

Advice Ignored

Climate Change and Iowa Water Quality Policy

Brian McDonough
Will Hoyer
David Osterberg

May 2012

The Iowa Policy Project

20 E. Market Street • Iowa City, Iowa 52245
(319) 338-0773 (phone) • (319) 354-4130 (fax)
www.IowaPolicyProject.org

Authors & Acknowledgements

Brian McDonough is an intern at the Iowa Policy Project, focusing on environmental and fiscal issues. He recently received his master's degree in Urban and Regional Planning from the University of Iowa, where he also received his bachelor's degree in Political Science.

Will Hoyer is a research associate for the Iowa Policy Project, joining IPP in August 2010. He spent five years in Madison, Wisconsin, working on local, state and regional water policies for Clean Wisconsin, and later as a grant writer for the City of Dubuque. He received his master's degree in Water Resources Management from the University of Wisconsin-Madison and has undergraduate degrees in Biology and Environmental Studies from Luther College in Decorah, Iowa.

David Osterberg is executive director of the Iowa Policy Project. A former Iowa state representative who chaired the Iowa House Energy and Environmental Protection Committee as well as the Agriculture Committee, he holds masters' degrees in Water Resources Management and Agricultural Economics from the University of Wisconsin-Madison. He is an associate clinical professor in the Department of Occupational and Environmental Health at the University of Iowa.

The Iowa Policy Project would like to thank the McKnight Foundation and the Fred and Charlotte Hubbell Foundation for their generous support.

The Iowa Policy Project

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Climate change is here and Iowans already feel its impacts. Perhaps most notably, Iowa is becoming a wetter place, putting cities and towns and farms at greater risk of flooding. Not only can the quantity of water be affected by a changing climate; so, too, is the quality of water. This report examines studies commissioned by the Iowa Legislature on climate change and flood prevention — and how state decision makers have largely ignored the recommendations. It also examines the increased risk of flooding on Iowa wastewater systems and agriculture and how they, in turn, hinder water quality.

The links between the quantity of water and the quality are most obvious when one considers just how long the city of Cedar Rapids pumped raw untreated sewage into the Cedar River during the 2008 flood. Cedar Rapids was not the only city to have its wastewater plant or other operations shut down during the flood, but it was the biggest. Moreover, the floodwaters carried toxic chemicals from factories and industrial locations as well as residences to downstream cities and towns.

In addition to urban areas and wastewater treatment plants, Iowa's rural agricultural areas will also affect water quality, especially those planted with row crops — corn and soybeans — unless steps are taken. Recent reports by the Environmental Working Group have shown that soil loss in parts of the state can be catastrophic, with losses of 64 tons of topsoil per acre *in a single storm*.¹

It's not just soil that leaves the field and enters Iowa waterways. Chemical fertilizers, insecticides, herbicides and fungicides also flow off fields and into the state's waters. The fertilizers, especially nitrates and phosphorus, contribute to excessive algae growth in lakes and rivers but also the so-called Dead Zone in the Gulf of Mexico, where oxygen levels plummet every year and make an area roughly the size of New Jersey uninhabitable.

The Convening of Experts

Beginning in 2007, Iowa legislators began to focus on climate change and potential impacts on the state. Three major expert panels authorized by the state have addressed climate change in Iowa in recent years, evaluated the best available evidence, considered specific impacts and provided recommendations for mitigation and adaptation. All three groups — the Climate Change Advisory Council, the Climate Change Impacts Committee, and a subcommittee of the Water Resources Coordinating Council (WRCC) — were established per directives from the Iowa General Assembly. A summary of major recommendations is shown in Table 1 below.

The Iowa Climate Change Advisory Council

The Climate Change Advisory Council developed greenhouse gas (GHG) emission reduction strategies, and accompanying policy recommendations in 2009. The Legislature established the Council in 2007, to consist of 23 voting members appointed by the Governor as well as four non-voting members of the General Assembly.² The Council was charged with developing cost-effective policy recommendations

for reducing Iowa’s GHG emissions. The Council approved 56 policy recommendations, 19 of which had net cost savings. In other words, there was a net cost savings or benefit for each ton of CO₂ reduced for these policies, even without accounting for benefits associated with CO₂ reductions.

