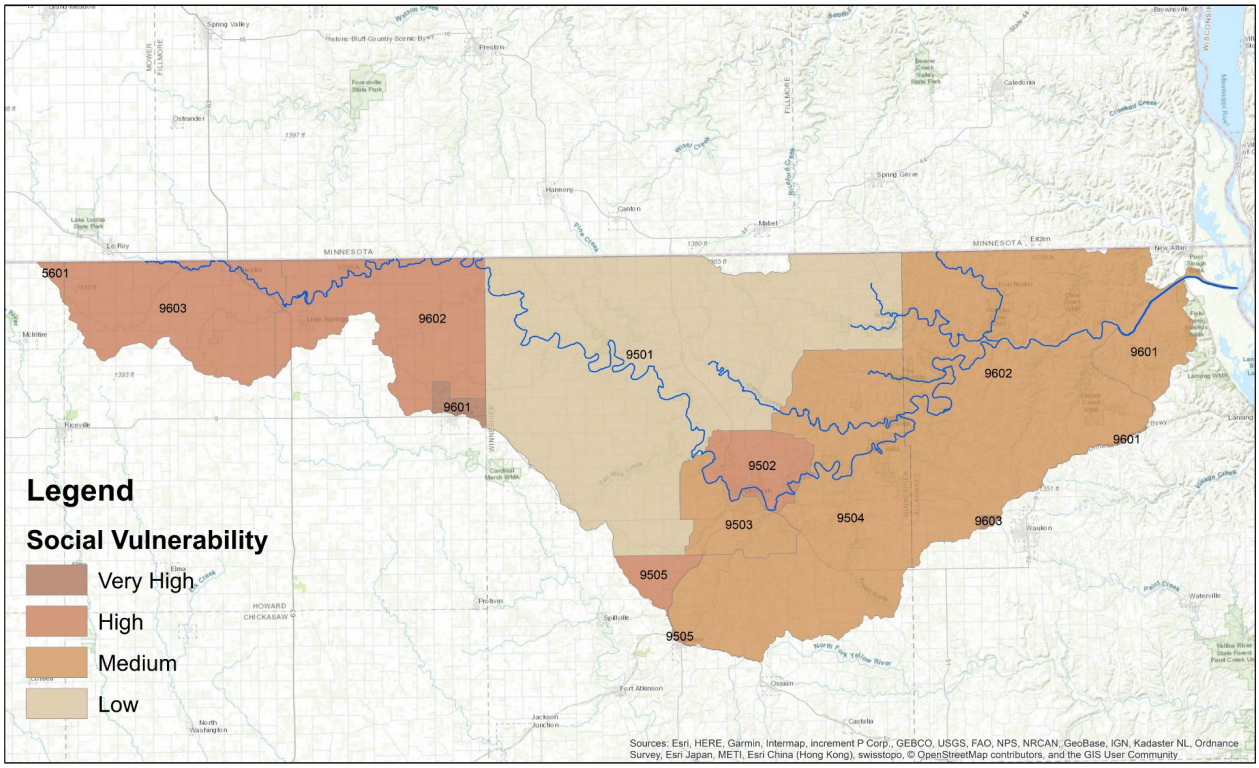
Through the Iowa Watershed Approach, the UIR WMA and their partners are working with the Resiliency Team from the University of Iowa to better understand resiliency issues in the UIR Watershed and identify ways to reduce the impact of flooding on the most vulnerable UIR Watershed residents.

Impact to Vulnerable Populations



The Iowa Flood Center analysed socially vulnerable populations in all of the Iowa Watershed Approach watersheds, including the UIR Watershed. They created Social Vulnerability Maps for each watershed. The Social Vulnerability Maps identify areas with high social vulnerability, which correlates with low resilience to disasters particularly flood disasters. The social vulnerability data combines percentage of 12 indicators from the U.S. Census Bureau including; African American, Language barrier, renters, unemployed, poverty, children, elderly, Hispanic, low education, female-headed household, disables, and no vehicle access.

The map on the right shows the social vulnerability of census tracts in the UIR Watershed. The table below correlates with the map and shows the top three indicators for social vulnerability for each Census Tract in the UIR Watershed. To explore more about social vulnerability in the UIR Watershed and other Iowa Watershed Approach watersheds explore the Iowa Flood Information System (link: http://ifis.iowafloodcenter.org/ifis/app/?snap_view=fmap)

Many physical factors influence the total impact of flooding in the UIR Watershed, including soil health, land use, topography, conservation practice location, and even road, culvert and bridge size and placement. Total rainfall quantities and locations, which shift with every rainfall event, greatly influence impact. In the UIR Watershed, the presence, absence and extent of karst development and how karst features influence runoff direction, quantity and intensity are also important. Many of these watershed characteristics and other factors are discussed further in the UIR WMA Plan section Understanding the Watershed (link: https://www.upperiowariver.org/understanding-the-watershed/) .

Although the total impact of flooding in the UIR Watershed can't be predicted for individual events, some information is available that can be used to help us understand why it is important to increase the resiliency of the UIR Watershed and prevent or reduce the potential for flooding.

