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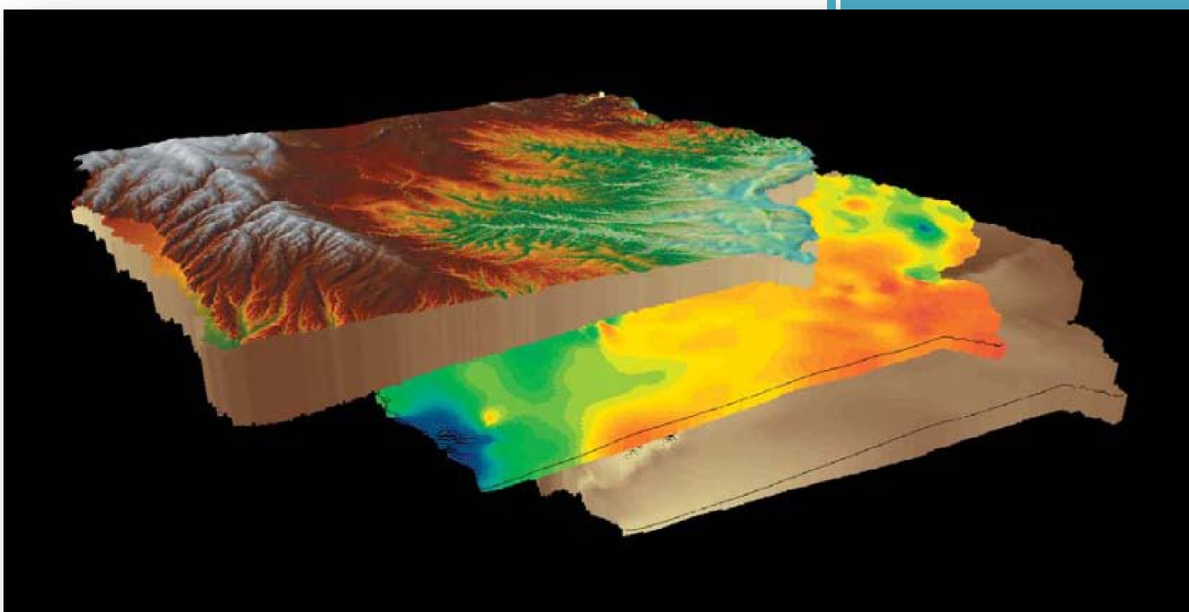
Management Strategy for Iowa's Water Resources



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Introduction

The issue of water quantity – how much water is available – has come to light in Iowa and across the nation due to climatic changes and recent increases in major industries that use water in their operations. While Iowa is not facing an immediate statewide water shortage, there have been localized shortages causing concern for sustainability and potential economic growth. How Iowa manages its water resources for both quality and quantity has the potential to impact the state's economic growth for years to come.

In Iowa, the Department of Natural Resources (DNR)is responsible for regulating water allocation and use through the issuance of water use permits, but improvements are necessary in this process to assure sustainable supplies into the future. In recent years, there have not been resources dedicated at the state level to properly track and assess water quantity issues. Resources for water use and water quantity monitoring (groundwater level and surface gauges) have continued to decline and have resulted in data becoming outdated and in a format that is difficult to analyze in order to make good decisions. Estimates on how much water is pulled from our streams, lakes, ponds, and aquifers are 10 years old. The last updates on sustainability of aquifers are more than 20 years old. To meet the water needs of Iowans both today and into the future, we need to know how much water we have available in both surface and groundwater supplies. Each of these resources have unique management challenges. While surface water systems and shallow alluvial aquifers are more responsive to short term climate changes (drought and flood), deep aquifers are not easily or quickly replenished and are impacted more by long term climate changes. In addition, water resources are not evenly distributed throughout the state.

In the 2007 Legislative Session of the Iowa General Assembly, an effort was initiated to begin addressing this data shortfall by appropriating $480,000 to the Iowa Department of Natural Resources "For regulating water quantity from surface and subsurface sources by providing for the allocation and management of water resources, and the preclusion of conflicts among users of water resources…"

Ultimately, as the agency charged with managing Iowa's natural resources, the DNR must be proactive and able to make responsible decisions regarding the use of Iowa's water resources.

Existing Water Policy in Iowa

Iowa's water allocation law was established in 1957 when the General Assembly passed legislation that allocates water, that is, who gets to use how much, through a regulatory system. Some significant amendments were added as a result of the State Water Plan in 1986, but the basic policies established in the 1957 legislation are still in place.

