water supply management is a complex subject that includes identification of surface and groundwater supplies, evaluation of proposed new developments in specific aquifers, identification and prevention of conflicts between water users and the efficient and equitable resolution of conflicts when they do occur. Solutions for these problems require a comprehensive water management system. Such a system is beyond the scope of this research, however, this project and others related to it will be included in future work to develop a more comprehensive management system. This research is limited to conflicts that result between high capacity well operators and the owners of adjacent small capacity wells (usually domestic).

### **Environmental Conflicts**

Well interference conflicts are one type of environmental dispute. Stakeholders in the disputes include the owners/operators of high capacity wells, the owners of affected

neighboring small capacity wells, surface water users, those with an interest in surficial ecological features such as wetlands, and local and state officials.

Environmental disputes are often complex and difficult to resolve because they involve not only conflict over scarce resources but also involve the parties' core values and beliefs (Thompson and Gonzalez, 1997). Wehr (1979) stated that environmental conflicts arise from differences in values, interests and facts.

Thompson and Gonzalez (1979) analyzed the basic types of environmental conflict using a 2x2 matrix of four cells. Their analysis (Ibid) went on to explore some of the assumptions that underlay each party's view of the other. Sinister and fanatical attribution errors were obstacles to open negotiations. These errors resulted from the belief held by lower power groups that groups with higher power acted with sinister motives. Similarly higher power groups tend to see lower power groups as being motivated by irrational fanaticism.

Burgess and Burgess (1994) explored the nature of conflict and the limits of mediation to resolve intractable environmental conflicts. There are several levels of conflict. Conflicts are defined as long-term divisions between groups with different beliefs regarding proper relationship between human society and the environment. Disputes are questions about enactment of specific policies. An endless series of disputes form and define the conflict. When negotiation cannot resolve basic differences between parties, the parties resort to power alternatives to negotiation such as political action or litigation.

Environmental conflicts are often intractable because they arise from fundamental moral beliefs or high-stakes distribution of resources. Environmental disputes often

involve the basic values and beliefs of the people involved. Such disputes become more complex as the scope of the disputed issue widens and involves more stakeholders. Well-to-well conflicts are often the simplest type of environmental dispute involving two opposing well owners. Larger conflicts can involve many groups of stakeholders with contradictory views and agendas.

Core conflicts are intractable conflicts over fundamental issues. Overlay components are visible conflicts that obscure core issues. Overlay conflicts result from confused interests, from misunderstandings or technical disagreements, from perceived procedural unfairness and from escalation and polarization (Ibid, 1994).

If parties don't like a voluntary agreement, they resort to other kinds of available power. Parties may resort to forcing power, leading to further conflict or persuasive power, which attempts to convert an opponent to their point of view. There are several levels of action available in the social power hierarchy in the public sector. These include administrative power, litigation, political power, public opinion and physical resistance. These levels of power can become obstacles to conflict resolution and encourage litigation (Burgess and Burgess, 1994).

In the context of this research, a well interference dispute between the owner of a small capacity well and the operator of a high capacity well involves fundamental issues of rights to water access. If the dispute, and possibly others in the same area, is not resolved equitably, they can rapidly escalate into a significant environmental conflict involving litigation or new legislation.

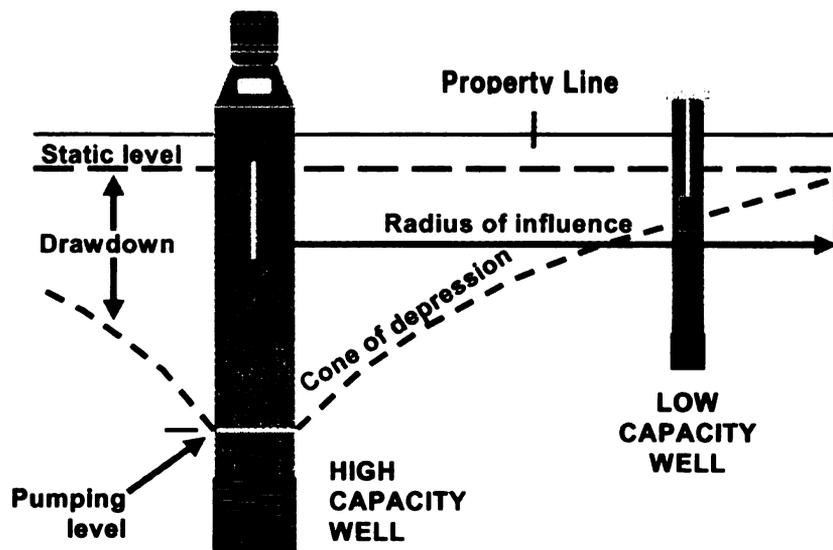
## Description of Well Interference

High capacity wells are commonly defined as those capable of pumping more than 70 gallons per minute. Conflicts may arise when a high capacity well is proposed or they may develop later during operations of the well.

Well interference occurs when the withdrawal of water from one well lowers the water table sufficiently to cause an adjacent well to produce less than its usual supply of water or fails to produce potable water (Driscoll, 1986). Pumping water from a well removes water from the aquifer in the area immediately adjacent to the well. Removal of the water lowers the water table around the well in a conical pattern called the cone of depression. Figure 1 illustrates this condition.

FIGURE: 1

### Cone of Depression\*



*\*Provided by Brant Fisher from the MDEQ*

The steepness of the slope and lateral extent of the cone of depression are functions of the rate and duration of the pumping and the transmissivity of the aquifer. If the cone of depression extends laterally and intersects the cone of an adjacent well it can lower the water table in the adjacent well sufficiently to cause the adjacent well to produce less than its usual supply of water or fail to produce potable water.

The lateral extent of the cone of depression of a high capacity well can extend more than 1 mile from the well (Driscoll, 1986). The extent of drawdown and the cone of depression vary between confined and unconfined aquifers. Significant drawdown can extend much farther from the pumping well in a confined aquifer than in an unconfined aquifer. In one example, an unconfined aquifer showed drawdown too small to plot at a distance of two miles from the pumping well, while in a similar situation drawdown in a confined aquifer measured about 10 feet (Alley, Reilly and Franke, 1999).

### **Theoretical Perspective and Status of State Laws**

The basis for groundwater conflicts is founded in the issue of rights to water access. The doctrine of riparian rights is the foundation for water law in most of the eastern United States. Under this doctrine, a landowner adjacent to a stream has the right to the water in that stream (Dzurik, 2003). Related to the Riparian doctrine is the Beneficial Use Principle which holds that a landowner can divert or withdraw and use any quantity of water as long as the diversion or use is for a beneficial purpose, usually defined in state law, and does not interfere with the reasonable use of other landowners (Cech, 2003).

Nearly all of the states in the East and Midwest have a policy of beneficial use for groundwater and surface water withdrawals. Many western states follow the doctrine of Prior Appropriation for determining water rights. This doctrine is significantly different from the Beneficial Use doctrine used in Michigan and is therefore beyond the scope of this research.

The interpretation of beneficial use can, however vary for high capacity wells. One interpretation views groundwater as a property right and the state has little authority to regulate water use. States that hold this view tend to resolve groundwater conflicts after they occur.

The Missouri Department of Natural Resources clearly states that Missouri is a riparian water law state, and all landowners adjacent to a stream or an aquifer have a right to reasonable use of those water resources (MODNR, 2003). Indiana's legislation does not require appropriation permits but does contain specific procedures for identifying and resolving well interference conflicts (IN Legislative, n. d.).

Historically, the supply of water has not been a problem in Michigan and groundwater withdrawals have not been regulated by the state. In Michigan, landowners essentially have had unrestricted rights, subject to reasonable use, to the groundwater under their land (MISFA, 2003).

Other states, notably Virginia (Virginia General Assembly, n. d.) and South Carolina (South Carolina Legislation, n. d.) do not regulate groundwater withdrawals except in specifically designated counties or water management districts. Water management districts are commonly coastal areas where high capacity withdrawals could cause significant problems from salt-water intrusion into the freshwater aquifers.

An alternative view of the beneficial use doctrine holds that the groundwater and surface water resources are held in trust for the people of the state by the state government. State government has a responsibility to ensure a supply of water for all citizens. The legislation that establishes the permitting system also commonly establishes the priority of water use to domestic and public water supplies. States using this process attempt to prevent well interference conflicts by controlling the withdrawals for critical aquifers. Permits are not required by an individual property owner for the installation and use of a domestic well. Allocation permits are required prior to the installation of high capacity wells for other uses such as industrial processes, irrigation, and most agricultural applications. Agricultural irrigation wells however, may be exempt from obtaining a permit or require different permitting procedures. The amount and detail of information required as part of the permit application varies widely, but commonly includes a statement justifying the beneficial use of the water.

Permit application data commonly includes the location of the well, quantity of water proposed for withdrawal, well construction and pump design details, identification of the source aquifer, location of adjacent wells and a statement of the proposed beneficial use of the well. A statement is often also required describing the expected impact of the withdrawal on adjacent wells and surficial water resources. Few states require information regarding the chemical, physical and bacteriological characteristics of the return flow.

Allocation permits also often contain provisions for resolving well interference conflicts. Permit conditions may include the restriction that the permitted high capacity well will not interfere with other legitimate water uses. This restriction is used in

Delaware, Florida and by the Delaware River Basin Commission (DRBC). In the event of a claimed conflict, several jurisdictions place the burden of proof on the permit holder of the high capacity well to demonstrate that their well is not causing the conflict. If the high capacity well is found to be affecting other wells, permits are revised to reduce the permitted quantity of the withdrawal or may be revoked entirely (Muzynski, DRBC, personal communication, 2004).

Among the states requiring appropriation permits, are Minnesota (MNDNR, n. d.) and New Hampshire (NHDES, n.d.). Early in 2004, Wisconsin enacted legislation, Assembly Bill 926, requiring permits for high capacity wells (Furbish, 2004).

Michigan is currently considering similar legislation that would require permits prior to the installation of high capacity wells (MI Legislature, 2004). Senate Bill 5643 and House Bill 1087 were introduced in March 2004. Together these bills represent an effort by the State of Michigan to exert a measure of control over high capacity groundwater withdrawals.

Nearly all states require some level of reporting on the quantity of water withdrawn. The most common form of the report requires a monthly tabulation of the quantity of water withdrawn, identification of the source, and the amount of water consumptively used. The reports are compiled monthly but are submitted annually on forms specified by the regulatory authority.

### **Limitations of Study**

The study included a review of groundwater withdrawal legislation and administrative rules in Michigan and other eastern and Midwestern states, as they existed

in 2003 and 2004. The results of this review are included in Appendix B. The review of legislation and administrative rules was not a legal review. A trained lawyer familiar with legal principles and procedures may recognize legal issues not discussed here. The review was conducted from the perspective of a Professional Geologist assisting a client in complying with applicable state laws and regulations in resolving a well interference conflict.

Well interference claim data were obtained from the files of various state agencies. These records were often incomplete since many agencies do not collect information on claims settled without state action and often stop collecting information about a claim as soon as it is apparent that a settlement has been reached between the parties.

Cost data used in the analyses were representative averages based on cost information provided by state regulatory personnel, specifically stated in various well interference claim files or obtained directly from well drilling contractors. Costs vary depending on the grade level of the personnel involved, distance and duration of travel and incidental filed costs.

### **Significance of Study**

The overall issue is one of managing water resources. Since surface and groundwater are one resource, any overuse of one results in problems with the other. The problem of competition for water will only get worse in the future. Urban growth is moving people, golf courses, industry and commerce into rural areas where high capacity wells are commonly used. While there seems to be enough water now, there may not be enough to meet all demands in the future. The challenge is to design a water

management system before a crisis occurs. The object of the management system is not to create unnecessary regulation or to deny water to anyone, but to assure there is a reasonable supply for everyone.

Interference between high and low capacity wells can be thought of as a dispute that can grow into a full-scale conflict between agricultural and industrial or other interests and their neighbors. Such larger conflicts are much more complicated to define and resolve since they touch on basic issues of rights, values, and worldview. If the small disputes between individual well owners can be quickly and equitably resolved, we may be able to prevent larger more socially divisive conflicts in the future.

### **Regulating Well Interference Conflicts**

Conflict regulation's need to approach the well interference situation from several perspectives. Water is a system in motion. Surface and ground water are moving and do not respect political or property boundaries. In this respect, water is not "owned" like land, forests, or mineral resources. Water is more like wildlife or migratory birds that visit property, but move on at its own pace. Just as over harvesting of wildlife by a single individual property owner can harm the greater resource, so does over utilization of water harm a public resource. Management of water must be structured to recognize this nature of water so that it is available for the common good.

Historically, high capacity wells have been located in rural areas where they are used for agricultural irrigation, quarry dewatering or municipal water supplies. As urban development spreads outward from the cities to rural areas, there is increasing water use by residents, small commercial and industrial facilities. Associated with population

growth, there is also increased interference between the high capacity wells and the new small capacity wells (Granneman and others, 2000). It is important, therefore, that procedures exist to resolve well interference conflicts efficiently and equitably.

The objective of this study is to develop a management system that satisfies the three primary goals of conflict resolution:

1. Reestablish the water supply to the affected well as soon as possible;
2. Protect high capacity well operators from malicious claims; and
3. Minimize regulatory agency costs in administering the resolution process.

The adversarial approach to resolving groundwater well interference conflicts through regulatory action, legislation, and litigation is difficult, costly and time-consuming. Adversarial approaches create greater conflicts in communities and between individuals. Alternative dispute resolution techniques have been successful in resolving other types of conflicts. ADR is used to relieve the burden on courts in judicial systems (Arkansas Alternative Dispute Resolution Commission, n. d.). Virginia has a system of mediated dispute resolution for permitting issues (9 VAC 25 Chapter 15). The Pennsylvania Department of Environmental Protection provides ADR services through its Center for Collaboration and Environmental Dispute Resolution (PA DEP, Dispute Resolution).

The approach used in this research is to investigate how various states in the Great Lakes Basin regulate and resolve well interference conflicts, to evaluate the use of alternative dispute resolution techniques to solve well interference conflicts and to develop a proposed model procedure that could be useful in Michigan.

## CHAPTER 3

### LITERATURE REVIEW

#### Subheadings

Michigan Aquifers and Hydrogeology

Stratigraphy

State Policy Overview

State Groundwater Laws and Administrative Rules

Regulation Policies of the Great Lake States

Other Eastern State's Regulation Policies

Alternate Dispute Resolution Techniques

#### **Michigan Aquifers and Hydrogeology**

Groundwater is an important resource in Michigan. Michigan uses approximately 855 million gallons of groundwater per day (Solley and others, 1998). There are four principal aquifers in Michigan's Lower Peninsula. Three are bedrock aquifers and one is unconsolidated glaciofluvial material deposited at or near the surface (Westjohn and Weaver, 1996).

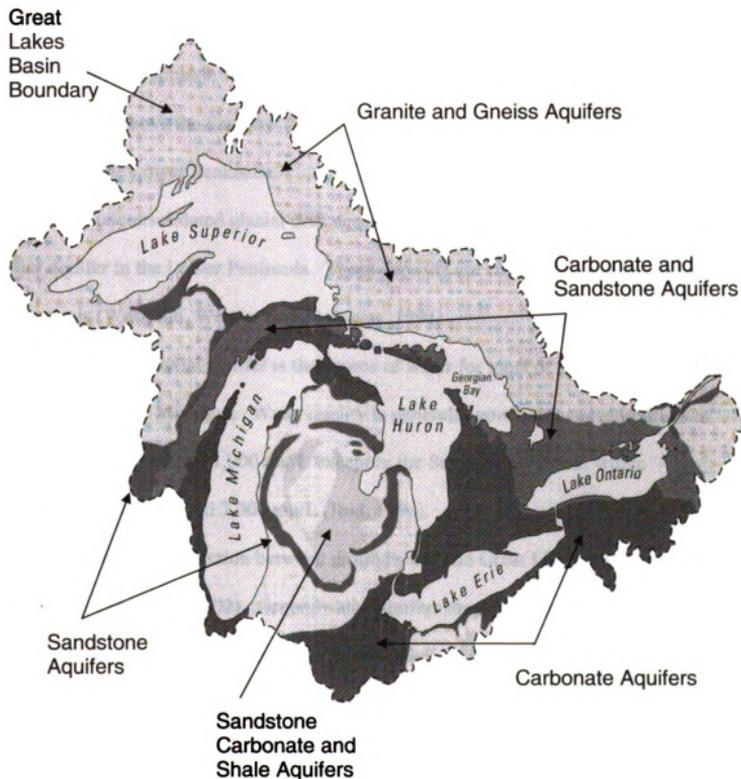
The Lower Peninsula is a structural basin that was tectonically active from Precambrian through Mesozoic time. Water quality in the bedrock aquifers is generally good where the rock is in contact with the overlying glacial drift. Down dip toward the center of the basin, the water quality decreases as salinity significantly increases (Ibid, 1996).

#### **Stratigraphy**

The Coldwater Shale of the Early Mississippian Age is the lowest stratum in the aquifer sequence. The Marshall Sandstone is the lowest major bedrock aquifer (Westjohn and Weaver, 1996a). Down dip, the Marshall is overlain by the Michigan confining unit and shows increasing salinity. Salinity increases from about 1000 mg/L

for freshwater through a transition zone 2 to 30 miles wide, to a reported maximum of 337,000 mg/L near the center of the basin (Ibid, 1996a).

**FIGURE 2**  
**Bedrock Aquifers of the Great Lakes Basin\***



\* Provided by Grannemann and others, 2000

The Michigan Formation consists of 50 to 400 feet of shale limestone dolomite evaporate and thin siltstone and sandstone lenses. The Parma-Bayport Aquifer is comprised of two minor formations, the Parma Sandstone and Bayport Limestone (Westjohn and Weaver, 1996b). The Saginaw Formation of Pennsylvanian Age is comprised of interbedded strata similar to the typical cyclothem sequence common in strata of this age. Jurassic Red Beds comprised of red shales and siltstones form a confining unit above the Saginaw aquifer and mark the top of the bedrock aquifer sequence in the Lower Peninsula.

The unconsolidated glacial drift deposits at and near the surface form the final major aquifer in the Lower Peninsula. These deposits are comprised of interbedded sands and gravels (Westjohn, Weaver and Zacharias, 1994).

The glaciofluvial aquifer is the source of water for most of the domestic and many municipal wells in Michigan. Water quality is generally good with concentrations of dissolved solids less than 1,000 mg/L except in the Saginaw Lowlands where concentrations can exceed 7,000 mg/L (Ibid, 1994).