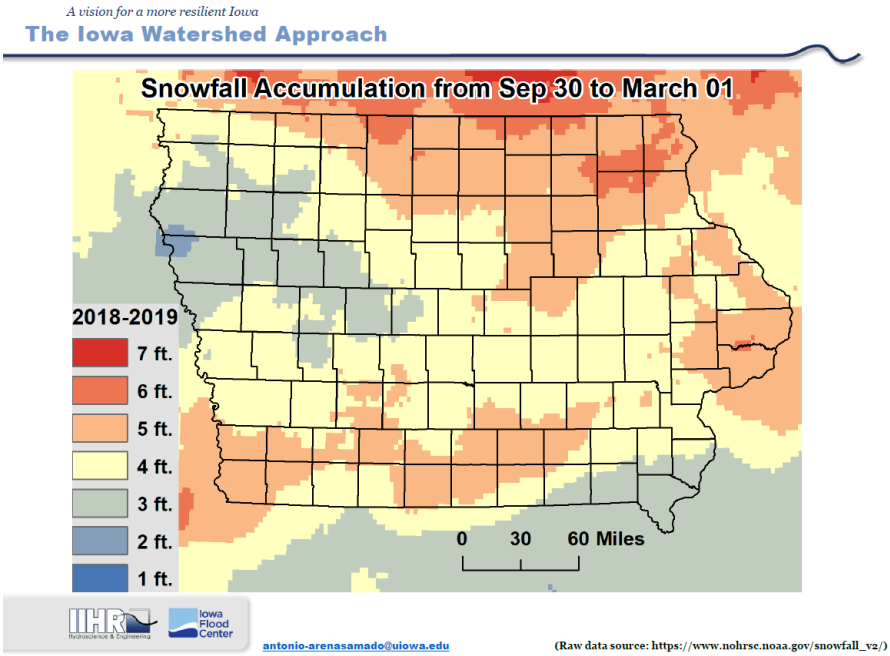
Once the public and all the partners better understand the impacts of flooding, they can better understand the value of investing time and money in mitigation. The National Institute of Building Sciences issued a report on the value of mitigation in January of 2018. The ongoing study found that there are measures governments, building owners, developers, tenants and others can take to reduce the impacts of flood events. They estimate that investment in mitigation can save $6 in future disaster costs for every $1 spent on hazard mitigation after an event. The report can be found here (link: https://www.nibs.org/news/381874/National-Institute-of-Building-Sciences-Issues-New-Report-on-the-Value-of-Mitigation.htm) .

Upper Iowa River Social Vulnerability Table.

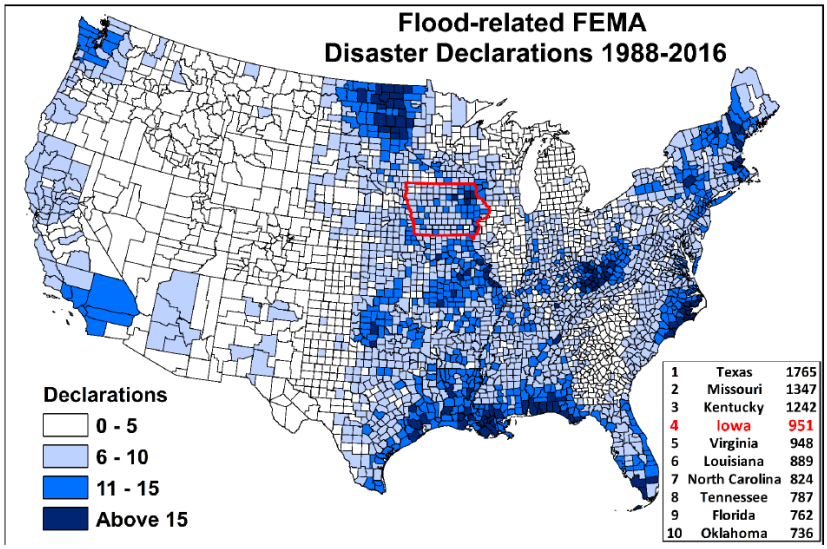
Census Tract	County	Social Vulnerability	Total Population	1st Indicator	2nd Indicator	3rd Indicator
9601	Howard	Very High	3895	% Female Head of Household	% Poverty	% Disabled
9603	Allamakee	Very High	3906	% Unemployed	% Disabled	% No High School Diploma
5601	Mitchell	High	3506	% Limited English	% No High School Diploma	% Children
9603	Howard	High	2842	% No High School Diploma	% No Vehicle Access	% Children
9502	Winneshiek	High	5937	% Black or African American	% No Vehicle Access	% Renter
9602	Howard	High	2693	% Limited English	% Disabled	% Unemployed
9505	Winneshiek	High	3404	% Unemployed	% Renter	% Female Head of Household
9602	Allamakee	Medium	2641	% Disabled	% Children	% Unemployed
9503	Winneshiek	Medium	3456	% Hispanic or Latino	% Renter	% Black or African American
9504	Winneshiek	Medium	4612	% Hispanic or Latino	% Female Head of Household	% Children
9601	Allamakee	Medium	1900	% Age 65 or Older	% Unemployed	% Disabled
9501	Winneshiek	Low	3380	% Children	% Female Head of Household	% Black or African American

According to NOAA, National Centers for Environmental Information (link: https://www.ncei.noaa.gov/news/national-climate-201712) , 2017 was the costliest year on record for weather and climate disasters in the United States, but Iowans, including residents of the UIR Watershed have been dealing with the economic impact of flooding for decades.

Given that 2018 was the wettest year on record and snow accumulation was exceptional in the winter of 2018-2019, UIR Watershed residents may face additional economic distress in 2019 and future years.



Economic Impacts of Flooding



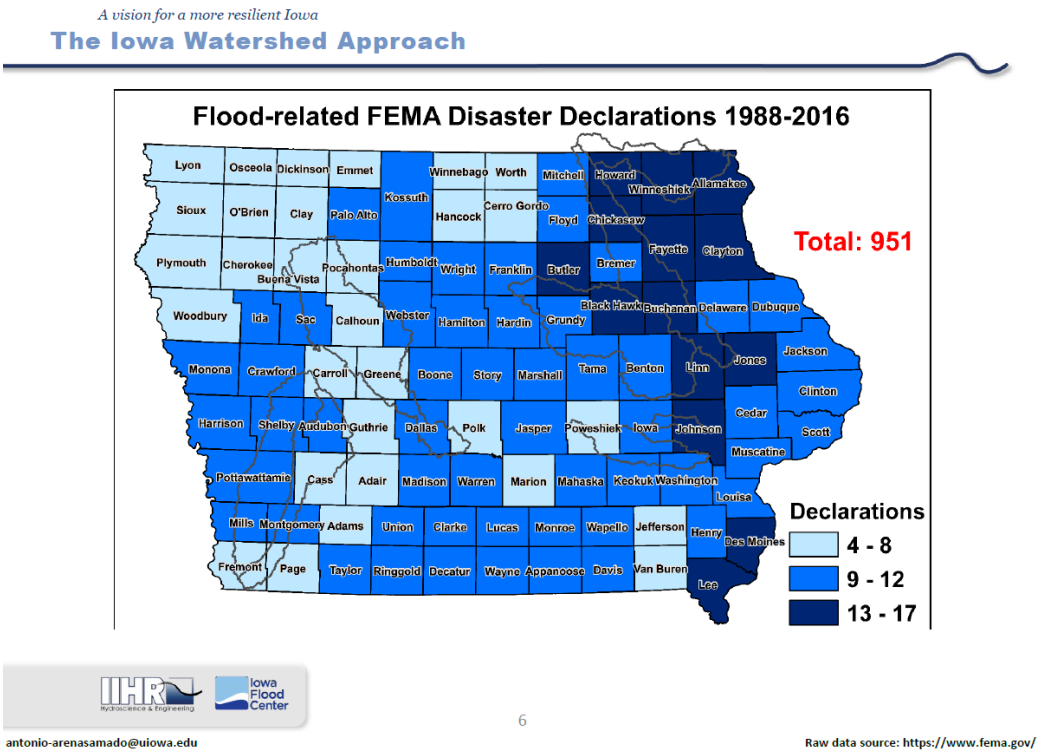
antonio-arenasamado@uiowa.edu
Raw data source: https://www.fema.gov/

