2019 REPORT CARD FOR IOWA'S INFRASTRUCTURE

Iowa Section of the American Society of Civil Engineers

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ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Aviation C-

Pages 6-12

Author: Michelle Riedinger
Title: Structural Engineer
Firm: Shive-Hattery

Bridges D+

Pages 13-19

Author: Dave Mulholland
Title: Transportation Engineer
Firm: Iowa Department of Transportation

Dams D

Pages 20-25

Author: Aaron Gwinnup, PE
Title: Project Manager
Firm: HR Green, Inc.

Drinking Water C

Pages 26-31

Author: Charles N. Kahlsdorf, PE/PMP
Title: Principal Engineer
Firm: Bolton & Menk, Inc.

Energy C+

Pages 32-37

Author: Brian Boelk
Title: Principal
Firm: Axiom Consultants, LLC

Inland Waterways D+

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Author: Stephanie Then
Title: Water Resources Engineer
Firm: HDR, Inc.

Levees C

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Author: Steve Sampson Brown
Title: Project Manager
Firm: City of Dubuque - Engineering Department

Parks, Recreation, & Trails C

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Author: Della Caldwell
Title: Civil Engineer
Firm: MMS Consultants, Inc., Iowa City

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Author: Edward Sowder
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Firm: Calhoun-Burns and Associates, Inc.

Roads C+

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Author: Aaron Moniza, PE
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Firm: Foth Infrastructure & Environment, LLC

Solid Waste B

Pages 70-75

Author: Aaron Granquist, PE
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Wastewater C-

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Author: Dave Claman
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Executive Summary

The condition of Iowa's infrastructure has a very real impact on every person and business in the state. All Iowans depend on roads, bridges, aviation, rail, water infrastructure, energy systems, wastewater removal, and recreation facilities. The condition of these essential infrastructure elements directly impacts Iowans' quality of life, opportunities, and future.

The 2019 Infrastructure Report Card for Iowa was created to help Iowans understand the state's infrastructure. The Report Card provides a snapshot for residents and policymakers to engage in conversation about current conditions and where Iowa needs to be. In their research and review, the authors of the Report Card concluded much of Iowa's infrastructure is old and outdated with significant concerns over resilience. The authors hope this information provides the insight needed to start that conversation and ignite action to improve these 2019 grades and, as a result, the state's future.

The expert civil engineers who developed the Report Card understand not only the fundamentals of infrastructure but also how the condition of these elements impacts daily living for Iowans. As civil engineers, their job is to plan, design, construct, and maintain our infrastructure networks. They are eager to help continue the conversation about current conditions as well as provide solutions.

About the 2019 Infrastructure Report Card for Iowa

A committee of the American Society of Civil Engineers – Iowa Section assessed all relevant data and reports, consulted with technical and industry experts, and assigned grades using the following key criteria:

- **Capacity:** Does the infrastructure's capacity meet current and future demands?
- **Condition:** What is the infrastructure's existing and near-future physical condition?
- **Funding:** What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?
- **Future Need:** What is the cost to improve the infrastructure? Will future funding prospects address the need?
- **Operation and Maintenance:** What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?
- **Public Safety:** To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?
- **Resilience:** What is the infrastructure system's capability to prevent or protect against significant multi-hazard threats and incidents? How able is it to quickly recover and reconstitute critical services with minimum consequences for public safety and health, the economy, and national security?
- **Innovation:** What new and innovative techniques, materials, technologies, and delivery methods are being implemented to improve the infrastructure?

2019 Infrastructure Report Card for Iowa

GPA C

Aviation	C-
Bridges	D+
Dams	D
Drinking Water	C
Energy	C+
Inland Waterways	D+
Levees	C
Parks, Recreation, & Trails	C
Rail	C+
Roads	C+
Solid Waste	B
Wastewater	C-

Grading Scale

A – Exceptional, Fit for the Future

The infrastructure in the system or network is generally in excellent condition, typically new or recently rehabilitated, and meets capacity needs for the future. A few elements show signs of general deterioration that require attention. Facilities meet modern standards for functionality and are resilient to withstand most disasters and severe weather events.

B – Good, Adequate for Now

The infrastructure in the system or network is in good to excellent condition; some elements show signs of general deterioration that require attention. A few elements exhibit significant deficiencies. Safe and reliable, with minimal capacity issues and minimal risk.

C – Mediocre, Requires Attention

The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.

D – Poor, at Risk

The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of serious concern with strong risk of failure.

F – Failing/Critical, Unfit for Purpose

The infrastructure in the system is in unacceptable condition with widespread advanced signs of deterioration. Many of the components of the system exhibit signs of imminent failure.

Solutions to Raise the Grade

Infrastructure = Economy

Our location in the center of the nation and our networks of inland waterways, railways and roadways are important to Iowa's economy, helping deliver goods to world markets at competitive prices. The needs of aging systems as well as adding capacity and service for demand will require increased and sustainable investment.

Innovative And Sustainable Funding Solutions

Funding for roadway and bridge infrastructure projects have historically been paid for with proceeds from gas and diesel taxes. As hybrid and electric vehicles become more common, the amount generated by these taxes will decrease. While gas and diesel taxes can provide enough revenue today, alternate funding methods must be pursued in the near future, before the funding losses become significant. Further, indexing the gas tax to inflation to keep up with rising costs is essential as well.

Prioritize Public Health and Safety

"Safety First" must be the approach to all of Iowa's infrastructure decisions. Integrated asset management is the critical first step in developing a foundation for safe and reliable infrastructure in Iowa. Safety can further be improved by properly maintaining Iowa's infrastructure. Proactive investment in infrastructure yields savings down the line and ensures the health and welfare of Iowans.

Proactive and Innovative Planning

The backbone of our state's infrastructure was built 50 to 100 years ago. As rural dynamics shift, upgrades are necessary for modernization, resiliency, and to meet the needs of its changing users. Unique strategies, emerging technologies, and research and development is needed to help optimize the rural transportation network, to understand and account for shifting and social economic trends, and to help stretch the limited funding available.

Subject	2019 Grade	2015 Grade	Change
Aviation	C-	C-	–
Bridges	D+	D+	–
Dams	D	D	–
Drinking Water	C	C+	▼
Energy	C+	C	▲
Inland Waterways	D+	D	▲
Levees	C	C-	▲
Parks, Recreation, and Trails	C	Not Graded	–
Rail	C+	C	▲
Roads	C+	C-	▲
Solid Waste	B	B+	▼
Wastewater	C-	C-	–

AVIATION

C-

Executive Summary

Iowa's air transportation system is performing sufficiently, provides adequate infrastructure for demand, and maintains safe operating conditions. However, pavement improvements have not kept up with needs, resulting in a decline in overall pavement condition. Additionally, improvement in the areas of safety and resiliency are necessary, as only about one-half of Iowa airports meet targets in these areas. Between 2012 and 2017, an annual average of $41 million was invested in Iowa airport infrastructure. While funding is being used for maintenance and improvement, the overall condition of airport infrastructure has not significantly improved.

Background

Aviation has a significant economic impact in Iowa. Not only does aviation increase the efficiency of productivity for private sector businesses, it also contributes to approximately $200 million annual increase in agricultural productivity. Additionally, aviation activities in Iowa support an estimated 47,000 jobs.

Iowa has 116 public use airports: eight commercial services, 100 publicly owned general aviation airports, and eight privately owned airports. All meet requirements for public use. Of the 108 publicly owned airports, 79 are listed on the Federal Aviation Administration (FAA) National Plan of Integrated Airport Systems (NPIAS). NPIAS identifies airports that contribute to a safe and efficient national system of airports. Inclusion in NPIAS provides the opportunity to receive funding through the FAA Airport Improvement Program (AIP).

The Iowa Department of Transportation (DOT) - Office of Aviation oversees certification of airports for public usage, while the FAA sets many of the guidelines for safe airport operation.

Capacity and Accessibility

Capacity is defined by the FAA as the hourly throughput that an airport's runways are able to sustain during periods of high demand. Nationally, air carrier, general aviation, and local civil operations activity is projected to increase 4.2%, 0.2%, and 1.8% respectively over the next 20 years. Air carrier traffic is defined as aircraft with more than 60 seats and is anticipated to be the largest growth as larger aircraft replace smaller regional aircraft. In Iowa, the fleet of aircraft is anticipated to increase from an estimated 2,900 in 2015 to approximately 3,600 in 2030.

As demand increases for air carrier traffic, general service airports that can support larger aircraft than basic service airports become more critical. The Sioux County Regional Airport recently opened to support larger aircraft than the existing Orange City and Sioux Center airport could support. As business grew in the area, the demand outgrew the existing airport. As commercial aircraft get bigger, aging commercial aviation facilities may struggle to accommodate larger aircraft and the associated larger number of passengers arriving on aircraft. General aviation facilities, which support emergency preparedness and response, community access, and agricultural and aerial surveying, remain key parts of the aviation system. Federal funding of general aviation airports in the past has been less than users spend on the facility.

Airports in Iowa serve a wide range of consumers and degrees of demand. A classification system was established, in the Iowa Aviation System Plan, to identify facilities and services required to ensure continued performance of airports in Iowa. Service criteria can range from airport attendants, restroom facilities, to internet access. This classification system can also be used to review performance of airports. The five classifications of airports are:

Commercial Service – support scheduled commercial airline service and require the infrastructure and services to support a full range of general aviation activities. Additionally, they serve as important transportation and economic centers.

Enhanced Service – runways 5,000 feet or greater in length that can support general aviation activity including most business jets. These airports serve business and public aviation and are regional transportation centers and economic catalysts.

General Service – runways 4,000 feet or greater in length that can support general aviation activity including small to mid-size business jets. These airports are an economic asset to their communities, they are usually staffed during regular business hours and generate local business and employment opportunities in training, charters, and aircraft maintenance and repair. They serve as a community economic asset.

Basic Service – runways 3,000 feet or greater in length that support local aviation.

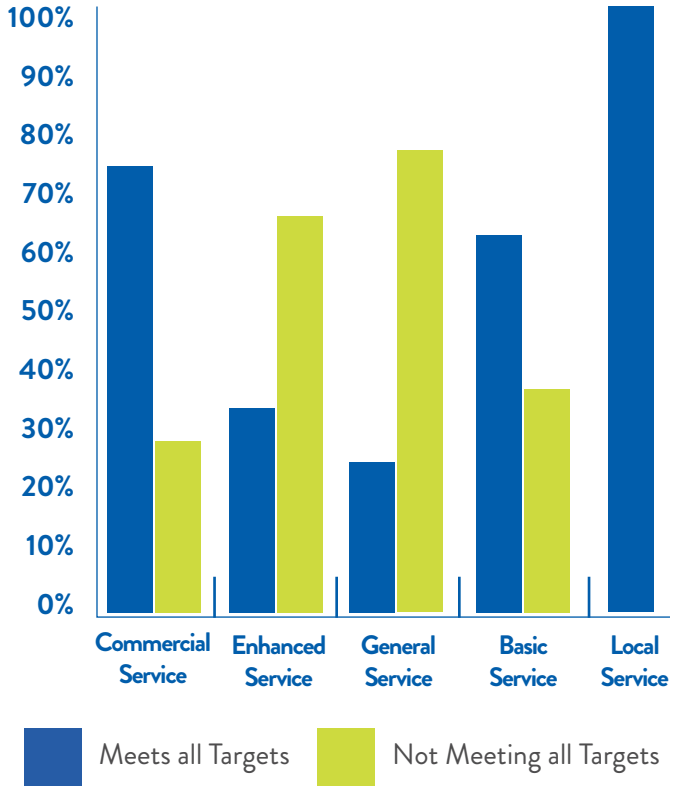
Local Service – Support local aviation with few or no services.