Hydrologic connection between groundwater and Great Lakes water is established (Hoaglund, and others, 2002). Groundwater aquifers may discharge directly to the Lakes or may discharge to stream tributaries into the Lakes.

The interrelationship between groundwater and the Great Lakes is not fully understood and raises important issues of groundwater withdrawal and the diversion of Great Lake's water (IJC, 2000). The International Joint Commission (Ibid Section 9) recommends additional research into the role of groundwater in supporting ecological

systems. There is a need to improve how water levels are estimated and the true extent of consumptive use. Better methods of identifying large groundwater withdrawals near boundaries of hydrologic basins and monitoring and tracking of water withdrawal permits should be implemented.

### **State Policy Overview**

States vary in their approach to resolving well interference conflicts. Based on their regulatory philosophy toward water access rights and the political interest in regulating groundwater use, states may take the following actions in resolving well conflicts:

1. Takes no action in conflict;
2. Defines and acts on groundwater emergencies that could involve well conflicts, loss of stream flow or drought;
3. Has procedures to resolve well conflicts as they occur;
4. Attempts to avoid conflict through permit application and review of the aquifer capability;
5. May make non-interference a permit condition. The conflict permit holder must prove they are not at fault or lose the permit; and
6. May have permit review and conflict resolution procedures.

### **State Groundwater Laws and Administrative Rules**

Groundwater laws and administrative rules were reviewed to better understand groundwater policy in Eastern and Midwestern riparian states and to identify efficient and equitable management systems for resolving groundwater conflicts.

A summary of the groundwater laws and administrative rules of Eastern and Midwestern states is shown in Appendix B. The review included an examination and comparison of groundwater laws and administrative rules in 30 Eastern and Midwestern states, Canadian province of Ontario, the Delaware and Susquehanna River Basin Commissions, and five Water Management Districts in Florida.

Regulation of groundwater withdrawals varies widely among the Great Lake states. States such as Pennsylvania have essentially no regulations concerning groundwater use, while Minnesota has detailed requirements for water allocation permits, water use reporting and well conflict resolution. All states recognize the right of a property owner to install and use a well for domestic purposes without obtaining a permit subject only to laws regarding proper well installation and the protection of public health.

Most states require annual reports of the well location, amount of water withdrawn and the uses of that water. Those states that require permits usually require that the applicant provide information about the need for the water, expected impact on the aquifer and other users of water. The permits may be modified or revoked in response to a groundwater conflict or emergency.

## **Regulation Policies of the Great Lake States**

### **New York**

In New York, the Great Lakes Water Withdrawal Registration Program requires water withdrawals greater than 100,000 gallons per day (gpd) averaged over a 30-day period or 3,000,000 gpd during any 30-day period from the Great Lakes Basin be registered. There is no state policy for resolving groundwater conflicts (New York Assembly, n. d.).

### **Ohio**

In Ohio, groundwater withdrawals must be registered and reported (Ohio DNR, 2002). No permit is required. Facilities with a capacity greater than 100,000 gpd (70 gallons per minute) must register. An annual report is required of the amount withdrawn and the amount of return flow.

### **Indiana**

In Indiana, no permit is required for the installation of high capacity wells (Indiana Legislature, IC 14-25-4). Significant water withdrawal facilities must register and report annually to the Natural Resources Commission. Significant withdrawals are defined as at least 100,000 gpd. Groundwater disputes are triggered by a complaint from an owner of a small capacity well. The owner of a facility producing less than 100,000 gpd that is affected by larger facility can file a complaint with the state.

### **Illinois**

In Illinois, the procedures for regulating groundwater conflicts are administered by the Department of Agriculture through County Soil and Water Conservation Districts (Illinois Legislature, 1983). Any person who plans to install a well that can reasonably

be expected to withdraw more than 100,000 gpd must notify the local Soil and Water Conservation District who in turn, notifies the Illinois Geological Survey, Illinois State Water Survey, local units of governments and other interested parties.

In Illinois, procedures for reporting and resolving well interference claims apply only in four Conservation Districts. These Districts include the counties of Kankakee, Iroquois, Tazewell, and McLean. An individual whose small capacity well fails to furnish its normal supply of water or fails to furnish potable water may make a written complaint to the local Conservation District. The District must investigate the complaint within two days.

If the investigation verifies that 1) the impacted well did fail to furnish its normal supply of water or failed to furnish potable water; 2) the failure was caused by a substantial lowering of the groundwater level; and 3) the impacted well's equipment was functioning properly, then the Conservation District recommends that the Department of Agriculture should impose restrictions on withdrawal from wells capable of yielding more than 100,000 gpd. The Department of Agriculture can impose restrictions on one or more wells in the District and these restrictions may remain in place until conditions justify their removal (Illinois Legislature, 525 ILCS 45/5.1).

### Wisconsin

Wisconsin requires that groundwater withdrawals be registered and permits are required for withdrawals greater than 70 gpm. In 2004, Wisconsin enacted Act 310 requiring the Department of Natural Resources approve all high capacity wells. Approval requires an environmental review for wells located in designated groundwater protection areas, wells that are expected to consume more than 95% of the water

withdrawn or may have a significant environmental impact on a spring (Wisconsin Legislature, 2003-04).

### Minnesota

In Minnesota, permits are required for withdrawals greater than 70 gpm or 100,000 gpd (Minnesota DNR, 2002). There are separate permits for agricultural, non-agricultural and general (temporary) withdrawals. Permit holders must report monthly water withdrawal in an annual report.

The application includes basic data about the location of the proposed well, proposed pumping rate and the types of crops and total acreage to be irrigated. The applicant must include readily available information about all other known wells within a 1.5-mile radius of the proposed well. If there are indications of potential conflicts between the proposed and existing wells, the DNR may require aquifer pump tests.

In the past, the DNR has required 24-hour tests for wells proposed in confined aquifers and 72-hours tests for wells in unconfined aquifers. More recently, the agency requires 7-day or 168 hour tests to better determine the expected extent of possible interference or impacts to surface waters (Frischman, written communication, March 2005). DNR personnel estimate the time to review a well permit application to be two (2) to three (3) hours and the total time to process and issue a permit to be 45 to 60 days (Metzker, email communication, July 2005).

Agency personnel believe the application process is vital to proper management of groundwater resources. Aquifer test records indicate numerous cases where potential well conflicts were identified during the application process allowing modification to pumping rates and avoidance of future conflicts.

Minnesota has detailed procedures of the resolution of well interference conflicts that are identified under different circumstances. In the first case, probable interference between wells is recognized prior to appropriation. Here adequate water supplies are available and the proposed uses are reasonable and proper, but probable interference with public water supplies or private domestic wells must be shown in the permit application. When this situation occurs, the applicant must provide all available construction details for existing public water and private domestic wells in the area. The Department of Natural Resources may require aquifer tests. DNR staff determines probable interference base on computations, aquifer tests and hydrologic studies and notifies the applicant. An appropriation permit may only be issued if it is modified to provide adequate water supply to domestic wells or if a written agreement is reached among well owners.

In the second case, conflicts occur with existing permitted wells. Claims are initiated when an individual well owner or public water supply makes a complaint. Upon receipt of a complaint, the state notifies all affected parties.

The DNR investigates the complaint based on facts stated in the complaint, hydrologic studies and local characteristics. The DNR investigator may request additional information from all parties and may dismiss the complaint if the claimant is uncooperative. The investigation may include field studies such as aquifer pump tests. If the claim is verified, the permittee is notified and permit is modified to restrict appropriation until an acceptable solution is reached between the parties. The permittee may appeal the decision of the agency.

The third case attempts to prevent conflicts with small capacity wells installed after the appropriation permit is issued. When small capacity wells are installed after a

high capacity well, is permitted the owner of a proposed new private domestic well is responsible for ensuring that the new well is deep enough to provide an adequate water supply and that it will not be affected by the proper operation of the permitted well. Valid permitted wells are not responsible for interference with private domestic wells installed after the appropriation is authorized.

### Pennsylvania

Pennsylvania has no requirement for well conflict resolution. The state has however, recently passed the Water Management Act, Act 220 requiring reporting of all withdrawals over 10,000 gpd (Pennsylvania General Assembly, n. d.).

### Michigan

Until 2003, Michigan did not have a legal mechanism to regulate withdrawal from high capacity wells or to identify, define, and resolve conflicts between groundwater users. In 2003, the Michigan Legislature considered several bills that would address the issue of groundwater conflicts resulting from high capacity withdrawal. Senate Bill SB 289 directed the Michigan Department of Environmental Quality (MDEQ) to compile data on groundwater use and to compile groundwater maps to better understand the groundwater situation in the state. House Bill HB 4087 established a mechanism by which the director of MDEQ can investigate, identify, and resolve conflicts resulting from high capacity groundwater withdrawals. The bills were passed by the Legislature and signed into law by Governor Granholm as PA 148 of 2003 (SB 289) and PA 177 of 2003 (HB 4087).

An owner of a small capacity well can make a formal complaint to the director of MDEQ or Michigan Department of Agriculture (MDA), for agricultural wells, if the

small capacity well fails to furnish its normal supply of water or fails to supply potable water. Information needed to make a complaint includes:

1. Name, address and telephone number of small capacity well owner;
2. Location of the small capacity well, county, township, section, address, and all other available information that defines the well location; and
3. Explanation of why the owner believes that a high capacity well caused the interference, along with the following information if known:
  - Location of the high capacity well;
  - Date or dates when the interference occurred; and
  - Reasonable evidence that a high capacity well is the cause of the problem.

In response to the claim, the director of MDEQ or MDA (for agricultural wells) may require written assessment of the small capacity well by a licensed well driller. The director of MDEQ or MDA (for agricultural wells) may refuse to accept an unreasonable complaint. The Act further states that if a complainant submits two unverified (no reasonable evidence to declare a groundwater dispute) complaints in a single year, the director may require that the complainant pay all costs for investigating the third and any subsequent complaints.

The MDEQ or MDA then investigates and proposes a solution to the complaint. If the MDA cannot arrange a satisfactory settlement, the case is returned to the MDEQ for resolution. If a satisfactory resolution to the conflict cannot be reached, the director of MDEQ can declare a groundwater conflict. In order to do so all of the following conditions must apply:

1. The small capacity well failed to furnish its normal supply of water or failed to furnish potable water.
2. The small capacity well and its equipment were functioning properly.
3. The well's failure was due to the lowering of the groundwater level in the area.
4. The groundwater lowering was greater than the normal seasonal fluctuation and impaired groundwater use in the area.
5. The groundwater lowering was caused by at least one high capacity well.
6. The small capacity well owner did not unreasonably reject a remedy proposed by the director.

When a groundwater conflict is declared, the Director can order an operator of the high capacity well to immediately provide a temporary supply of potable water and can order restriction of high capacity withdrawals.

## **Other Eastern State's Regulation Policies**

### **New Hampshire**

Other states in the Eastern U.S. have enacted laws and regulations that take a slightly different approach to regulating groundwater withdrawal. New Hampshire requires registration and reporting of all groundwater withdrawals greater than 20,000 gallons per day. Permits are required for high capacity wells. New Hampshire uses a 2-tiered system for defining high capacity wells. Large withdrawals are those producing more than 57,600 gallons per day while major withdrawals are those that produce more than 144,000 gallons per day. Well interference conflicts are investigated if a permittee

or other entity requests an investigation (New Hampshire Legislature, Title L, Water Management and Protection).

### South Carolina

South Carolina designates a capacity use area where excessive groundwater withdrawals present potentially adverse effects to the natural resources or poses a threat to public health, safety or economic welfare or where conditions pose a significant threat to the long-term integrity of a groundwater source, including saltwater intrusion. Permits for high capacity wells are required in the Coastal Capacity Use Area (South Carolina Legislature, South Carolina Code of Laws, Title 49).

### Virginia

In Virginia, Groundwater Management Areas may be designated by the State Water Control Board on its own motion or in response to a petition from a county, city or town if any one of four conditions applies:

1. Groundwater levels are declining or are expected to decline;
2. Wells of two or more groundwater users in an area are interfering with each other or are expected to interfere;
3. The available groundwater supply has been or may be overdrawn;
4. The groundwater in an area has been or may be polluted (Virginia General Assembly, Code of Virginia, Title 62.1).

### Florida

The State of Florida has the most extensive system of Water Management Districts of any Eastern state. The entire state is divided into five Water Management Districts each of which administers its own set of Administrative Rules. Water Use

Permits are required for consumptive and non-consumptive use. Well conflicts are regulated by making non-interference with other legal water users a condition of the permit (Florida Administrative Code, Title 40)

### **Alternative Dispute Resolution Techniques**

Literature describing conflict resolution techniques was reviewed to identify possible approaches for resolving public and environmental issues. Alternative Dispute Resolution (ADR) techniques appeared to have potential uses for resolving well interference conflicts. ADR techniques are not a specific set of formalized procedures, rather they are a more generalized format for resolving disputes through negotiation.

Alternative dispute resolution processes have been used in a wide variety of natural resource management contexts. ADR provides an alternative to the traditional means of resolving water resources conflicts, which has been through the courts.

ADR techniques have been recognized and encouraged by the Federal government as an important technique for dispute resolution. The Negotiated Rulemaking Act of 1996, and the Administrative Dispute Resolution Act of 1996 (U.S. Congress, 1996) are recent legislation that encourages negotiations to resolve complex issues at the federal level. The Alternative Dispute Resolution Act of 1998 establishes federal requirements for utilizing negotiations as an acceptable method for conflict resolution (U.S. Congress, 1998). The Environmental Protection Agency has also established a policy for utilizing ADR techniques where appropriate (US EPA, 2000).

The negotiating process is a joint process in which people having a stake in the outcome are the actual decision makers. In the negotiation process, each side identifies a

reservation point or position representing the least acceptable terms the party can accept. Susskind, Levy and Thomas-Larmer (2000) outlined a theoretical mutual gain approach to negotiating. In the process each party identified their “best alternative to a negotiated agreement” or BATNA. Based on this approach to negotiations, Susskind, Levy and Thomas-Larmer (2000) outlined basic steps in a negotiating process called the Mutual Gains approach:

- a. Analyze and improve your BATNA while raising doubts about opponent’s BATNA;
- b. Probe to clarify interests and positions;
- c. Invent options that meet both sides’ interests;
- d. Use objective criteria to argue for the package you favor; and
- e. Negotiate as if relationships matter.

The parties may conduct the negotiation process themselves or they may include a facilitator or mediator. The role of the mediator includes specific duties and responsibilities (Dukes, Firehock, Leahy, and Anderson, 2001) such as:

- a. Ensure common understanding of goals;
- b. Keep discussions focused on the intended subject;
- c. Maintain a productive, safe climate for all parties;
- d. Maintain meeting agenda;
- e. Encourage participation by all participants;
- f. Ensure all parties understand the discussion;
- g. Uncover hidden or unpopular issues; and

- h. Ensure assigned deadlines and those responsible understand other expectations.

Mediators may or may not be used in well-to-well conflicts. While mediators are more useful in larger, more complex conflicts, the smaller well interference conflicts may be resolved by the parties themselves. Even in these cases, it is beneficial that the state regulatory agency monitors negotiations and is available to serve as a mediator if necessary to reach a successful resolution. Whether or not a mediator is used, it is necessary that both parties to the conflict are familiar with the negotiating process.

The Mutual Gains Approach described by Susskind, Levy, and Thomas-Larner (2000) can be divided into separate steps. First, all parties should prepare for the negotiation. They should evaluate their own position defining their wants and needs from the negotiation. They should specifically identify the minimum result they will accept from the negotiation. This decision will define their BATNA and will influence their decision whether or not to negotiate. Each party should also realistically evaluate the position of the other party and try to anticipate that party's BATNA.

Based on their preparation each party should try to create value from the negotiation. They should try to create or identify potential solutions that create a win-win solution to the dispute. This process can lead to a modification of each party's BATNA. As negotiations begin, each party should be aware that proposals presented for discussion are for discussion only and do not necessarily constitute a commitment. Each party should be free to make proposals without being irrevocably committed to that position. As negotiations progress, each party should negotiate in good faith and attempt to

honestly reach a solution. Proposed solutions should be defined in detail so that there are no later misunderstandings. The agreement should be finalized in writing.

Each party should negotiate such that relationships between the parties are maintained in a position of trust. It should be remembered that the specific dispute in question is the result of a single event in time. Other situations may arise in which the parties may have to negotiate again or may negotiate on the same side of an issue. Resolution of a single issue should not be allowed to create long-term mistrust between the parties.

## CHAPTER 4

### WELL INTERFERENCE DATA AND METHODS

#### Subheadings

#### Data Sources

#### Sources of Interference Claims

#### Validity of Claims

#### Claim Resolution

#### **Data Sources**

Records of well interference claims were collected from The Michigan DEQ, Indiana DNR, Iowa DNR, and Minnesota DNR. These agencies were selected because they represent a variety of approaches to conflict regulation.

The Michigan DEQ has been regulating well conflicts for approximately one year in response to PA 177 of 2003. The majority of claims submitted in Michigan are related to quarry operations in Monroe County and agricultural irrigation in Saginaw County. Other states have been regulating conflicts for more than 20 years.

Eighty-eight claim forms from calendar year 2004 were collected from the various states. The data was tabulated into a database and analyzed. Costs to investigate and resolve the claims were recorded or estimated based on data obtained from agency officials, licensed well drillers, reported on claim forms or other reliable sources. These data were examined and, although the results were good, it is believed that additional records would be useful.

Additional claim records were available from the State of Indiana. These records consisted of a set of claim reports organized by county of origin for the years 1986 through 2002. Along with these records were copies of annual summaries of claim activity prepared by the staff of the Division of Water for senior DNR management.

These summaries contained additional information and could be correlated with claim information from the database. Together, these sources provided information for nearly 1000 additional claims.

The Minnesota DNR Division of Water provided an electronic copy of a database of 296 well interference claims from March 1967 through September 2003. Due to the difference in defining categories, it is difficult to consolidate data from all sources; however, data has been consolidated whenever possible. When data consolidation was not possible, data were analyzed separately. Together, the various sources provided information regarding 1316 well interference claims.

The claims were tabulated and entered into a database for analysis. These records are contained in Appendix C. In addition, another 500 claims were not tabulated because they described instances where water levels were only monitored, but gave no indication of whether or not an actual well conflict occurred.