An analysis of FEMA declarations conducted by the Iowa Flood Center found that Iowa has experienced more federal flood disasters than the majority of other states in the Nation. It also found that many of the FEMA declarations were in Northeast Iowa.

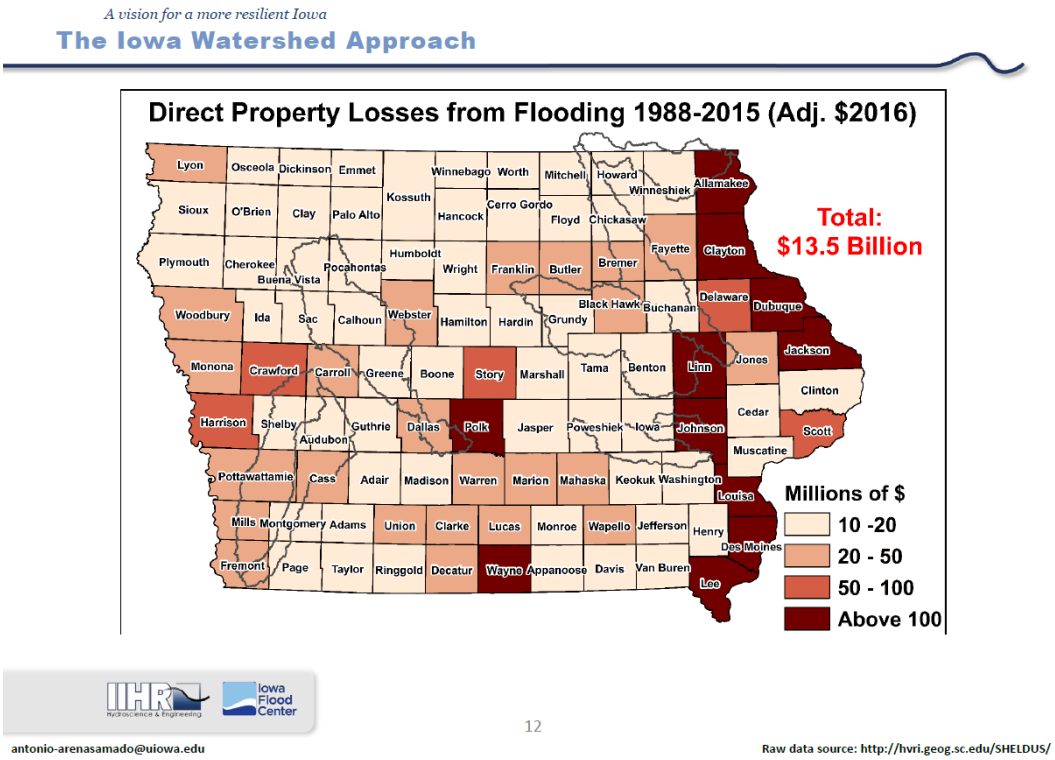
The Upper Iowa River Watershed Hydrologic Assessment (UIRW Hydrologic Assessment) summarizes some of the costs associated with major flood events in Iowa and shows the numbers of Federal Emergency Management Agency (FEMA) Federal Declaration from Iowa counties due to flooding. Some of the findings from the UIRW Hydrologic Assessment are noted below. The full UIRW Hydrologic Assessment is available here.

According to the Hydrologic Assessment, *"FEMA records show 952 flood-related disaster declarations (FRDD) in Iowa between 1988 and 2016. Of these, 951 were reported for Iowa counties (see Figure 1.12) and one for the Sac and Fox Tribe of the Mississippi in Iowa. All the FRDD in Iowa have been major disaster declarations except the 99 related to Hurricane Katrina evacuation, which were classified as emergency disaster declarations.*" The State of Iowa ranked fourth in the number of flood related disaster declarations from 1988-2016.

Federal disaster declarations give impacted regions access to federal recovery assistance. Current regulation permits two kinds of disaster declarations: "Emergency Declarations" and "Major Disaster Declarations" (Stafford Act). Both are granted at the discretion of the president of the United States after the governor of the impacted state makes the request. Federal disaster grants provide assistance for debris removal emergency protective measures and the repair, replacement, or restoration of disaster damaged, publicly owned county and state facilities and some private facilities.



The geographic distribution of flood related Disaster Declarations in Iowa is focused in the eastern half of the state, particularly Northeast Iowa, including within the Upper Iowa River. Each county in the Iowa portion of the UIRW received at least 13 flood related disaster declaration between 1988 and 2016.