Iowa's water allocation program has two fundamental principles:

- All the water in Iowa's streams, rivers, lakes, ponds, and aquifers are considered "public waters and public wealth" of Iowa citizens and are subject to the control of the state.
- Water is to be used for beneficial use to the fullest extent of which they're capable; waste or unreasonable uses are to be prevented.

The concept of this program is that Iowa's water belongs to all its citizens and a permit to withdraw and use water can only be acquired by demonstrating that a proposed use is needed and not wasteful, will not unduly harm others' ability to use the water, and will not have a detrimental impact on the state's water resources in general. Unlike some states, the authorization to use water in Iowa, once acquired, cannot be bought and sold like real property; nor is the usage a perpetual one. A permitting program is used to ensure consistency in decisions on the use of water.

The withdrawal or diversion of less than 25,000 gallons per day by any person or entity from any source is a non-regulated use, meaning the approval of the state is not needed. For all other withdrawals and uses, approval is needed from the Iowa DNR.

Before the Iowa DNR can issue a permit authorizing the withdrawal and beneficial use of water, it must investigate the effects of the proposed use on other users and the water resources of the state, including the long term availability of water. The fundamental question that must be addressed is whether there is enough water to meet all demands on a continuing basis. If not, the request may not be approved or the permit may limit the amount of water to less than what was requested. In addition, permits can only be issued for a maximum of ten years which provides the Department the opportunity to reassess water usage and respond to changing circumstances.

Once acquired, a water permit does not provide absolute authority to withdraw and use the amount of water authorized by the permit. For instance, a permit authorizing the withdrawal of water for irrigation might contain a condition that requires the irrigator to cease irrigating if the flow in a nearby river drops below a certain level. In times of localized, regional, or statewide shortages or drought, the Department has powers to require regulated water users to implement water conservation measures or to suspend or restrict use based on priority categories as spelled out in Iowa Code Section 455B.266. The use of water for human consumption and sanitation has the highest priority while use for recreational or aesthetics has one of the lowest priorities. In other words, water withdrawn only for recreational purposes would be one of the first uses to be suspended or restricted. Irrigation of traditional and non-traditional crops is also a relatively low priority.

Iowa's water allocation law has served the state well and there have been no successful legal challenges to the fundamental concepts underlying Iowa's regulatory program. However, the continued success of the program rests on the state's ability to estimate the long term availability of its water resources and to allocate water resources on an equitable basis. In times of plenty, there are few challenges and Iowa has not had a sustained, long term drought for many years. It is probable that Iowa will face drought conditions in the future and the existing approach will be tested. Rather than reacting to the crises caused by shortages brought about by a drought or over-appropriation of available water (e.g., "water mining"), it will be far better to plan by determining what levels of water withdrawal and use are sustainable on a long term basis and allocate water on that basis. That way, conflicts arising from over-appropriation can be prevented before they occur.

Strategy for Water Resource Management

The Department has the responsibility to acquire and make water quantity and quality information available to the public, in particular, major water users in private industry and utilities. This information is necessary in order to assure sustainable water resources in the state. Much information is available in various forms within the Department and with other agencies, but it needs to be gathered, assessed, analyzed, integrated, and input into an electronic format (interactive database) to be used for planning and allocation purposes. Once this interactive database is developed, ongoing compilation of new data and assessment of trends will be necessary to maintain a valuable tool for managing Iowa's water resources.

In Fiscal Year 2008, the DNR initiated a pilot project for the Dakota Sandstone Aquifer in northwest Iowa to serve as an example for the type of work to be done throughout the state. The Dakota project was designed to identify the data needs and analysis efforts that will be needed to develop an aquifer specific real-time management system and use the technologies identified here.

Advances in technology now allow us to provide information in a map-based format (Geographic Information Systems or GIS), and database technology allows for the organization of large amounts of data that can be used by anyone with internet access. DNR, working with its stakeholders, will use current technology to provide real time data analysis to improve the management of Iowa's water resources, resulting in improved community and rural planning for economic development and industrial growth.

This Strategy will build on existing knowledge and meet the following four Objectives:

1. Characterize Iowa's surface and groundwater resource availability, quality, use, and sustainability.
2. Identify and estimate present and future water use by geographic area and types of user groups.
3. Make necessary policy recommendations for the sustainable use of Iowa's water resources.
4. Implement a comprehensive, real-time water resource permitting management and development system.

Objective 1: Characterize Iowa's surface and groundwater resource availability, quality, use, and sustainability.