The Iowa Climate Change Impacts Committee

Soon after the Iowa Climate Change Advisory Council’s final report was released, Iowa legislators created the Iowa Climate Change Impacts Committee to investigate the specific effects of climate change in Iowa. This committee’s members included scientists from Iowa’s Regents universities. The introduction of their 2011 report stated:

“This report documents the impacts of changing climate on Iowa during the past 50 years. It seeks to answer the question, ‘What are the impacts of climate change in Iowa that have been observed already?’”³

Lead authors Jerry Schnoor of the University of Iowa and Gene Takle of Iowa State began the report by providing scientific evidence of a changing Iowa climate over the last 50 to 100 years. They noted Iowa is realizing greater increases in annual statewide average precipitation over the last 100 or so years.

Furthermore, the entire Upper Midwest region (including Iowa) has seen a 31 percent increase in heavy rainfall events (defined as the heaviest 1 percent of all events) over the last 50 years. In the United States only the Northeast has seen a greater increase.

Additional data showed the number of days in a given year with rainfall exceeding 1.25 inches has significantly increased over the last 100 years in the state — an important measure because Iowa’s soils can, on average, only absorb 1.25 inches of rainfall per day.⁴ A more recent report by the Rocky Mountain Climate Organization and the Natural Resources Defense Council showed a 32 percent increase between 1961 and 2011 in the frequency of rainfall events of 3 inches or more in 24 hours in the state.⁵ These changes to Iowa’s climate mean more frequent and extreme flooding events, especially in areas not historically prone to flooding.

Table 1. Iowa Lawmakers Reject, Ignore Experts on Climate Response

Recommendation	Entity	Legislative Action
Adopt a state GHG emissions reduction strategy. (This recommendation was accompanied by detailed and cost-saving implementation strategies.)	Iowa Climate Change Advisory Council (ICCAC)	Further investigation of climate change with the creation of the Iowa Climate Change Impacts Committee. ICCAC was dissolved in 2011.
State leaders should consider the financial and social impacts of climate change when making policy decisions	Iowa Climate Change Impacts Committee (ICCIC)	None; it is not evident that such impacts are being considered. Shift away from climate change to flooding mitigation with the creation of WRCC subcommittees. ICCIC was dissolved in 2011.
Adopt the 500-year flood as the new statewide regulated floodplain or base flood elevation	Water Resources Coordinating Council (WRCC)	Rejected
Adopt minimum standards for new stormwater construction	Water Resources Coordinating Council (WRCC)	Rejected
Increase the safety and operation requirements for critical facilities in the floodplain	Water Resources Coordinating Council (WRCC)	Rejected
Conduct a study to determine the impact of field tiling upon flooding	Water Resources Coordinating Council (WRCC)	Rejected

It has become clearer with each passing year that our traditional classifications of floods as 100-year (1 percent chance every year) and 500-year (0.2 percent chance every year) do not reflect current patterns and conditions, due to climate change. The Climate Change Impacts Committee's report noted Iowa effects of climate change in four main issue areas: agriculture, plant and wildlife, public health, and the economy. Most pertinent to Iowa's water are the future changes in agricultural practices that could result from climate change.

Climate change does not just affect water quantity, but potentially may affect water quality indirectly as well. In the short term, warmer temperatures and increased CO₂ levels are predicted to produce greater crop yields. However, over time as increased spring rainfall and warmer overall temperatures become the norm, crop productivity could fall as new pests and diseases are introduced to the Midwest region. Farmers may adapt the best way they know, by increasing the application of pesticides and chemicals to increase their yields.

Increased chemical applications coupled with growing amounts of rainfall across the state, especially in the form of heavy storms, will result in higher levels of nitrogen, phosphorus and other chemicals in Iowa's rivers and streams. The Iowa Climate Change Impact Committee's findings were presented to the Governor and Iowa General Assembly in January 2011. In addition to quantifying the effects of climate change, the committee provided a set of recommendations. They are broad and largely advise Iowa policy makers to consider the financial and social impacts of climate change when making decisions, and to continually fund ongoing research on this issue. Their application to any new policy is not yet evident.