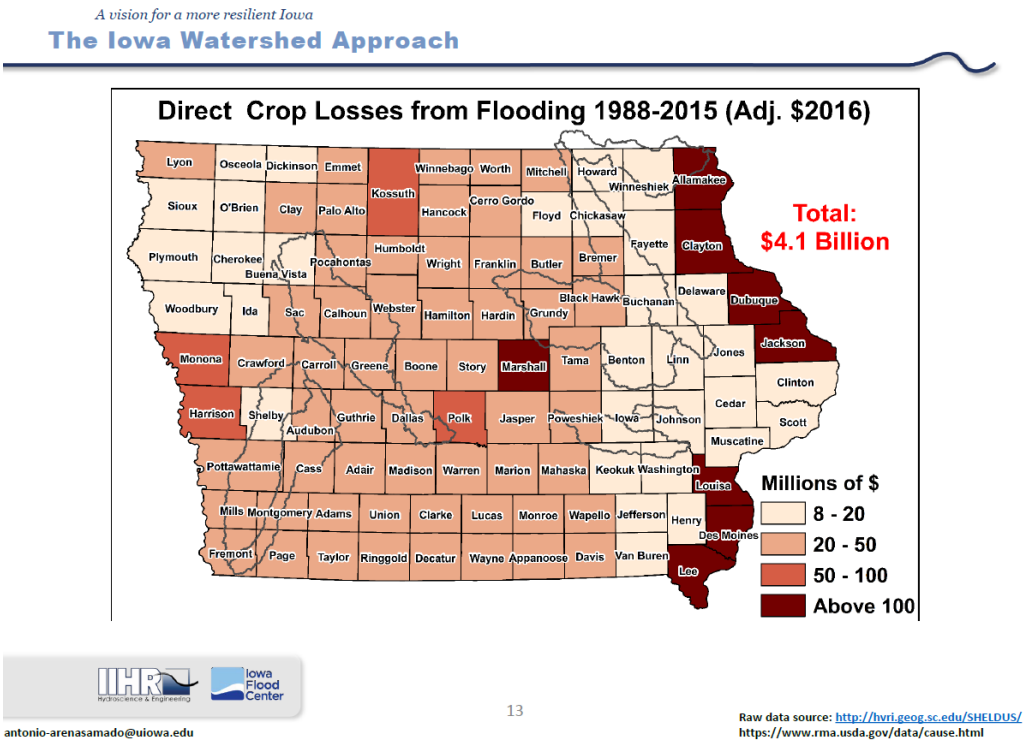


Between 1999 and 2016, Iowans received $1.7 billion dollars in public assistance from flood related disaster declarations. Iowa is the only landlocked state to receive this high of an amount from federally declared funding (FEMA).

From 1988-2016, counties in the Upper Iowa River Watershed experienced a combined over $188 million in property damage (pictured on the Right) and over $162 million crop damage (Pictured on next page). (SHELDUS) Allamakee County, which is at the lower end of the watershed, had the highest direct property loss and direct crop loss of any

county in the UIR Watershed from 1988-2016, at $155,518,148 and $133,948,444 respectively (SHELDUS). Howard and Winneshiek Counties also experienced high losses from 1988-2016.

Howard County reported property losses of $14,402,929 and crop losses of- $11,251,758. Winneshiek County reported property loss of $18,698,327 and crop loss of $17,603,592. (Note: These are county-wide totals. Not all of the dollars reported for these counties were spent in the UIR Watershed).



FEMA data is linked to declared events only. Property and crop damages reported to and through FEMA are estimated to be a fraction of the actual costs incurred in these counties from flooding. Some costs associated with flooding cannot be, or are not, measured. County FEMA dollars spent on public infrastructure repair and property buyouts to convert private properties to public lands does not count loss of life, private expenditures on flood clean up, private home owner or business property restorations, loss of business income or businesses, loss of work income, health impacts of flooding, or increased travel costs associated with reroutes or bridge or road closure, community population loss, loss of tax revenue – including sales and property taxes etc.

County engineers from the UIR Watershed, report that there are many flood events that cause damage to county infrastructure but don't qualify for FEMA grant dollars and therefore are never tracked in the FEMA database. For example, during the June 2013 flood event, Winneshiek County alone spent over $87,000 in materials just for road and bridge repairs. County engineers also report other cost that are not recognized, tracked or reimbursed by FEMA, such as employee time to complete repairs, deal with road closures, and complete flood clean-up. The private and public cost of road closures and detours is also not recognized, tracked or reimbursed. After a flood event, a county may get approval from FEMA for funding to repair a bridge, but bridge repairs can be delayed by the FEMA process for years, costing citizens time and money when bridges are closed or weight limits are imposed.