Table 1 (see next page) is a compilation of the well interference claim data. The records of well interference claims showed that well interference conflicts occur in clusters around large water withdrawal facilities such as quarries, municipal well fields and agricultural irrigation projects. The table lists seven uses of high capacity wells that were reported. In many cases a single high capacity well or well system was responsible for the failure of multiple local domestic wells. Each of the individual domestic well failures were reported a separate claim. The data shown on Table 1 have been normalized to reflect multiple claims resulting from a single high capacity well as a single incident. The agricultural irrigation was the most common use of high capacity

wells alleged to have caused well interference conflicts. Municipal water supply wells and wells at quarries and mines ranked second and third.

**TABLE 1**  
**Well Interference Claim Data**  
**Michigan, Indiana, Iowa, and Minnesota**  
**1967 - 2003**

<i><b>TYPE OF HIGH CAPACITY WELL IN CONFLICT SITUATIONS</b></i>	<i><b>NUMBER OF CLAIM EVENTS</b></i>	<i><b>PER CENT OF TOTAL CLAIMS*</b></i>
Agriculture	200	23.1
Municipal water supply	179	20.6
Quarries and mines	129	14.9
Construction dewatering	66	7.6
Industrial process	45	5.2
Golf course/non-crop irrigation	36	4.2
Water level maintenance/ miscellaneous	4	0.4
Not recorded	208	24.0
<b>Total</b>	<b>867</b>	<b>99.9</b>

*\*Percent of claims does not total 100% due to rounding*

#### **Sources of Interference Claims**

The claims were analyzed to determine the real or perceived problem that caused the claims. Table 2 (see next page) shows the results when the claims were examined. In 1031 claims or 28.3% of the total, the claim was made due to an actual or perceived well

failure or loss of water. It was not necessary for the well to completely fail, in order to produce water. In many cases the small capacity well owner believed that the well was producing less than its normal supply of water. In an additional 194 or 14.7% of the claims, the small capacity well owner did not actually experience a loss of water but was concerned that an actual or proposed high capacity well in the area would affect their well.

**TABLE 2**  
**Reasons for Filing Interference Claims**  
**Michigan, Indiana, Iowa and Minnesota**  
**1967 – 2003**

<i>PROBLEM</i>	<i>NUMBER OF CLAIMS</i>	<i>PERCENT OF TOTAL CLAIMS*</i>
Real or perceived well failure or loss of water	1031	78.3
Concerns of potential well failure	194	14.7
Water quality	23	1.7
Unreported cause	68	5.2
<b>Total</b>	<b>1316</b>	<b>99.9</b>

*\*Percent of claims does not total 100% due to rounding*

Claims for impact to water quality are considered valid by most state laws. However, the claim records report only that a water quality claim was investigated by collecting a water sample. No record of resolution of water quality claims was recorded.

### Validity of Claims

One thousand thirty-one (1031) claims were made based on real or perceived well failure due to a loss of water. Of the claims, 520 were found to be valid claims resulting from a reduction in water level by high capacity pumping. The remaining 511 claims were found to be invalid. Invalid claims were repeated for a variety of reasons. Table 3 shows the reasons for rejection of claims.

**TABLE 3**  
**Results of Claim Investigations**  
**1967 – 2003**

<i>PROBLEM</i>	<i>NUMBER OF CLAIMS</i>	<i>PERCENT OF TOTAL CLAIMS*</i>
Investigation could not substantiate a decline in water level	249	48.7
Well failure due to problems with affected well itself	141	27.6
Did not record reason for claim rejection	62	12.1
Water level decline due to seasonal fluctuations	19	3.7
Situation not covered under applicable state law	15	2.9
Affected well installed in different aquifer from high capacity well	13	2.5
Affected well not installed to applicable standards	12	2.3
<b>Total</b>	<b>511</b>	<b>99.8</b>

\*Percent of claims does not total 100% due to rounding

In 249 cases, or 48.7% of the total, the state investigator could not substantiate that an actual decline in water level had occurred. The water level could not be substantiated because the investigator could not locate the well or because the observed water level was within normal historical levels. In at least one case, the observed water level was above historical levels. In some cases the investigator believed that the high capacity well had stopped pumping, which allowed the water level to recover its normal level prior to the investigation.

In an additional 141 cases or 27.6% of the claims, the affected well was itself found to be the cause of the well failure. These problems were due to sediment in the well screen, pump failure or failure of equipment. Fifteen claims were rejected because applicable state laws did not cover the situation. This included cases of conflicts between two small capacity wells or where high capacity pumping lowered lake levels.

Finally, 12 claims were rejected because they involved small capacity wells that were not installed to state standards. These wells were installed after the high capacity well was permitted or installed and were not installed to standards designed to prevent conflicts between new small capacity wells and existing permitted wells.

### **Claim Resolution**

Valid claims, those resulting from a decline in water level due to high capacity pumping, resulted in a settlement to the affected well owners. Of the 520 valid claims, the high capacity well operator settled 450 or 86.5 percent voluntarily. Seventy claims or 13.5 percent required an order or recommendation by the state regulatory agency. Recommendations of compensation were made based on investigations that showed the

high capacity well was responsible. If not promptly acted on, recommendations would be followed by agency department orders.

Settlement of the valid claims involved a variety of actions to restore a permanent, reliable water supply to the affected well owner. These remediations are shown in Table 4. Most valid claims were resolved simply by lowering the pump in the affected well. This action is relatively quick and inexpensive for a licensed well contractor. In 133 cases, a new well was installed, and in an additional 44 cases, the affected well was abandoned and replaced with a connection to a municipal water system. In only 29 cases were restrictions placed on the pumping rate of the high capacity well.

**TABLE 4**  
**Resolution of Valid Claims**  
**1967-2003**

<i>PROBLEM</i>	<i>NUMBER OF CLAIMS</i>	<i>PERCENT OF TOTAL CLAIM</i>
Lower or replace the pump	176	33.8
Install a new well	133	25.6
Unrecorded action	71	13.7
Unspecified "repairs"	57	11.0
Connect to a public water system	44	8.5
Restriction on pumping rate permit (suspended or revoked)	29	5.6
Rejection of offer by affected well owner	10	1.9
<b>Total</b>	<b>520</b>	<b>100.1</b>

*\*Percent of claims does not total 100% due to rounding*

## **CHAPTER 5**

### **FINDINGS**

#### **Subheadings**

**Negotiations in Well Conflicts**  
**Encouraging Conflict Resolution**  
**Summary of States' Approach to Conflict Resolution**  
**Settlement Terms**  
**Costs Involved in Well Conflicts**  
**Claimant Costs**

#### **Negotiations in Well Conflicts**

Negotiations between high capacity well operators and affected domestic well owners are common. The nature of these negotiations is different from environmental negotiations discussed elsewhere in the literature. The classic ADR procedures discussed earlier apply in situations where a regulatory agency is proposing new administrative rules or where a notice of violation has been issued. In these situations, negotiations are more formal and may involve numerous parties, including citizen groups, environmental and industrial groups, governmental agencies and other local or national interests.

Negotiations in well conflict situations are simpler than permitting cases or situations involving surface water, and usually involve two parties. The conflict situations occur in two circumstances. First, the responsibility for the failure of the affected well is reasonably determined by the regulatory agency to be the result of the high capacity well. This situation is common in areas where historic and current groundwater levels are known and monitored and the pumping schedule of the high capacity well can be correlated to loss of water in the affected well. Such situations occur around large quarrying or agricultural irrigation projects and commonly affect numerous local wells. In these cases, the operators of the high capacity well commonly

are proactive and offer settlements of affected well owners often before regulatory agencies become involved.

Well conflict negotiations are most commonly offers to compensate affected well owners for connection to municipal water supplies, well replacement, or well modification. Compensation is often based on receipts for well repairs made by the affected well owner.

In the second circumstance, negotiations may occur in cases where the responsibility for loss of water in the affected well is not clearly the responsibility of the high capacity well or alleged responsibility is disputed. These negotiations may be more extensive and involve a more detailed investigation by the regulatory agency or third party experts.

### **Encouraging Conflict Resolution**

Discussions with officials of regulatory agencies in Michigan, Indiana, Iowa and Minnesota indicate that certain factors are important in identifying and resolving well interference conflicts quickly and efficiently. Officials in states that regulate well conflicts commented that they did not wish to be involved in the details of the actual settlement (DeYoung, 2005). The state agencies were satisfied as long as an agreement was reached and the conflict was resolved.

In each state, officials support the requirement for registration of all high capacity wells and annual reporting of the well location, pumping schedule and quantity of water withdraw (Ron Anderson, MNDNR, personal communication, 2005).

Historic and recent water level measurements in the area surrounding the high capacity well are essential to determining whether a high capacity well caused the failure of a nearby small capacity well. However, recent water level measurements are not always available. A regional or statewide system of monitoring wells is very helpful in collecting current water level data. A database of past well conflict claims and the resolution of the claims is extremely important in evaluating new claims.

The Indiana Department of Natural Resources believes its actions to establish credibility as a fair and impartial third party mediator with both the high capacity well operator and owners of affected wells was the key to efficient resolution of conflicts. The credibility of the department and staff was commonly believed the single most important factor in achieving rapid, efficient resolution of the conflict claims (Mark Basch, personal communication, 2005).

### **Summary of States' Approach to Conflict Resolution**

Laws and regulations tell only part of the story about a state's approach to resolving well interference conflicts. Each state interprets their laws in terms of the conditions and opinions in that state. Therefore, when compiling data on state regulations and claim histories, state officials were asked to explain and clarify their actual policies in resolving interference conflicts. This information provided a clearer view of each state's approach to resolving conflicts.

## Michigan

Michigan has limited experience regulating well interference conflicts. The primary areas of well conflict have been in Monroe and Saginaw Counties.

The applicable state law, PA 177 of 2003 was initially applied to Monroe County and parts of Saginaw County beginning in September 2003. In July 2004, the law was applied statewide. In both of these areas, the high-capacity well operators have been proactive in resolving the conflicts through voluntary settlement agreements. The director of MDEQ has not formally declared a groundwater conflict to force a settlement.

## Indiana

Indiana has adopted a proactive policy in which the DNR Division of Water acts as a neutral third party mediator to actual or potential conflict situations (Mark Basch, IDNR, personal communication, 2005). The agency conducts Water Rights Investigations in cases where an actual conflict has not occurred but where residents may be concerned about potential conflicts with proposed or expanded high capacity pumping.

In Water Rights Investigations, agency personnel monitor groundwater levels in the area around the proposed high capacity well. Monitoring may be done weekly, biweekly, monthly or less frequently as needed. The results of each monitoring are simultaneously reported to the homeowner and the owner of the high capacity well. The state maintains a computerized database of all historical water levels. Monitoring provides a current record of groundwater conditions and is used to indicate affects of high capacity pumping. The proactive approach prevents numerous conflict situations and encourages voluntary negotiations. When claims are filed, the Agency investigates and encourages voluntary settlements.

Indiana's groundwater protection laws also contain a provision for establishing state standards for the installation of water wells (Indiana Legislature, 312 IAC 12, n. d.). Water wells installed after the effective date of the law are subject to the state standards. Owners of domestic wells are not required to install their wells to the standard; however, in the event that the well fails because of high capacity pumping, the owner of the non-conforming well does not have protection under the conflict interference process.

### Iowa

In 1988, Iowa passed a law that discourages well conflict claims as much as possible because too many claims of well interference were being filed (Michael Anderson, IDNR, personal communication, March 2005).

A claimant who has a well suspected of being impacted by high capacity pumping makes a written claim to the IDNR. The claim must be endorsed by a licensed well driller stating that the affected well was functioning properly when it failed and that a high capacity well is responsible. The IDNR reviews the claim and most frequently returns it to the well driller for more investigation, including a review of computerized well logs. All of this work is at the cost of the claimant. According to Mr. Anderson, several informal claims are filed each year, most of which are returned without action and never resubmitted to the agency. The parties usually settle claims themselves.

If the IDNR accepts the claim, it becomes an "official" claim. Iowa consolidates their claims. One "official" claim may actually involve a dozen or more affected wells surrounding a high capacity facility. Only "official" claims are investigated by the agency. They review records first, then may do a site visit. The site visit takes two people about sixteen person-hours each. Most claims are rejected because the agency

finds that the affected well is in fact responsible for the failure, or the high capacity well is too far away to influence the affected well. If the high capacity well is at fault, the agency can order compensation. According to agency officials, they have had three claims resulting in ordered compensation since 1988 (Michael Anderson, personal communication March 2005).

A second perspective was obtained from Mr. Roger Brunner, formerly of the Iowa State Geological Survey and a participant in numerous well interference cases. Mr. Brunner stated that many of the high capacity wells in Iowa are installed by agricultural cooperatives or agribusiness firms who are interested in maintaining good relations with their customers, and are therefore, more likely to settle conflict claims quickly without state intervention (Brunner, personal communication, June 2005).

### Minnesota

Minnesota requires a permit for high capacity wells. When the permit system was started in 1977, there was a rush by the public to apply for permits because the perception was that without a permit, a landowner would lose rights to water access. This was not the case, but the agency was deluged with permit applications. There are now more than 10,000 permits outstanding. Some permits cover wells that were never drilled, others are for wells that were never used. The DNR is currently trying to purge the system of inactive permits (Frischman, personal communication, June 2005).

According to MDNR Staff, the permit is the key to a successful conflict resolution process. The permit gives the agency the authority to restrict pumping rates or completely revoke permits if necessary. However, they have never revoked a permit and

do not intend to unless there is no other alternative (Frischman, personal communication, June 2005).

When the legislation for conflict resolution was passed in 1977, the agency expected a large number of frivolous or unsubstantiated claims. This did not occur. The number of frivolous or malicious claims is very small, and in some cases, such claims are not related to wells but are the result of personal or family conflicts that go back many years (Ron Anderson, MN DNR, personal communication, March 2005). Many of the conflicts, particularly those involving agricultural irrigation, are resolved privately between the irrigator and the affected neighbor. Friends settle the conflict as neighbors, without filing a claim with the DNR. In many other cases, the agency investigates a claim only to find that the parties have settled informally.

District Hydrologists at the county level handle many of the claims and no record is forwarded to the state office. The available records are often incomplete because agency personnel stop recording information once they learn that the parties have settled the claim themselves. Therefore, there is no record of claim closure. The state office gets about five to ten claim reports per year.

Minnesota has an association of irrigators called The Pomme De Terre Sands Irrigation Association, which has created a revolving fund to compensate owners of wells affected by high capacity withdrawals. Each member of the association contributes to the fund. When a conflict is claimed and it appears that a member is responsible, the association fund pays to replace or repair the affected well. If it is later discovered that a member was not responsible, the association attempts to recover the costs from the claimant (Ron Anderson, personal communication, March 2005).

With more than 10,000 permitted wells in the state, it is very difficult to evaluate all appropriate wells in the area when a new well is proposed. The agency is preparing a GIS based database of all permitted wells to aid in evaluating conditions. Currently, the biggest problem with well conflicts is coming from municipal wells. Due to rapid urban growth, many small villages with residents on individual wells are expanding and incorporating as cities and creating or expanding their municipal water systems with new or larger wells. These new wells are conflicting with neighboring existing wells. Since the new municipal wells are installed after the neighboring wells, the municipality is responsible for the conflict. This is a difficult situation for some municipalities to accept and object to having to compensate affected well owners (Frischman, personal communication, March 2005).

The Minnesota DNR Division of Water provided an electronic copy of a preliminary data base containing records of well interference claims, aquifer tests (performed as part of well permit applications or well conflict investigations), and an inventory of high capacity permitted wells. The database is still being compiled by the agency, though incomplete, does provide valuable information.

### Ohio

The Ohio DNR has a Mineral Resources Section that has jurisdiction in cases where a mining related high capacity well affects a neighboring well. In these cases, the Agency can issue a "Director's Order" requiring compensation to the owner of the affected well. In all other unrelated mining cases, the agency has no authority to act. They can and do conduct investigations and issue recommendations but cannot issue orders. The affected well owners' only recourse is to file a civil suit against the high

capacity well owner. The DNR report can be used as evidence in the court proceedings (Raab, personal communication, February 2005).

## **Settlement Terms**

### **Partial Restitution**

Proposed settlement offers often do not provide full reimbursement for the affected well owners. The Minnesota claim report recorded 25 cases where the negotiation continued for several years and were often contentious. In an additional eight claims, the affected well owner rejected the proposed settlement offer.

In 16 other cases, actual costs for well replacement or repair and the amount reimbursed were recorded. These cases showed that the costs incurred were greater than the amount reimbursed. The records for these cases indicated that reimbursed costs averaged \$915 less than the incurred costs. Several records contained the comment that the DNR recommended the lower amount as a reasonable offer. In several of the cases, an Administrative Law judge upheld this decision.

There may be several reasons for the partial reimbursement. States commonly require only that the responsible high capacity well operator provide an adequate permanent replacement for the affected well. This requirement may be met by lowering the pump intake, by replacing the pump if damaged, deepening the existing well, installing a new well or by providing a connection to a municipal water supply system if available. The responsible party need only use the least expensive method that meets the requirement for a reliable permanent replacement water supply.

Some affected well owners may, however, prefer a new well or other option when an alternative, less expensive option is available. In these cases, the responsible party may provide reimbursement equal to the lower cost alternative regardless of the work done by the well owner or may simply provide a cash settlement and let the affected well owner apply that amount toward whatever option they choose. In many cases, this option is not acceptable to the affected well owner leading them to reject the offer.

In Minnesota, as in most other states, the regulatory agency does not become involved in the details of the settlement offer unless the parties reach an impasse in their negotiations. The philosophy of the Minnesota DNR in these cases is to consider the least cost alternative that restores the affected well owner to a pre-conflict condition.

A similar situation exists in Michigan. Terms of a proposed settlement offer were attached to one of the claim records obtained from the Michigan DEQ. According to these proposed terms, initial claims of water loss in a well were directed to the Township Supervisor who determined whether the affected well was within the geographic area covered by the agreement. If the well was within the geographic area, the Supervisor contacted the irrigator.

If the affected well in Michigan was within one-half mile of the irrigator's facility and a well assessment by a licensed well driller determined that the affected well was operating properly at the time of the failure, the irrigator agreed to pay direct well and pump replacement costs up to \$3,500, including the cost of the well assessment. If the affected well was within one mile of the irrigation facility the irrigator agreed to pay 50 percent of the direct cost of the pump and well replacement, up to \$3,000. This limitation

did not apply to low income households or households with at least two people aged 62 years old or older.