The overall availability of water resources throughout the state will be determined for each water resource. The general water quality characteristics and concerns will be summarized for each resource. A summary of the existing uses of each resource will be compiled and "safe yield" levels will be determined.

Large quantities of data exist regarding the water resources of Iowa, however, much of this data exists in formats that are not easily accessed or utilized. In other cases, data gaps may exist and require the collection of new data to better understand and characterize the water resources of Iowa. This information will be put into a web-based data system.

Element 1: Water Quantity Monitoring
Groundwater Level Measurements

The Iowa groundwater level network was suspended in 2004 due to budget constraints, but was reestablished for one year in late FY07 with one-time Legislative funding. A long-term regional groundwater monitoring network is necessary to evaluate the effects of natural and human-induced stresses on the principal ground-water systems in Iowa. Information from long-term monitoring will provide baseline information for aquifer studies, as well as documenting long-term trends. Monitoring data will be used to assess the ground-water resource, project future conditions of supply, address contamination concerns, and provide the information necessary to effectively manage the resource.

The primary objectives of the Iowa groundwater level monitoring network are to:

1. Collect data documenting the change in ground-water storage over time in the principal aquifers;
2. Provide both the long-term and short-term data necessary to assess and predict the response of hydrologic systems to natural climatic variations and human-induced stresses;
3. Quantify the hydrologic characteristics of aquifers including transmissivity, hydraulic conductivity, and specific capacity; and
4. Provide historical baseline data for aquifer studies.

The current reinstated network of 156 wells is considered an ambient monitoring network, with samples collected quarterly from the same set of wells to obtain long-term records on aquifer levels. The current network results in an average of one well for every 360 square miles. Additional locations are needed as part of this ambient groundwater level monitoring network. Three hundred locations will provide a more comprehensive network to fully monitor ambient aquifer levels.

These monitoring elements are critical ongoing measures of the status and trends of Iowa's surface and groundwater supplies, and will provide continuous, real time information needed to forecast water sustainability.

Stream Flow Measurements

Information for characterizing streams and lakes is supplied by gauges that measure stream flow continuously. There are about 130 such gauges in Iowa, scattered across 56,000 square miles of watersheds containing 72,000 miles of streams. These gauges are paid for by numerous cooperating entities for a variety of purposes; 25 are funded by the DNR.

Nationally, stream gauge networks have met severe limitations, as federal budgets (USGS) have been cut or remain at status quo levels. This results in additional financial burden being borne by local entities to maintain existing gauges, or risk gauges being discontinued.

DNR also uses stream gauges to manage drought conditions through the low-flow stream protection program. This requires consumptive water users that withdraw water directly from streams or rivers, or alluvial wells within one quarter mile of the stream, to curtail or cease withdrawals of water if the stream or river level falls below the level designated by DNR to protect the aquatic environment or to assimilate wastewater discharges.

Additional gauges are necessary to adequately describe stream flow characteristics, particularly the critical low flows that are used to set restrictions for water withdrawals from surface waters (Appendix, Table 1). Stream flow rates are also necessary to assess the withdrawal capacity for water supply reservoirs and to properly understand the quality of our surface waters, as quality is highly dependent on flow conditions. Continuous flow data is utilized by numerous programs, and supporting additional gauges would allow sufficient data to be collected for other uses, such as:

1. Assess water resources;
2. Operation of reservoirs;
3. Operation of industries;
4. Forecasting
5. Pollution control and disposal of wastes;
6. Discharge data to accompany water-quality measurements; and

7. Research or special studies,

Element 2: Targeted Water Resource Data Collection

In addition to stream gauging and groundwater level monitoring, additional aquifer specific monitoring is necessary to produce accurate characterizations. This includes: 1) seismic cross sections needed to accurately characterize the alluvial, sand and gravel systems, 2) aquifer pump test and water level data, and 3) groundwater quality and age dating.

Some of this targeted monitoring will be collected by the DNR, but a significant amount will require cooperation with project partners, including private sector drilling/engineering firms; geology and engineering departments at the Regents institutions or private colleges, Iowa State University College of Agriculture, Iowa State University Water Center, University of Iowa Institute for Hydraulic Research, University of Iowa Hygienic Laboratory, and the United States Geological Survey.

Element 3: Characterization of Water Resources

A comprehensive assessment of Iowa's water resources is a key step in properly managing groundwater and surface water supplies in a sustainable manner. Such an assessment requires significant information. This information needs to be analyzed and applied using methods that model and predict the response of water sources to water withdrawals and climatic changes. It also needs to be accessible and useable by many public and private sector users. But before such data analysis and accessibility can occur, the information must be collected and compiled into useable databases and formats.