Facility and service targets are established to help airports ensure they meet the needs of their users. Meeting all the targets is not a requirement for inclusion in a service category, but they do provide a suggested level of service or quality of facility to meet the needs of each consumer group. Targets are separated into four categories: airside facilities, landside facilities, services, and planning. Table 1 lists targets for each service category including highlighted requirements for inclusion in a category.

The most recent assessment of airports in Iowa found that 61% of airports meet 100% of facility targets, including two commercial service airports that do not meet 100% of the facility targets. Figure 1 shows the breakdown of airports meeting 100% of facility targets; 70% of airports meet at least 75% of service targets.

Iowa's airports are sufficiently accessible from both ground and air transportation methods. Most Iowans are within a 120-minute drive to a commercial service airport, and 71% are within a 30-minute drive of a commercial or enhanced service airport, both of which meet DOT accessibility performance measures.

Figure 1: 100% of Facility Targets Met



Operations, Condition, and Maintenance

All airports must maintain facilities, hangers, and runways to maintain satisfactory performance. One key indicator of maintenance and pavement health is Pavement Condition Index (PCI). The Iowa DOT has set the Critical PCI for runways at 65, 60 for taxiways, and 55 for aprons. Pavement with a PCI of 65 to 100 that does not exhibit significant load related distress can be maintained with preventative maintenance such as crack sealing, surface treatments and preventing vegetation growth in cracks. Pavements with a PCI of 40 to 65 may require major rehabilitation, such as an overlay. When PCI is less than 40, typically reconstruction is the only viable approach due to the substantial damage to the pavement structure. Of Iowa's primary runways, 77% have a PCI of 70 or greater. This has decreased since the 2015 Report Card; however, 20 airports indicated improved PCI ratings from the 2015 Report Card, including eight that improved from being below 70 to going above 70.

Table 1: Targets for Each airport Service Category

Description	Commercial Service/ Enhanced Targets	General Service Targets	Basic Service Targets	Local Service Targets
Airport Reference Code	C-II	B-II	B-I or below	A-I
Primary Runway Length	Minimum 5,000 ft	Minimum 4,000 ft	3,000 ft	Not an objective
Primary Runway Width	Minimum 100 ft	Minimum 75 ft	Minimum 60 ft	Minimum 50 ft
Type of Parallel Taxiway	Full parallel	Turnarounds meetnstandards (both ends)	Exits as needed	Not an objective
Type of Runway Approach	Vertical guidance	Non-precision	Visual	Visual
Runway Lighting	MIRL	MIRL	LIRL	Not an objective
Taxiway Lighting	MITL	MITL	Not an objective	Not an objective
Visual Guidance Slope Indicator	Both runway ends (or ILS)	Both runway ends	Not an objective	Not an objective
Runway End Indentifier Lights - as required	Both runway ends (or ILS)	Both runway ends	Not an objective	Not an objective
Rotating Beacon	Yes	Yes	Yes	Not an objective
Lighted Wind Indicator	Yes - multiple as needed	Yes	If open for night	If open for night
RCO Facilities	Tower or RCO	Not an objective	Not an objective	Not an objective
Wind Coverage or Crosswind Runway	Crosswind runway or 95% wind coverage for NPIAS facilities	Crosswind runway or 95% wind coverage for NPIAS facilities	Not an objective	Not an objective
Covered Storage	100% of based aircraft	100% of based aircraft	100% of basedaircraft	Not an objective
Overnight Storage for Business Aircraft	Typical average aircraft/ business user demand	Typical average aircraft/ business user demand	Not an objective	Not an objective
Aircraft Apron	100% of average daily transients	100% of average daily transients	50% of average daily transients	Not an objective
Terminal/Administration Building	Yes	Yes	Waiting area	Not an objective
Paved Entry/Terminal Parking	Yes	Yes	Not an objective	Not an objective

Public Safety and Resilience

There are a number of safety and security items airports should maintain. A key safety concern is obstructions, which are tall, fixed objects that encroach on runway approaches. Typical obstructions can include trees, power poles, and buildings. A majority, 60%, of airports have clear approaches on at least one end of primary runway. In 2010, only 36% of airports had clear approaches on both ends of runways, but this was an improvement from 2004. Ordinances are being implemented to prevent future construction of obstruction, with zoning ordinances in place at 80% of Iowa airports. Height ordinances not only work to protect those flying out of the airport, but also the public by preventing construction of large or tall buildings close to airports. Existing obstructions are identified and evaluated as potential hazards, and from there, hazards are removed or runway thresholds must be reestablished. Obstructions that are not deemed a hazard may be marked or lit.

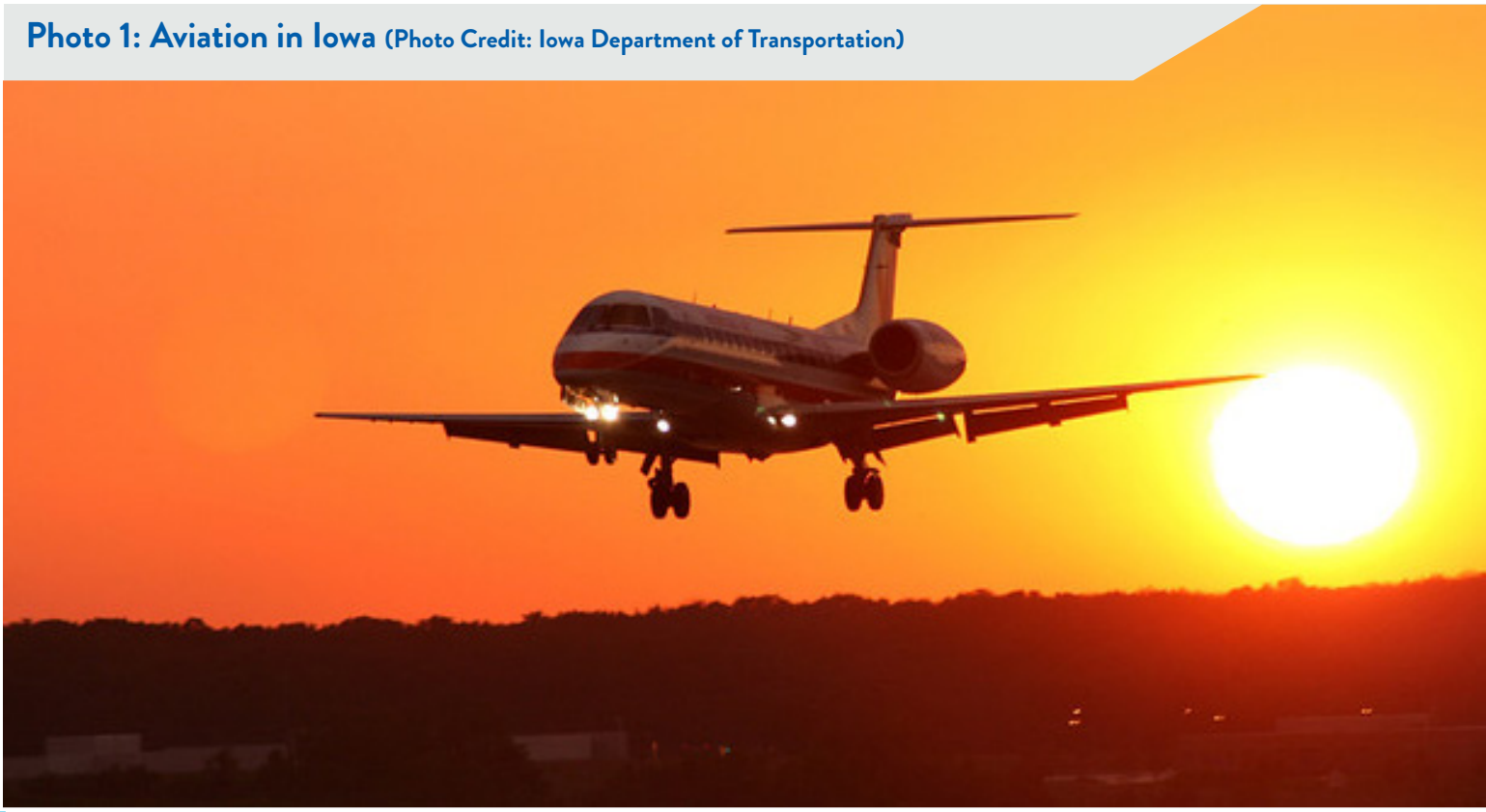
Airports in Iowa are also working with local communities to enact land use planning to maintain safe operation and meet facility targets. As previously discussed, many airports have height zoning ordinances, but only 43% have land planning use plans in place with local counties or cities.

In addition to obstructions, emergency response and security planning have an impact on public safety. While having an emergency response and security plan is a planning target for all classifications of airports, 51% of Iowa airports have emergency response plans and 66% have security plans. Commercial airports are required to have such security plan, and the DOT has been working to supply general aviation airports with a template to develop a security plan. Developing and implementing emergency response and security plans will support resiliency of airports by preventing incidents and efficiently handling if one were to occur.

Funding and Future Need

Commercial aviation has rebounded in recent years and is anticipated to continue to grow after a decline following the September 11, 2001, terrorist attacks as well as the 2008 and 2009 recessions. The biggest anticipated growth is in general aviation, as smaller jet aircraft has become feasible for more companies.

Photo 1: Aviation in Iowa (Photo Credit: Iowa Department of Transportation)



Additionally, with growing security and processing time for commercial flights, companies are looking toward company or charter flights as a practical alternative to transport people and goods.

Airport infrastructure is funded by federal, state, local, and private sources. The State Aviation Fund, established in 2008, includes revenue from aircraft registration and aviation fuel taxes. This fund provided approximately $3.8 million for airport projects and statewide safety initiatives in 2018. As part of the fuel tax increase for roads, the jet fuel tax increased by 2 cents per gallon in 2015. Airport sponsors are tasked with maintaining safe operating conditions and often must match federal or state grants for projects. All eight commercial airports are approved to collect a Passenger Facility Charge (PFC) for use on FAA approved projects. PFC funds are generated for individual commercial airports which makes more of the AIP funds available for non-commercial airports. Between 2012 and 2017, an annual average of $41 million was invested in Iowa airport infrastructure - $38 million from federal sources and $3 million from state sources. While funding is being used for maintenance and improvement at many airports, the overall condition of airport infrastructure has not significantly improved and continued maintenance and improvements are needed to continue safe operation of airports and provide new infrastructure as demand increases.