March 2019. Photo courtesy of Winneshiek County

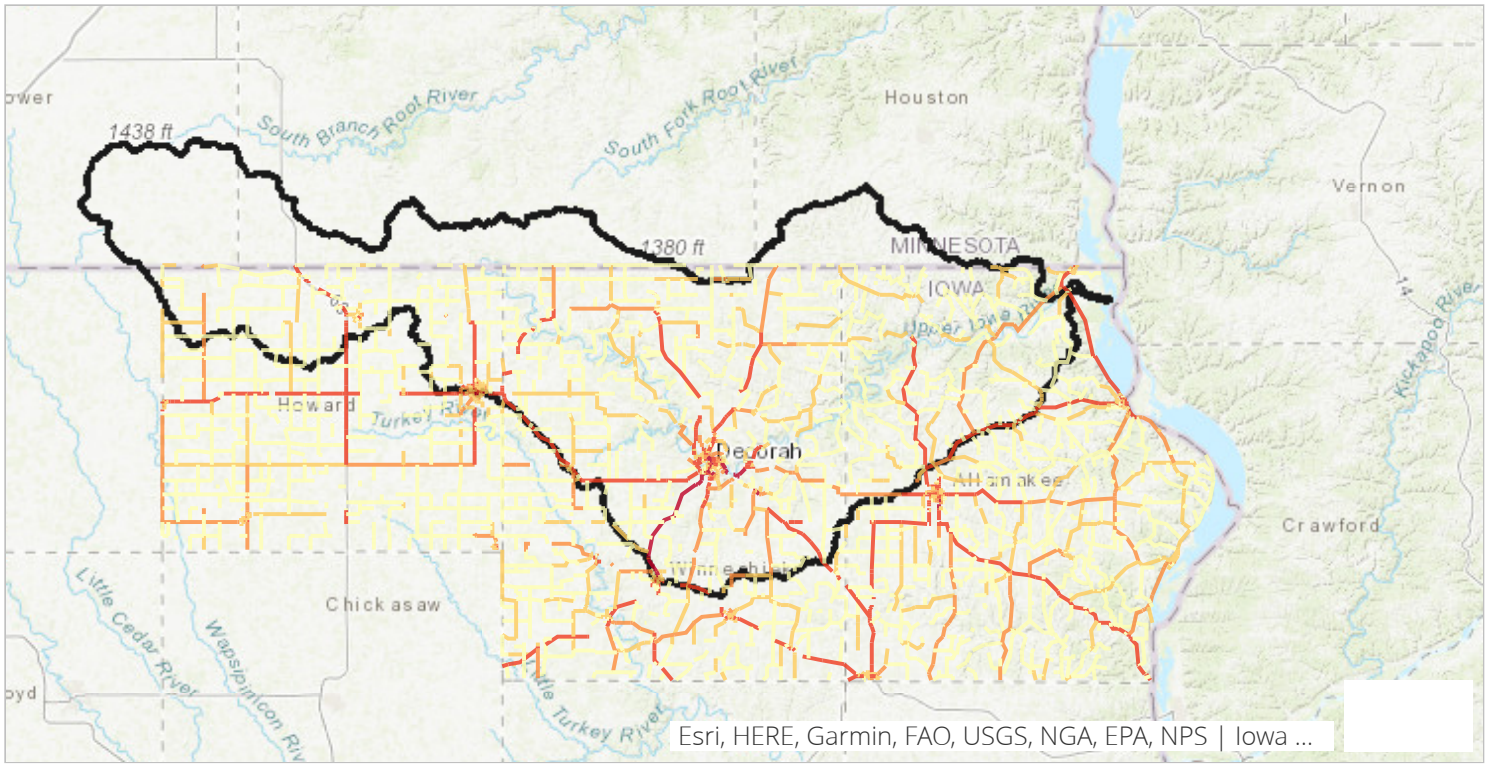
Impacts to County Public Infrastructure

Much of the documented costs of flooding are related to the damage to roads, bridges, businesses, houses and other physical infrastructure that occurs during a flood event. A closer look at the public infrastructure in the UIR Watershed and the impact of flooding on public infrastructure is provided below.

Even though county secondary roads and engineering departments work to expand county taxpayer contributions to their budgets by applying for and utilizing state and federal grant and program dollars for projects, funding for timely bridge and road replacement is still limited. As a result, road and bridge infrastructure is aging and in some cases bridges have deteriorated to the extent that they have been closed because of funding limitations imposed by Iowa Code. Exacerbating the issue, the bridges, and some of the roadways in the UIR Watershed are directly in the path of increasingly powerful flood waters.

Photo courtesy of Winneshiek County.

Impacts to Public Infrastructure



Nearly 2000 miles of hard surface and gravel roads meander through the UIR Watershed. Although two major federal highways, U.S. 63 and U.S. 52, and five state highways cross through the UIR Watershed, the vast majority of the roads and bridges, and their right of ways, are managed by counties and cities. Hundreds of miles of county and city hard surface and gravel roadways wander through the UIR Watershed's karst landscape.

Legend

Road Network

AADT

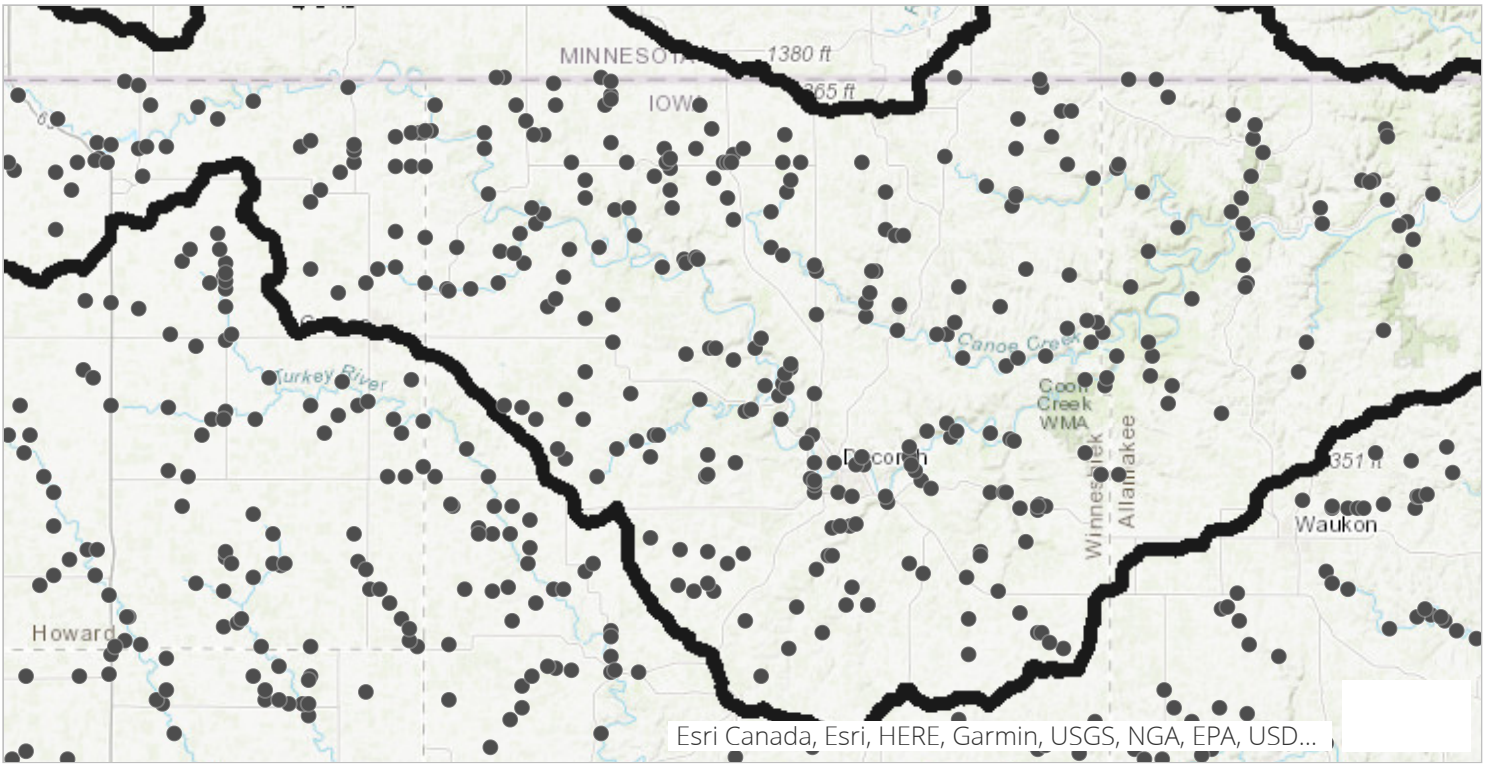
- > 5,000 - 14,700
- > 1,000 - 5,000
- > 500 - 1,000
- > 100 - 500
- 0 - 100