The agreement did not include inconvenience costs or the cost of properly plugging the abandoned well. The affected well owner was required to pay these and all other additional costs. In addition, the affected well owner and his family had to agree to hold the high capacity operator harmless for future problems.

### Settlement Rejection

According to Michigan claim records, at least one affected well owner rejected a settlement offer. The MDA then simply closed the case saying the well owner had rejected a reasonable offer.

According to Mr. David DeYoung of the Michigan DEQ, terms of the proposed settlement offer are negotiable (DeYoung, personal communication, September 2005). When a claim is filed MDEQ and MDA notify the high capacity well operator who contacts the claimant and offers a settlement. Details of the settlement offer are negotiable. According to Mr. DeYoung, the agency is satisfied if both parties are satisfied and the agreement is in accordance with the law. The MDEQ and MDA consider an offer reasonable if the offered settlement is what would be required by a department order. If a claimant rejects such a settlement offer, the agencies dismiss the claim.

## **Costs Involved in Well Conflicts**

### **Permit Application Costs**

In states such as Minnesota, a permit is required prior to the installation and operation of a high capacity well. Other states have similar requirements, but Minnesota is the only Great Lakes state to do so. The permit requirement is one way of determining the potential impact of a proposed well on an aquifer and nearby wells. Costs involved in applying for a water appropriation permit may vary depending on the complexity of the local geology, available information of aquifer characteristics, the proposed withdrawal rate and the number and depth of nearby wells.

Estimated costs for a permit application for a proposed high capacity well are:

- Estimated consultant costs range from \$4,000 to \$5,000, depending on the complexity of the local geology, a hydrologic consultant may be needed to assist in preparing the permit application (Roger Brunner, personal communication, August 2005); and
- An aquifer pump test may be required by the state agency if there is insufficient existing information about the characteristics of the aquifer. Costs for the aquifer pump test vary with the size of the well and the duration of the test. It is assumed for this estimate that the well is a 12-inch diameter irrigation well 100 ft deep in glacial drift (Greeley, personal communication, July 2005).

Costs for the aquifer pump test include:

- Mobilization and demobilization is \$3,500-\$4,000
- Hourly rate to run and log the test is \$70 to \$100 per hour

- A 24-hour test is \$1,680 to \$2,400
- A 72-hour test is \$5,040 to \$7,200
- A 168-hour test is \$11,760 to \$16,800

For municipal water supply wells, hydrologic consultants include the cost for preparing the appropriations permit application in a package that includes a wellhead protection area study. The cost usually ranges from \$50,000 to \$60,000.

In addition to these costs, there are logistical problems associated with aquifer tests of this duration. A 12-inch diameter well is capable of producing between 300 and 700 gallons of water per minute (Driscoll, 1986, p 415), or 3,024,000 to 7,056,000 gallons in a 168-hour test. Disposal of this amount of water can be a problem, primarily because of the sheer amount of water produced while pumping, but the water can also contain various agricultural chemicals and other contaminants in the return flow.

Finally, the estimated cost for an 12-inch diameter well 100 feet deep, with a 20-foot screen, is approximately \$120 per foot, or \$12,000 exclusive of pump and associated equipment (Will Greeley, telephone communication, July 2005). If the test indicates that the proposed pumping rate must be restricted, it is possible that the final permitted rate will be insufficient for the proposed use.

As an alternative to extensive aquifer testing, it may be possible to conduct a test of shorter duration on a smaller well. This pump test could be used to obtain aquifer characteristics that could be used to construct a computer model of the proposed well area and simulate the effects of long term pumping by the larger well.

## **Claimant Costs**

The high capacity well owner must reimburse costs incurred by the owner of the affected well if their well is found to be responsible. However, the extent of reimbursement may not include everything, based on claim details of individual settlement records.

The claim records from Indiana, Michigan and Iowa indicate that the average claim was open for 61 to 65 days before settlement. Minnesota records indicate an average of 301 days from the date the claim is opened until the claim is closed. However, it is not well documented how long an affected well owner must experience life without water, or without their normal water supply. Claim data seldom show the actual time involved from the first loss of water until the reliable supply is re-established.

In four cases, claim reports did record the approximate time of water loss. Records indicate the homeowner was without a reliable water supply for periods ranging from five to 120 days. Contact with licensed well drillers involved with claim situations in Michigan indicated approximately one to two weeks without water was usual (M.J. Henry and Helen Oehring, personal communication June 2005).

Although most state laws regulating well conflicts require the responsible high capacity well operator to provide temporary water to the affected homeowner, this may not always occur. Well drillers (M.J. Henry and Helen Oehring, Ibid) in Michigan stated that they usually provide temporary water tanks to homeowners. The cost of this water is often paid by the high capacity well operator and in other cases by the homeowner. Cost to haul temporary water was quoted at \$75 per month.

In addition, there are inconvenience costs that are difficult to quantify. These include the inconvenience of obtaining temporary water for showering, laundry, dishes or other essential domestic tasks. It was assumed that these costs averaged \$100 per month.

Cost for an assessment of the affected well by a licensed well driller varies from \$110 to \$150, based on costs quoted in Michigan claim documents.

#### Well Replacement and Remediation Costs

Well replacement costs vary with the size and depth of the well. Michigan and Indiana records quoted prices for eleven replacement wells averaging \$5,410. Minnesota data showed replacement well costs averaging \$6,183.

In most cases, new wells were not drilled. Instead, existing wells were upgraded by deepening, lowering or replacing the pump. Indiana costs for pump lowering averaged \$365 and usually required two workers and a truck for about two hours. Minnesota data indicated costs of \$345. New pumps ranged from \$395 to \$1,357 and averaged \$942 for Michigan and Indiana. Costs for new pumps installed in Minnesota ranged from \$1,060 to \$5,706 and averaged \$2,033.

#### Well Abandonment Costs

When an existing well is abandoned and a new well is drilled, or the homeowner connects to municipal water, the previous well must be properly drilled, grouted and abandoned. These costs were not recorded in the claim records. Minnesota was the only state that specifically recorded the requirement to properly abandon a well as part of a conflict settlement. Several cost estimates prepared by well contractors were included in the Michigan DEQ claim files. All but one of these estimates included costs for properly abandoning the old well as part of the well replacement work.

Costs to abandon a well were obtained from licensed well drilling contractors (M. J. Henry and Helen Oehring, personal communication, June 2005). Shallow wells that were installed in glacial drift in Saginaw County, Michigan, were abandoned at a cost of \$150 to \$200 (M.J. Henry, personal communication, June 2005). Larger diameter bedrock wells in Monroe County, Michigan cost \$600 to \$800 to properly abandon (Helen Oehring, personal communication, June 2005).

Where municipal water systems were available, the usual practice was to connect the affected homeowner to the municipal system. Based on costs quoted in six claims reports, the average cost to connect an affected homeowner to a municipal water system was \$3,431.

#### Claim Investigation Costs

Agency costs were based on an average hourly rate of \$50 per person and vary based on the extent of the investigation. Record checks and similar office investigations were estimated to require approximately four hours. The record checks included review of historic water level data, review of claim forms and the preparation of letters or other communication with affected parties.

Field investigations usually required one person for one day. Estimated costs for the site visit are approximately \$400 for personnel and \$100 for travel and miscellaneous expenses. Site investigations involve inspection, location of the affected well, measurement of water level and communication with the affected well owner and usually a representative of the high capacity well. The site visit may also include a brief pump test to measure the response of the affected well (Mark Basch, Indiana DNR, personal communication, April 2005).

Minnesota conducts a more formalized investigation that includes a review of historic groundwater levels in the aquifer and may include an aquifer pump test. The results of the investigation are documented in a report. Aquifer test records showed 41 tests conducted as part of claim investigations. These pump tests reported an average duration of 48 hours.

Contact with large drilling contractors in Minnesota (Will Greeley, telephone communication, July 2005) provided estimated costs for performing an aquifer pump test. A pump test for a 12-inch diameter high capacity irrigation well includes the following costs:

- Mobilization and demobilization is \$175 plus \$200/hour, or a lump sum of \$3,500 - \$4,000
- Hourly rate to run and log the test is \$100/per hour
- The average running time is 48 hours, which equals \$4,800
- Estimated total cost is \$8,800

Information provided by the Minnesota DNR staff indicated that agency personnel spend approximately 40 hours investigating claims. At an assumed rate of \$50/hour, agency costs are estimated to be approximately \$2,000 (Metzker, personal communication, July 2005).

The Iowa DNR uses a slightly different procedure for investigating well conflicts. Iowa requires that a licensed well driller perform an assessment of the well and collect additional information about possible high capacity wells in the area. These costs are the responsibility of the affected well owner. Agency costs are significantly lower. The work by agency personnel involves a record check and review of the submitted claim

with a letter to the claimant. These tasks usually involve approximately four hours and costs approximately \$200. Since Iowa consolidates several well interference incidents into one official claim, field investigations are conducted on an area-wide basis. The field investigation usually involves two staff members for two days and consists of a site visit and one or more public meetings (Michael Anderson, IDNR, personal communication, March 2005). The cost for field investigations amount to approximately \$800 for personnel plus \$200 for travel and miscellaneous costs.

### Duration of Claims

Many of the costs resulting from well interference conflicts are dependent on the time needed to resolve the conflict. Such variable costs include alternative temporary water supplies, hydrogeologic studies, legal fees, and additional regulatory agency costs for investigations in response to appeals. These extended costs are difficult to quantify since the time involved and effort may vary widely. It is therefore beneficial to resolve claims as quickly as possible.

Records of well interference claims show a range from the time the claim was filed until the agency reported the claim closed. Table 5 summarizes the time that claims were open compared to the approach used by the state to resolve claims.

The data shown on Table 5 requires interpretation. The additional time required to resolve claims in Minnesota is not entirely due to the requirement for a permit. This approval is formalized and bureaucratic. The agency operates in a more formal regulatory capacity and conducts a more structured investigation than agencies in other states. The additional time required to resolve a claim is due more to this formalized operation procedure than to the permit required.

**TABLE 5****Average Time to Resolve Claims**

<i>STATE</i>	<i>APPROACH TO CLAIM RESOLUTION</i>	<i>AVERAGE DAYS TO RESOLVE CLAIMS</i>
Michigan	No permit required. Agency investigates claim	61.3 Days
Indiana	No permit required. Agency investigates as neutral third party	65.3 Days
Minnesota	Permit required. Agency conducts detailed regulatory investigation	301.8 Days

**CHAPTER 6**  
**PROPOSED ADR-BASED MANAGEMENT SYSTEM**  
**FOR CLAIM RESOLUTION**

Subheadings

Introduction  
Public Education Program  
Recommended Well Maintenance  
Water Level Monitoring  
Actions on Loss of Water  
Negotiate a Voluntary Settlement  
Negotiation Techniques Following the Mutual Gains Approach

**Introduction**

Data collected during this research indicates that a negotiated approach with a neutral mediator is the most appropriate approach to resolving well interference conflicts. Records of well interference claims showing the time the claim was open indicates that those states that use a mediated approach settle claims more quickly than those that use a more formal regulatory approach.

The claim data also show that the majority of well failures from alleged high capacity withdrawals are in fact due to mechanical problems with the affected well itself. A proposed management system designed to resolve well conflicts should stress public education and well maintenance to prevent claims.

In addition, the data show that when it is clearly shown by recent water level measurements that high capacity wells are the cause of the affected well failure, nearly all well operators voluntarily settle claims quickly.

The data collected and reviewed here indicate that a negotiated mediated settlement process is most likely to produce a conflict resolution that is acceptable to all

parties. Alternative Dispute Resolution (ADR) techniques are currently used extensively by the courts in several states as a means to settle disputes without costly and time-consuming litigation. ADR techniques are also used by many government agencies as a means to reach acceptable agreements on proposed new environmental regulations.

The conflict resolution system I am proposing is based on the principles of Alternative Dispute Resolution (ADR) negotiations. The system is designed to anticipate and prevent conflicts and to reach voluntary equitable resolution of those conflicts that do occur. The procedures utilize the regulatory agency as a neutral third-party mediator between the high capacity well operator and possible affected well owners. The agency's role is seen as one that works to prevent conflicts through education, technical support and to facilitate efficient, equitable resolutions to conflicts.

ADR is not a set of specific procedures. Rather, it is a framework for reaching a resolution to a problem by negotiation between two or more affected parties. The ADR process may or may not include using a mediator or facilitator to aid in negotiations. However, the management system I am proposing includes a mediator to oversee the process. In addition, I propose a public education program to prevent conflict situations and an ADR-based negotiation process to resolve conflicts.

### **Public Education Program**

The review of well interference claims described earlier showed that 511 or 38.9 percent of claims were determined to be invalid. State authorities investigated each of these claims. The affected well owner was often without water and incurred other inconvenience costs until the investigation was complete. Once the decision was made to

reject the claim, the claimant had to make necessary repairs themselves. Significant savings of time and money could be realized if many of these unsubstantiated claims could be prevented.

The first step in the conflict management system is therefore, a public education program. The education program should be organized and monitored by the appropriate regulatory agency, but be conducted by other groups such as the Michigan State University Extension System, the Michigan Township Association, the Michigan Municipal League, and/or other community groups.

At a minimum, the education program should include information about:

- How a well works, how conflicts occur, and recommended well maintenance procedures;
- Actions to take if well interference is suspected; and
- Rights and responsibilities under law.

A suggested outline of materials that might be included in such a public education program is in Appendix D, Public Education Fact Sheets.

### **Recommended Well Maintenance**

Claim reports showed that 141 or 27.6 percent of the invalid claims were rejected because the investigations found that well failure was due to mechanical problems. Many of these problems could be prevented by routine, periodic well and equipment maintenance checks.

A recommended program of well maintenance should be developed in cooperation with licensed well contractors. The program should be included in the public

education materials, but expanded through media announcements, postings in community centers and similar advertisements.

At a minimum, the well maintenance program should include:

1. Location and access information to the well;
2. Periodic inspection and maintenance by a licensed well driller. The

inspection report should include:

- Total depth of the well;
- Depth of pump setting;
- Condition of the pump;
- Condition of the pressure tank and filters;
- Condition of treatment equipment; and
- Static and pumping water levels.

If the pump is found to be located near or at the current water table, it should be lowered to a level that is suitably below the water table.

### **Water Level Monitoring**

Records of well interference claims provide strong incentives to monitor water levels in small capacity wells. Nearly half (249 out of 511) of the invalid claims were rejected because the investigation did not substantiate claims that the water level had been lowered. An additional 19 claims were rejected because the water level decline was due to normal seasonal fluctuations. Good water level documentation aids in substantiating claims and encourages rapid voluntary settlement. Records of valid claims

showed that 450 or 86.5 percent of the 520 claims were settled voluntarily, once responsibility for the measured water level decline was established.

If high capacity wells are in use in the area, a monitoring program should be implemented. Experienced personnel trained to collect the data while properly protecting the safety of the water supply should perform monitoring. However, the monitoring may be performed by homeowners, Township employees, representatives of high capacity wells, or volunteers from groups such as watershed councils if they are properly trained, equipped and supervised by knowledgeable people. To increase communication and shared knowledge, copies of all water level measurements should simultaneously be provided to homeowners, the high capacity well operator and the appropriate regulatory agency.

### **Actions on Loss of Water**

First, in the event that a small capacity well should experience a loss of water, the owner should have the well inspected by a licensed well driller to ensure that the well was functioning properly when it failed. The inspection by a licensed well driller is already required as part of the claim process in Michigan and Minnesota.

Second, the well owner should file a claim with the appropriate state agency and notify the high capacity well operator. Many states have toll-free telephone numbers for reporting possible well interference conflicts. Claim forms are usually available on the Web. If the affected well owner has properly maintained his well and kept records of recent water levels, he will have the foundation of evidence to support his claim that a

high capacity well is responsible for his well failure. Based on past claims, high capacity well operators are willing to voluntarily settle most claims.

Affected well owners should keep all records of expenses incurred because of well failure. Common costs include:

- The well assessment by a licensed well driller;
- Estimated costs for the repair recommended by the well driller. This may include lowering the pump, replacing the pump, deepening the existing well, or drilling a new well;
- Cost to properly abandon the existing well if necessary; and
- Cost for temporary water until the well is repaired or replaced.

### **Negotiate a Voluntary Settlement**

The recommended negotiation process follows the Mutual-Gain Approach proposed by Susskind, Levy, and Thomas-Larmer (2000). The process does not establish specific positions for each party since the objective of negotiation is to reach a mutually acceptable resolution based on the circumstances of each conflict. The procedure suggests possible offers based on the provisions of Michigan's PA 177 and the circumstances commonly seen in other claim situations.

### **Negotiation Techniques Following the Mutual Gains Approach**

#### Overview

Both sides should analyze and improve their Best Alternative to a Negotiated Agreement, or BATNA, while raising doubts about the other side. The alternative to a

negotiated settlement is a delay in resolving the well interference problems. For the homeowner, the delay could mean a longer dispute time with additional inconveniences from lack of water. Lack of negotiations may mean the rejection of a reasonable offer and dismissal of the claim by the regulatory agency with all costs becoming the responsibility of the homeowner. For the high capacity well operator, lack of negotiations could result in poor public relations, alienation of a neighbor, creation of a long-term conflict rather than a short-term dispute, and increased sanctions from the regulatory agency.

#### Actions by Affected Well Owner

The small capacity well owner should collect information to strengthen their case. They should begin by first learning what their rights and responsibilities are under applicable law. Next, they should collect evidence that the high capacity well is responsible. This information includes dates when water was lost, dates of high capacity pumping, local groundwater measurements, well assessment results from a licensed well driller, and details about the well that failed (age, depth, diameter, pump type and capacity pumping rate).

If the collected data suggests that the high capacity well is responsible for the drop in water levels, the affected well owner should file a claim promptly with the appropriate agency. Presumably, the claim will be valid based on the information collected about the well. If the available data, such as water level measurements do not indicate a high capacity well as a source of the problem, then they should not file a claim.

Although the state agency will notify the high capacity well operator, the affected well owner should also contact the high capacity well operator to notify them that a claim

has been made against them. The affected well owner should decide on the preferred settlement offer, which might be a new well, an upgrade of their existing well, or connection to a municipal water system (if available). The affected well owner should decide on the relative importance of these settlement choices and be willing to negotiate.

