

# Corridor Deserves a Sound Water Supply Management Strategy

April 15, 2008

A recent survey of Iowans by the Heartland Regional Water Coordination Initiative<sup>1</sup> reports about half (51.6%) of those polled do not consider water supply to be a serious issue – that is, most people do not consider or understand that supply is limited and can be over used to the point of threatening its natural and economic viability. Such an opinion may develop because nearly three quarters of the state's population receive their water from a municipal (66.3%) or community (5.8%) water system, where users often take water *quantity* for granted because the tap always flows but may view water *quality* as an issue because of aesthetic reasons at the tap (e.g., hardness, red water, etc.). However, there is no reason to split hairs either – water issues collectively are important for everyone. In the Linn County / Johnson County Corridor we are fortunate to have a reliable source of supply; however, that reliability has limits and development of a wise management strategy for the water sources is an issue worthy of attention.

Consider that the water supply of Linn / Johnson Counties is derived almost exclusively from groundwater. Presently, there are 266 water use permits that incorporate 973 public wells, where a public well is defined as using over 25,000 gallons of water per day. In addition, there are nearly 2,000 permitted private wells with many more than that in operation but not accounted for because such wells are likely under-reported for a variety of reasons. The constant operation of these wells creates a focused and intense use of groundwater within the Corridor.

To illustrate this point the U.S. Geological Survey estimated that for Year 2000 the total groundwater withdrawal for all purposes within Linn and Johnson Counties was 59.0 million gallons per day (Mgal/d) (U.S.G.S., Circular 1268, county-level data). For Year 2005 the estimate has increased to 68.7 million gallons per day (U.S.G.S., per. com., 2005 provisional data-subject to revision). This represents a 16.4 percent increase in groundwater withdrawal over a relatively brief 5 year period, while, in contrast, population increased by about 4.1 percent during the same period (Woods & Poole, 2006). This shows an increasing reliance on groundwater as a critical source of water supply, with the highest users accounting for about 93 percent of all groundwater withdrawal in 2005, including public supply (53.2 Mgal/d), industrial (8.2 Mgal/d), and domestic (2.8 Mgal/d) uses.

Such reliance on groundwater necessitates prudent management of the natural resources that provide the basis for our drinking water and economic vitality; in short, sustainability of our water supply into the future is critical. To assess conditions further we first look at what is groundwater and what are the groundwater resources?

Groundwater is defined as water that exists beneath the land's surface. The rate groundwater moves through the subsurface depends on the type and character of the material (i.e., geologic formation). Where groundwater flows relatively fast the formation is known as an aquifer – a unit that gives up water readily and which can be tapped as a source of water supply. If an aquifer is not replenished its water level, or depth to groundwater, declines (becomes deeper). If water levels fall too far an aquifer can lose its ability to function reliably as a source of water supply. Under natural conditions aquifers are replenished (recharged) in various ways, including surface water – mainly precipitation (rain) – that infiltrates or seeps into the ground and groundwater inflow from interconnected aquifers. Areas of recharge are very large and occur within the Corridor and

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<sup>1</sup> Water Issues in Iowa: A Survey of Public Perceptions and Attitudes about Water. Technical Report SP 290, 2007, Iowa State University, Department of Sociology.

beyond. In a rapidly developing area such as the Corridor the natural space available for such infiltration of surface water is decreasing as a function of increased development. For example, urban / suburban developments require streets and storm water routing, which takes water away from the natural areas of infiltration, thus potentially decreasing the amount of water available to sustain an aquifer. Such conditions are not inherently damaging to our aquifers because the majority of recharge occurs beyond the Corridor; however, they do require recognition of potential harmful effects and, as a result, careful management to prevent excessive loss of available recharge in order to maintain the viability of the resource.

The continued use of an aquifer is also related to the amount and rate of discharge, which is the amount of groundwater that leaves an aquifer, either naturally or through pumping. Groundwater is collected by drilling a water well (casing, screen and pump) that extends below the ground surface into the groundwater. Once the well is constructed pumping begins and groundwater is collected and used for a variety of purposes, such as public or private water supply, irrigation, commercial or industrial applications. The increasing use (pumping) observed in the Corridor has the potential to upset the natural balance of a sustainable water supply source.

So, just where does the groundwater supply that the Corridor depends upon come from? Several aquifers are tapped within the Corridor, including shallow sand deposits along the Cedar River and Iowa River known as Alluvial aquifers (generally less than 75 feet deep); limestone and dolomite sedimentary rocks that are buried deeper beneath the land surface known the Silurian-Devonian aquifer (generally less than 500 feet deep); and sandstone, dolomite and limestone buried very deep beneath the land surface known as the Jordan aquifer (generally less than 2,000 feet deep).