Upper Iowa River Watershed

Watershed Boundary Dataset

HUC 08

Annual Average Daily Traffic (AADT)



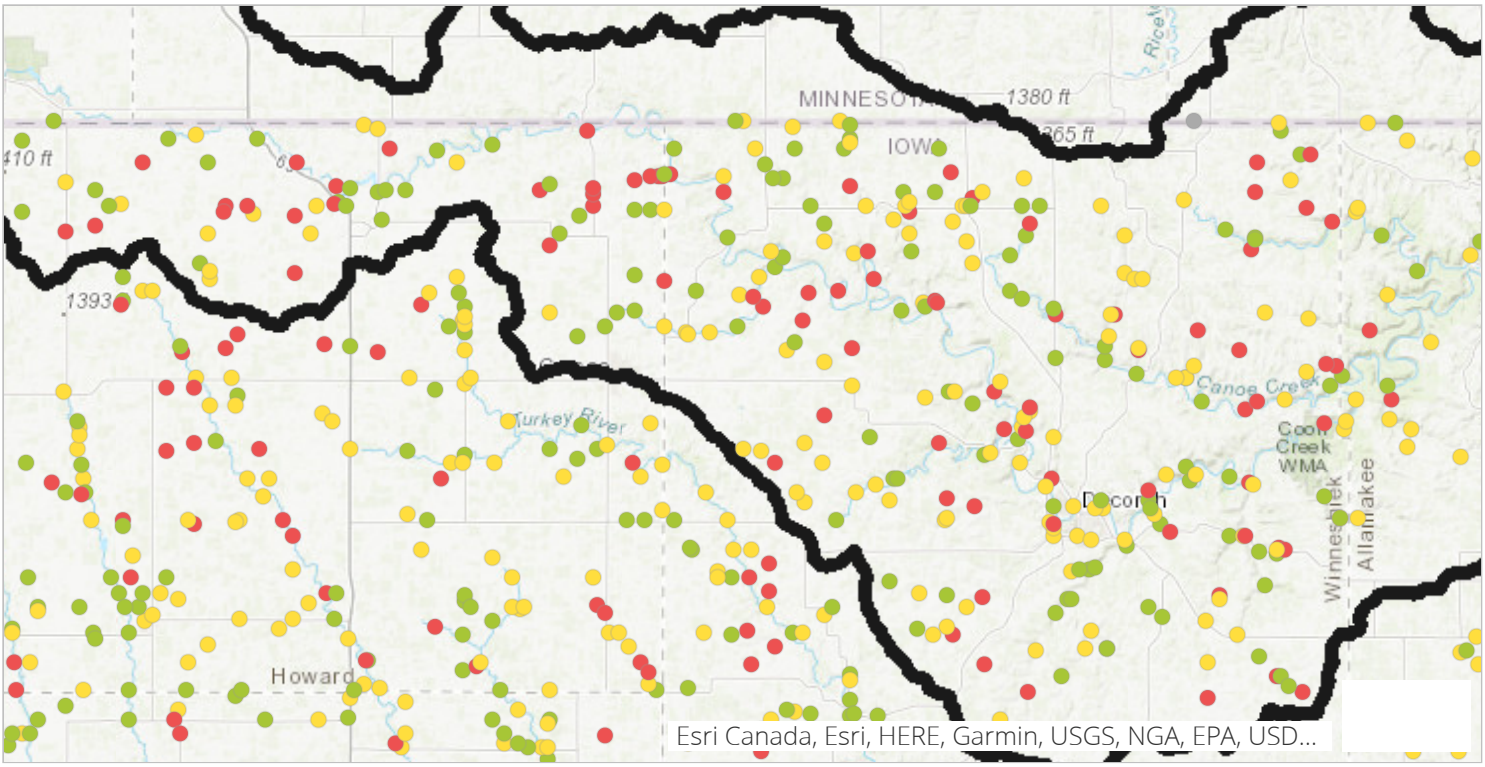
Due to the winding, hilly terrain and high number of road miles, many roads intersect with surface water, including stormwater runoff. According to a GIS Analysis conducted by Northeast Iowa RC&D, there are 1,233 instances where roads intersect with surface water or stormwater flow in the UIR Watershed.

Bridges and roadways adjacent to water courses or stormwater runoff in the UIR Watershed are often at risk of washouts during large rain events. In the Winneshiek County section of the UIR Watershed, there are 12 roads that frequently wash out during large rain events (Winneshiek County Engineer). Although the Allamakee County Engineer reports that none of the roads in Allamakee County are regularly closed or vacated due to flooding, there are some locations that experience damage during flood events, particularly where a water course or its floodplain intersect with a roadway.

According to an analysis of recent bridge failures in the United States reported by the Journal of Performance of Constructed Facilities and conducted by Kumalasari Wardhana and Fabian Hadipriono on over 500 bridge structure failures that occurred in the United States between 1989 and 2000, the most frequent causes of bridge failures were attributed to floods and collisions with flood and scour contributing to almost 53% of the failures. The analysis of bridge failures is significant given that until the past six years flood prevention has not typically been a consideration for bridge replacement. Condition, use, detour length, funding availability and other factors have been priority factors for county engineers considering bridge replacement. As flood frequency, size and scope increase, protection of both roads and bridges from flood and scour impacts is becoming even more relevant, especially given limited county resources and financial constraints. UIR Watershed counties are now evaluating how flood prevention can protect roads and bridges, especially those that are structurally deficient, are along primary emergency routes, have high traffic counts or other significant factors.