#### Actions by High Capacity Well Operator

The high capacity well operator should also prepare to negotiate a settlement. First, they should verify the data to be certain that their activities are likely the cause of the claimed well failure. Next, they should notify the affected well owner and regulatory agency that they are willing to negotiate a settlement. They must consider the circumstances and decide on replacing the affected well, upgrading the existing well or connecting the homeowner to a municipal water supply. The high capacity well operator should decide on the relative importance of these settlement choices and be willing to negotiate.

Each side should consider the other's offer and counter offer to achieve a settlement. Both should be willing to explore options that meet the needs of both sides. Both must be prepared to give up some conditions in exchange for other terms.

Finally, both parties must negotiate as if the relationship matters. Both sides need to remember that they are, and will continue to be neighbors. It is in the interest of both sides to prevent ill feelings that can lead to continued and possibly increased conflict. Based on a review of claim reports, some irrigators settle their neighbors' claim immediately to maintain friendships. By having the affected well owner hook up to a municipal water system (if available), claims are often settled amicably, even if no clear responsibility is demonstrated. The affected well owner must remember that the high

capacity well operator is making a good-faith offer to settle a dispute. The situation is not an opportunity to reap a windfall profit.

### Actions by Regulatory Agencies

The role of the regulatory agency is that of mediator. Regulatory agencies have an important role in the conflict prevention and negotiation process and serves as a neutral third-party mediator, helping both sides resolve conflicts efficiently and equitably. The agency does this by overseeing the process and coordinating public education. They should create files of potential conflict situations and monitor known conflict areas.

When claims are filed, they should make decisions based on monitoring records and available information. Agencies should make a site visit and inspection only in cases where either party disputes the decision, or when existing information is inadequate to support a decision of responsibility. The agency uses records of historic groundwater levels, aquifer and groundwater test results, and other available data to determine whether a well interference conflict exists, and whether the high capacity well is responsible. Agency personnel may also perform, or require other parties to perform, field tests to determine responsibility. The agency makes the results of its investigations with supporting data available to all parties involved in the conflict.

Once responsibility is established, the agency encourages voluntary settlements through communication with all parties. The agency is also available to provide technical assistance in support of negotiations. Finally, the role of the agency is to monitor proposed settlement offers and determine what constitutes a “reasonable offer”.

### Reasonable Offers

A reasonable offer may include provision for a convenient, temporary water supply, replacement of a permanent water supply, and/or properly plugging the abandoned well as required by law. Determination of what constitutes a “Reasonable Offer” is an important part of the mediator’s function. Both parties have access rights to water under the Beneficial Use Doctrine.

In a free market, resource allocation decisions are made based on price. Producers adjust their output and prices in response to market conditions until there is a resource allocation where no additional social benefit is possible without leaving at least one party in a worse-off condition. This condition is referred to as the Pareto Optimality (Nas, 1996, p 11). In the case of the well interference conflict, the beneficial use of water for irrigation or other high capacity withdrawals causes harm to a third party and therefore violates the Pareto condition.

Well failure and water loss create a negative externality in the form of additional costs to the domestic well owner. These costs might include the cost of a well assessment by a licensed well driller, cost of well and pump replacement, or connection to a municipal water system. In addition, costs could also include the proper abandonment of the original well, costs for a temporary water supply, and inconvenience costs such as difficulty in bathing or other personal hygiene needs if the temporary water supply is insufficient.

These externalities violate the Pareto Optimality, but can be corrected by internalizing them to the benefiting party, here the high capacity well operator. The internalization is accomplished by compensating the losing party to eliminate the loss.

Internalization may be through negotiation between the parties or, if this market mechanism fails, by government intervention (Nas, 1996, p 40). Thus, a third party mediator needs to be involved.

The objective of defining a reasonable offer is not for the affected well owner to profit from a well failure. Rather, it is designed to compensate the affected well owner for losses that occurred due to the actions by another party. Both parties have access rights to the water under the terms of the Beneficial Use doctrine. Since the beneficial use of the high capacity well operator has created a negative externality (well failure), the objective is to compensate the affected well owner sufficiently to avoid a loss. Government intervention is usually recommended when markets fail. Government actions would be in the role as a neutral third party mediator to “level the playing field” between small capacity well owners and high capacity operators.

The regulatory agency should also consider establishing well standards for small capacity wells installed in areas where high capacity wells already operate. In this context, well standards are guidelines for the construction of small capacity wells installed in areas where high capacity wells are already permitted and are operating. These well standards are beyond those included in current well and pump installation codes. The standards are designed to protect existing high capacity well operators from conflict claims of new wells installed after the high capacity well was in operation. Such well installation standards are already in place in Minnesota and Indiana. These states require all new wells be installed to sufficient depths so that the high capacity well does not affect them. In both states, owners of small capacity wells who do not install their

wells according to standards, have no recourse to the state agency for relief if their well fails due to nearby high-capacity withdrawal.

It is reasonable to assume that as growth continues, new homes will be built and additional well interference conflicts will occur. In order to avoid these new conflicts and to protect the high capacity well operators from additional claims, I recommend that the MDEQ in collaboration with MDA, and local authorities, and high capacity well operators establish standards for the installation of new small capacity domestic wells such that interference conflicts can be avoided.

The standard should consider the current and projected amount of groundwater levels, seasonal fluctuations, and the availability of municipal water supplies. The standards could include recommended depths for new wells, depth for pump settings and capacities such that the new wells will not be affected by the existing or reasonably expected activities of the high capacity wells now and in the future.

High capacity well operators would not be responsible for conflicts involving wells that were installed after their well was drilled and that do not meet specified standards. However, if the high capacity well increases its withdrawal rate or otherwise modifies its operations it could be held responsible for any new well conflicts resulting from the new conditions.

## **CHAPTER 7**

### **EVALUATION OF PROPOSED ADR-BASED MANAGEMENT SYSTEM**

#### Subheadings

Cost Effectiveness Analysis  
Application of Cost Effectiveness Analysis  
Approaches for Managing Groundwater Conflicts  
Establishing Criteria for Evaluating Effectiveness  
Criteria to Measure Effectiveness  
Effectiveness of Groundwater Management Approaches  
Cost Elements for Groundwater Conflict Management  
Cost Summary for Managing Groundwater Conflicts  
Groundwater Management Approaches Ranked by Cost Effectiveness

#### **Cost Effectiveness Analysis**

Cost Effectiveness Analysis (CEA) is an evaluation technique that considers alternative processes in terms of cost and effectiveness when producing an outcome or set of outcomes (Levin, 1983, p 17). It is especially well suited to evaluating outcomes that cannot readily be monetized. CEA is extensively used in evaluating educational and healthcare processes.

Cost Benefit Analysis (CBA) and Cost Effectiveness Analysis (CEA) are similar techniques in that they evaluate alternative courses of action in terms of cost and outcomes. However, CBA evaluates competing processes when outcomes can be reliably monetized or where the choice is between two or more conflicting outcomes. CBA is extensively used to evaluate engineered water resource projects in which the benefits such as reduced flood damage or hydroelectric generated power can be reliably estimated, or when valuable habitat is lost and compared to project construction costs. CEA is more appropriate for evaluating processes where the outcomes are difficult to

quantify or where multiple processes are considered for achieving similar results. For example, CEA is commonly used to evaluate healthcare processes where the outcomes are measured in human lives saved.

I am proposing that the primary objective of the conflict resolution process is to restore a water supply as soon as possible. If a CBA evaluation were preformed, it would be necessary to determine the costs for alternative methods of providing a permanent water supply, or to not restore the water supply at all. CEA on the other hand, evaluates the effectiveness of different approaches in achieving the common goal of restoring a water supply in the most cost effective manner.

Establishing the value of a reliable water supply is difficult (Cox, 1989). The National Research Council states that, "Typically, water in the United States has not been traded in markets. Because of this, there is no market-generated price or meaningful estimate of the value that markets would assign to water if, in fact, water was a traded good. This undetermined value for water is most apparent in the case of ground water..." (National Research Council, 1997, p 13). Any calculated value does not adequately represent the actual value of water as a necessity for life. Cox states (1989, p 13), "In developed countries, the accepted standard of service is an individual water supply for each resident in essentially unlimited quantity, with a high level of quality and reliability." Since the value of the desired outcome cannot readily be quantified, a cost effectiveness analysis is a more appropriate option.

### **Application of Cost Effectiveness Analysis**

Using CEA to evaluate the cost effectiveness of an approach to resolving well interference conflicts involves a five-step process:

1. Define the objective of the process;
2. Identify the approaches;
3. Establish criteria for effectiveness;
4. Identify costs; and
5. Compare approaches.

The first step is to define the objective of the process being evaluated. In the case of well conflicts, the objective is to resolve the conflict by restoring a reliable water supply to the affected well as rapidly and equitably as possible to all parties.

The second step is to define the approaches to resolving the conflict. The approach used to resolve well conflicts is a political and operational decision, and varies from state to state. Some states take little or no action while others use a more detailed regulatory approach.

The third step is to define the criteria used to judge whether an approach is effective. At a minimum, the approach must determine that a well failed to produce its normal supply of water or failed to supply potable water. Next, the approach must be able to determine whether the cause of the well failure was a lowering of the water level in excess of normal fluctuations, or if a high capacity well was responsible for the drop in water level. Finally, the approach must be capable of enforcing a decision and securing compensation.

The fourth step in the evaluation process is to identify all costs involved in implementing the approach. Costs should include wages for agency personnel; equipment and administrative costs; costs by the affected well owner such as well inspection and inconvenience costs resulting from the lack of water; and, costs by the

high capacity well owner, including administrative costs to reply to the claim, arrangements for temporary and permanent remediation and possibly legal costs involved to appeal agency decisions.

The fifth and final step is to compare the costs and effectiveness of the various approaches. This can be done by tabulating the approaches, listing their components and associated costs. The various components can be compared to the established criteria for effectiveness. The preferred approach is the procedure that achieves the best possible effectiveness at the best cost. This decision may be in part subjective, since the most effective solution may not be the lowest cost.

## **Approaches for Managing Groundwater Conflicts**

### **Definition of Cases**

States and other jurisdictions employ a variety of approaches in managing well conflicts. These approaches range from taking no action to extensive and detailed investigation actions. The specific cases selected for study were based on the approaches used by states in the Great Lakes Basin. As previously described Ohio only regulates well conflicts involving mining related wells. In all other cases the Ohio DNR will investigate a claim and prepare a report that may be used in civil litigation. Illinois regulates well conflicts in only four counties and, according to local and state officials, operates ineffectively. Wisconsin regulates well conflicts only involving public water supplies.

New York and Pennsylvania do not regulate well interference conflicts. However, parts of these states are included in the Susquehanna and Delaware River Basin

Commission areas. These interbasin compact agencies do regulate well conflict situations. The Delaware River Basin Commission, along with the State of Delaware and the various Water Management Districts in Florida use a permit system to evaluate the impact of a proposed high capacity well on the aquifer and adjacent existing wells. The permit also authorizes a specific allocation of water that may be withdrawn and includes a provision that the permitted well will not cause interference with other wells. In the event of a claim of interference the permitted high capacity well is assumed to be responsible and in violation of the permit. The permit holder is then responsible for conducting any investigation needed to prove innocence. This approach is the basis for the first case described below.

Minnesota has a detailed permit system to evaluate the impact of the proposed high capacity well on the aquifer and uses a formal regulatory approach for investigating interference claims. The investigation process can involve formal large-scale pump tests and a detailed review of historical water level records and hydrogeologic information. The results are described in a formal report. This approach to well interference resolution is the basis for Case 2 described on the following pages.

Indiana uses a less formal and more neutral mediated approach. No well permit is required and the Indiana DNR will investigate and monitor water levels prior to actual well failure. The agency works closely with all well owners in an area, investigates interference claims quickly and encourages voluntary negotiated settlements. This process was similar to the mediated approach used as the basis for Case 3 as described in the following pages.

The various approaches can be generalized into three generic cases:

### Case 1 - Well Permit With Non-Interference Requirement

In this case, the agency requires a permit for high capacity wells. The permit applicant must provide detailed hydrologic information that the agency can evaluate. This includes any impact of the proposed well on the aquifer and identity of any potential conflicts with adjacent wells. The permit contains a provision that the permitted well may not cause interference with other legally operated wells in the area. In the event that an adjacent well owner claims that a conflict exists, the agency requires that the permitted high capacity well operator prove that they are not responsible for the alleged conflict. This proof usually requires a detailed hydrologic study at the well operator's expense. Here the well operator is presumed responsible for the interference conflict unless proven innocent. The agency may suspend, restrict or revoke the well permit until the situation is resolved.

### Case 2 - Well Permit and Detailed Agency Investigation

In this situation, the agency adopts a relatively structured regulatory approach. High capacity wells require a permit before they can be installed and operated. The permit application process includes a detailed hydrologic investigation based on available information supplemented by newly developed field data. If adequate aquifer information does not exist, the agency may require an aquifer pump test. In Minnesota, this test may be for 196 hours and entail pumping from a large diameter well. The agency then evaluates the hydrologic data provided in the application, but may restrict the withdrawal rate to avoid potential conflicts with adjacent wells.

If actual well conflicts do occur, the agency requires a formal claim including an assessment of the impacted well by a licensed well contractor before conducting a

detailed investigation. A state hydrologist investigates the claim and may require a pump test of 24 to 72 hours duration. The hydrologist then reviews existing geologic and hydrologic data and prepares a formal report. The report is reviewed and serves as the basis for an agency finding of responsibility. If found responsible, the agency will then order compensation to the impacted well owner. This process is relatively bureaucratic and can result in an appeal by the high capacity well operator. Appeals may take years to resolve and entail extensive legal expenses.

### Case 3 - Mediated Approach

A third approach is a less formal process in which the agency acts as a neutral third party mediator between the parties. No permit is required. When a potential conflict situation is recognized, agency personnel commonly perform periodic groundwater monitoring in the area. Results of the monitoring are given to the owners of the monitored wells as well as the high capacity well operator. If a groundwater decline is due to the high capacity well, all parties are notified and actions are taken to prevent a conflict. If a conflict does occur, the recent monitoring data provides “the smoking gun”, indicating responsibility for the conflict. Since the process is transparent, all parties have access to the information and the high capacity well operator is encouraged to give voluntary compensation without the need for a formal department order. In this situation, there are few appeals and conflicts are resolved quickly.

### **Establishing Criteria for Evaluating Effectiveness**

The basic criteria for evaluating the effectiveness of a groundwater management approach are efficiency and fairness. Efficiency means that the management system

determines, as rapidly as possible, whether or not a groundwater conflict actually exists and if a high capacity well is responsible. The finding is extremely important to both parties. If a conflict situation does not exist, it is possible that the alleged failure is due to problems with the impacted well itself. In this case, the impacted well owner is responsible for the well repair or replacement, and should have the opportunity to initiate these repairs as soon as possible. If a high capacity well is found to be responsible, the operator of this well should provide compensation as soon as possible.

Fairness means that compensation, if required, is awarded to cover all incurred costs including repair or replacement of the failed well, proper abandonment of old wells, pumps and associated equipment, and temporary water supplies. At the same time, the responsible well operator should not be required to provide excessive or uneconomical replacement systems.

The various approaches described above are currently being used successfully to manage well interference conflicts in various Great Lakes states and throughout the eastern United States.. However, some approaches are more effective than others are. In order to evaluate the effectiveness of an approach, effectiveness criteria must be defined.

### **Criteria to Measure Effectiveness**

The following criteria were selected as measures of effectiveness:

Impartiality - State policies should recognize the rights of property owners to access water for beneficial purposes. These rights are the basis of the Beneficial Use Doctrine, accepted as policy by nearly all eastern and Midwestern states. Policies should recognize that all parties in well conflict disputes have access rights to the groundwater

resource. State agencies should be neutral in these conflicts between citizens. State agencies should also protect small capacity well owners from intimidation by large corporate interests while protecting the corporate citizen from malicious or unfounded claims.

Resource Protection – Increasingly, urban, commercial, and industrial growth is placing more demands on water resources. State agencies should have policies that mediate between conflicting demands and protect water resources from over exploitation. Agency policies should include a compilation of all information necessary to evaluate the impact of proposed developments on an aquifer and, if necessary form the basis for restricting withdrawal rates. Resource protection should include not only groundwater and surficial streams but also wetlands and other sensitive areas.

Minimize Costs - State management practices should be sufficient to achieve the desired goals of mediating between competing water users, but should be cost sensitive. Management practices should strive to minimize administrative costs. In minimizing agency costs, state policies should also minimize the cost burdens imposed on water users. If a well permit application process is used, it should require only the minimum amount of information required to adequately evaluate any impact on the aquifer.

Minimize Conflicts - Management policies should attempt to identify and prevent groundwater conflicts before they occur. Once a conflict does occur, one party is commonly without a reliable water supply. Water management policies should encourage actions that anticipate conflicts and encourage actions by well operators to modify or replace wells before actual well failure occurs.

Timely Compensation – When a well fails, the impacted party suffers a loss of water, inconvenience and potential health issues through no fault of their own. State policies should encourage full compensation to include temporary water supply, restoration of a permanent water supply by repairing or replacing the impacted well, and properly plugging the abandoned well or connecting to a municipal water system. This compensation should be provided as soon as possible to minimize the impact on the affected well owner. At the same time, the responsible high capacity well operator should not be required to provide excessive or unnecessarily expensive replacement systems.

### **Effectiveness of Groundwater Management Approaches**

#### Case 1 - Well Permit With Non-Interference Requirement (refer to Table 6)

Impartiality - This approach is not impartial. The approach includes a permit requirement for a high capacity well and includes a provision that the wells not interfere with other wells. If the owner of a small capacity well claims interference, it is assumed that the high capacity well operator has violated the permit. The burden of proof is placed on the high capacity well operator to show that they did not cause the interference. This approach requires little action by the regulatory agency. There is also the potential for abuse from malicious or unsubstantiated claims.

Resource Protection - This approach protects the resource. First, a permit application is required that collects and presents hydrologic data and allows evaluates the impact of a well on the aquifer. If necessary, withdrawal rates can be restricted to limit

over exploitation of the aquifer. Additionally, permits can be revoked in conflict situations to prevent harm until the situation is investigated and resolved.

Minimize Costs - This approach minimizes agency costs but shifts the burden of investigating potential conflicts to the high capacity well operator. Well permit applications can be costly and time-consuming. In the event of an alleged conflict, the permit holder incurs the cost of proving his innocence.

