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Kettren

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Investigating the Groundwater Quantity Effects on Ecosystems and Human Activities for Informed Groundwater Policy

Leroy P. Kettren, PG, Graduate Assistant
Institute of Water Research, Michigan State University
(248) 685-8021 – kettrenl@msu.edu

Steve Miller, Registered Professional Engineer
Institute of Water Research, Michigan State University
(517) 622-5830 – miller.biz@attbi.com

Pamela K.B. Hunt, Hydrologist
Institute of Water Research, Michigan State University
(517) 432-4555 – huntpam@msu.edu

Andreanne Simard, Graduate Assistant
Civil & Environmental Engineering, Michigan State University
(517) 699-1662 – simardan@msu.edu

Jon Bartholic, Director
Institute of Water Research, Michigan State University
(517) 353-9785 – bartholi@msu.edu

Introduction

Recently much attention has focused on groundwater, particularly with regards to water withdrawals in areas that are susceptible to dewatering and lowering the aquifer or surface-water bodies. Increasing demand from industry, agriculture and growing suburban and rural populations are causing more frequent cases of interference among water users. Lowered aquifers and the loss of water to domestic wells presents at best an inconvenience and potentially a health risk for many rural residents. Decreased stream flow, lowered lake levels, and a loss of wetlands affect local ecosystems and impacts fish and wildlife resources. Return flow to streams from agricultural and suburban irrigation sites often contains a variety of agricultural chemicals that can increase algal growth and directly impair other uses of lakes and streams (Glennon, 2002). Such impacts can have a direct affect on human activity and the local ecology. While the loss of water to private domestic wells is commonly reported and investigated, the affects on stream flow, wetlands and lake levels may not be obvious.

While these conflicts have been recognized throughout the West for many years, they are becoming increasingly contentious issues in the east. Even relatively water-rich Michigan, surrounded by four of the five Great Lakes, is experiencing more frequent conflicts between high and low capacity well users (MIHLAS, 2003a). Residents in west-central Michigan are challenging a bottled water facility, which they claim is causing a loss of surface water to wetlands and other ecological problems. In Saginaw County rural residents blame high capacity groundwater withdrawals for irrigation of potato crops as the cause of water loss to their private

domestic wells. In Monroe County in southeast Michigan, dewatering of a sand and gravel mining operation is believed to be the cause of a loss of water to local domestic wells (MIHLAS, 2003b).

Research on surface water and groundwater has shown their direct connectivity. The interactions have often not been considered in water resources management. State regulators and the general public are coming to realize that groundwater is not merely an alternative source to be used when surface water is not available. The two sources are intimately connected as part of the same resource. In response to these conflicts interested parties and state legislators are beginning to reexamine their policies toward water access. Various groups are calling for increased regulation of groundwater withdrawals. However before proposing new legislation it is necessary to understand the various state policies toward water access. Decision-makers must also know how much water is being used annually, the source of that water and the affect of its withdrawal on the aquifer and other resources. In addition, hydrologic information upon which to make informed decisions must be available and understandable to legislators, other public officials and the interested public.

Historically, Eastern states have followed the riparian and reasonable use doctrines (Cech, 2003). The Doctrine of Riparian Rights defines rights relating to the bank of a watercourse, which says that a landowner adjacent to a stream has the right to the water in that stream. This places the responsibility on the upstream users and protects private rights in streams and lakes. With regard to ground water, the riparian rights doctrine is called the overlying rights doctrine. Ground water belongs to the owner of the overlying surface. Michigan common law indicates that a person or entity cannot utilize his or her riparian rights in such a fashion so as to unreasonably interfere with or burden the rights of other riparian property owners. Unfortunately, what constitutes "unreasonable interference" with other riparian property rights is not based on any specific numerical formula, but rather must be tested on a case-by-case basis, often in the courts.

Litigation is not always the best solution to water resource problems Litigation is extremely expensive and time-consuming. While the cases proceed through the courts, the adverse affects of the water conflict continue to impact the parties. In addition, although the litigation eventually imposes a resolution to the conflict it is often a resolution that is unsatisfactory to one or more of the parties involved.

Investigations

Our research at MSUs Institute of Water Research is designed to better understand groundwater policy in Eastern riparian states and to develop more efficient and equitable management systems for resolving groundwater conflicts. Our research program is multi-faceted and includes an examination and comparison of groundwater laws and administrative rules in 30 Eastern and Midwestern states as well as two Canadian provinces. Our examination considers the states' policy toward regulation of groundwater withdrawals; how well interference conflicts are investigated and resolved; and the type, extent, and format of hydrologic information available to the public.