Debris deposited on bridge after recent flooding

Bridge condition Index-"Poor Condition" Bridges



A bridge's rating, as determined using the Bridge Condition Index, is a significant consideration. Bridges are rated based on the quality of the structure as explained in the U.S. Department of Transportation Federal Highway Administration's Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges. The National Bridge Inventory includes an assessment of the physical conditions associated with the flow of water through bridges 20 feet wide or greater. It includes identification information, bridge types and specifications, operational conditions, and much more.

The Bridge Condition Index combines the criteria explained below to rate the overall condition of the bridge. It takes into consideration factors such as, structural condition, load carrying capacity, horizontal and vertical clearance, width, traffic levels, and the surface of the roadway. It also considers who is served and the length of the detour in the event of bridge closure. A bridge that is in "good condition" is considered to be adequate for today's traffic and vehicle loads. A bridge in "poor condition" is not unsafe, but should be considered for repair, replacement, restriction posting, weight limits or monitoring on a more frequent basis. The National Bridge Inventory reveals that the infrastructure in the UIR Watershed is deteriorating due to age, usage, and damages caused by flood events.

Based on this data the UIR Watershed contains 88 bridges categorized as being in "poor condition". According to the Winneshiek County Engineer, the cost of repairing or replacing a bridge ranges between 35-150 per square foot of bridge.

Legend

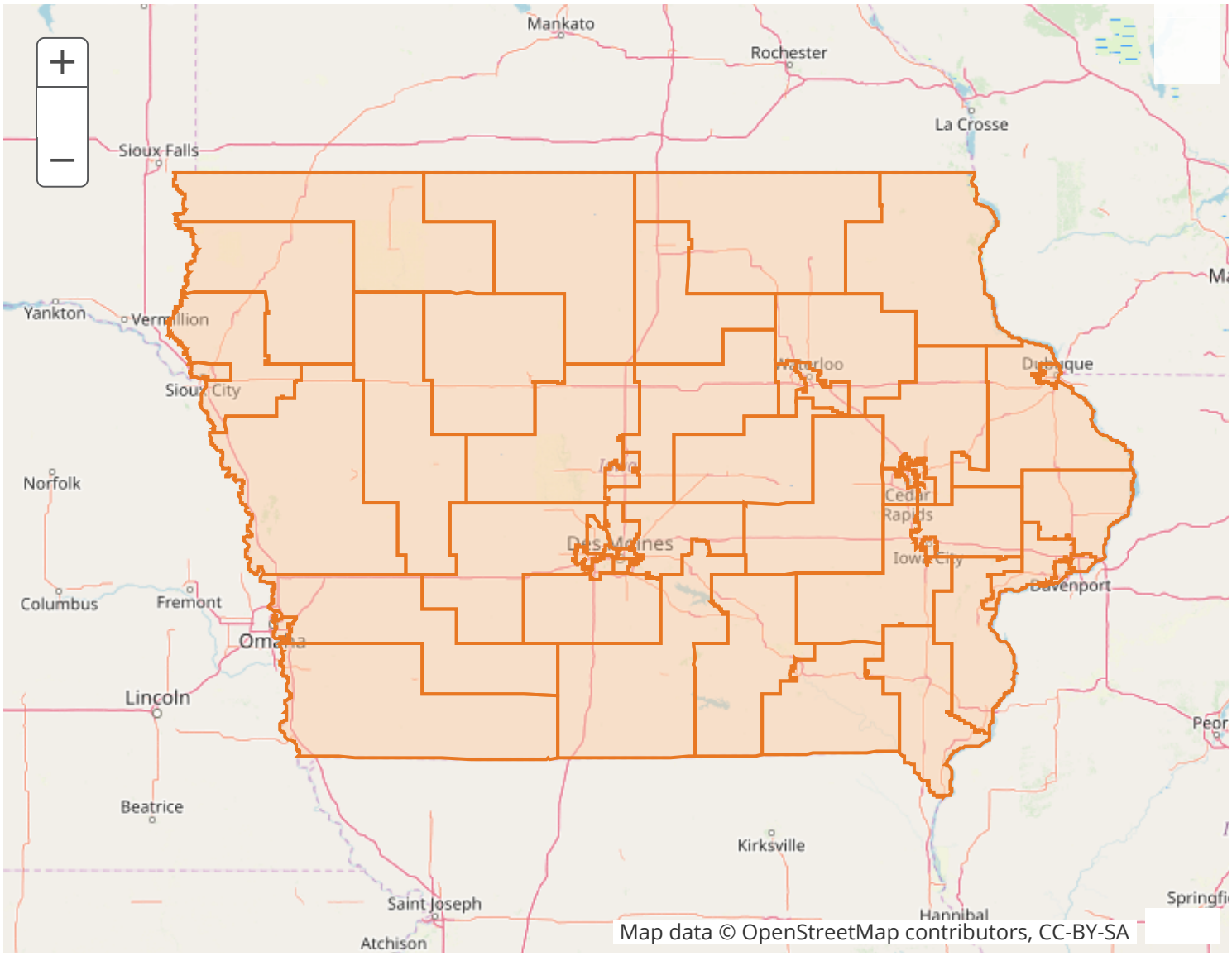
Iowa Bridges (Points)

- Good
- Fair
- Poor
- Other

National Bridge Inventory

Iowa Bridges

All Bridges



By Senate District

Next: By House District

1 - All Iowa Bridges

Next: State Owned Bridges

Website: https://arcg.is/1ueC81

According to the National Bridge Inventory, there are only 370 inventoried bridges in the Iowa portion of the UIR Watershed. (Bridges smaller than 20 feet, culverts, and water diversions within ditches, the majority of which are managed locally, are associated with the remainder of the intersecting flowing water.)

This Story Map was put together by the IDOT. It shows bridge locations in Iowa and their condition based on current and historical National Bridge Inventory data. The inner point represents any restrictions placed on the bridge structure. Restrictions include weight restrictions or designations such as “Closed to All Traffic”. The middle ring represents bridge serviceability according to the Federal Bridge Rating Standard. Bridges can be “non deficient” or “structurally deficient”. The Iowa DOT defines “structurally deficient” as, “One of more structural elements are in need or

repair or replacement. Bridge length may be inadequate for waterway size. Load carrying capacity may be insufficient for today's legal truck sizes."