In addition to typical recommended maintenance, airports may also identify specific infrastructure needs in capital improvement plans and long-range needs assessment. The total estimated funding need is approximately $820 million over the next 20 years to meet needs that include maintaining PCI ratings, as well as meeting facility, service, and planning targets, and performing annual maintenance. The largest category of need is airside development, which includes pavement maintenance and runway construction. As seen in Figure 2, general and commercial service airports have the highest funding needs totaling about $511 million. One potential funding source could be a state implementation of passenger facility charge for commercial flights as well as larger craft flying from enhanced service or general service facilities. Funding could be spread among the facilities for maintenance as well as capital improvement and projects identified in long-range needs assessment. With increased funding at these

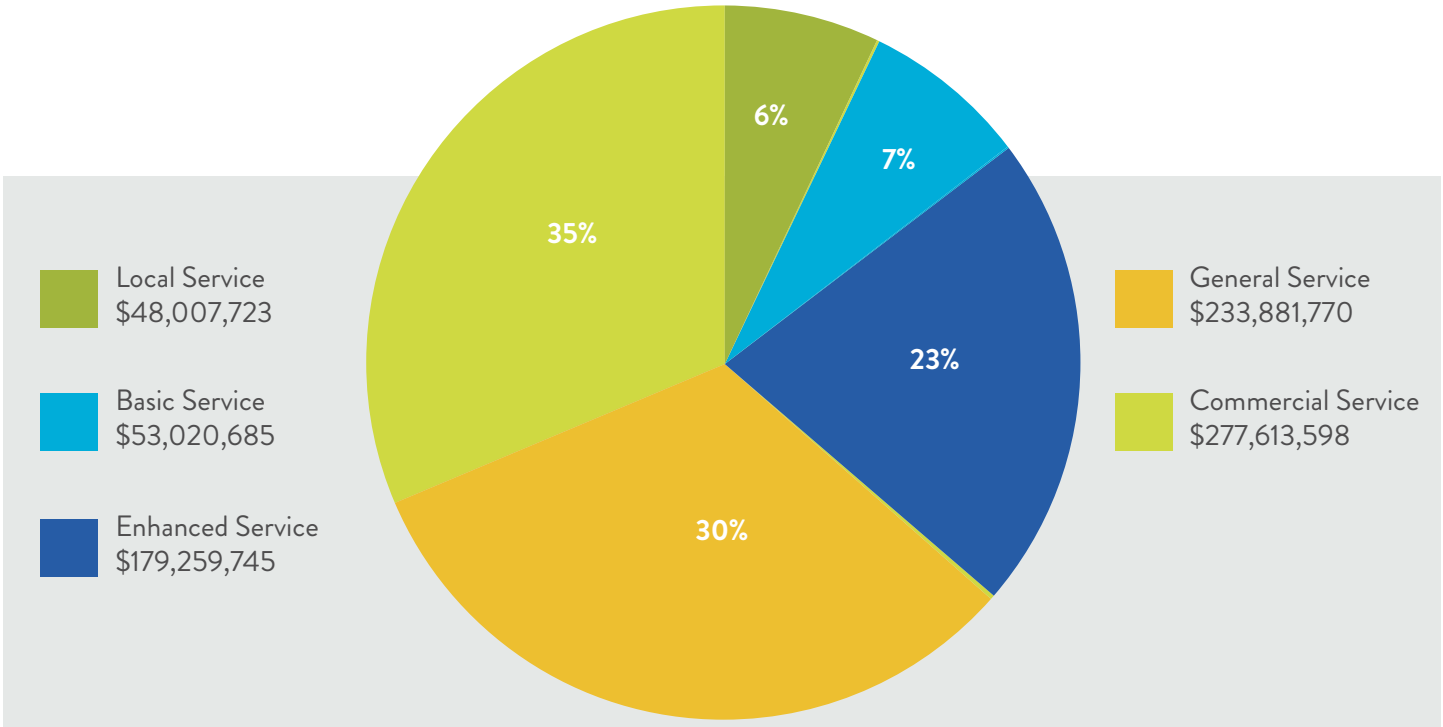


Figure 2: 2011-2030 Future Project Needs by Airport Role

Source: 2011-2016 CIP plans, LRNA plans, Mead & Hunt

facilities, more money from the state aviation fund could be allotted to basic and local service facilities.

Innovation

NextGen is the FAA-led modernization of the air transportation system. The key focus is incorporating satellites to provide more accurate, real time information to pilots and air traffic controllers, which will provide safer and more efficient travel. NextGen system implementation began in 2007 and is targeted for completion in 2025. Most of the foundational infrastructure has been implemented, and supplemental features are being developed and implemented now.

As sustainable practices and responsible energy consumption becomes more emphasized, airports look to incorporate green building design as part of facility upgrades. Geothermal heating/cooling and automatic building controls can maintain the temperature of buildings with decreased dependence on outside energy sources and improved maintenance of temperature while building is unoccupied. Light emitting diode (LED) lights are being installed in buildings and there is ongoing investigation into incorporation of LED applications in runway lighting.

Photo 2: Aviation in Iowa (Photo Credit: Iowa Department of Transportation)

Recommendations

To maintain the airport system in Iowa:

- Pavement management activities and inspection should remain at the current schedule. Maintenance should push to a more accelerated schedule to improve condition before complete pavement repair is required.
- At a minimum, funding must continue, if not increase, for maintenance.
- Investigate state PFC for commercial and business aircraft or other funding source to secure money for maintenance and improvements at commercial, enhanced, and general service airports.
- Identify, evaluate, and remove obstruction at runway approaches.
- Increase the quantity of airports, focusing particularly on the commercial, enhanced, and general service airports that meet 100% of the state aviation system plan facility targets, identified for commercial service, enhanced service, general service, basic service, and local service airports in Table 1.
- Ensure funding is secured on a state and federal level for continued implementation of NextGen system.
- Provide incentive or requirement for inclusion of green building construction and building systems when state and federal funding is used for facility improvements.

Resources

Uses and benefits of aviation in Iowa (2009 Economic Impact report): https://iowadot.gov/aviation/aviation-in-iowa/aviations-impact-on-iowas-economy

Iowa Aviation System Plan 2010-2030: https://iowadot.gov/aviation/studiesreports/systemplanreports

FAA National Plan of Integrated Airport Systems: https://www.faa.gov/airports/planning_capacity/npias/

FAA Terminal Area Forecast, FY 2017-2045: https://www.faa.gov/data_research/aviation/taf/media/taf_summary_fy_2017-2045.pdf

Sioux County Regional Airport Open for Business: https://www.ksfy.com/content/news/Sioux-County-Regional-Airport-open-for-business-500543591.html

Iowa airports hope to land millions in state funding: https://www.radioiowa.com/2019/03/04/iowa-airports-hope-to-land-16-5-million-in-state-funding/

General Aviation Airports: A national asset: https://www.faa.gov/airports/planning_capacity/ga_study/media/2012AssetReport.pdf

About the DOT; Aviation Funding: https://iowadot.gov/about/AviationFunding

Office of Aviation; State Funding Programs: https://iowadot.gov/aviation/airport-managers-and-sponsors/State-Funding/state-funding-programs

Airport Improvement Program (AIP) Grand Histories: https://www.faa.gov/airports/aip/grant_histories/#history

NextGen: https://www.faa.gov/nextgen/where_we_are_now/

BRIDGES

D+

Executive Summary

There are approximately 24,087 bridges in Iowa, the seventh largest number of bridges in any state in the nation. The Iowa Department of Transportation (DOT) owns 4,130 bridges, counties own 18,759 bridges, and cities own 1,165 bridges. Bridges, along with the roadway system, significantly impact Iowa's economic competitiveness. Iowa is first in the nation with the number of structurally deficient bridges, with just under 20% structurally deficient in 2018. Reducing the number of bridges with key elements in poor or worse condition is a priority for the Iowa DOT, counties, and cities. Many of the bridges in poor condition are owned by counties and require significant funding for maintenance and improvement. Additionally, Iowa's bridges are aging, which contributes significantly to higher maintenance costs. In 15 years, half of the bridges on the state highway system will be at least 50 years old. Fortunately, Iowa lawmakers acted in 2015 to provide enough funding for critical highway and bridge needs, and the system is just now beginning to see signs of investment. However, significant portions of the system must eventually be addressed that are not critical at this time.

Background

Inspection data on bridges is compiled by the Iowa DOT and information is submitted to the Federal Highway Administration (FHWA). The FHWA records this information in the National Bridge Inventory (NBI) database. Structures included in the NBI are bridges on public roads. Bridges not part of the NBI are those structures owned by railroads, toll bridges, as well as privately owned and pedestrian bridges. Although not part of the NBI, toll and privately-owned bridges are inspected in the same manner and inspection records are submitted to the FHWA.

The FHWA defines a bridge as any structure including supports erected over a depression and/or obstruction, such as water, highway, or railway and possessing a track or passageway for carrying traffic or other moving loads, as well as having an opening measured along the center of the roadway of more than 20 feet. Inspections on bridges are performed during a 24-month cycle or less. Data collected is used to calculate the sufficiency rating, determine structural deficiency, and Good-Fair-Poor ratings for a particular structure. Definitions and information regarding sufficiency rating, structural deficiency and Good-Fair-Poor ratings are explained in more detail in the Condition section of this report.

Photo 1: Interstate 74 Bridge in Davenport, Iowa

Capacity

Capacity is the ability of a bridge structure to convey vehicles and people without causing delays in the transportation system. Bridges can act as bottlenecks in certain circumstances which can be time consuming and costly for the traveling public and freight traffic. Although congestion is not a major concern in Iowa, traffic volumes have steadily been increasing. Passenger vehicle miles traveled (VMT) on Iowa roadways has increased 42% between 1990 and 2015. If these trends continue, congestion will become more problematic without an increase in structure capacity.

Additionally, there are 3,575 posted bridges within the state and another 733 restricted bridges. Posted structures are often bridges that have a weight restriction while restricted bridges are those that limit traffic on the structure a certain number of vehicles at any one time.

Condition

The condition of a bridge is the physical ability of the structure to carry design loads. An evaluation of the structure by qualified personnel based on a ratings system is required by the FHWA for bridges or culverts longer than 20 feet. These inspections must be done at least once every two years.

The Iowa DOT has created a Bridge Condition Index (BCI) rating, which takes into account the structural condition of the bridge, load carrying capacity, horizontal and vertical clearances, width, traffic levels, type of roadway the structure services, and the length of out of distance travel if the bridge is closed. The BCI is not the same system the FHWA uses for determining the physical condition of a bridge. The BCI was designed to produce a rating more sensitive to changes in condition compared to the FHWA ratings. All state-owned and locally-owned bridges in Iowa have been rated using this system. The BCI is a value from zero to 100, with 100 being the best condition. The Iowa DOT rates a bridge as Good, Fair, or Poor using the BCI ranges in Table 1.

A good rating indicates the bridge is sufficient for current traffic and vehicle loads. A fair rating does not have a specific definition other than not falling under the extremes of good or poor. A poor rating means a bridge is not necessarily unsafe, but it should be considered for repair, replacement, restriction posting, weight limits, or inspecting on a more frequent basis. Table 2 shows the number of Good, Fair, and Poor bridges in Iowa organized by ownership.