Minimize Conflicts - This approach does attempt to prevent or minimize conflicts through the permit application and review process. The hydrologic data are reviewed and potential conflicts are addressed before the high capacity well is installed.

Timely Compensation - This approach provides for complete compensation. However, since the conflict investigation is actually performed by the high capacity well permit holder, there may be a delay in resolving the situation. Many of the permit holders are small public water supply systems that do not have the financial resources to conduct detailed hydrologic investigations needed to prove or disprove their responsibility.

#### Case 2 - Permit Application and Detailed Agency Investigation (refer to Table 6)

Impartiality - This process is impartial. There is no presumption of responsibility for well interference conflicts. Hydrologic conditions can be evaluated before the high capacity well is installed and the withdrawal rate can be restricted to avoid potential conflicts. If conflicts do result, the detailed investigation is impartial.

Resource Protection - This process does attempt to protect the resource by evaluating the impact of the proposed high capacity well on the aquifer and adjacent wells before the well is installed.

**Minimize Costs** - This approach tends to be costly. The hydrologic studies required for a permit application commonly require a consultant and can involve a long duration aquifer pump test. The permit applicant incurs these costs. Agency review costs are minimal; however claim investigation costs can be substantial. The detailed investigation is conducted by a professional agency staff member and may involve field investigations and pump tests. A formal report is prepared and reviewed by supervisors and the decision is based on this report. Since this approach is more regulatory in nature, appeals are common and may involve costly legal fees for both the agency and well operators.

**Minimize Conflicts** - This approach seeks to prevent conflicts through the permit application process. Potential conflicts are commonly identified in the permit application process and resolved. There is little effort to monitor well performance and conflicts can occur during operation of the wells.

**Timely Compensation** - This process provides complete compensation to impacted well owners. However since appeals are more common with this approach than with others, compensation may be delayed pending resolution of the appeal.

**Case 3 - Mediated Approach** (refer to Table 6)

**Impartiality** - This process is very impartial. The agency serves as a neutral third party mediator and all monitoring and investigations are transparent to all participants.

**Resource Protection** - This approach is designed to efficiently resolve claims and not necessarily protect the resource from over exploitation. There is no permit application process to evaluate the impact of the proposed well before installation.

Minimize Costs - This approach may be costly for the agency since agency personnel may perform groundwater monitoring before conflicts occur. However, with current water level data available, investigations of actual conflicts are completed very quickly with responsibility established within days of the claim. Because of the agency neutrality and transparency of the process, there are very few appeals and claims are resolved quickly.

Minimize Conflicts - This approach seeks to prevent conflicts by monitoring groundwater levels during high capacity pumping. If a conflict becomes apparent, it can be quickly resolved.

Timely Compensation - Due to the transparent investigation process and the neutral approach of the agency, responsibility for well conflicts can be established quickly. The agency encourages voluntary settlements without the need for department orders.

**TABLE 6****Relative Effectiveness of Approaches to Managing Well Interference Conflicts**

## Rating

1. Most Effective Approach
2. Effective Approach
3. Least Effective Approach

	<i>Impartiality</i>	<i>Protect Resource</i>	<i>Minimize Costs</i>	<i>Minimize Conflict</i>	<i>Timely Compensation</i>
<b>Case 1.</b> Permit with Non-Interference	3	1	2	1	2
<b>Case 2.</b> Permit with Agency Investigation	2	1	2	1	3
<b>Case 3.</b> Agency Mediates	1	2	1	1	1

**Cost Elements for Groundwater Conflict Management**

Costs associated with the various approaches can be broken down into agency costs, impacted well owner costs and high capacity well operator costs.

Agency costs include salaries for professional staff members during permit reviews or conflict investigations. Field investigation costs include staff time, direct costs for transportation, per diem and equipment costs. Agency costs also include

administrative costs for support personnel and overhead costs for facilities. These administrative costs were estimated to be 50% of the agency's direct costs.

Cost to the owners of impacted wells include costs for well assessments by licensed well contractors, provisions for temporary water supplies unless provided by the high capacity well operator, and inconvenience costs to prepare claims forms and interruption to life style due to the loss of a reliable water supply. Inconvenience costs were estimated to be \$75 per month to provide a temporary water supply and an additional \$100 per month for bathing and other functions away from home and delayed activities such as house cleaning.

High capacity well operators incur a variety of costs. These include administrative costs involved with permit preparation, supervision of consultants, consultants costs themselves, costs for well installation, equipment, and operation during pump tests.

During a claim investigation, the high capacity well operator may incur costs for administration, loss of revenue during suspension of a permit, aquifer pump tests and legal fees involved in appeals. If responsibility is established, the high capacity well operator is also responsible for temporary water supplies to the impacted well owner, installation of a permanent water supply system including well repairs or replacement, abandonment of the old well or connection to a public water supply system.

Depending on the results of the investigation, there may be additional costs for negotiation with the agency regarding permit restrictions and possible legal fees for an appeal. Legal fees are dependent on the time involved and complexity of the case. They could be as little as two hours to prepare a letter or reach hundreds of hours in cases that

go to trial and appeal. It was decided to arbitrarily assume ten hours as a basis for preparing cost estimates.

The time in which these costs are incurred is based on the time that the claim is open. The average duration of claim activity is shown on Table 5 (refer to Chapter 5). Minnesota uses a permit requirement and a detailed claim investigation process. Minnesota records show that claims are open for an average of 301 days or approximately 10 months. This duration was used to estimate costs for Cases 1 and 2 since both of these cases use a permit requirement and involve a formalized claim investigation. Michigan and Indiana do not use a permit system and have a more informal claim investigation process. These states have claim open for an average of about 60 days. This duration is used for Case 3.

#### Case 1 - Well Permit with Non-Interference Requirement

The estimated costs shown in the following tables are based on estimated rates and levels of effort provided by agency personnel in Indiana, Minnesota and Iowa as well as contractors in Michigan and Minnesota. The time in which these costs were incurred is based on the time the claim is open. No direct data were available to document how long claims in this class were open, however, since the approach is similar to the more regulatory approach used in Minnesota, it was assumed that claims would be open for a comparable length of time of 301 days of approximately 10 months.

Agency Costs – (Refer to Table 7) During the permit application process, the agency costs include professional staff time to coordinate with and assist the applicant, and time for permit application review. When a conflict claim is filed, agency staff performs an initial review and notifies the permit holder. The staff also reviews the

permit holder's investigation report and issues an agency decision. There may be minor amounts of field investigation costs during the claim investigation. These costs include staff time, transportation, per diem and equipment costs. Agency administrative costs and facility overhead costs were estimated at 50% of agency direct costs.

**TABLE 7**  
**Case 1**  
**Agency Costs**  
**Well Permit with Non-Interference Requirement**

<i>Type of Service</i>	<i>Time</i>	<i>Cost Description</i>	<i>Total Cost (\$)</i>
<b>Permit Application</b>			
Permit Review	24 hours	\$50/hr	1200
Field Investigation	16 hours	\$50/hr	800
Field Expenses	2 days	\$200/day	400
Administrative and Overhead Costs		50% of Direct Costs	\$1200
<b>Subtotal</b>			<b>\$3600</b>
<b>Claim Investigation</b>			
Claim Investigation	16 hours	\$50/hr	800
Field Investigation	8 hours	\$50/hr	400
Field Expenses	1 day	\$200/day	200
Administrative and Overhead Costs		50% of Direct Costs	\$700
<b>Subtotal</b>			<b>\$2,100</b>

Impacted Well Owner Costs – (Refer to Table 8) There are no costs to the adjacent well owners during the permit application process unless the owner objects to the permit application. These costs are unknown and highly variable. During the conflict claim process, costs to the impacted well owner include a well assessment and inconvenience costs resulting from lack of water.

**TABLE 8**  
**Case 1**  
**Impacted Well Owner Costs**  
**Well Permit with Non-Interference Requirement**

<i>Type of Service</i>	<i>Cost</i>
Well Assessment by Licensed Well Contractor	\$110-\$150
Inconvenience Costs (10 months@ \$175 / Month)	\$1750
<b>Subtotal</b>	<b>\$1860-\$1900</b>

High Capacity Well Operator Costs – (Refer to Table 9) Costs to the high capacity well operator could be significant. Permit application costs include administration and professional staff time and field expenses. Subcontracted costs include the hydrologic consultant, well installation and pump tests. These costs vary with the complexity of the local geology and the duration of the pump test.

In addition, during a claim investigation, well operator costs may include a hydrologic consultant and an aquifer pump test. In this case, these charges may be less than for a permit application.

**TABLE 9**  
**Case 1**  
**High Capacity Well Operator Costs**  
**Well Permit with Non-Interference Requirement**

<i>Type of Service</i>	<i>Description</i>	<i>Total Cost (\$)</i>
<b>Permit Application</b>		
Hydrologic Consultant		4,000-5,000
Well Installation	12 " diameter, 100 ft deep in glacial drift	12,000
Aquifer Pump Test	Mobilization and Demobilization	3,500-4,000
Aquifer Pump Test	Run / log test (196 hrs@ \$40-\$100/hr)	13,720-19,600
<b>Subtotal</b>		<b>\$33,220-\$40,600</b>
<b>Claim Investigation</b>		
Consultant		4,000-5,000
Pump Test	Mobilization and Demobilization	3,500-4,000
Pump Test	Run / log test (\$70 to \$100/hr)	
	24-hour test	1,680-2,400
	72-hour test	5,040-7,200
Administration and Potential Legal Fees	10 hrs@ \$150-\$400/hr	1,500-4,000
<b>Subtotal</b>		<b>\$10,680-\$20,200</b>

Case 2 - Well Permit With Detailed Agency Investigation

The estimated costs shown in the following tables are based on estimated rates and levels of effort provided by agency personnel in Indiana, Minnesota and Iowa as well contractors in Michigan and Minnesota. The time during which the costs were incurred

was based on the average time that a claim was kept open in Minnesota. The time was 301 days or approximately 10 months.

Agency Costs – (Refer to Table 10) During the permit application process, agency costs include professional staff time to coordinate with and assist the applicant. There is also a tremendous amount of time involved in the review of permit applications. When a conflict claim is filed, agency staff performs an initial review and notifies the permit holder. The staff also reviews the permit holder's investigation report and issues an agency decision.

In addition, agency costs during a claim investigation are significant. These costs include staff time for a field investigation, historical data review, field expenses, report preparation and supervisory review. Administration costs are estimated to be 50% of the agency's direct costs.

**TABLE 10**  
**Case 2**  
**Agency Costs**  
**Well Permit with Detailed Agency Investigation**

<i>Type of Service</i>	<i>Time</i>	<i>Cost Description</i>	<i>Total Cost (\$)</i>
<b>Permit Application</b>			
Permit Review	24 hours	\$50/hr	1,200
Field Investigation	16 hours	\$50/hr	800
Field Expenses	2 days	\$200/day	400
Administrative and Overhead Costs		50% of Direct Costs	1,200
<b>Subtotal</b>			<b>\$3,600</b>
<b>Claim Investigation</b>			
Professional Staff	40 hours	\$50/hr	2,000
Field Investigation	16 hours	\$50/hr	800
Field Expenses	2 days	\$200/day	400
Administrative and Overhead Costs		50% of Direct Costs	1,600
<b>Subtotal</b>			<b>\$4,800</b>

Impacted Well Owner Costs – (Refer to Table 11) There are no costs to adjacent well owners during the permit application process unless the owner objects to the permit application. During the conflict claim process, costs to the impacted well owner include a well assessment and inconvenience costs resulting from lack of water.

**TABLE 11**

**Case 2  
Impacted Well Owner Costs  
Well Permit with Detailed Agency Investigation**

<i>Type of Service</i>	<i>Cost (\$)</i>
Well Assessment by Licensed Well Contractor	110-150,000
Inconvenience Costs (10 months@ \$175/month)	1,750
Legal Fees (10 hours@ \$150-\$400/hr)	1,500-4,000
<b>Subtotal</b>	<b>\$3,360-\$5,900</b>

High Capacity Well Operator Costs – (Refer to Table 12) Costs to the high capacity well operator could be significant. Permit application costs include administration and professional staff time and field expenses. Subcontracted costs include the hydrologic consultant, well instillation and pump tests. These costs vary with the complexity of the local geology and the duration of the pump test.

In addition, costs during a claim investigation include administration, lost revenue due to interrupted operations and investigation support costs such as providing an aquifer pump test. If found responsible for the conflict, the operator is responsible for compensation costs including a temporary water supply, well repair or replacement or connection to a municipal water system.

**TABLE 12**

**Case 2  
High Capacity Well Operator Costs  
Well Permit with Detailed Agency Investigation**

<i>Type of Service</i>	<i>Description</i>	<i>Total Cost (\$)</i>
<b>Permit Application</b>		
Hydrologic Consultant		4,000-5,000
Well Installation	12" diameter, 100 ft deep in glacial drift	12,000
Aquifer Pump Test	Mobilization and Demobilization	3,500-4,000
Aquifer Pump Test	Run / log test (196 hrs@ \$40-\$100/hr)	13,720-19,600
<b>Subtotal</b>		<b>\$33,220-\$40,600</b>
<b>Claim Investigation</b>		
Pump Test	Mobilization and Demobilization	3,500-4,000
Pump Test	Run / log test (\$70 to \$100/hr)	
	24-hour test	1,680-2,400
	72-hour test	5,040-7,200
Administration and Potential Legal Fees	10 hours@ \$150-\$400/hr	1,500-4,000
<b>Subtotal</b>		<b>\$6,680-\$15,200</b>

Case 3 - Mediated Approach

The estimated costs shown in the following table is based on estimated rates and levels of effort provided by agency personnel in Indiana, Minnesota and Iowa as well contractors in Michigan and Minnesota.

Agency Costs – (Refer to Table 13) Agency costs may initially be moderate. These costs include staff time and field expenses to periodically monitor water levels in areas of potential conflicts. Administrative costs and overhead expenses estimated at 50% of the agency’s direct costs.

**TABLE 13**  
**Case 3**  
**Agency Costs**  
**Mediated Approach**

<i>Type of Service</i>	<i>Time</i>	<i>Cost Description</i>	<i>Total Cost (\$)</i>
<b>Preconflict Monitoring</b>			
Monitoring	1 day/month for 3 months	\$50/hr	1,200
Field Expenses	3 days	\$200/day	600
Administrative and Overhead Costs		50% of Direct Costs	900
<b>Subtotal</b>			<b>\$2,700</b>
<b>Conflict Investigation</b>			
Data Review	4 hours	\$50/hr	200
Field Investigation	8 hours	\$50/hr	400
Field Expenses	1 day	\$200/day	200
Administrative and Overhead Costs		50% of Direct Costs	400
<b>Subtotal</b>			<b>\$1,200</b>

Impacted Well Owner Costs – (Refer to Table 14) These costs are minimal and may include a well assessment and inconvenience costs.

**TABLE 14**

**Case 3  
Impacted Well Owner Costs  
Mediated Approach**

<i>Type of Service</i>	<i>Cost (\$)</i>
Well Assessment by Licensed Well Contractor	110-150
Inconvenience Costs (2 months@\$175/Month)	350
<b>Subtotal</b>	<b>\$460-\$500</b>

High Capacity Well Operator Costs – (Refer to Table 15) Costs during a claim investigation include administration, lost revenue due to interrupted operations and investigation support costs such as providing an aquifer pump test. If found liable for the conflict, the operator is responsible for compensation costs including a temporary water supply, well repair or, replacement or connection to a municipal water system.

**TABLE 15**

**Case 3  
High Capacity Well Operator Costs  
Mediated Approach**

<i>Type of Service</i>	<i>Time</i>	<i>Cost Description</i>	<i>Cost (\$)</i>
Investigation Support	8 hours	\$50/hr	400
Legal Fees	10 hours	\$150-\$400/hr	1,500-4,000
	<b>Subtotal</b>		<b>\$1,900-\$4,400</b>

**Cost Summary for Managing Groundwater Conflicts**

Based on the estimated costs shown previously in Tables 7 - 15, estimates for the total cost, including permit application and claim investigation, involved in each case are as follows:

Case 1 - Well Permit with Non-Interference Requirements	\$51,460-\$68,400
Case 2 - Well Permit with Detailed Claim Investigation	\$51,660-\$70,100
Case 3 - Mediated Approach	\$6,200-\$8,800

**Groundwater Management Approaches Ranked by Cost Effectiveness**

All three approaches are successful in managing groundwater resources and resolving well conflict claims. Each approach described represents an approach used in one of the eastern or Midwestern states. According to my assessment of effectiveness

and cost estimates, the Mediated Approach is the most economical. A ranking of the preferred approaches is as follows:

1. Case 3 - Mediated Approach
2. Case 2 - Well Permit with Detailed Claim Investigation
3. Case 1 - Well Permit with Non-Interference Requirements

## **CHAPTER 8**

### **CONCLUSIONS**

#### Subheadings

##### Introduction

##### Application of the Proposed Management System to Michigan Future Research

#### **Introduction**

Well interference conflicts are and will continue to be a problem as urban growth expands into rural areas conflicting with existing high capacity water uses and creating new ones. Well failure can be a very real and difficult situation for owners of small capacity wells. They want and need a rapid, effective and equitable resolution to the problem of no water. The small capacity well owner is often confronted with a high capacity well owned and operated by a large corporation creating a potentially intimidating situation. The conflicts have the potential to create long-term disruption to a community.

Well interference conflicts are only one type of environmental dispute. Such disputes are often complex and difficult to resolve because they involve not only conflicts over scarce resources, but also involve the parties' core values and beliefs. The conflicts become more complex as the physical nature of the problem becomes more complex and the number of stakeholders increases. Well interference conflicts can be relatively simple, involving only two parties. Larger conflicts such as the impact of high capacity withdrawals on wetlands, surface waters and sensitive habitats involve more stakeholders with wider conflicting interests and agendas. Such larger, more complex issues are increasingly difficult to resolve. While some stakeholders are interested in reaching a solution to the conflict, others may have a larger agenda that is better served by

increasing the conflict. The larger, more complex conflicts have commonly been addressed through political action or litigation.

Environmental disputes that have been resolved through regulatory agency, political action and/or litigation are costly, time-consuming and lead to greater divisions between the parties. Attempts to settle disputes by political action or litigation may not actually solve the dispute. Political action involves application of political power that satisfies some of the parties involved in the dispute, while ignoring the needs and interests of others. Similarly, litigation may not provide a satisfactory solution. Courts must decide issues of law while not actually considering and encouraging a settlement that is acceptable to the parties involved. In cases of political action or litigation, one party prevails or forces a settlement on another. This solution may not involve a mutually satisfactory outcome and may increase the conflict.