The characterization of Iowa's water resources requires analysis of geologic materials and data from wells to establish the three-dimensional physical map of geologic units for the state. Information on water yield capabilities, water level responses to pumping, groundwater quality, current and projected withdrawals, and other aquifer properties will be combined with the physical geological framework. For shallow aquifers this will also require characterization of the stream-aquifer systems that carry water, their low-flow characteristics, and interactions between precipitation, surface water, and groundwater.

Very little existing data is easily accessible by the general public, and even trained geologists require significant time to process the data for such tasks as generating routine well forecasts. This extensive, ongoing "data-mining" and interpretation task includes both paper information sources and the processing and describing of aquifer materials from archived and new well cuttings. A draft priority schedule has been determined for data analysis, and will be reviewed and modified in consultation with water supply stakeholders and technical partners.

Drill cuttings from new wells are provided to the DNR by well drillers from across the state. Less than half of the samples received are processed each year. Currently, there are no resources committed to routinely analyzing and logging these samples, rather, specific projects dictate which wells are logged and when. To obtain all of the needed data to accurately characterize Iowa's water resources, a concerted effort must be undertaken to process and log the needed well records.

Staff and products associated with this element will provide ongoing consultation and support for permit review activities, water supply developers, and other resource and environmental issues regarding geology and water, including water quality assessments.

Element 4: Maintenance of Water Resource Characteristics

Approximately 118,000 feet of drill cuttings from new wells are received by the DNR each year. Currently, less than half of these are processed to be ready for analysis each year, resulting in a significant and growing backlog each year. It is estimated that approximately half of these samples are in priority areas. To minimize the backlog, priority samples should be processed as they are received.

Objective 2: Identify and estimate present and future water use by geographic area and types of user groups.

Existing water use will be determined in large part through water use permit records and annual reporting of water usage. Estimation of future water use will be determined by analyzing existing water usage and historic trends, and combining that data with projected growth in industries and public water supplies.

Element 5: Development of Predictive Models

This task involves the hydro geologic analysis of the data collected, and the development of computer simulation models that can predict responses of aquifers and watersheds to different pumping, climatic, and recharge situations, providing long-term estimates of sustainability. Given the differing nature of our bedrock and alluvial-stream aquifer systems, the different factors affecting sustainable use, varying levels of current demand, and questions of scale, different modeling efforts and approaches will be needed.

Staff and products associated with this task will also be involved in ongoing consultation and support for permit review activities, water supply developers, and other resource and environmental issues regarding geology and water, including water quality assessments.

Element 6: Maintenance of Predictive Models

For these predictive models to be available in a real time format, it is necessary to update the models with new data as it becomes available, and also to adapt the model to new, localized scenarios.

Objective 3: Make necessary policy recommendations for the sustainable use of Iowa's water resources

A necessary component of this water resource strategy is to evaluate and update Iowa's existing water law. Policy recommendations will be developed in conjunction with stakeholders and technical advisors, and made to the Environmental Protection Commission and Legislature. At a minimum, this should include:

1. The need for implementing a program to assure appropriate routine and emergency water conservation measures are put into place;
2. A review of the existing priority allocation strategy*; and
3. Redefining the State's original drought management procedures.
   *The existing priority allocation strategy is presented in the Appendix.

Element 7: Policy Review

Working with stakeholders and technical advisors, a review of existing authorities and policy will be conducted as they relate to water use and allocation.

Objective 4: Implement a comprehensive, real-time water resource permitting, management, and development system.

This will be accomplished by improving the characterization of critical aquifer and stream systems, making information and expertise easily available to developing industries and department permit staff, adding technical support and enhanced review to the permit process, providing assistance for drought management, implementation of conservation, water re-use, and other planning measures to assure sustainable water supplies. The products from Objectives 1-3 will be utilized by DNR permitting staff to improve the water use permitting process.

Element 8: Water Allocation Permitting

The products of the other seven Elements will be utilized by the water allocation program to improve water use permitting, both in quality of reviews and in process time. Additional staff are needed to more adequately review the permitting of agricultural drainage wells, and aquifer storage and recovery. Planning activities, such as water conservation planning and implementation, review and update of emergency procedures and drought plans need a more proactive approach by the Department.

Water Resource Priorities

A Draft prioritization of Iowa's groundwater resources was completed based on several factors, including available data and understanding of the aquifer, current and potential use, and susceptibility to drought. These factors resulted in the following priorities:

1. Dakota Aquifer. Study of the Dakota aquifer was undertaken in FY08 because of the large amount of historical data available, limited regional extent, and an existing aquifer study completed in 1983. The Dakota is identified in IDNR rules as an aquifer to monitor in order to prevent excessive water level declines.