Another common method to measure the condition of a bridge is a determination of whether it is structurally deficient. Bridges are considered structurally deficient if significant load carrying elements are found to be in poor or worse condition due to deterioration and/or damage or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to point of causing intolerable traffic interruptions. A deficient bridge does not immediately imply it is likely to collapse or is unsafe. Unsafe conditions may be identified with hands-on inspection and if the bridge is determined to be unsafe, the structure must be closed. When a deficient bridge is left open to traffic,

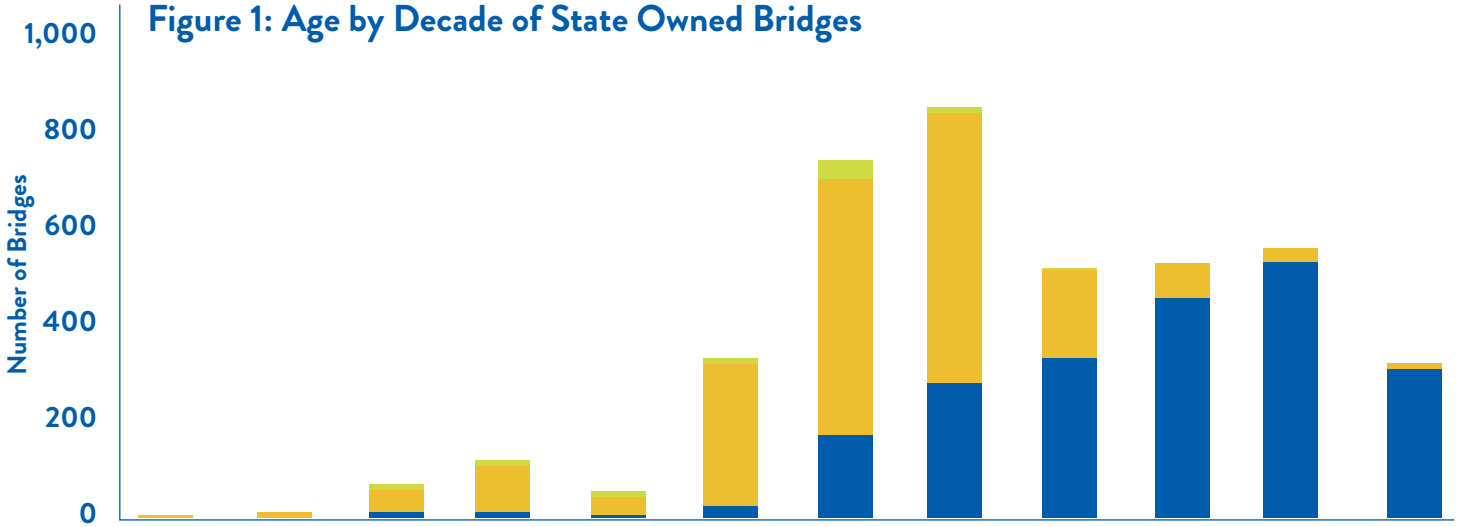
Table 1: Bridge Condition Index Range

Good	≥ 70
Fair	Between 37.5 and 70
Poor	≤ 37.5

Table 2: Good, Fair, and Poor Bridges

	State Owned	County Owned	City Owned
Good	1,997 (48%)	6,695 (36%)	473 (41%)
Fair	2,119 (51%)	7,641 (41%)	489 (42%)
Poor	43 (1%)	4,427 (23%)	203 (17%)
Total	4,159 (100%)	18,763 (100%)	1,165 (100%)

Figure 1: Age by Decade of State Owned Bridges



	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Poor	0	0	7	7	7	6	13	2	1	0	0	0
Fair	6	7	67	110	57	281	617	606	240	102	16	10
Good	1	0	7	7	6	28	145	205	334	412	524	328

it typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. To remain in service, structurally deficient bridges are often posted with weight limits to restrict the gross weight of vehicles the bridges can carry to less than the maximum weight typically allowed by statute.

Structurally deficient bridges generally do not affect small vehicles, but they do affect larger vehicles such as trucks, school buses, fire engines, and farm equipment. In Iowa, there are 4,673 structurally deficient bridges - just under 20% - placing Iowa first in the nation for the number of structurally deficient structures.

Figure 1 shows the age of state-owned bridges by decade and their Good-Fair-Poor rating. The bridges built 50 to 60 years ago (in the 1950s, 1960s and early 1970s) had 50-year design lifespans, while modern bridges have 75-year design lifespans. Approximately every five to 10 years, an additional 500 bridges will reach an age of 50 years. The average age of a structurally deficient bridge in Iowa is 72 years.

Safety

A bridge deemed structurally deficient may be posted for weight limits for the bridge to remain in service. If a bridge is considered unsafe it is closed to traffic. There are currently 4,308 bridges posted or restricted to a number of vehicles on the bridge at any one time. This number represents approximately 18% of the total number of bridges in the state. Due to the posting system these bridges do not pose an immediate threat to the public, but this data is an indication of an aging system in which safety must be addressed.

Many of the bridges in the secondary, or rural areas, are undersized for the types of vehicles currently using them which poses a definite safety hazard. Approximately 99% of the structurally deficient bridges, and 99% of the posted and restricted bridges, in the state are located on the county and city systems. While not all of these deficient and posted bridges are an immediate threat to the traveling public, a failure of these structures can be detrimental as illustrated in the photo below.

Iowa has many bridges that cross waterways. These structures are subject to a process known as scour. Scour is the erosion of streambed and bank material due to flowing water. The removal of this material near bridge abutments and piers can cause bridge failure and when enough material is removed to cause the unstable bridge foundations, the bridge is categorized as scour critical. Scour is the primary cause of bridge failure in the nation. Iowa has eight scour critical bridges on the state system and there are additional bridges with unknown foundations that may be scour critical. There are 500 total scour critical bridges within the city and county system. Virtually all scour critical bridges on the state system have scour countermeasures installed to prevent scour from occurring or to lessen its impact to a bridge. Within the last 20 years, only four bridges in the state are known to have failed due to scour. Damage to a bridge abutment due to scour is shown in Photo 3.

Photo 2: Bridge Failure

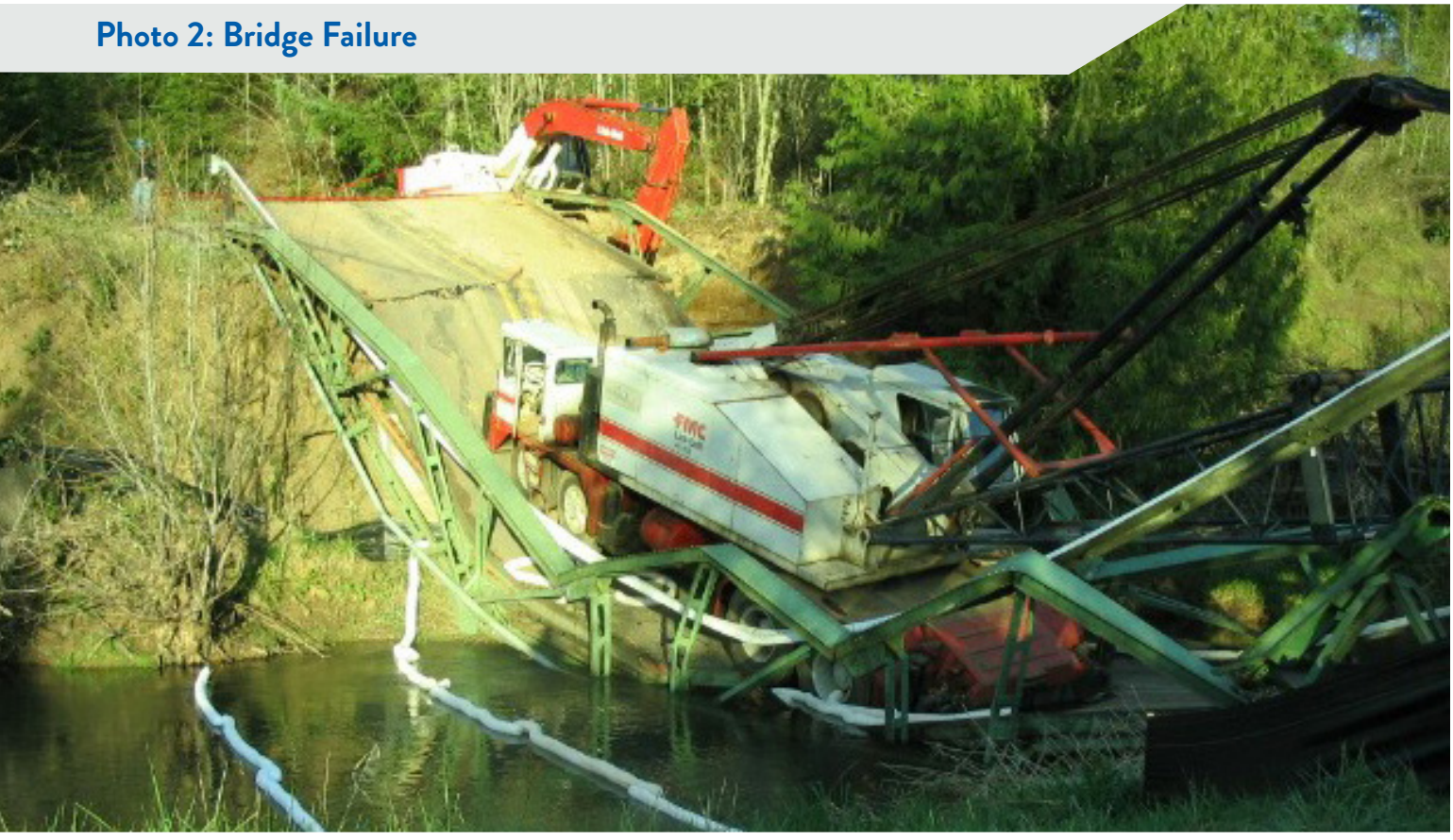
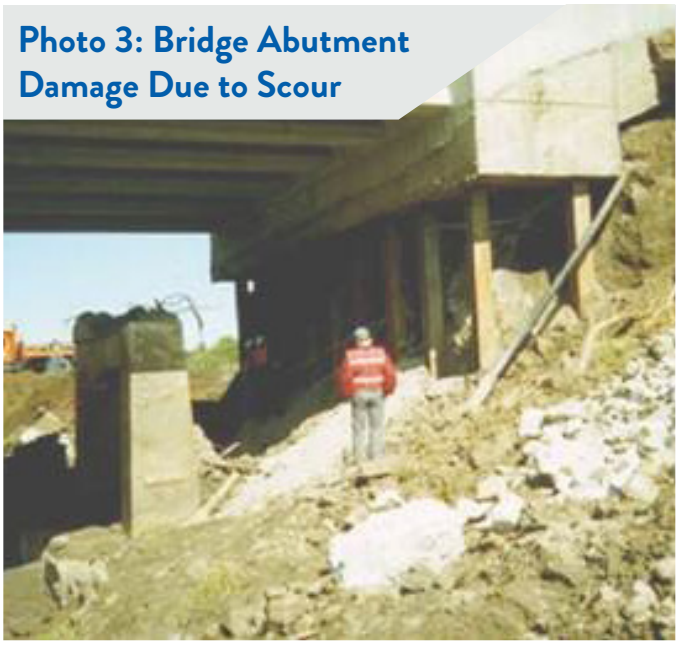


Photo 3: Bridge Abutment Damage Due to Scour



Funding

The Iowa DOT has developed a Transportation Improvement Program which outlines the projects planned over a five-year period on the primary and interstate systems. The current program covers fiscal years 2019 through 2023. Funding for the Transportation Improvement Program comes from federal, state, and local sources.

A significant portion of funding for the Transportation Improvement Program comes from the federal government, based on the current federal authorization bill, Fixing America's Surface Transportation (FAST) Act, which was signed into law on December 4, 2015. This bill provides funding through September 30, 2020. Based on the provisions of this bill, federal funding for roads and bridges in Iowa is expected to increase 14.7%. In dollars, the FAST Act provided an additional $25 million in funds from 2015 to 2016 and an additional $10 million per year through 2020.

Funding for bridge and roadway improvements is also derived from state revenues. The Road Use Tax Fund (RUTF) and the Transportation Investment Moves the Economy in the 21st Century (TIME-21) Fund are two means by which transportation projects are funded within the state.

The revenue to the RUTF and TIME-21 is obtained from sources listed in Table 3.