A second part of the research examines the nature of environmental disputes and identifies management systems such as Alternative Dispute Resolution (ADR) techniques that may be utilized for resolving multi-party conflicts. Related research has developed a new interactive groundwater modeling program capable of performing nested analyses at a variety of regional scales (Li, 2004). It is expected that this program will be extremely useful to environmental mediators working to resolve conflicting claims to use groundwater resources. A detailed description and a two-dimensional demonstration version of this program are available at http://www.egr.msu.edu/~lishug/research/igw/index

Results

The results of the first phase of our investigation, the review of state groundwater withdrawal legislation is presented here. The results of the other phases are being compiled and will be presented later.

Nearly all of the states surveyed have a policy of beneficial use for groundwater withdrawals. 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 protection of public health. 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 touching or lying above water sources have a right to reasonable use of those water resources (MODNR, 2003). Similarly, Indiana's legislation does not require appropriation permits but does contain specific procedures for identifying and resolving well interference conflicts (IN Code, 2003).

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 gallons per day that is affected by a larger facility can file complaint with a state regulatory agency. The common criteria for a complaint are that the small capacity well failed to produce its normal supply of water or failed to produce potable water. State regulatory agencies investigate the complaint and may perform field tests. If the complaint is verified a conflict is declared and corrective measures may be taken. High capacity facilities that cause failure of a smaller user can be required to provide an alternative water source and may be required to restrict the quantity of water withdrawn from the well.

Historically, the supply of water supply 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 (VADEQ, 2003) and South Carolina (SCDHEC, 2003) 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. No permit is 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. 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. Agricultural irrigation wells are commonly exempt from obtaining a permit.

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.

Among the state requiring appropriation permits are Minnesota (MNDNR, 2002) and New Hampshire (NHDES, 2003). 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 are known as the Water Legacy Act and 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.

In order to make informed decisions regarding the regulation of groundwater use, it is necessary for legislators, public officials, and the general public to have access to reliable, understandable hydrologic information. Our research appears to indicate that, while much valuable hydrologic information is available within state and federal agencies it is often not organized, accessible or understandable by non-professionals.

All states have an agency such as a state geological survey, water survey or environmental protection agency that is responsible for compiling hydrologic data and making it available to the public. These agencies may be part of state government or may be a research office of a state university. Often the state relies heavily on well logs and reports of the U.S. Geological Survey. While these sources are well known to water resources professionals it may

be difficult for the average citizen to identify the agency, locate applicable records and understand the information without expert help.

Many states have attempted to correct this apparent problem by compiling well logs, historic and real-time water level data for principal aquifers and by preparing reports on a county or aquifer basis. Some states have compiled reports on geographic information systems (GIS). Where state agencies have had the funding and personnel support to prepare such reports, the information is very useable and valuable. However much of the information is more appropriate for professional use than by the average homeowner whose well has gone dry.

In Michigan recent legislation, PA 148 of 2003, recognized that while a large amount of data was available it was not compiled or readily available. The legislation directed the Michigan Department of Environmental Quality, (MDEQ) to begin a two-year program to compile maps and a database of hydrologic information for use by citizens (MI Legislature, 2003)

Conclusions and Recommendations

Increased use and demand for additional groundwater development is leading many Eastern states to reexamine their policies and laws regarding access to groundwater. The reexamination reflects a growing awareness of the changing conditions in which more people are competing for a share of a finite resource. There is no change in the traditional right of a property owner to install a well for domestic use. However the use of high capacity wells is becoming subject to state regulation.

The change in groundwater policy involves some fundamental questions about access to water. Therefore the debate must include all stakeholders. Local officials, property owners, farmers, and the general public as well as legislators will have to contribute to the discussion. For the public discussion to be meaningful and resulting equitable solutions all parties will require convenient access to reliable and understandable hydrologic information.

Our investigations have produced the following recommendations:

- There should be more public education regarding the importance and vulnerability of water resources including the occurrence and movement of groundwater, interconnection to surface water and the results of over withdrawals.

- A wide range of stakeholders should be encouraged to contribute to the discussion of water policy. This should include private citizens as well as local governments, industrial and commercial interests as well as agricultural and environmental groups.

- Each state should coordinate its efforts to compile technical hydrologic information in a central agency.

- Technical hydrologic information should be reviewed for understanding by non-professionals and should be made available in a format that is easily accessible by the general public.

Water resource professionals must take the lead in educating the public as well as state and federal decision-makers. Through education and information we can achieve the cooperation necessary to ensure reliable water supplies for all user.

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