2. Jordan/Prairie du Chien-St. Peter/Dresbach. The Jordan aquifer is one of two aquifers identified in IDNR rules as an aquifer to monitor to prevent excessive water level declines. It has a high potential for groundwater mining, but a relatively low recharge rate. This low recharge rate results in relatively old water in this aquifer, causing the sustainability of this aquifer for the long term to be unknown. In addition, there has been a considerable shift in the demand upon the aquifer over the past 20 years as far as geographical location of pumping centers. The usage area of this aquifer covers over two-thirds of the state of Iowa and the Jordan is the most reliable aquifer for high capacity wells. Approximately 14% of Iowans drink water from this aquifer. Nearly all Jordan wells are logged as they are received by the DNR. The level of effort to complete this aquifer is similar to that of the Dakota.

3. Alluvial Aquifers. Various alluvial aquifers are used by approximately 30 percent of Iowans as a source of drinking water. Alluvial aquifers are very vulnerable to contamination from the land surface, and in the recent past there have been many new complaints from various water users regarding quantity and quality. Because of the interaction with surface water systems, the alluvial systems are easily recharged but also very drought susceptible.

The level of effort to complete Iowa's alluvial systems is very high compared to the Dakota aquifer. Additional data needs to be collected, including seismic cross to define the container. These systems will be extremely difficult to model regionally, however, localized modeling would be extremely valuable. Issues of concern include the lateral and vertical extent of alluvium, average saturated thickness, aquifer properties, withdrawal centers, irrigation permits, quarry water-use permits, radial collector/horizontal wells, and potential yields.

The Alluvial systems can be divided into five main areas for analysis:

1. **Missouri & Mississippi River** (Muscatine & Louisa Counties)
2. **Northwest Iowa Systems**
   Big Sioux River Alluvium
   Rock River
   Little Sioux River
   Floyd River

3. **Portions of the Skunk, Des Moines, and Raccoon River Systems**
4. **Cedar River Alluvium (downstream of Waterloo), Iowa River Alluvium (downstream of Tama County)**
5. **Southwest Iowa Systems**
   East and West Nishnabotna
   Boyer River Systems

4. Silurian/Devonian Aquifer. The Silurian/Devonian aquifer is used by approximately 15 percent of Iowans as a source of drinking water. This system is very vulnerable to surface contamination, as many geothermal "pump and dump" wells are in this aquifer. This system frequently has elevated levels of nitrates, but some of the highest capacity wells (>3,000 gpm) in the state are in this aquifer.

The level of effort to complete the Silurian/Devonian aquifer is considered very high when compared to the Dakota aquifer. It may be necessary to model the system at the county level or smaller rather than regionally, due to the tremendous amount of variability in the recharge. Issues of concern include karst, transmissivity, storativity, and potential yields.

5. Buried Sand and Gravel Aquifers. The buried sand and gravel systems are some of the least known and understood systems in Iowa, with very little data available statewide. While there appears to be a high potential for use of these systems, currently approximately 12% of Iowans use these systems as a source of drinking water. The level of effort to complete these systems is considered very high compared to the Dakota aquifer due to the limited amount of data available. Needed data includes seismic cross sections and groundwater level data. These systems can be broken down into four areas:

A. **Cleona Channel**
B. **Fremont Channel**
C. **Skunk River**
D. **Unnamed Aquifers**

6. Mississippian Aquifers. Approximately four percent of Iowans use this system as a source of drinking water. This system would have a low level of effort when compared to the Dakota, but may not have as high of a potential use as some of the other systems. The Mississippian can be broken out into two areas:

A. **North-central Iowa** — this could be modeled
B. **Southeast Iowa** — very difficult to model, much more complexity and variability

7. Ordovician Aquifer above the St. Peter Sandstone. This system generally provides low capacity wells, with only two percent of Iowans using a source of drinking water. There are large amounts of geologic and hydro geologic data available, resulting in a low level of effort as compared to the Dakota.

Work Products

Work products from this strategy will be threefold with respect to the management of Iowa's water resources.

1. **Development of a comprehensive data system**
2. **Improved Water Use Planning and Decision Making**
3. **Full Implementation of Required Water Resource Programs**

Development of a Comprehensive Data System

In order to provide data in a useful format for improved decision making, a web-based system will be developed to allow access to accurate real-time information. This data system will be critical for decision makers with regard to permit review and issuance, conservation planning, and economic development.