The Water Resources Coordinating Council and Subgroups

Yet a third group was commissioned by the Iowa Legislature to advise policy makers on a specific subset of issues arising from climate change — flooding and related water concerns. After the 2008 floods, legislation required that a state citizen advisory body, the Water Resources Coordinating Council (WRCC), develop recommendations to mitigate the impact of flooding in the state. Specifically, the WRCC was asked to

“develop recommendations for policies and funding promoting a watershed management approach to reduce the adverse impact of future flooding on the state's residents, businesses, communities, and soil and water quality.”⁶

Work groups were created to address specific issues and provide recommendations in four areas: floodplain management, lowland areas, upland areas, and stormwater management. The subcommittee's work groups were staffed with representatives from the Regents universities and state agencies.

Each work group made recommendations. The floodplain work group focused on regulations regarding structures in floodplains. Currently, the regulated floodplain is defined by the 100-year flood. A major recommendation was to move the regulated floodplain to the 500-year flood. Other recommendations included financial and policy support for levy systems as well as flood risk education.

The lowland areas work group focused on the use of wetlands, conservation easements, and other land management practices to reduce the impact of flooding. Recommendations focused on increasing funding and planning efforts that promote water management practices such as reconnecting waterways to their floodplains and designing on-site water drainage systems, which utilize responsible detention and infiltration — practices that reduce the overall impact of flooding in the state.

The uplands work group focused broadly on watershed planning. Its recommendations also included on-site water retention and infiltration techniques such as increasing perennial ground cover and

agricultural conservation practices such as no-till farming. The fourth work group focused on stormwater management. One recommendation aimed to promote community compliance with the Iowa Stormwater Management Manual (ISMM). This manual promotes designs and practices that improve water quality and reduce the potential for flooding by utilizing bioretention and bioswale designs to infiltrate stormwater back into the ground as opposed to piping it directly to surface waters. After review by the WRCC, 16 policy and nine funding recommendations were submitted to the Governor and General Assembly in late 2009.

Water Quality Implications of Climate Change

Agriculture

In 2008 alone over 3.3 million acres of corn and soybeans were flooded in Iowa. These floodwaters alone removed vast quantities of soil and chemicals from inundated fields as they flowed downstream.⁷ The 2011 Missouri river flood covered fewer acres, 284,000, but this land was under water for several months so replanting was never an option.⁸ But it is not just inundated fields that impact water quality. Increased rainfall is expected to further increase the rate of soil loss from Iowa fields; the Climate Impacts Committee report noted research has shown that a 20 percent increase in precipitation increases erosion by 40 percent. Also, as crop prices remain high and crop losses to flood disasters become ever-present, farmers may be tempted to push the envelope and grow even more crops on marginal land not traditionally farmed, and/or add additional fertilizer to eke out slightly higher yields. These fertilizers, especially nitrogen, may have easier routes to Iowa waterways as more farmers invest in additional subsurface drain tiling to help dry their fields from the additional precipitation. Data are showing that nitrate losses are greatest in subsurface tiles during years of high precipitation. Unless captured in restored or constructed wetlands, these additional nitrates will contribute to the Gulf of Mexico's Dead Zone. Furthermore, as the Climate Impacts Committee report pointed out, warmer temperatures and increasing soil moisture levels make weeds a much greater threat — one most easily dealt with by additional chemical applications.⁹ With more acres in production alongside increased chemical applications and increasing rainfall, a perfect storm exists that stands to severely harm Iowa's water quality.

Urban Areas

Following the devastating 2008 floods, Iowans in many parts of the state were left looking for solutions and ways to limit future flooding damage. The city of Cedar Falls took the initiative, with the city council passing an ordinance that made building in the flood plain more difficult and making the 500-year flood level the new base flood elevation. No new lots could be created in the 100-year flood plain and existing lots in the 100-year flood plain could be developed only if the structure was elevated above the 500-year flood level.

Many in Iowa took this to be a sensible start to limiting future flood damage and pushed for similar statewide restrictions. State Senator Rob Hogg of Cedar Rapids introduced legislation doing just that. The modest bill called for the development of a model ordinance for the regulation of the 500-year flood plain; it included suggested language on flood insurance, limits on new construction and categories of development that should be prohibited in flood plains. It also required that new construction of facilities such as hospitals, jails and fire, police and rescue facilities be designed to maintain operation or be able to be safely shut down in the event of 500-year floods. The bill was not enacted.