Table 3: Revenue Sources for RUFT and TIME-21 Is Obtained from the Following Sources

Funding Source	FY 2017 (estimated)	Percent of Total	State Constitution Requires Funds be Used Only for Roads?
Fuel Tax	$671 million	41%	Yes
Annual Registration Fee	$550 million	34%	Yes
Fee for New Registration	$340 million	21%	Yes
Other*	$75 million	4%	No
Total	$1.64 billion		

*Driver's license fees, title fees, trailer registration fees and other miscellaneous fees
Source: Iowa DOT-Offices of Program Management and Systems Planning

The Iowa Constitution requires 95% of all revenue contributed to the RUTF and TIME-21 funds to be spent on public roadways and diversion of these funds to other programs is prohibited.

RUTF revenue is distributed as follows: 47.5% to the primary system, 32.5% to the secondary system, and 20% to the cities. TIME-21 revenue is distributed as follows: 60% to the primary system, 20% to the secondary system, and 20% to the cities.

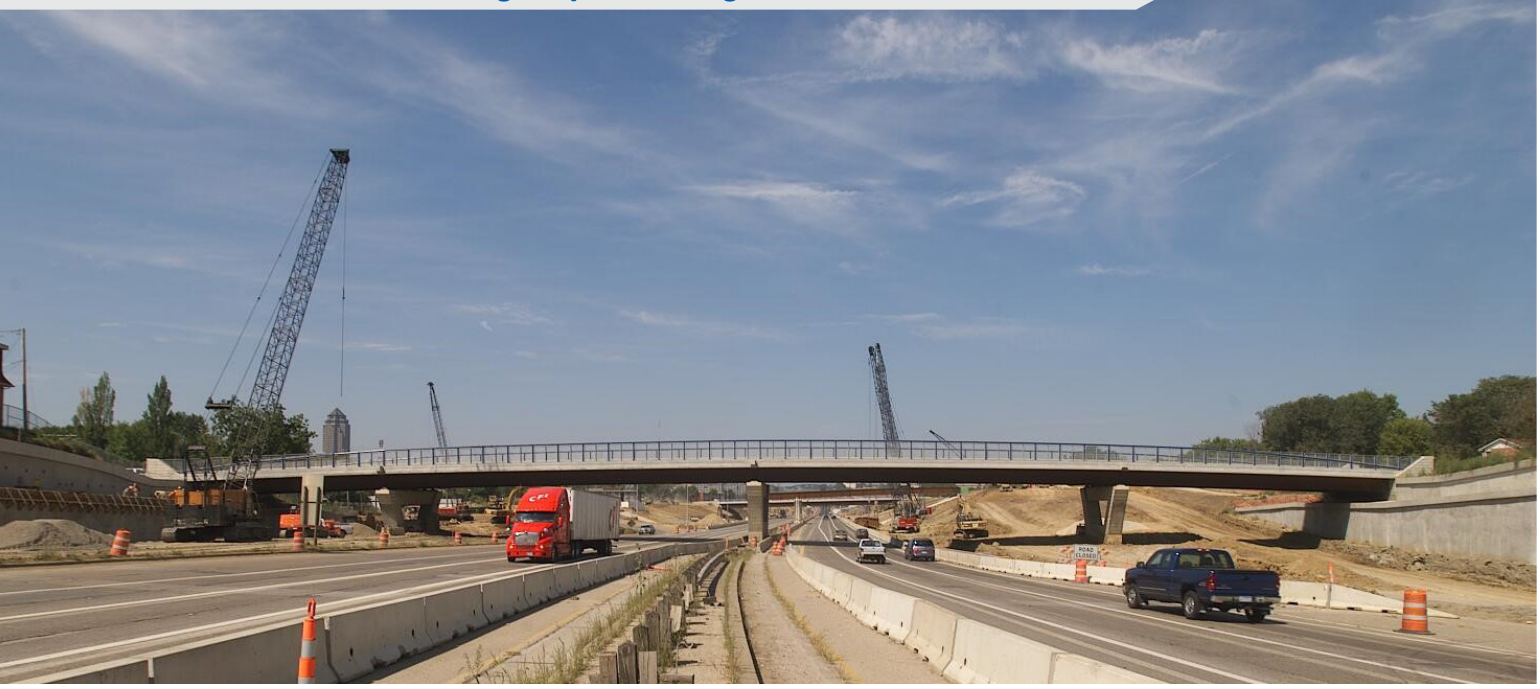
To shore up available funding for both RUTF and TIME-21, the Iowa State Legislature increased the state motor fuel excise tax rates in 2015 with the passage of Iowa Senate File 257. This bill contained many provisions but the most significant was the increase of fuel tax rates by 10 cents per gallon. An additional $220 million was generated in FY 2016 and 2017, which is put toward road and bridge repairs in the state. This is higher than the initial estimate from the state legislature that Senate File 257 would bring in $215 million annually.

Thanks in part to the additional funding from Senate File 257, Iowa DOT estimates $1 billion will be spent on Iowa's state-owned bridges from 2019 to 2023. Currently, the agency spends approximately $80 million per year on replacement, rehabilitation, and repair for bridges on the primary system, but expects funding will be ramped up in the near future. Of the current amount, DOT typically allocates 70 to 74% for replacements, 9 to 23% for rehabilitation and seven to 17% for maintenance. Counties, meanwhile, spend approximately $100 to $200 million per year on replacement, rehabilitation, and repair for their bridges.

Every four years, Iowa DOT is required to assess the ability of existing revenues to meet the needs of the system and submit its findings to the State Legislature. The most recent study, compiled in 2016, found passage of Iowa Senate File 257 effectively closed the critical funding shortfall last identified as $215 million per year in the 2011 RUTF Study. In addition, the increase in federal funding offset the lost buying power since the tax increase was enacted which further enabled the critical needs to be addressed.

However, while critical needs across the transportation system are being met, significant portions of the system must eventually be addressed that are not critical at this time. Bridge conditions will continue to deteriorate across the network. Additionally, bridges owned by municipalities and counties are more likely to fall into the poor range and will require significant funding to remove their structurally deficient rating.

Photo 4: Interstate 235 Highway and Bridge Reconstruction



Recommendations

- Obtain funds and create more refined management systems to address the needs of the bridges that will be at least 50 years old within the next few years.
- Maintain focus on repair and/or replacement of the most structurally deficient bridges.
- State funding should be required to be adjusted for inflation.
- Electric and hybrid vehicles cause the same wear and tear on the roadway and bridge system but they contribute less towards maintenance than gas and diesel fueled vehicles. As hybrid and electric vehicles become more common, an alternate means of funding beyond the gas tax must be created, so such vehicles pay their fair share of the burden. A means to accomplish this is the implementation of a mileage-based user fee in which a tax is levied based on the number of vehicle miles traveled. A pilot program should be created in which a study would be done to determine the best way to enact the user fee system.
- Continued use of innovative technologies such as accelerated bridge construction, nondestructive testing, and structural health monitoring should be used to improve project delivery and better evaluate the condition of existing bridges.

Resources

Iowa Department of Transportation, Iowa In Motion 2045, State Transportation Plan, May 9, 2017 (https://iowadot.gov/iowainmotion)

Iowa Department of Transportation, 2016 Road Use Tax Fund (RUTF) Study, December 30, 2016 (http://publications.iowa.gov/23228/)

Iowa Department of Transportation, Iowa Strategic Highway Safety Plan 2017 (https://iowadot.gov/systems_planning/pdf/12-5-17-SHSP.PDF)

Iowa Department of Transportation, Transportation Asset Management Plan, November 2016

Federal Highway Administration, 2015 Status of the Nation's Highways, Bridges and Transit: Conditions and Performance (https://www.fhwa.dot.gov/policy/2015cpr/)

Iowa Department of Transportation, 2019-2023 Iowa Transportation Improvement Program, June 2018 (http://publications.iowa.gov/27714/)

Iowa Department of Transportation, Annual Bridge Report, 2018 Bridge Status

Iowa Department of Transportation, Office of Bridges and Structures

The Cedar Rapids Gazette, "Gas tax hike pumps half a billion into Iowa road projects", November 18, 2017

DAMS

Executive Summary

There are currently 4,018 Iowa dams in the U.S. Army Corps of Engineers' National Inventory of Dams and more than 100 additional dams listed on the Iowa Department of Natural Resources (DNR) Dam online database. Approximately half of dams in the state are privately owned. Iowa's State Dam Safety Program budget is below $50 per regulated dam, much lower than the national average of $700 per regulated dam. Less than 30% of the state's high hazard potential dams have emergency action plans, compared with approximately 70% nationwide. Iowa does not have a state loan or grant program to assist dam owners with rehabilitation projects and many structures are aging beyond their original design life. Additional factors such as accumulating sediment in reservoirs behind dams, increasing public risk exposure (based on population growth-related increases in recreation and development), and climate change related increases in flood frequency and severity are adding urgency to improve the state of Iowa's dams, or remove them where appropriate.

Introduction

Many of Iowa's dams serve useful purposes including flood control, recreation in reservoirs, water supply (for irrigation, drinking water, fire control, etc.), power generation, and more. However, there are many vestigial dams in Iowa that are no longer needed for their original purpose (small scale power generation, grain milling, etc.), and create public safety hazards, owner liability, unnecessary maintenance expenses, impaired ecological conditions, and public safety hazards.

Condition

There are 4,018 Iowa dams in the U.S. Army Corps of Engineers' 2018 National Inventory of Dams (NID) and 4,142 dams listed in the Iowa DNR Dam online database, about half of which are privately owned (see Figure 1). Of Iowa's dams, 96 (2.5%) are classified as "high hazard," according to the Iowa DNR database (a designation based on height, location, and volume detained, it is NOT a condition assessment), 239 are "significant hazard," and the rest are "low hazard."