The following work products are examples of data that could be developed and presented through a web-based system for each aquifer.

Water Quantity Characteristics

- More accurate and efficient well forecasting (potential yields)
- Current withdrawals (i.e. demand) by aquifer and/or use (public, private, industrial, mining, etc.)
- Historic withdrawals
- Usage color contour maps
- Groundwater availability maps used to estimate sustainable use
- Potentiometric/groundwater table contours (historic and current)
- Future potentiometric/groundwater table/drawdown contours based on various scenarios (i.e. current usage, 10-year estimate based on industrial growth rate, population increase or decrease)
- Evaluation of long-term impact of potential climate change on water availability
- Drawdown maps for the Jordan aquifer using an estimated 10-year growth and comparing it to the 200-foot regulated drawdown limits for the aquifer
- Site specific modeling for a specific 10-year water permit
- Site specific modeling to predict projected water demands to assist in permitting decisions and prevent well interference with other users

Water Quality Characteristics

- Detailed vulnerability of each aquifer
- Water Quality maps (being able to generate concentration contour maps for individual constituents, historical and current maps, natural water quality and human induced water quality, being able to generate graphs showing water quality trends over time for various constituents.)
- Simulation of future water quality based on leakage rates or upwelling within an aquifer based on pumping rates

Physical Characteristics

- Spatial distribution of each aquifer
- Elevation, depth, lithology, thickness, and stratigraphy of each aquifer
- Aquifer physical parameters, such as permeability (transmissivity), hydraulic conductivity (K), storage (storativity), porosity

Improved Water Use Planning and Decision Making
These improved data systems will result in better decision making ability, particularly with regards to water use permitting and water use conflict resolution. It is expected that the three most significant improvements in the water use permitting process are:

1. Comprehensive (Enhanced) Permit Reviews
2. Shorter review times
3. Resolution of water use conflicts

1. Comprehensive permit reviews. The availability of current data and methods of analysis will allow significant improvements in the water use permitting process, both in quality of reviews and in process time. Current reviews are somewhat cursory; and average two pages of analysis and one to two days of work effort. Most requests for new and modified permits are not modeled. Rather, DNR staff applies best professional judgment and an analysis of water usages by nearby permittees to assess if a new or enhanced water usage is feasible and will adversely impact neighbors. Aquifer characteristics that are currently estimated based on hydrogeologic studies conducted in the 1960s and 1970s will be updated and regional numbers with significant extrapolations will be replaced with more site-specific information. An available predictive model will allow a more thorough analysis of all nearby water withdrawals to minimize well interference conflicts and over allocation. The potential for groundwater mining (exceeding the safe aquifer yield or the "carrying capacity" of the aquifer) will be minimized.

2. Shorter review times. An enhanced permitting program with water resource data available electronically will result in an estimated 30 percent reduction in the time it takes to review and approve permits.

3. Resolution of water use conflicts. Water use conflicts may include any of the following; need to preserve instream flows, need to protect lake levels, well interference, declining water tables, water quality degradation. With data more easily accessible and a more sustainable knowledge base, gathering baseline data for site-specific water use conflicts and making determinations will be much more efficient. As a result of an improved data system and analysis, fewer water use conflicts will arise because potential well interference effects will be more accurately considered prior to issuance of water use permits.

Full Implementation of Required Water Resource Programs

In addition, improved data systems along with increased water management resources will allow other required water resource programs to be fully implemented. Each of these programs has suffered some degree of neglect due to inadequate resources devoted to water resource management.

1. Water conservation planning and implementation.
2. Agricultural drainage well analysis and permitting
3. Aquifer storage and recovery well analysis and permitting
4. Review and update of emergency procedures.
5. Review and update of plans for longer term droughts
6. Compliance assistance for water use permits.

1. Water conservation planning and implementation. IDNR will be able to help water users by being proactive in developing drought response plans and reviewing proposed strategies. Effective drought response plans and site specific local conservation plans have been developed by several Iowa communities and industries, and should be comprehensively implemented statewide.

2. Agricultural drainage well (ADW) analysis and permitting. ADWs continue to operate under the authority of DNR permits that will begin expiring in 2009. Changes to relevant rules and policies that apply to ADWs need to be determined prior this expiration.

3. Aquifer storage and recovery well analysis and permitting. Continued development of aquifer storage and recovery systems need increased monitoring and more comprehensive review.