The aquifer-type that is used most in terms of volume pumped is the alluvial aquifers which supply the majority of supply for the Cities of Cedar Rapids (Cedar River alluvial aquifer) and Iowa City (Iowa River alluvial aquifer). These aquifers are generally not under threat of depletion because well-spacing and pumping are designed on the basis of the aquifer's natural capability. The aquifer-type that is used most often is the Silurian-Devonian aquifer, where approximately 40 percent of the public wells and the majority of the private wells within the Corridor tap the Silurian-Devonian bedrock aquifer, which takes a toll on its ability to sustain the demand. For example, a recent U.S.G.S. report (SIR 2005-5266) predicts for Johnson County a near county-wide decline, or drawdown, in water levels ranging from less than 1 foot to greater than 10 feet between 2004 and 2025, with 3 to 6 feet decline typical across much of the north-central portion of the county and the greatest area of decline anticipated near Solon. Under a future drought scenario the predicted county-wide decline worsens to greater than 5 feet to about 30 feet, with the greatest area of decline in the east-central to northeast portions of the county and with impacts of 5 to 10 feet decline extending north into Linn County. Available drawdown, which limits well capacity, is variable throughout the Corridor; however, 30 feet of decline, or drawdown, roughly represents 30-60 percent of what is available before well efficiency problems arise - an effect that is accelerated in the vicinity of pumping wells. Even though the report specifically assessed Johnson County it is reasonable to project that similar impacts will arise in Linn County and across the entire Corridor due to anticipated increases in pumping from the Silurian-Devonian aquifer.

With respect to the Silurian-Devonian aquifer it is also noteworthy that recharge is complicated and varies within the Corridor. For example, recharge is generally greater in the north Corridor where stream deposits are more extensive and in direct contact with the shallow bedrock aquifers, which also receive more recharge from direct infiltration of precipitation, and where major confining units are less prevalent. In contrast, in the south portion of the Corridor stream deposits

are not as well connected to the major bedrock aquifers, the bedrock is not as shallow and there is a greater occurrence of overlying confining units (shale), which inhibits recharge.

In the deep Jordan aquifer there is evidence that the water level decline since pumping from this aquifer began in the late-1800's is in the range of 150 to 250 feet across the majority of the Corridor, with the greatest decline extending from Cedar Rapids to Iowa City. A graphic depicts an east-west 'trough' representing the area of greatest groundwater level decline (as measured in wells). Plenty of available water remains from this aquifer but the trend of declining water levels from the aquifer's predevelopment condition is obvious. In addition, the Jordan aquifer has the regulatory restriction of a maximum collective long-term decline in groundwater levels in any high use area of 200 feet from the 1977 'baseline' level. This regulatory limit is already approached within the high-use areas of eastern Iowa and so it is in the best interests of all users to consider regional management of this aquifer.

What does this mean? The impact is highly dependent upon hydrogeologic setting and the design of the water well but general scenarios can be anticipated. First, as water levels in aquifers fall it becomes more costly to operate water wells because you have to pump water farther just to get it out of the ground. Second, closely spaced wells compete to withdrawal the same water and in the process become even less efficient – again increasing operating costs. Third, in areas where pumping is excessive the quality of the water can be compromised, for example, the introduction of iron bacteria or a change in quality characteristics such as an increase in hardness.

The Corridor is fortunate to be in a 'wet' cycle right now and there is little thought of drought and water rationing. However, all we need do is look at the recent drought conditions of the southeastern United States ([www.drought.unl.edu/dm/monitor.html](http://www.drought.unl.edu/dm/monitor.html)) and recall the frequent news stories relating the associated impacts. The conditions described herein should not be taken in an overly alarming way, for even though dry cycles are bound to happen the Corridor is not going to 'run out of quality groundwater' under any scenario. Further, groundwater management at the state-level is already addressed administratively by the Department of Natural Resources and monitored by them and the Iowa Geological Survey (not to mention the monitoring efforts of the U.S. Geological Survey and others).

Rather, the discussion herein is to raise awareness that the supply upon which we rely for drinking water and economic development is finite and vulnerable to both over use and natural limitation. As such, the proper location, construction, maintenance and operation of wells should be given due consideration to ensure efficient use and application of the Corridor's groundwater resources. In addition, an understanding of the aquifer source and its potential limitations within a larger supply context is warranted. In this fashion, the framework for sound and sustainable development of the sources can be achieved for the mutual benefit of all.