In this analysis, three approaches to resolve well interference conflicts were selected and examined. All three approaches are being successfully used in parts of the Great Lakes Basin. However, the question is, which method is the most equitable to all parties and the most economical to the well owners and the state regulatory agencies involved. It must be restated that well conflicts are commonly not the result of intentional criminal acts. Rather, they arise from the legitimate use of groundwater for a beneficial purpose by both parties. It is important then to find a resolution to the conflict that protects the rights and interests of both parties while minimizing costs to them and to the regulatory agency.

The proposed ADR-based management system and other conflict resolution approaches were evaluated for equitability and cost. Equitability was evaluated using

criteria that include impartiality, resource protection, minimizing agency costs, minimizing conflicts between parties and securing timely compensation for the affected well owner. The ADR-based management system was found to provide more equitable conflict resolution than other approaches. The various approaches to conflict resolution were also evaluated on the basis of estimated costs to the affected well owner, high capacity well operator, and the regulatory agency.

Data collected during this research indicated that a negotiated mediated approach is the most equitable and economical approach in resolving well interference conflicts. Records of well interference claims showing the time in which the claim was open indicated that states that use a form of mediated approach settle claims in less time than states that use a more formalized regulatory process. Data also indicate that the majority of the alleged well failures are not due to high capacity withdrawals, but rather are due to mechanical problems with the affected well itself. The proposed management system is designed to include public education regarding well functions and stresses preventative maintenance of wells. Such education and maintenance is expected to reduce the number of well conflict incidents and claims. The claim data also indicate that, when it is clearly shown by recent groundwater level measurements that a high capacity well is the cause of a drop in water level and well failure, nearly all high capacity well operators voluntarily settle claims quickly.

The estimated costs involved in the various approaches to well conflict resolutions indicate that a mediated approach is the most economical. The approaches involving a permit application process and a more formalized regulatory action resulted in significantly higher costs to the high capacity well operator and regulatory agency. At

the same time these more regulatory approaches required more time in reaching a solution to the conflict.

The data collected and reviewed here strongly indicate that a mediated negotiated settlement process is more likely to produce a conflict resolution that is acceptable to both parties. States such as Indiana that use a form of mediated resolution have a lower incidence of appeals than states such as Minnesota that use a more regulatory approach. Alternative Dispute Resolution (ADR) techniques are currently used in many areas of civil law as a means to reach settlements without time-consuming and costly litigation. ADR techniques are also used by numerous regulatory agencies to reach acceptable agreements on proposed environmental regulations.

An ADR-based management system, monitored by a state agency acting as a neutral mediator, can efficiently and equitably provide efficient solution to conflicts. As a neutral mediator, the state agency protects the interests of all parties and works to prevent conflicts before they occur and achieves a mutually acceptable solution to those conflicts. An ADR-based management system can provide a model for addressing more complex withdrawal disputes, such as those involving lakes and wetlands. A review of more than 1,300 well interference claims showed that approximately half of the well conflict claims are not the result of actual lowering of the water table, and can be prevented by proper maintenance and a proactive public education program.

I have proposed an ADR-based management system to encourage mediation and well maintenance. This system works because it fosters voluntary negotiations between high capacity well operators and the owners of affected domestic wells. I examined this management system using Cost Effectiveness Analysis, which showed that a mediated

approach using the regulatory agency as a neutral third-party mediator is the most cost effective means to equitably resolve well interference conflicts.

### **Application of the Proposed Management System to Michigan**

Michigan has limited experience in regulating well interference conflicts. The applicable legislation, Public Act 177 of 2003 has only been in force for a short time. During that time the majority of well conflict situations have involved a quarry operation in Monroe County and agricultural irrigation in Saginaw County. In both of these areas, the high capacity well operators have been highly responsive and responsible in providing equitable settlements with their neighbors. As the number of conflicts is expected to increase, other operators may not be as cooperative. It is helpful, therefore, to apply some of the knowledge gained in this research to Michigan's situation.

Adoption of a requirement for a permit to install a high capacity well is determined by the philosophy of each state. In Michigan, decision-makers have been reluctant to implement regulations for groundwater withdrawals (MIFSA, 2003). In 2004, several bills were introduced in the Michigan Legislature to require permits for high capacity wells. These bills include provisions for water withdrawal permits, create a groundwater advisory committee, and call for the development of an assessment tool to help owners of high capacity wells evaluate the impact of their well on adjacent water users and critical habitats. The Legislature passed the substitute bills in 2006. Together, these bills require permits for new or increased withdrawals of more than two million gallons per day averaged over 30 days. This value is based on the Great Lakes Charter (Council of Great Lakes Governors, 1985). The Legislature also provides temporary protection to trout streams and requires approval of well withdrawals that impact surface

water based on an assessment tool that will be developed by the State (Michigan Legislature, 2006).

A permit requirement or alternative means to evaluate the potential impacts of high capacity wells is a valuable tool to prevent adverse impacts resulting from high capacity withdrawals. It is expected that interference conflicts will become more frequent as residential areas expand into rural areas where irrigation, quarries and other high capacity withdrawals are found (Grannemann and others, 2000, p 2). Urban development also brings use of high capacity wells for golf course irrigation, new or expanded municipal well fields, and construction dewatering for commercial and industrial uses.

Better understanding of the hydrologic conditions in these areas will help reduce the incidence of future well interference cases. The expected impact of high capacity pumping on the various aquifers should be evaluated. Given the occurrence of highly concentrated brine in many areas of the principal bedrock aquifers in the lower peninsula of Michigan, brine intrusion into freshwater areas of the aquifers is inevitable (Rheaume, 1991, p 38). In fact, cases of brine migration into fresh water aquifers have already been reported in the Mt. Pleasant area (Mandel and Westjohn, 1988, p 85) and in the Flint area (Wiitala and others, 1963, p 59).

A series of Water Management Districts or Critical Groundwater Areas should be considered as an alternative to a statewide permit system. These districts could be designated based on a careful evaluation of groundwater levels, groundwater use and the potential for brine intrusion. Special regulations, including permits, should be applied in the district as needed to meet special conditions. In order to implement this approach,

new legislation and administrative rules is needed in critical areas, along with detailed research into hydrogeologic conditions.

In the area of conflict definition and resolution, Michigan has patterned itself after the laws, rules and policies of Indiana. This has been a wise choice. Indiana does not have a permit system allowing an evaluation of a proposed well on the aquifer and other wells in the area. Indiana officials believe that this requirement is not necessary.

However, the Indiana DNR works as a neutral third party to investigate and mediate conflict situations. The agency works to develop credibility with high capacity well operators and the public to prevent well interference conflicts and to quickly and equitably resolve any conflicts that do occur. Based on my research, Michigan should actively work to adopt such practices. Michigan should also extend its current program and implement a program of public education and encourage preventive well maintenance. Public education does not require actual training by MDEQ personnel. The Michigan DEQ can compile and distribute educational materials and coordinate the educational program while groups such as the Michigan State University Cooperative Extension, Michigan Association of Counties, Michigan Municipal League, Michigan Township Association, Michigan Farm Bureau, Michigan Association of Planning and others can provide the actual training as a part of their existing educational programs.

It is recognized that state budgets are constrained. Prevention of conflicts and encouragement of voluntary negotiations and settlements will reduce the need for state regulatory action and achieve more equitable and economical resolution to well interference conflicts.

## **Future Research**

My research work addresses one part, and possibly the simplest part, of a larger problem. It addresses conflicts between high and small capacity wells. Other issues that can, and should be studied further include:

- How do we evaluate the impact of a proposed major withdrawal on the resource? Do we use a permit, water allocation permit or a notice of intent to give managers a chance to evaluate and regulate potentially adverse consequences?
- What is the best way to evaluate the impact of a proposed well on an aquifer? Do we look at historical records, do a 7-day pump test on a large diameter well, or can we do a shorter test on a smaller well, and then use numerical modeling to predict the longer-term impact?
- How do we resolve conflicts between high capacity wells and surface water users?
- How do we resolve conflicts between high capacity wells and wetlands and other important ecologies?
- How do we handle problems of return flow containing various agricultural chemicals and the water quality and quantity of receiving streams?
- How do we resolve conflicts between two or more small capacity wells?

These questions will serve as the basis for additional research into effective, equitable and economical resolution of other types of groundwater conflicts.

## **APPENDICES**

## **APPENDIX A**

### **DEFINITIONS**

#### **Definition of Terms**

Alternative Dispute Resolution Techniques - Means any structured process in which disputants in a conflict reach a voluntary settlement by means of dispute resolution techniques such as mediation, conciliation, early neutral evaluation, non-judicial settlement conference or any other proceedings leading to a voluntary mutually acceptable settlement. The process may or may not involve a neutral facilitator or mediator (Dukes and Firehock, 2001).

Aquifer – A formation or group of formations or part of a formation that contains sufficient saturated material to yield economic quantities of water to wells or springs (Driscoll, 1986, p 885).

Beneficial Use - Often called The Reasonable Use Principle, means that a landowner can divert or withdraw and use any quantity of water as long as the diversion or use is for a beneficial purpose, usually defined in state law, and does not interfere with the reasonable use of other landowners (Dzurik, 2003).

Cone of Depression - A depression in the groundwater table or potentiometric surface that has the shape of an inverted cone and develops around a well from which water is being withdrawn. It defines the area of influence of the well (Driscoll, 1986, p 887).

High-Capacity Wells - Often called large capacity wells or significant groundwater withdrawals. A well or system of connected wells on the same property

under common ownership capable of pumping 70 gallons per minute or 100,000 gallons per day.

Transmissivity – The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient (Driscoll, 1986, p 891).

Water table – The surface between the vadose zone and the groundwater; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere (Ibid, p 891).

Well Interference Conflict – The condition occurring when the area of influence of a water well comes in contact or overlaps that of a neighboring well, as when the two wells are pumping from the same aquifer or are located near each other (Ibid, 1986, p 889).

## **APPENDIX B**

### **STATE GROUNDWATER LAWS AND ADMINISTRATIVE RULES**

Records are recorded on the included CDROM.

**\*Disclaimer \*** pages in appendices B and C are numbered separately from the main document.

**APPENDIX C**  
**WELL INTERFERENCE CLAIMS**  
**1967-2003**

Records are recorded on the included CDROM.

**\*Disclaimer \*** pages in appendices B and C are numbered separately from the main document.

## **APPENDIX D**

### **PUBLIC EDUCATION FACT SHEETS**

The following fact sheets were prepared for general educational purposes and for educational purposes in other Great Lake states. The fact sheets have been reformatted to meet Michigan State University dissertation format requirements.

# WELL INTERFERENCE PRINCIPLES

## Introduction

Managing competing water resources is a growing problem. Surface and groundwater are one resource, any overuse of one result in problems with the other. Competition for water will only get worse in the future. Urban growth is moving people, golf courses, and industry into rural areas where high capacity wells are commonly used. If there is enough water now, there may not be enough in the future. The challenge is to design an equitable water management system before a crisis occurs.

Interference between high and low capacity wells can be thought of as a dispute that can grow into a larger touch on basic issues of rights, values, and worldview. States in the Great Lakes Basin have adopted differing approaches to deal with the problem of well conflicts. The information presented here will attempt to explain those approaches.

## WELL INTERFERENCE CONFLICTS

### Background

Increasing demands for reliable supplies of fresh water have led to interest in developing the groundwater resources. High capacity groundwater withdrawal wells, sometimes called significant withdrawals, are being used as a source of this water. High capacity wells are commonly defined as those capable of producing more than 70 gallons per minute (gpm) or 100,000 gallons per day. Among the common uses for high capacity wells are:

- Irrigation for agriculture and golf courses
- Quarry dewatering
- Dewatering for major construction projects
- Municipal well fields

### Groundwater Basics

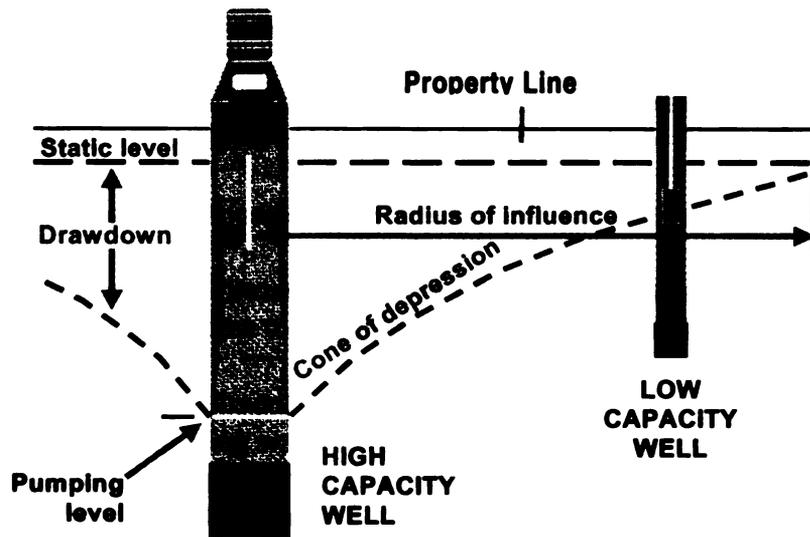
Groundwater, the source of water for wells, most commonly occurs in the pore spaces between the grains of soil or rock in layers called aquifers. In areas of limestone or crystalline bedrock, water can also occur in open channels along fractures in the rock. The part of the aquifer in which all of the pore spaces are filled with water is called the Zone of Saturation. The top of the zone of saturation is the Water Table.

Pumping water from a well removes water from the aquifer in the area immediately adjacent to the well. Removal of the water lowers the water table around the well in a conical pattern called the **cone of depression**. The steepness of the slope and lateral

extent of the cone of depression is a function of the rate and duration of the pumping and the physical characteristics of the aquifer.

The lateral extent of the cone of depression of a high capacity well can extend more than 1 mile from the well. If the cone of depression extends laterally and intersects the cone of an adjacent well, it can lower the water table in the adjacent well sufficiently to cause the adjacent well to produce less than its usual supply of water or fail to produce potable water. This condition is known as **well interference**.

### CONE OF DEPRESSION



*\*Provided by Brant Fisher from the MDEQ*

### Well Interference

Well interference conflicts are becoming more common as more people move into rural areas where high capacity wells are used. Many states have enacted laws to help resolve these conflicts and to provide compensation to homeowners whose wells are affected by nearby high capacity pumping. Under these laws a person whose small capacity well, usually a domestic well, is affected by a high capacity well can file a complaint with the State. If there is a high capacity well in your area, it is a good idea to become familiar with the laws of your state regarding well interferences and to take some simple precautions to protect your water supply.

## **Well Maintenance**

Recent research shows that slightly more than half of the claims of well failure due to high capacity withdrawal are actually due to problems with the affected well itself and not a nearby high capacity well. In these cases, the homeowner may be without water for a week to ten days while the state agency investigates only to have the claim disallowed. Many of these claims can be prevented by performing routine preventative maintenance on your well.

## **How to Maintain Your Well**

1. Locate and access the well. Many people do not know where their well is located and cannot maintain it or assist the state agency in investigating their claim.
2. Perform periodic inspection and maintenance by licensed well driller.
  - Total depth of the well – Remove sediment that may have collected in the well and have the well screen cleaned.
  - Depth of pump setting – Check the depth of the pump intake relative to the water level in the well. Normal seasonal fluctuations in the water level may lower the water level below the intake of the pump. Lower the pump intake if necessary.
  - Condition of the pump - Be sure the pump is free of sediments and working properly
  - Condition of the pressure tank and filters – Check the condition of the mechanical systems to be sure they are in good condition and working properly
  - Condition of treatment equipment
  - Static and pumping water levels – Check the water level in the well when the pump is running and when it is not. This measurement is a good indicator of whether a potential well failure is the result of a drop in water level or a failure of the well and equipment.

## **Do you Suspect Well Interference?**

If you have a well and there is a high capacity well such as a golf course, agricultural irrigator, quarry, or municipal water supply well is located within a mile of your home it is a good idea to prepare for possible well interference.

Periodically monitor water levels in your well. It is also a good idea to have the neighbors monitor the water levels in their wells also. Keep a record of the water levels for use if a claim is needed. If water levels do not drop when the high capacity well is pumping, or if they drop in only 1 nearby well and not others then any well failure is probably not the fault of the high capacity well.

## **When Well Failure Occurs**

Have the well inspected by a licensed well driller to ensure that the well was functioning properly at the time of failure. The inspection by a licensed well driller is required as part of the claim process in Michigan and Minnesota and elsewhere.

Notify high capacity well operator and file claim with the appropriate state agency. Many states have toll-free telephone numbers for reporting possible well interference conflicts and claim forms may be available on the Web. If you have properly maintained your well and kept records of recent water levels, you will have good evidence to support your claim that a high capacity well is responsible for the well failure. Experience shows that nearly all high capacity well operators are willing to voluntarily settle claims often before the state agency investigates the claim.

Be prepared to negotiate a voluntary settlement. Keep records of your expenses incurred as a result of the well failure. Common costs include:

- The well assessment by a licensed well driller;
- Estimated costs for the repair recommended by the well driller. This may include lowering the pump, replacing the pump, deepening the existing well, or drilling a new well;
- Cost to properly abandon the existing well if necessary;
- Cost for temporary water until the well is repaired or replaced.

This information will help you determine whether the settlement offers are reasonable and give you sound reasons for rejecting inadequate offers.

# **MICHIGAN INTERFERENCE CLAIM PROCEDURES**

In Michigan, well interference conflicts are regulated under the terms of PA 177 of 2003, which is administered by the Michigan Department of Environmental Quality (MDEQ) and Michigan Department of Agriculture (MDA). If a small capacity well fails to furnish its normal supply of water or fails to supply potable water, an owner of a small capacity well can make a formal complaint to the director of MDEQ or to the MDA. Information required in the claim is specified in the law.

## **Information required when making a complaint**

- Name, address and telephone number of small capacity well owner;
- Location of the small capacity well, county, township, section, address, and all other available information that defines the well location;
- Explanation of why the small capacity well owner believes that a high capacity well caused the interference and any available information about the location of the high capacity well;
- Date or dates when the interference occurred; and
- Reasonable evidence that a high capacity well is the cause of the problem.