4. Review and update of emergency procedures. The State has never had to address the complete loss of a water system due to insufficient water. However, this possibility should be examined and appropriate planning measures prepared.

5. Review and update of plans for longer term droughts. The State's mechanism for utilizing a Governor's task force for drought response needs to be formalized and analyzed as to its effectiveness.

6. Compliance assistance for water use permits. The DNR should provide increasing technical assistance to consultants citing new industries and utilities planning new municipal supply wells. The submittal of annual water use reports needs to be enforced in cases where the reports are not submitted.

Draft Schedule

Level of Effort
- On going (yellow)
- Preparation (green)
- Development (dark red)

Project	Element	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Program	1 Water Quantity Monitoring	Development	Development	Development	Development	Development	Development	Development	Development	Development	Development	Development
	8 Water Allocation Permitting	Development	Development	Development	Development	Development	Development	Development	Development	Development	Development	Development
	3 Hydrogeologic Support--permits, water supply development, well interference	Development	Development	Development	Development	Development	Development	Development	Development	Development	Development	Development
	5 Database - Web Applications	Design and Development	Design and Development	Design and Development	Database Update and Maintenance	Database Update and Maintenance	Database Update and Maintenance	Database Update and Maintenance	Database Update and Maintenance	Database Update and Maintenance	Database Update and Maintenance	Database Update and Maintenance
	7 Policy Review	Development	On going	On going	On going	On going	Development	On going	On going	On going	On going	Development
Dakota	2 Targeted Water Resource Data Collection	Development	On going	On going	On going	On going	On going	On going	On going	On going	On going	On going
	3 Characterization of Water Resources	Development										
	4 Maintenance of Water Resource Characteristics		On going	On going	On going	On going	On going	On going	On going	On going	On going	On going
	5 Development, Interpretation & Implementation of Predictive Model	Development	On going									
	6 Maintenance of Predictive Model		On going	On going	On going	On going	On going	On going	On going	On going	On going	On going
Jordan	2 Targeted Water Resource Data Collection		Development									
	3 Characterization of Water Resources	Preparation	Development									
	4 Maintenance of Water Resource Characteristics			On going	On going	On going	On going	On going	On going	On going	On going	On going
	5 Development, Interpretation & Implementation of Predictive Model		Development	On going								
	6 Maintenance of Predictive Model			On going	On going	On going	On going	On going	On going	On going	On going	On going
Alluvial Aquifer-Stream Systems	2 Targeted Water Resource Data Collection		Preparation	Development	Development	Development	Development	Development				
	3 Characterization of Water Resources			Missouri & Lower Miss.	NW Iowa Systems	Skunk, DM River, Raccoon	Lower Cedar & Iowa	SW Iowa				
	4 Maintenance of Water Resource Characteristics								On going	On going	On going	On going
	5 Development, Interpretation & Implementation of Predictive Model				Development	Development	Development	Development	Development			
	6 Maintenance of Predictive Model					On going	On going	On going	On going	On going	On going	On going
Silurian	2 Targeted Water Resource Data Collection				Preparation	Development	Development	Development				
	3 Characterization of Water Resources					Preparation	Development					
	4 Maintenance of Water Resource Characteristics							On going	On going	On going	On going	On going
	5 Development, Interpretation & Implementation of Predictive Model						Preparation	Development				
	6 Maintenance of Predictive Model								On going	On going	On going	On going
Devonian	2 Targeted Water Resource Data Collection					Preparation	Development	Development				
	3 Characterization of Water Resources					Preparation	Development					
	4 Maintenance of Water Resource Characteristics							On going				
	5 Development, Interpretation & Implementation of Predictive Model						Preparation	Development				
	6 Maintenance of Predictive Model								On going	On going	On going	On going
Mississippian	2 Targeted Water Resource Data Collection							Preparation	Development	Development		
	3 Characterization of Water Resources							Preparation	Development	Development		
	4 Maintenance of Water Resource Characteristics										On going	On going
	5 Development, Interpretation & Implementation of Predictive Model								Preparation	Development		
	6 Maintenance of Predictive Model								On going	On going	On going	On going
Buried Sand and Gravel	2 Targeted Water Resource Data Collection									Preparation	Development	Development
	3 Characterization of Water Resources						Preparation	Development	Development	Development	Development	Development
	4 Maintenance of Water Resource Characteristics											On going
	5 Development, Interpretation & Implementation of Predictive Model										Development	Development
	6 Maintenance of Predictive Model											On going