The outer ring for each bridge point shows the Iowa Bridge Condition Index. The Iowa DOT notes that this measurement reflects, "*The overall condition of the bridge, taking into account things such as structural condition, load carrying capacity, horizontal and vertical clearances, width, traffic levels, type of roadway it serves, and the length of out-of-distance travel if the bridge were closed.*" Good , Fair and Poor ratings indicate the following.

Good: All elements of the bridge are sound. No maintenance is needed.

Fair: All elements are sound. Some preventive maintenance would prolong the life of the bridge.

Poor: One or more elements are deteriorating. Repairs or replacement will be needed in the near future."

The UIR Watershed contains seven bridges that are closed to all traffic. Five of them are located in Winneshiek County and are not scheduled for repairs. Two are in Howard County. Three of the seven closed bridges are over 100 years old. According to an article by Marcie Klomp, editor of the Cresco Times Plain Dealer, "*There are 56 bridges (or 29%) considered structurally deficient or functionally obsolete [in Howard County]. In the 2010s decade, the county has replaced 35 structures over 20 feet. This is the most in any one decade since the 1950s."*

Some flood damage to public infrastructure in the UIR Watershed is less obvious. (Data Source: U.S. Department of Transportation Federal Highway Administration's Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.)

- 13% of the bridges have bank and embankment protection that is severely undermined, severely eroded banks, or trees and brush that restrict the channel and are in need of repairs.

- 12% of bridges in the watershed have severe damage to their channel and are in need of major repairs. Damages could be from severe erosion where the structure is at risk of failing, major blockage of the channel from large debris in stream or river, or major changes in the realignment of the stream.

- 70% of bridges have minor damages to bank protection or river control structures and need minor repairs. Damages are in the form of erosion to stream banks due to lack of vegetation and increased flows or debris that is blocking the channel slightly.

County Policy to Reduce the Economic Impact of Flooding

Recognizing the actual and potential cost of flooding to county infrastructure, some of the UIR Watershed County Board of Supervisors and County Engineers have adopted policies to utilize secondary roads to help increase watershed resiliency and decrease the impact that flooding has on county infrastructure in the future. The policy encourages consideration for and implementation of on-road structures during regular culvert replacement. Although it would slightly increase the cost of any individual project, implementation of the policy is expected to save on future road and bridge repair and replacement costs. Winneshiek County has already worked with several landowners to implement "on-road" or road embankment structures. On-road structures are typically placed where a county roadway dips with the landscape, the road is built up, creating a dam like structure that can hold stormwater runoff temporarily. The use of a special outlet culvert allows the structure to temporarily hold back water during a large rain event and then release it at a reduced volume over a few days. An easement or agreement between the landowner and county engineer is established with the arrangement that water may be temporarily backed up onto the private land. Responsibility for inspection and maintenance is also assigned.

These structures have multiple benefits, improving the safety of the roadway, protecting downstream infrastructure and reducing flow during rain events. They can also provide water for livestock and a water source for the fire departments (dry hydrant), which is particularly helpful in rural areas where other water sources are scarce.

Economic Impacts of Flooding on Businesses

The economic impact of flooding on rural Iowa businesses is poorly understood and difficult to quantify in any measurable way because it has rarely been recognized, reported, or recorded by any entity other than the individual business owners. Businesses are directly impacted by flood waters, some of them are repeatedly. Over the past thirty years, dozens of Northeast Iowa businesses, located in areas of small communities that had never previously flooded or aren't even in the floodplain, have been hit repeatedly by flooding and as a result closed their businesses and/or abandoned their damages properties. As flood damaged buildings are left vacant and deteriorating, other nearby businesses suffer. An even greater number of businesses are believed to be impacted by secondary economic stressors. Many are impacted by the loss of customers and sales directly before, during and after a storm event, during preparation for an event and during event clean-up. Disposable customer income that may have been spent on services, movies, dinner, new clothes or other items must be redirected to home repair and temporary living expenses. A loss of employee productivity, damaged or spoiled inventory related to electrical outage or low sales, detours that take customers away from businesses, and other factors can also impact sales and profitability. Combined, these stressors can have a devastating impact on both short and long term business viability. Impacted businesses can

include everything from grocery stores, restaurants, clothing stores and specialty shops to factories and other larger businesses.

Economic Impact of Flooding on Tourism

Although tourism is a major industry in the UIR Watershed, the economic impact of flooding on tourism in the UIR Watershed has not yet been quantified. Given the value of tourism to the counties in the UIR Watershed, an economic analysis of the impact that flooding has on tourism would be prudent. According to U.S. Travel Association's Travel Economic Impact Model (TEIM) domestic travelers spent a total of $8.5 billion in Iowa in 2017. This included an estimated $40.21 million in expenditures in Allamakee County, $30.47 million in Winneshiek County, and $4.88 million in Howard County. (Travellowa.com) Tourism in the UIR Watershed has historically been directly linked to water resources. According to a former Winneshiek County Tourism Director surveys conducted by hotels and motels found that four of the top five activities identified by travelers as important to their stay included activities associated with water (e.g.canoeing, fishing, kayaking, and tubing).

Trout Unlimited conducted an economic impact study in 2016. Results from their survey quantified just how important one sector of tourism, trout fishing, is to the economy. According to *The Economic Impact of Recreational Trout Angling in*

the Driftless Area (link: http://www.darestoration.com/documents/Economic%20Impact%20Summary%20of%20Trout%20Angling%20in%20the%20Driftless%20Area.pdf) ,

"The entire economy of the region is strengthened by returning anglers and their friends and family."

Results from this survey showed that anglers coming to the area are traveling over 100 miles and they rarely travel alone. Anglers that come in groups usually stay more than one day, and enjoy the rest of the area during their stay. They stay in hotels or campgrounds and eat at nearby restaurants which helps the area's economy thrive. The total spending and economic impact of recreational angling in the Driftless area was estimated at 1.6 billion dollars in 2016. Although the study draws attention to the importance of the coldwater streams and the UIR, which harbor trout, it does not quantify the economic loss that occurs when flooding swells the streams and/or the UIR.

Data used include: presidential disaster declarations, FEMA public assistance program, USDA crop insurance program, University of South Carolina SHELDUS database, summarized by Antonio Arenas