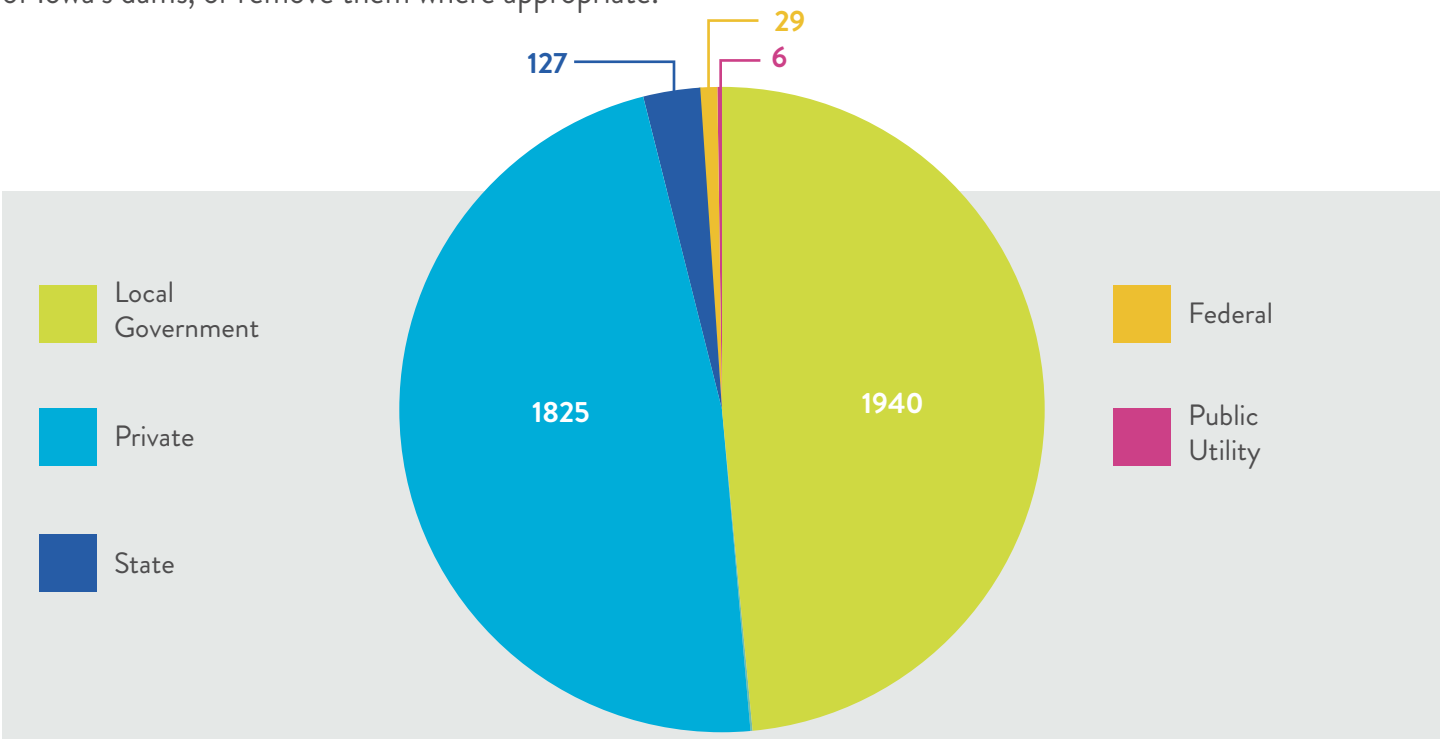


Figure 1: Dams by Primary Owner Type

Source: Iowa Department of Natural Resources

Like all infrastructure, dams are subject to regular wear that requires periodic inspection and maintenance to ensure proper function and safe operation. Unlike most infrastructure that has the potential to affect the safety and welfare of the general public, such inspection and maintenance are the primary responsibility of the dam owner. With half of Iowa's dams privately owned, this means safety of the public downstream is often in the hands of private entities. This public-private risk factor creates the need for stringent condition monitoring, oversight, and maintenance standards. Despite this need, less than 10% of Iowa dams are regularly inspected – high hazard dams are inspected every two years and all other major dams are inspected every five years. Major dams include all high hazard dams, as well as any significant dams and low hazard dams that meet specific size, potential hazard, or public importance thresholds.

The Iowa Department of Natural Resources Dam Safety Program has regulatory authority for the large majority of the state's dams, and in 2018 the Program released the draft Dam Safety Rule Updates, which are currently pending approval by the Environmental Protection Commission. The Rule Updates propose modifications to the state's Program, including:

Update the size of dams that fall under the Program's authority, to match the standards in the National Dam Inventory;

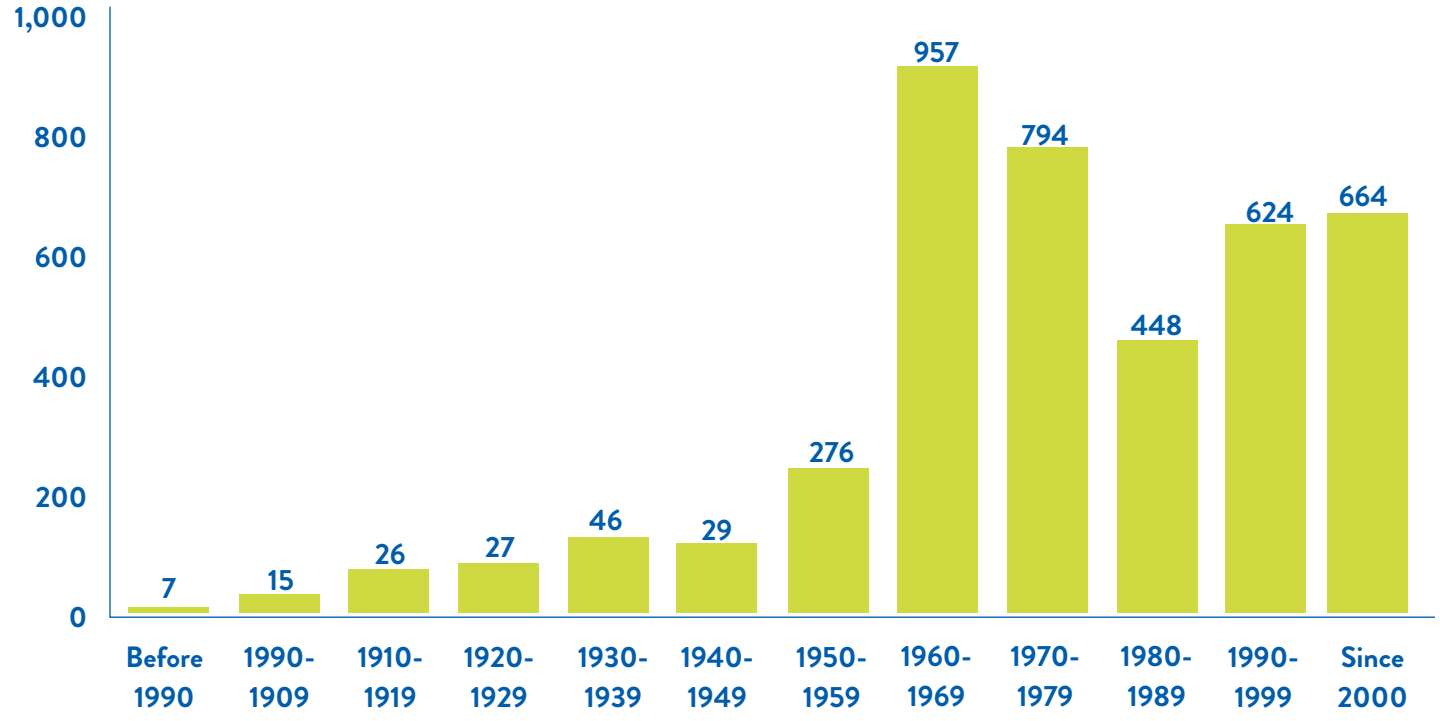
Require Emergency Action Plans for all High Hazard Dams;

Less prescriptive dam design requirements and allowing dam designers to use national standards as appropriate; and

Allows for reduced freeboard designs in some specific situations, based on specific analysis.

Dams are typically designed to be in service for approximately 50 years (35 to 100 depending on the design) before major maintenance, replacement, or removal is expected. This means that approximately half of Iowa's dams may be currently exceeding their intended design life, with another 10 to 20% added to that list with each coming decade, see Figure 2.

Figure 2: Dams by Completion Date



Source: Iowa Department of Natural Resources

The condition of Iowa's dams are included in Table 1.

Table 1: Condition of Dams

Condition	All Dams[1]	High Hazard Dams[2]
Satisfactory	272	80
Fair	40	16
Poor	13	3
Unsatisfactory	5	0
Not Rated[3]	3,809	0

1 - According to the Iowa DNR Online Dam Inventory
2 - According to the 2018 National Inventory of Dams
3 - "Not Rated" means not inspected in the last 10 years

These condition assessments are defined as:

Satisfactory – No existing or potential dam safety deficiencies are recognized;

Fair – No recognized deficiencies for normal loading conditions, however rare or extreme events may result in a deficiency;

Poor – A dam safety deficiency is recognized and remedial action, or further investigation is necessary;

or

Unsatisfactory – A dam safety deficiency is recognized that requires immediate or emergency remedial action.

Capacity

Dams intended for water supply preservation and flood control are typically designed for specific impoundment volumes in the reservoirs upstream, based on intended use forecasts and historical river discharge observations. Currently, the capacity of such dams is under the dual threat of reduced volume due to sediment accumulation and rapidly changing discharge due to increasing flood frequency and severity. These incidents are punctuated by changes in drought frequency (which can adversely impact shallow reservoirs intended for recreational purposes). While the effects of climate change vary by region within the state, the general expectation for Iowa is a warmer, wetter trend with larger increases in precipitation expected for the eastern part of the state as compared to the western region, with a marked increase in rainfall intensity and large precipitation events.

Iowa is largely an agricultural state with much of the rural landscape converted to cultivation of annual row-crop grains. While adoption of farming methods focused on soil conservation is growing rapidly, soil loss by erosion is a significant and continuous concern. After eroding from the landscape, the soil is transported into creeks and rivers, and remains suspended in flowing water until the velocity slows enough to halt further transport, where the particles settle to the bottom. This sedimentation process occurs naturally in water bodies, especially river deltas which are artificially simulated at the upstream end of reservoirs behind dams. Most reservoirs in Iowa are losing water detention capacity as the volume is filled by sediment. While sedimentation does reduce the consequences of dam failure, volume lost to sedimentation is value lost for the dam, if the original intent was for water supply or flood control impoundment. Reservoirs can be dredged to remove the sediment; however, the process is prohibitively expensive for all but the most critical cases.

Operations and Maintenance

An Emergency Action Plan (EAP) identifies potential emergency conditions at a specific dam site and lists pre-planned actions to be followed to help mitigate the disastrous effects of an emergency event. Iowa's Dam Safety officials continue to make progress developing EAPs for high hazard dams, however the number that do have EAPs is still less than 30%, compared with approximately 70% nationwide. They

have also completed inundation mapping (available online) for 60 of the 88 state regulated high hazard dams.

The state does not currently require EAPs for all Iowa dams. Upon final approval by the Environmental Protection Commission, the Rule Updates will require all high hazard dams have EAPs - a critical improvement to protecting the public. Until then, Iowa remains below national averages in state authority related to legislation, inspection, enforcement, Emergency Action Planning and response, permitting, education and training, as well as public relations.

Funding

Many states have loan or grant programs to assist dam owners with rehabilitation projects. Iowa has no such program. In its absence, much of the routine maintenance or rehabilitation needed to modernize dams, complete spillway repairs, remove problematic vegetation, and fix seepage problems may be deferred or not be completed at all.

According to data from the Association of State Dam Safety Officials, Iowa's state budget for its Dam Safety program per regulated dam is a fraction of the national average. The national dam safety budget average is about $700 per regulated dam while Iowa's budget is below $50. For each high hazard dam, the national dam safety budget is about $5,000, while Iowa's budget is about $1,400 (data from 2017, the most recent available).

Future Need

It is critical that the Iowa Environmental Protection Commission approve the 2018 Rule Updates to protect public safety, especially for high hazard dams. It is also essential that the State's Dam Safety Program funding be increased - not just for inspections, but also for enforcement and increasing analysis of existing dams to compare their design to modern criteria. The 2017 Oroville Dam spillway failure in California showed that inspections alone are not enough. A State Revolving Loan Fund or other loan program would be an important low expense mechanism to improve dam safety and bring Iowa in line with most other states.

The Lake Delhi dam failure in July 2010 is a stark reminder of the dramatic impact a dam failure can exact on the state, local community, and private citizens. With an estimated $12 million in repair costs, $50 million in property damage, and another $120 million in economic losses, the Lake Delhi area felt the effects of that dam failure for years following the disaster. While the dam and affected properties have now been restored (as of 2018), this dam failure makes a case that adequate resources and funding need to be established in Iowa to avoid additional dam failures in the future.

Resilience

Increasing flood frequency and severity associated with climate change is adding new importance to the concept of infrastructure resiliency for assets near rivers and streams. To make infrastructure more resilient, critical-route bridges are built higher, primary storm drains are designed larger, and levees are raised above the original design height to protect communities developed around waterways that previously had lower and less frequent flood events. Unfortunately, modifying a dam to address increasing river flows is not so simple. Raising the height of a dam to reduce flooding downstream increases the flood elevation and flooded area upstream. Decreasing a dam's height to prevent increasing upstream inundation reduces the dam's original design utility and may increase the severity of flooding downstream.