Wastewater

Protecting critical infrastructure in the event of floods is something that needs to apply to wastewater treatment plants. Cedar Rapids' plant was inundated in the 2008 floods along the Cedar River, and the plant was forced to shut down for four weeks¹⁰ during which billions of gallons of raw or partially

treated sewage flowed into the river and on to downstream communities.¹¹ This sewage becomes a much bigger water quality problem if it continues to be discharged after the floodwaters recede and it is no longer being diluted by high flows.

Wastewater treatment plants are almost always located at low elevations (and therefore near lakes and rivers) to take advantage of gravity flow. As a result, wastewater treatment plants, the first line of defense in helping to ensure clean water, are especially vulnerable to floods. In Iowa, it is suggested that treatment works remain operational and accessible during the 100-year flood, but it is only required that they remain so for the 25-year flood (4 percent annual chance), per state code. These regulations apply to new construction, but are only advisory for existing facilities, even those being updated or modified.¹²

Large, centralized wastewater treatment plants such as those recently affected by flooding in Cedar Rapids, Iowa City, Ottumwa and elsewhere are very efficient, but remain vulnerable to flooding due to their centralized structure and location in, or very near, floodplains. Iowa City's wastewater treatment facilities present an excellent example of how to ensure proper functioning even during major flooding events. In 2008 Iowa City's north plant was hit by the flooding on the Iowa River and overtopped, but its relatively new south plant had been designed to encompass the north plant's diverted flow. In other words, all wastewater that could no longer be treated at the north plant was piped to and treated at the south plant, which remained high and dry, as it was not constructed so close to the river.

In a 2005 report, IPP noted that there are many ecological wastewater treatment methods that, if managed well, work effectively for small communities and rural areas.¹³ Protection from flooding might be an additional reason to promote such systems because they are often modeled on natural systems. Therefore, they may handle the expected increases in rainfall better than many of the large traditional centralized wastewater systems in the state in many situations.

State Action

Many recommendations came out of the state's expert climate groups and the Water Resources Coordinating Council. These panels kept the state's scientific experts busy for several years, but state policy makers have not been busy implementing the recommendations. Take for instance, the WRCC flooding subcommittee and its recommendations.

The Flooding Subcommittee

The flooding subcommittee worked for six months, took public input at several meetings around the state and online, and in the fall of 2009 gave its recommendations to the WRCC. With a few changes the 16 policy recommendations and nine possible funding options were sent to the Iowa General Assembly.

The WRCC received a report on the results of the recommendations at its July 13, 2010, meeting.¹⁴ The Legislature decided against adopting the 500-year flood rather than a 100-year flood as the regulated flood plain (0.2 percent rather than the 1 percent). Minimum statewide stormwater laws were rejected. Prohibiting the reconstruction of substantially damaged structures in the floodway failed. There would be no study to investigate the hydrological effect of field tiling. Also there would be no update in conservation practice criteria to reflect changing precipitation. All nine funding recommendations were rejected.

However, two new laws were adopted containing five of the recommendations of the subcommittee. The WRCC was to adopt a marketing campaign to educate Iowans about the need to take personal responsibility for the quantity of water in their local watersheds. The Iowa State University Agricultural Extension service was tasked — “to the extent feasible” — to educate the public about flood plains, flood risks, and basic flood plain management principles. The WRCC was to encourage and support the formation of a chapter of the association of state flood plain managers in Iowa. None of these items

received any new money. A pilot program to combine an expansion in the size of field tiles together with constructed wetlands was funded. However, expanding the size of tile and constructing wetlands did not have clear flood reduction implications.

Lastly, the fifth item the Legislature was interested in was a watershed management authority that would, among other duties, “assess options for reducing flood risk and improving water quality in the watershed.” This, of course, was exactly what the subcommittee had endeavored to do.