Budget/Resource Needs

Element		FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19
1	Stream Gauge Installation	0	187,000	0	0	0	0	0	0	0	0	0	0
	Stream Gauges	30,000	97,000	102,000	107,000	112,000	118,000	124,000	130,000	136,000	143,000	150,000	158,000
	Groundwater Level Monitoring	60,000	105,000	110,000	116,000	122,000	128,000	134,000	141,000	148,000	155,000	163,000	171,000
2	Targeted Water Resource Data Collection	0	336,000	353,000	370,000	389,000	409000	430,000	258,000	272,000	286,000	302,000	317,000
3	Characterization of Water Resources	425,000	512,000	543,000	575,000	609,000	647,000	685,000	727,000	770,000	338,000	358,000	380,000
4	Maintenance of Water Resource Characteristics	0	0	275,000	292,000	309,000	328,000	347,000	368,000	390,000	414,000	438,000	465,000
5	Development of Predictive Models and web-based database	165,000	347,000	325,000	345,000	365,000	387,000	410,000	435,000	461,000	489,000	518,000	0
6	Maintenance of Predictive Models and web-based database	0	0	125,000	133,000	140,000	149,000	158,000	167,000	177,000	188,000	199,000	211,000
7	Policy Review	0	0	0	0	0	0	0	0	0	0	0	0
8	Water Allocation Permitting	300,000	600,000	636,000	674,000	715,000	757,000	803,000	851,000	902,000	956,000	1,014000	1,075,000
Total		980,000	2,184,000	2,469,000	2,612,000	2,761,000	2,923,000	3,091,000	3,077,000	3,256,000	2,969,000	3,142,000	2,777,000
Existing Level of Effort		500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Environment First Appropriation		480,000	480,000	480,000	480,000	480,000	480,000	480,000	480,000	480,000	480,000	480,000	480,000
Funding Needed			1,204,000	1,489,000	1,632,000	1,943,000	1,943,000	2,111,000	2,097,000	2,276,000	1,989,000	2,162,000	1,797,000

Budget Revised on November 13, 2007
All personnel costs assume 6% annual increase.
Existing Level of Effort includes 5 FTEs. This strategy assumes the addition of 11 FTEs.
Stream Gauge assumptions: 11 new gauges, Installation cost (IDNR Share) FFY08= $17,000; annual operation and maintenance IDNR share FFY08 = $7480; 5% annual cost increase.
Existing Stream Gauge Network is 25 stations and $195,000 per year
Groundwater Level monitoring assumes and annual cost of $350 per well for 300 wells; annual cost increase of 5%; **does not include any installation costs**.

Appendix

Existing Water Use Fees

Water use permits are issued by the Iowa Department of Natural Resources. Permits are given for a ten-year period, and convey a "right" to use the water if it can be shown to be "beneficial". Permits are required for any use where 25,000 gallons of water per day is used, and may be modified, suspended, or cancelled within the ten-year period. Water use permits are required whether water is used from surface or groundwater resources. A ten-year water use permit fee is currently $25, regardless of volume. This generates approximately $7000 annually in permit fees, which are deposited in the State's General Fund.

Iowa's Current Water Allocation System

Iowa's current priority allocation system is spelled out in Iowa Code Section 455B.266. Conditions that warrant the implementation of the priority allocation plan are defined in Iowa Code Section 455B.266(1)*a-d*. If any one of these conditions are met, the Department may suspend or restrict usage of water by category of use on a local or statewide basis in the following order:

a. Water conveyed across state boundaries.
b. Uses of water primarily for recreational or aesthetic purposes.
c. Uses of water for the irrigation of hay, corn, soybeans, oats, grain sorghum or wheat.
d. Uses of water for the irrigation of crops other than hay, corn, soybeans, oats, grain sorghum or wheat.
e. Uses of water for manufacturing or other industrial processes.
f. Uses of water for generation of electrical power for public consumption.
g. Uses of water for livestock production.
h. Uses of water for human consumption and sanitation supplied by rural water districts, municipal water systems, or other public water supplies as defined in section 455B.171.
i. Uses of water for human consumption and sanitation supplied by a private water supply as defined in section 455B.171.

Needed Stream Gauges

Table 1. Location of Stream Gauges

Indian Creek - Mingo	North Central Iowa (Kossuth and surrounding counties)
Little Maquoketa River - Dubuque	
Mosquito Creek/Keg Creek - Pottawattamie County	South West Iowa (Ringgold, Adams, Union, Madison, Adair counties)
Perry Creek - Sioux City	
Platte River/Tarkio River - SW Iowa	
Wapsinonoc Creek - Muscatine	Pottawattamie County