Resilience-based improvements to dams are typically treated on a case-by-case basis depending on a wide variety of risks and benefits. Generally speaking, the first line of infrastructure resiliency is consistent inspection and maintenance. Implementing the draft Rule Updates, followed by increasing funding for inspection and maintenance would lead to increased resilience. In many cases the most sustainable improvement for resiliency may be the removal of the dam if it no longer serves its original purpose, which would allow the river to return to a more natural state and permanently eliminate an unnecessary maintenance burden.

Public Safety

Dams inherently pose numerous public safety risks and owner liability concerns, which are exacerbated by inadequate funding for dam maintenance, inspection, emergency action planning, and mitigation or removal. Specifically, risks to public safety posed by dams include structural dam failure, flooding induced by mechanical failures of dam appurtenances (accessory parts), uncontrolled overtopping during flooding, and recreational hazards posed by low head dams. Additional risks can include public health issues associated with stagnant water in reservoirs, nuisances such as blockage of fish migration routes or harboring of invasive species in reservoirs, among others.

There have been 172 dam related fatalities in Iowa since record keeping began in the early 1900s, with the trend being relatively constant at just under two per year. While most fatalities are accidental, many recreational injuries and fatalities occur because citizens underestimate the dangerous recirculating currents present at low head (aka roller) dams and dam outfall structures. Indeed, low head dams have earned the nickname "drowning machines" by industry officials, partly to serve as a warning to recreationists, and partly because so many dam-related fatalities occur on low head dams where the low, rolling structures don't typically appear life-threatening.

Innovation

Many smaller low head dams on Iowa's waterways are vestigial remnants of previous uses (such as grain or timber mills) and no longer serve their original purpose. These dams present a public safety hazard, impediment to fish migration and ecological continuity, as well as ongoing unnecessary maintenance burdens. Retiring dams from service, also a nationwide trend, is driving an overall movement toward dam mitigation in Iowa. This includes modifications to reduce the hazard or complete removal of the dam and restoration of the natural river channel.

Since 2008, a total of 21 hazardous low head dams have already been mitigated or removed across Iowa. The option to innovatively re-purpose vestigial low head dams and transform the hydraulic head differential into recreational amenities is creating an encouraging, value-added economic incentive for Iowa communities. Manchester, Charles City, and Elkader, among others, have removed or modified their dams, and created entirely new recreation economies and river based public park spaces in their wake. Dam conversions carry the additional benefits of removing the former safety hazard, reducing maintenance, reconnecting fish passage and ecological corridors, and improving water quality. The Iowa Dam Mitigation Manual lists 82 dams that have strong potential for removal or mitigation based on both ecological and safety/navigation benefits (50th percentile or greater based on specific factors).

Photo 1: Pinicon Ridge Park Dam in Central City, Iowa - Low Head/Roller Dam (Photo Credit: Nate Hoogeveen, Iowa DNR)

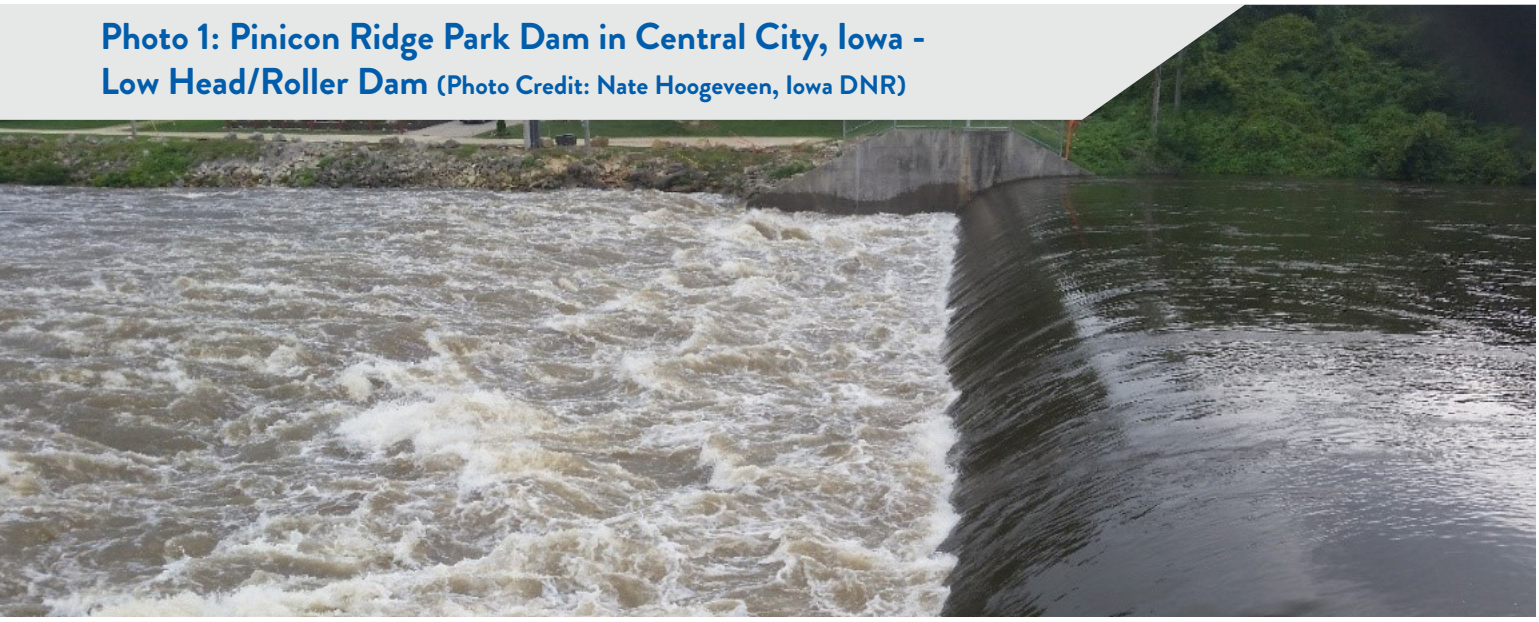


Photo 1: Manchester, Iowa's Former Dam Site, After Conversion to a Public Recreational Amenity (Photo Credit: Iowa Rivers Revival)

Recommendations

- Develop and implement Emergency Action Plans for all high hazard dams in the state.
- Increase state funding for dam inspection, Emergency Action Plan development, analysis and enforcement to levels that match or exceed the national averages.
- Implement a State Revolving Fund for repair and maintenance of dams owned by cities, counties, and private entities (the vast majority of dams in Iowa).
- Increase funding and create a separate revolving fund program for the state water trails program and dam removal, mitigation, and safety improvements.
- The Environmental Protection Commission should approve the draft 2018 Iowa Dam Safety Rule Updates.
- Expedite the removal of vestigial dams that pose risks to public safety, obstruct navigation, create liability for owners, and create unnecessary ecological discontinuity.

Resources

Iowa DNR Dam Safety Program – multiple websites

IDNR – DSP - Jonathon Garton, PE (personal communications)

Iowa DNR Rivers Program – Multiple websites

National Inventory of Dams - Iowa, United States Army Corps of Engineers

Dam Safety Performance Report – Iowa, Association of State Dam Safety Officials, 2018

Iowa Rivers Revival – Images and data

American Rivers – General data

Reconnecting Rivers: Natural Channel Design in Dam Removal and Fish Passage, Minnesota DNR, 2010

Iowa Whitewater Coalition – Iowawhitewater.org – Dam related fatality data

The Gazette – 2018-12-07 – Iowa gives new life to rivers by removing over 20 dangerous dams

DRINKING WATER

C

Executive Summary

Iowa's drinking water supply infrastructure is in fair condition. Funding for system operation and maintenance is generally sufficient, but additional revenue is needed to enable water distribution system replacement and treatment plant modernization. Rural water systems are relatively new in Iowa and generally have distribution systems less than 50 years old. However, in some municipal water systems, more than 50% of the distribution systems are 50 years or older, and some systems have pipes in excess of 100 years old. Older infrastructure requires increased funding for regular maintenance. Surface and groundwater sources are seeing excessive nutrient concentrations and will need to be addressed. Groundwater sources are also at risk of overuse, and approaches need to be implemented to provide continued long term use.

Capacity

The Iowa Department of Natural Resources (DNR) defines a public water supply system (PWS) as a system that provides water to the public for human consumption, has at least 15 service connections, and regularly serves an average of at least 25 individuals daily for a minimum of 60 days out of the year.

A PWS is further classified as a community water system, a non-transient non-community system, or a transient non-community system:

A community water system (CWS) is a PWS that meets the above definition for year-round residents. CWS examples include municipalities, unincorporated towns, subdivisions, and mobile home parks.

A non-transient non-community water system (NTNC) is a PWS that regularly serves at least 25 of the same people four hours or more per day, for four or more days per week, for 26 or more weeks per year. Examples of these systems are schools, day-care centers, factories, and offices. Other service-oriented businesses, such as hotels, resorts, hospitals, and restaurants, are classified as an NTNC if they employ 25 or more people and are open for 26 or more weeks of the year.

A transient non-community water system (TNC) is a PWS other than a CWS or NTNC that regularly serves at least 25 individuals daily at least 60 days out of the year. TNC examples are highway rest areas, bars, restaurants with fewer than 25 employees, golf courses, camps, and parks.

Iowa's drinking water infrastructure is comprised primarily of small systems. Of the state's public water suppliers, 93% serve less than 3,300 people. See Table 1.

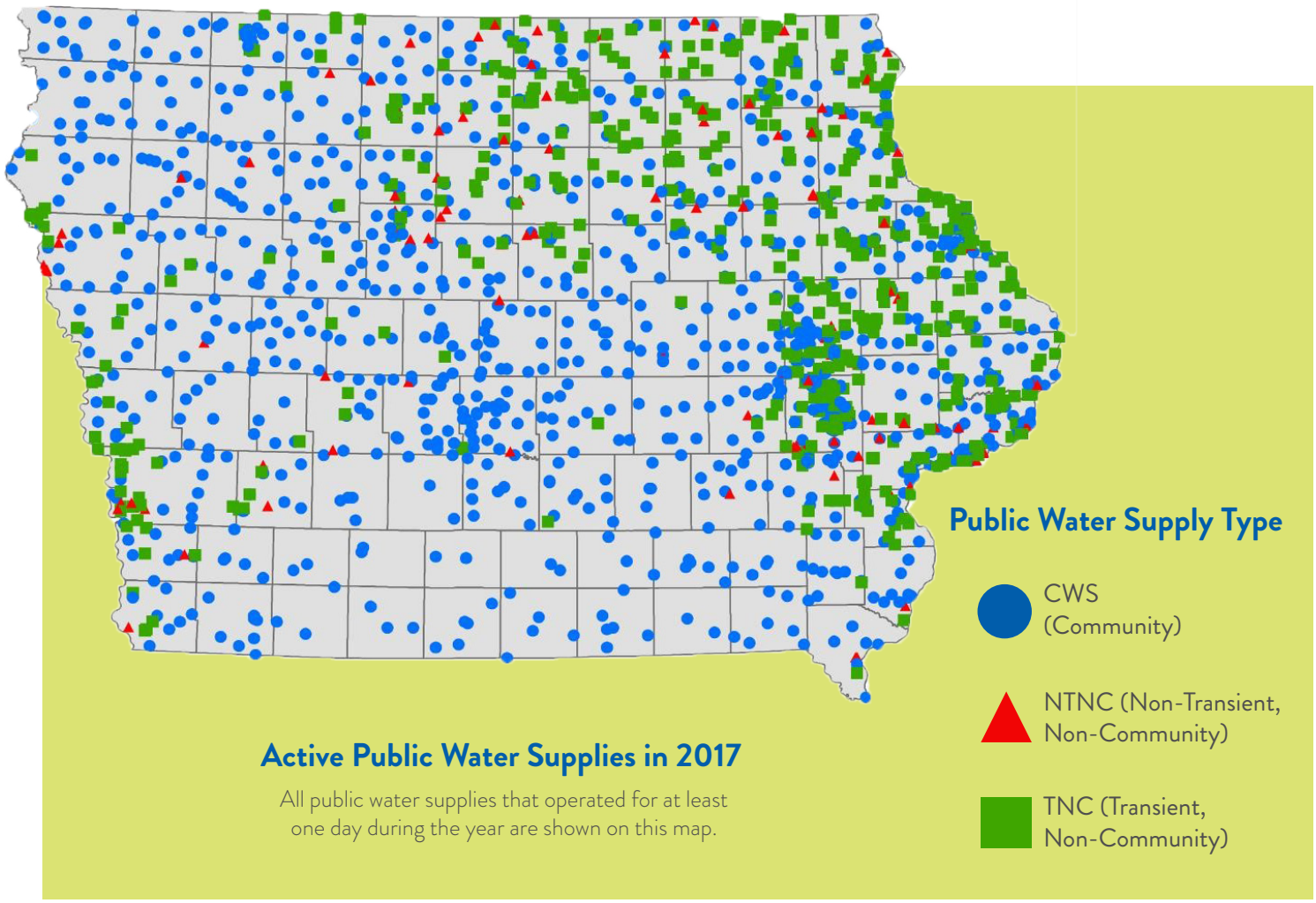
Table 1: Number of Water Systems and Population Served