## **Actions by MDEQ or MDA**

- The director of the Michigan Department of Environmental Quality or by the Michigan Department of Agriculture (for agricultural wells) may refuse to accept an unreasonable complaint.
- The Agency may require a written assessment of the small capacity well by a licensed well driller.
- The Act further states that if a complainant submits 2 unverified (no reasonable evidence to declare a groundwater dispute) complaints in a single year the director may require that the complainant pay all costs for investigating the third and subsequent complaints.
- Agency investigates and proposes a solution to the complaint.
- If a satisfactory resolution to the conflict cannot be reached, the director of MDEQ can declare a groundwater conflict.

## **Declaring a Groundwater Conflict**

The well interference procedures do not apply to conflicts involving a high capacity well owned by a local government if that government agrees to connect the affected well owner to a municipal water system, or by drilling a new well and paying installation costs. The procedures also do not apply to public water supplies owned by local governments if the recharge area for the well is protected by an approved wellhead protection program, construction dewatering wells or fire suppression wells.

To declare a conflict, all of the following conditions must apply:

1. The small capacity well fails to furnish its normal supply of water or fails to furnish potable water.
2. The small capacity well and its equipment are functioning properly.
3. The well's failure is due to the lowering of the groundwater level in the area.
4. The groundwater lowering is greater than the normal seasonal fluctuation and impaired groundwater use in the area.
5. The groundwater lowering is caused by at least 1 high capacity well.
  - a) The small capacity well owner does not reject a reasonable remedy proposed by the director.
- 2) If a groundwater dispute is declared, the owner of the high capacity well may be required to provide compensation to the owner of the affected small capacity well. Compensation will be required if the small capacity well failure was due to groundwater withdrawals by the high capacity well and the small capacity well was installed prior to February 14, 1967, or if installed after that date, was constructed in compliance with the public health code.
- 3) Compensation is limited to either or all of the following:
  - a) Reimbursement for reasonable expenses incurred beginning 30 days before the date of the complaint, including the cost of a well assessment;
  - b) Costs for a temporary water supply;
  - c) Costs for restoring the affected small capacity well's water supply, or a permanent alternative water supply.

### **Agency Contact Information**

To obtain a complaint form and information about the program, call the toll free "NO WATER" hotline at 1-866-709-0019. A toll free fax line, at 1-866-709-0039, is available for filing complaints, or the complaint may be mailed or delivered to the DEQ. Additional information is available at the DEQ Website: [www.michigan.gov/deq](http://www.michigan.gov/deq).

### **Reference**

Michigan Legislature, Michigan compiled laws, Act 177 of 2003, Part 317, Aquifer Protection and Dispute Resolution, Lansing, available at: <http://www.legislature.mi.gov>

# INDIANA CLAIM PROCEDURES

## **Background**

Indiana has adopted a proactive policy in which the DNR Division of Water acts as a neutral third party mediator to actual or potential conflict situations. The agency conducts Water Rights Investigations in cases where an actual conflict has not occurred but where residents may be concerned about potential conflicts with proposed or expanded high capacity pumping. In Water Rights Investigations, agency personnel monitor groundwater levels in the area around the proposed high capacity well. Monitoring may be done weekly, biweekly, monthly or less frequently as needed. The results of each monitoring are reported to the homeowner and the owner of the high capacity well. This monitoring is in addition to a computerized database of historical water levels in the state. This monitoring provides a current record of groundwater conditions and is used to indicate affects of high capacity pumping. The proactive approach prevents numerous conflict situations and encourages voluntary negotiations to resolve claims.

## **Well Interference Claims**

Owners of small capacity water wells are protected against conflicts with high capacity ground-water withdrawals under the provisions of Indiana Code 14-25-4, The Water Rights: Emergency Regulation Statute. A high capacity well or "significant ground water withdrawal facility" is defined in the statute as "the ground water withdrawal facility of a person that, in the aggregate from all sources and by all methods, has the capability of withdrawing at least one hundred thousand (100,000) gallons of groundwater in one day."

Groundwater disputes are triggered by a complaint from an owner of a small capacity well. The owner of a well that is thought to be affected by a larger facility can file a complaint with the DNR. DNR personnel will conduct an on-site investigation of the problem, usually within 2 days of the claim.

## **Filing a Claim**

Compensation may be awarded if the on-site investigation shows:

- 1) The small capacity well has failed to provide its normal supply of water due a substantial lowering of the ground water level in the area, and;
- 2) The lowering of the ground water level was caused by one or more significant ground water withdrawal facilities; and
- 3) The well and its equipment were functioning properly at the time of the failure, and;
- 4) If installed after December 31, 1985, the small capacity well was constructed in accordance with Nonrule Policy Document Information Bulletin No. 26 (1986 thru 1990) or Rule 312 IAC 12. Water wells installed after the effective

date of the law are subject to the state standards. Owners of domestic wells are not required to install their wells to the standard; however, in the event that the well fails because of high capacity pumping, the owner of the non-conforming well does not have protection under the conflict interference process.

### **Settlements**

When claims are filed, the Agency investigates and encourages voluntary settlements. However, if a voluntary settlement can not be reached between the parties, the DNR director shall, by temporary order, declare a groundwater emergency and require timely and reasonable compensation be provided to the owner of the small capacity well. "Timely and reasonable compensation" consists of the following:

- 1) The immediate temporary provision of an adequate supply of potable water at the prior point of use; and
- 2) Reimbursement of expenses reasonably incurred by the complainant to:
  - a) obtain an immediate temporary provision of an adequate supply of potable water;
  - b) restoration of the affected small capacity well to its former relative capability;
  - c) permanent provision for an alternate potable supply of equal quantity; and/or
  - d) permanent restriction or scheduling of the high capacity withdrawal so that the affected water well continues to provide its normal supply of water, or its normal supply of potable water if the well normally furnishes potable water.

### **Reference**

Indiana legislature, Indiana Code 14-25-4, Emergency Regulation of Groundwater Rights, Water Resources Management Act, Chapter 4, Indiana legislature, Indianapolis, available at: [www.in.gov/legislature/ic/code/title14/ar25/ch4.htm](http://www.in.gov/legislature/ic/code/title14/ar25/ch4.htm)

### **Contact Information**

Contact the DNR Division of Water  
Mailing address for the Division of Water:  
Indiana Department of Natural Resources  
Division of Water  
402 West Washington Street, Room W264  
Indianapolis, IN 46204  
Phone numbers for the Division of Water:  
Main office - (317)232-4160 or toll free 1-877-928-3755  
Fax number - (317)233-4579  
Email questions or comments to the Division of water:  
[water\\_inquiry@dnr.IN.gov](mailto:water_inquiry@dnr.IN.gov)

# MINNESOTA INTERFERENCE PROCEDURES

Minnesota requires a water appropriation permit for the operation of a high capacity well. The permit application process includes a detailed hydrologic investigation of the proposed well area and an evaluation of the impact of the new well on the aquifer and nearby wells. There are detailed procedures of the resolution of well interference conflicts that are identified under different circumstances.

## **Probable Interference Procedures**

This procedure is used when information obtained in the permit application shows probable interference between wells. In this case, water supplies are adequate; however, there is evidence of probable interference with other wells based on information provided in the well permit application. In order to prevent future well conflicts, the applicant must provide all available construction details for existing wells in the area. The DNR may require aquifer tests to determine the impact of the proposed well on others in the area. Aquifer tests are carefully monitored tests in which a well is pumped continuously for several days and the impact on nearby wells is observed. DNR hydrologists then determine the probable interference based on all available hydrologic information. The appropriation permit may be issued with restrictions on the amount of water that can be withdrawn.

## **Conflicts with Neighboring Wells Procedures**

This procedure is used when conflicts arise with existing neighboring wells. In this case, a written complaint is made to the DNR by an individual well owner or public water supply operator that a high capacity well has caused their well to produce less than its normal supply of water or failed to supply potable water. DNR hydrologists will investigate the claim. During the investigation, the hydrologist may request additional information from all parties and may conduct field studies. The DNR hydrologist may dismiss the complaint if the claimant fails to provide requested information. If the investigation verifies that the high capacity well was responsible for the failure of the claimant's well, the high capacity well operator is notified and the permit is modified to restrict the amount of water that can be withdrawn until a mutually satisfactory solution is reached.

## **Prevention of Conflicts**

This procedure is used for prevention of conflicts with small capacity wells that are installed after the high capacity well is operating. Owners of new private domestic wells are responsible for ensuring that their well is deep enough to provide an adequate water supply and will not be affected by the proper operation of a permitted high capacity well. High capacity well operators are not responsible for interference with private domestic wells installed after the high capacity well is authorized.

## **CLAIM PROCEDURES**

If a small capacity well fails to provide its normal supply of water or fails to provide potable water and the owner suspects that a high capacity well is responsible, they should file a complaint with the DNR.

### **Step 1**

The first step is to contact their Area Hydrologist to request a Water Well Information and Complaint Questionnaire. The questionnaire can also be downloaded from the DNR's Website at:

[http://www.dnr.state.mn.us/waters/watermgmt\\_section/appropriations/index.html](http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/index.html)

### **Step 2**

The owner must then have the affected well inspected by a licensed well driller to verify that it was functioning properly at the time of failure. The licensed well driller is required to complete parts B, C & D of the questionnaire.

### **Step 3**

The Regional Hydrologist will evaluate the complaint and determine whether an investigation is necessary. Some investigations require an aquifer-pumping test. Aquifer test data and other information will be analyzed and the extent of the interference will be determined.

### **Step 4**

If the Department determines that a well interference condition exists, the operator of the responsible high capacity well will be required to perform one or more of the following actions within 30 days:

- Request a modification or restriction of the permit in order to provide the affected well owner with an adequate domestic water supply,
- Negotiate a reasonable agreement with the affected domestic well owner, or
- Request a public hearing.

## **References**

Minnesota Department of Natural Resources, 2002, Well interference resolution process, Minnesota Department of Natural Resources, St. Paul, available at:  
[http://www.dnr.state.mn.us/waters/watermanagement\\_section](http://www.dnr.state.mn.us/waters/watermanagement_section)

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Minnesota legislature, Minnesota statutes, 2004, Chapter 103 G, Waters of the State, Minnesota legislature, St Paul, available at:  
<http://www.revisor.leg.state.mn.us/statutes/103G>

## **Contact Information**

Contact the DNR Division of Water for additional information:

**Central Office, St. Paul, MN**

DNR Waters Information (651) 296-4800

Central Office Fax: (651) 296-0445

[http://www.dnr.state.mn.us/waters/watermgmt\\_section/appropriations/index.html](http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/index.html)

# **ILLINOIS INTERFERENCE CLAIM PROCEDURES**

## **Background**

In Illinois, the Department of Agriculture (IDA) through the County Soil and Water Conservation Districts (SWCD) administers the procedures for regulation groundwater conflicts. The procedures for reporting and resolving well interference claims apply only in four Conservation Districts. These Districts are Kankakee, Iroquois, Tazewell, and McLean Counties. An individual whose small capacity well fails to furnish its normal water supply or fails to furnish potable water may make a written complaint to the local Conservation District. The District must investigate the complaint within two (2) days.

The Conservation District can recommend that the Department of Agriculture impose restrictions on withdrawal from wells capable of yielding more than 100,000 gallons per day if the investigation verifies the following conditions:

- the impacted well fails to furnish its normal supply of water or fails to furnish potable water;
- the failure is caused by a substantial lowering of the groundwater level
- the impacted well's equipment is functioning properly.

The Department of Agriculture can impose restrictions on one or more wells in the District and these restrictions may remain in place until conditions justify their removal.

## **Information Required when Filing a Claim**

When filing a claim the written complaint must contain the following information:

- Complainant's name, address, and phone number
- Date the complaint is filed
- Legal description of the location of the effected well, including county, Township, range, and section (quarter/quarter)
- General location description (e.g., nearby buildings or landmarks)
- Well identification (i.e., name or number if assigned)
- Well depth (in feet)
- Well causing diameter (inches), depth to bottom (feet), weight and thickness
- Well screen length (feet), diameter (inches), and depth to bottom (feet)
- Well pump type, gallons per minute capacity, head rating, horse power, and power source
- Type of aquifer utilized (e.g., consolidated, unconsolidated, confined, or unconfined)
- Present static water level and original static water level, along with the dates measured, name of the person who obtained these measurements, and the method used to obtain the measurement
- A description of the kind of access available at the wellhead through which the well water level can be measured and when access to the well can be

made. Access to the well's head for measurement purposes shall be made available by the well owner before any measurements can be taken.

- Use of the well:
  - a) If for domestic use, the number of people served and total number of additional wells in use
  - b) If for agricultural use, the number of people and farm animals served
  - c) If used for irrigation, the total acres, crop rotation, acres to be irrigated, type of irrigation equipment, travel speed, maximum capacity in gallons per minute, and total number of additional wells in use
  - d) If for municipal or non-community (e.g., seasonal resort) use, the total population, average daily withdrawal, and total number of additional wells in use, or if for industrial use, purpose for which water is used, average daily withdrawal, and total number of additional wells in use
- Name, address, and phone number of the contractor who drilled the well
- Normal yield in gallons per minute, pumping water level, and date measured
- Description of the problem
- Suspected cause of the problem
- Past well problems
- Estimated number of gallons required per day
- A copy of the well log with pump performance curve (if available). The Illinois State Water Survey and Illinois State Geological Survey can be contacted for a copy of the well record if one exists in their files.

### **Claim Investigation Procedures**

Staff from the Soil and water Conservation District will investigate the complaint within two (2) working days to determine if the complaint is valid. In order to be considered a valid complaint, the investigation must confirm all of the following points:

- The well is failing to furnish a normal uninterrupted supply of water.
- The failure of the well to furnish its normal supply of water is caused by a lowering of groundwater levels in the area below the critical groundwater elevation, and not by physical equipment malfunctions, such as a faulty pump, a clogged well screen, a cracked or corroded drop pipe, a collapsed well casing, or a malfunctioning pressure tank. If it appears that a physical equipment malfunction is the problem, the investigation shall be suspended until a licensed water well drilling contractor, water well installer, or plumber can inspect the well.
- The well and its equipment meet or exceed the recommended guidelines set forth in the Illinois Water Well Construction and Pump Installation codes. Wells in violation of the codes shall be brought into compliance to validate the complaint. Copies of the recommended guidelines shall be printed by the Department of Agriculture and shall be made available upon request from the Kankakee, Iroquois, Tazewell, and McLean County Soil and Water Conservation District offices.

The District shall prepare a written report describing the findings of the investigation with respect to the validity of the complaint, a description of the problem, the probable causes of groundwater impacts to the affected well, the probable causes for groundwater deficiencies, conclusions, and a recommended plan of action.

### **References**

Illinois Legislature, Administrative Code, Title 8; Agriculture and Animals; Chapter I; Department of Agriculture; Part 675, Groundwater Use Guidelines, Illinois legislature, Springfield, available at:

[www.legis.state.il.us/commission/jcar/admincode/008/00800675sections.html](http://www.legis.state.il.us/commission/jcar/admincode/008/00800675sections.html)

Illinois Legislature, Illinois Compiled Statutes, Conservation, Water Use Act of 1983, 525 ILCS 45, Illinois legislature, Springfield, available at:

[www.legis.state.il.us/ilcs/ch525/ch525act24.htm](http://www.legis.state.il.us/ilcs/ch525/ch525act24.htm)

### **Contact Information**

McLean County  
Soil and Water Conservation District  
402 N. Kays Drive  
Normal, IL, 61761  
Phone: 309-452-0830 (Ext. 3)  
Fax: 309-452-6642

Tazwell County  
Soil and Water Conservation District  
1440 Valle Vista Blvd.  
Pekin, IL, 61554-6229  
Phone: 309-346-4462 (Ext. 3)  
Fax: 309-346-4223

Kankakee County  
Soil and Water Conservation District  
685 Larry Power Road  
Bourbonnais, IL, 60914  
Phone: 815-937-8940 (Ext. 3)  
Fax: 815-937-8952

Iroquois County  
Soil and Water Conservation District  
1001 E. Grant St., Ste. A  
Watseka, IL, 60970  
Phone: 815-432-6055 (Ext. 3)  
Fax: 815-432-5740

# **OHIO WELL INTERFERENCE CLAIM PROCEDURES**

Ohio does not have formal procedures for investigating and resolving well interference claims. The DNR Division of Water has the authority to investigate conflicts between ground water users by conducting technical investigations and preparing reports. If a small capacity well fails to supply its normal supply of water, the owner should call the Ohio DNR, at the address listed below.

Agency staff will conduct a brief interview to evaluate well problems. In most cases, the problem is found to be caused by something other than high capacity pumping. However, if several well owners contact the DNR and the problem appears to be the result of high capacity pumping, the agency will conduct a field investigation. According to DNR staff, most high capacity well operators are interested in reaching a voluntary settlement if their well is found to be responsible for a well conflict.

## **Reference**

Ohio legislature, Ohio Revised Code Title XV Conservation of Natural Resources Section 1521 et seq Division of Water, Ohio Legislature, Columbus, available at: <http://onlinedocs.andersonpublishing.com/oh>

## **Contact Information**

Additional information is available from the DNR Division of Water at the URL address below. Ground Water Conflict Resolution and Investigations at <http://www.dnr.state.oh.us/water/maptechs/techserv/gwconflc.htm>

Ohio Department of Natural Resources  
Division of Water  
Water Resources Section  
2045 Morse Rd., Bldg. E-1  
Columbus, Ohio 43229-6693  
(614) 265-6740  
[water@dnr.state.oh.us](mailto:water@dnr.state.oh.us)

# WISCONSIN WELL INTERFERENCE PROCEDURES

Wisconsin does not have procedures for investigating well interference conflicts unless the conflict involves a municipal water supply well.

## **Contact Information**

For more information, see the Wisconsin DNR website at:  
[www.dnr.state.wi.us/org/water](http://www.dnr.state.wi.us/org/water)

## **References**

Wisconsin Department of Natural Resources, Wisconsin Administrative Code, Chapter NR 812, Environmental Protection – Water Supply, Well Construction and Pump Installation, Wisconsin Department of Natural Resources, Madison. Available at: <http://www.legis.state.wi.us/rsb/code/nr/nr809.html>

Wisconsin legislature, 2003-04, Wisconsin Statutes and Annotation, Chapter 281 Water and Sewage, Subchapter III Water Quality and Quantity, Section 281.34 Groundwater withdrawal, Wisconsin legislature, Madison. Available at: <http://www.legis.state.wi.us/rsb/Statutes.html>

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