The Iowa Climate Change Advisory Council, Iowa Climate Change Impacts Committee, and the flood work groups from the Iowa Water Resources Coordinating Council have collectively demonstrated the reality of climate change in Iowa and provided Iowa policymakers with clear, well-researched mitigation and adaptation strategies. These groups have been dissolved and their recommendations have been largely or fully ignored. With three major reports from these expert bodies at their disposal, Iowa leaders have essentially done nothing. The legislation that has passed is only a token gesture toward the need to seriously and competently deal with the reality of climate change.

Not Waiting for the Legislature

Some communities are not waiting for state action to protect their valuable water resources and protect themselves from future flood damage. For example, communities in Dickinson County in Northwest Iowa have adopted low-impact design standards for new construction in an effort to protect their vital natural lakes. New stormwater designs must meet the Iowa Stormwater Management Manual standards due to ordinances in Okoboji, Spirit Lake and Wahpeton.¹⁵ As previously noted, the city of Cedar Falls’ City Council adopted an ordinance that does follow the WRCC recommendation to move away from using the 100-year flood plain and using the 500-year flood plain instead. It appears that state decision makers are leaving all adaptation and mitigation steps to local government rather than to establish a set of common-sense requirements that would ultimately benefit Iowans across the state.

Conclusion — What Should Be Done?

As rainfall events get bigger with the potential for greater and more expensive damage it becomes imperative to keep water on the land where it falls rather than let it run off and create dangerous floods. This is exactly the opposite of the goals of many past infrastructure engineering projects. Agricultural subsurface drain tiling, the straightening and channeling of streams and rivers, urban storm sewers — all of these were done with the idea of getting rid of water as quickly as possible. What is needed now is a rethinking of those systems and an increase in infiltration that allows water to be absorbed and stored in the ground. That is occurring on a very small fraction of Iowa’s landscape.

Across the state, rain gardens, bioswales, pervious pavers and other so-called ‘low impact development’ tools are being employed in urban neighborhoods and helping to increase infiltration and reduce the need for, and stress on, traditional stormwater infrastructure. Unfortunately because the vast majority of the state is rural and agricultural these steps do not add up to much at the state level if steps to increase infiltration on farmland are not taken simultaneously.

Data show that infiltration rates on land for corn, soybeans and continuously grazed pasture are half to a quarter that of filter strips and forests.¹⁶ This means that the runoff (and therefore flooding) impacts of the types of agriculture that dominate the Iowa landscape are enormous. Ongoing studies in Iowa are showing that even just devoting 10 percent of fields to perennial grass cover can dramatically increase infiltration and reduce runoff and soil erosion.¹⁷ Unfortunately, data show that Iowa farmers are going in the wrong direction and are reverting grasslands and wetlands into cropland at astonishing rates to take advantage of record-high commodity prices. According to data released by the Environmental Working Group in April 2012, 14 counties in north-central and northwest Iowa had seen more than 20 percent of

the remaining grasslands and wetlands converted to cropland from 2008 through 2011, and another 13 counties had seen 16 to 20 percent converted.¹⁸

While actions by Iowa cities and towns to increase infiltration are laudable, until Iowa growers embrace their role in reducing future flood damage, Iowa towns will be left rebuilding infrastructure again and again as severe rainstorms get more and more frequent.

Cities also can follow Cedar Falls' lead in developing floodplain ordinances and using the 500-year flood plain rather than the 100-year level, and limiting what can be built in the floodplain. While no town would rip out what has already been built, it makes sense for communities to restrict new development in floodplains, use floodplains as recreational land uses, and require stormwater design standards that increase infiltration — things that help improve residents' quality of life without being financially burdensome.

Larger towns with expensive existing centralized wastewater treatment plants in floodplains need robust flood-management plans to protect their treatment systems and minimize the risk of being forced to discharge untreated sewage during a flood. As communities invest in new treatment plants they need to strongly consider whether the heightened risk of future flooding warrants expanding the storage area for times of high water inflow, as Iowa City has done.

Climate change is a reality for Iowans. Experts convened at the behest of the state's Legislature through the Climate Change Advisory Council, the Climate Change Impacts Committee and the Water Resources Coordinating Council have laid out recommendations and options that, unfortunately, have been largely ignored. The consequences of ignoring reality will be increased problems of water quality and water quantity across the state and greater costs to address those problems.

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