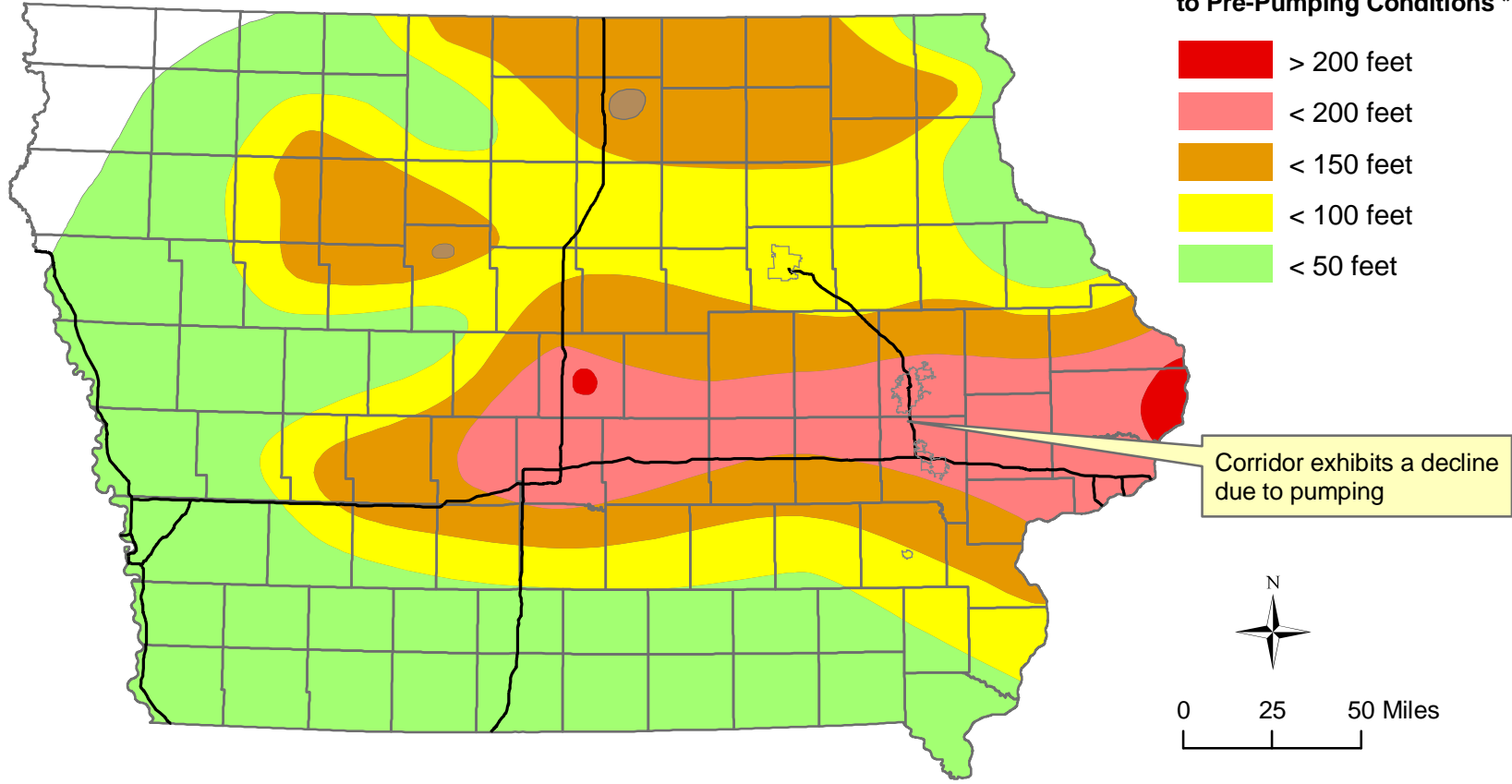
For further information contact:

Greg Brennan, P.H.G., P.G.  
HOWARD R. GREEN COMPANY  
8710 Earhart Lane SW  
Cedar Rapids, IA 52404  
Phone (319) 841-4383 or (800) 728-7805  
Fax: (319) 841-4012  
Email: [gbrennan@hrgreen.com](mailto:gbrennan@hrgreen.com)  
Website: [www.hrgreen.com](http://www.hrgreen.com)



# JORDAN AQUIFER

Showing Areal Recession, in feet, of the Potentiometric Surface (Water Level) of the Jordan Aquifer in Iowa



Source: Iowa Geological Survey,  
Natural Resources Geographic Information Library  
Web Link: <http://www.igsb.uiowa.edu/nrgislib/>  
Modified From: Jordan Aquifer Recession coverage.

\* Note:  
The scale depicted here is a record of decline since the first wells drilled to the Jordan aquifer began pumping water in the late-1800's. The scale is not in reference to Iowa Administrative Code Chapter 52.4(3), which pertains to the 1977 baseline level.