Population Served	EPA Classification	Number of Iowa PWS	% of Total Number of PWS	Population Served
25-500	Very Small	1,281	69.6	177,692
501-3,300	Small	427	23.2	515,765
3,300-10,000	Medium	86	4.7	483,587
10,000-100,000	Large	44	2.3	1,262,486
Over 100,000	Very Large	3	0.2	498,422
Total		1,841	100.0	2,937,952

The total number of water systems declined, continuing a downtrend from 2004, with a majority of the decreases coming in the small and very small classification. The primary reasons for this decline include consolidation of smaller systems to larger rural water systems or municipalities, and non-community systems that close, no longer meet the minimum population thresholds, or no longer serve water to the public.

Of the total state population (based on 2010 census population of 3,046,355), 92.6% were served by community public water supplies, with the remaining 7.4% of the population served by private water supplies at their residences. Iowa's 1,841 public water supply systems in 2017 included 1,086 CWS, 140 NTNC, and 615 TNC systems.

Of Iowa's systems, 92 percent are served by groundwater sources, which serve 55% of the population. Surface water and influenced groundwater sources are used in the remaining 8% of systems and serve 45% of the population.



Active Public Water Supplies in 2017

All public water supplies that operated for at least one day during the year are shown on this map.

Table 1: Number of Water Systems and Population Served

Source of Water	# of PWS	% of Total PWS	% of Residents Served
Surface Water	123	6.7	35.9
Influenced Groundwater	23	1.2	8.9
Groundwater	1,695	92.1	55.2

The sources from which Iowa draws water are mostly adequate, but there are signs challenges lie ahead. During the most recent drought (2011-12), surface water sources became marginal for a number of communities. Groundwater, especially the Jordan Sandstone, is showing signs of overuse, so water utilities that depend on it may have to also make investments in surface sources. This can be extremely expensive as surface water requires additional treatment processes and may not be as reliable or provide an adequate volume for the majority of PWS. Investment in groundwater conservation and recharging technologies is important to maintain the use of groundwater systems.

Condition

The visible components – wells, pumps, intakes, plants, towers, and controls – of the water production process are adequately maintained, but additional capital will be needed in the future. Typical water systems such as wells, pumps, and treatment facilities have a 20-year expected useful life before requiring major rehabilitation or replacement. Due to aging existing infrastructure, significant improvements will be required for these systems in the next two to 10 years. Many communities have exceeded the life of these components and they must invest in major rehabilitation or replacement projects.

The network of distribution piping in the state varies widely in age. Rural water systems are relatively new in Iowa and generally have distribution systems that are less than 50 years old.

Other municipal water systems report that greater than 50% of their distribution system is greater than 50 years old, with some systems having pipes in excess of 100 years old. Because older pipes generally leak more than newer pipes, aging networks impose a surcharge on operations above what is needed to meet regular user demand. Older pipes are also more susceptible to breaks. Water main breaks can force temporary boil orders if the break causes a loss of system pressure.

Substantial portions of the distribution lines in systems are becoming old enough to cause concern about future reliability. The generally accepted life of pipe is between 80 years to 100 years, depending on material type and other environmental conditions. Therefore, communities should be investing between 1% to 3% of the value of their distribution system to replace their aging buried infrastructure, but few utilities invest at that rate. Additionally, the regulatory requirements to provide fire suppression from the drinking water system, mean many smaller communities have significantly under sized systems and cannot meet modern minimum fire flow requirements. In general, these under sized systems need to be fully rebuilt to meet fire flow capacity.

Operations, Maintenance, and Funding

There are several challenges related to operations and maintenance and funding of drinking water infrastructure. Many of Iowa's treatment facilities are more than 50 years old and while they may be in fair condition, these aging facilities demand more preventative and reactive maintenance to keep them operational. Similar to the distribution systems, many of these facilities are aging and will require significant rehabilitation in coming years.

Another challenge is the quality of source water, primarily nitrates in source water. State and local jurisdictions along with industry representatives have been debating the appropriate nutrient reduction standards. The fiscal impact of degraded surface water will need to be addressed for most water systems. For example, when nutrients or nitrates in Des Moines Water Works' source waters are too high, the treatment plant must spend an extra $7,000 per day to operate a nitrate removal facility.

Additionally, many certified operators are retiring or nearing retirement, and many smaller communities are struggling to find certified operators to replace them. A few communities provide financial incentives for becoming certified but find many candidates reluctant to pursue this course. This does follow other engineering and construction labor trends, and an outreach program should be considered to educate and invite greater participation.

Water is primarily financed by usage charges billed to individual consumers. A large portion of the funding is directed to operations and maintenance with the

remainder used to fund capital projects. Because capital projects typically are both long term and expensive, they must often be financed by borrowing against future revenues, adding interest expense. State and federal governments assist with grants and low-cost revolving loans. The Drinking Water State Revolving Fund (DWSRF) is one of Iowa's primary sources of financing for water system upgrades and water quality projects. Since state Fiscal Year 2000, more than $590 million has been provided in loans to Iowa's Public Water Supply Systems for 463 drinking water projects.

America's Water Infrastructure Act of 2018, signed into law by President Donald Trump on October 23, 2018, includes the Secured Required Funding for Water Infrastructure Now (SRF WIN) Act language, as well as the Drinking Water System Improvement Act. This legislation will help communities across the nation maintain and enhance their water infrastructure by providing much needed financial support.

Future Need

The EPA's 2015 Drinking Water Needs Assessment reported to Congress that Iowa drinking water systems have an estimated capital need of more than $7.8 billion over the next 20 years with the majority needed for the small and medium sized systems that dominate the state.

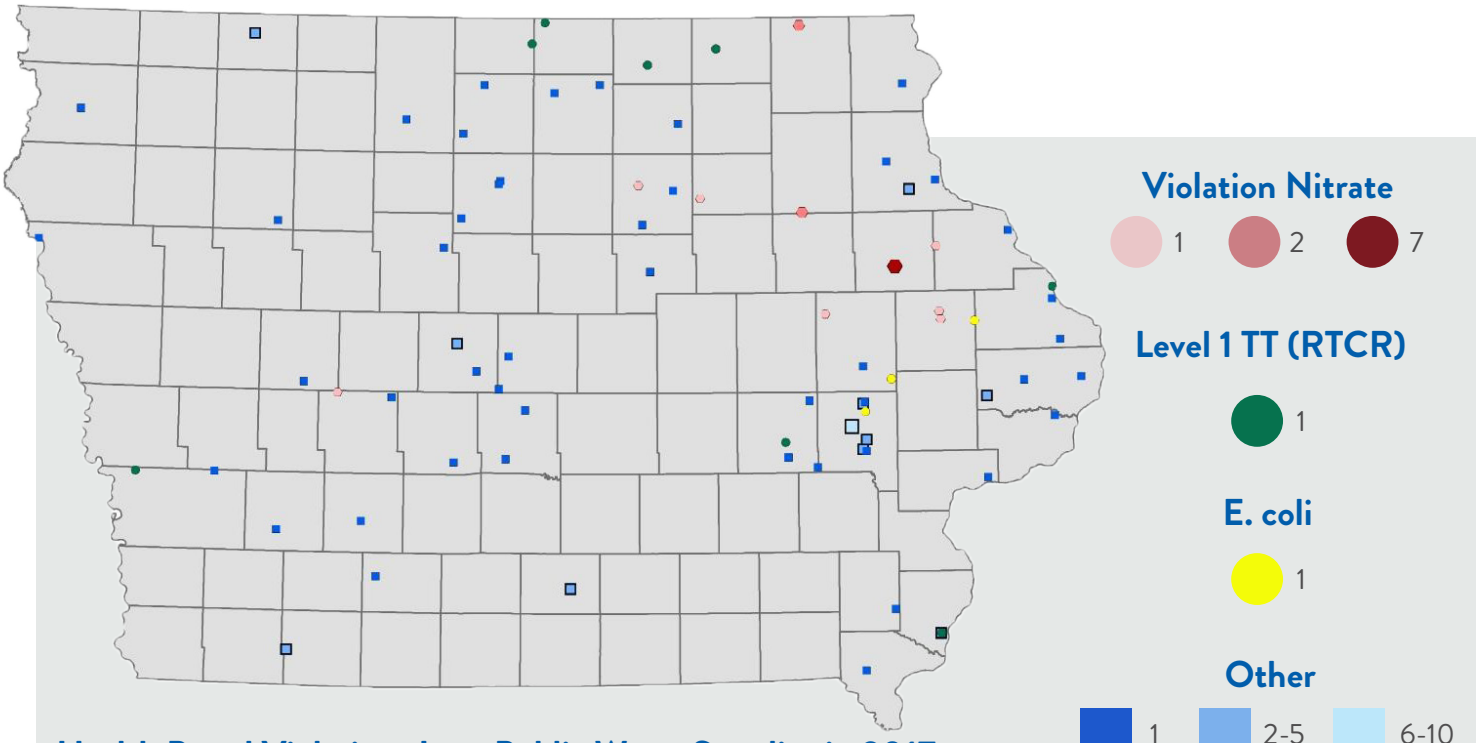
Public Safety

At the highest level, Iowa's drinking water infrastructure is meeting its core purpose of protecting public health.

No waterborne diseases or deaths were reported from Iowa public water supply systems (PWS) in 2017.

Over 2.54 million people (of the 2.94 million people served by Iowa's PWS) regularly received water from systems meeting all health-based drinking water standards.

Health-based drinking water standards were met by 95.8% of the 1,841 regulated public water supplies. There were 77 public water supplies that had 122 violations of a health-based drinking water standards, maximum residual disinfectant level, treatment technique, or action level.



Health Based Violations Iowa Public Water Supplies in 2017

This map indicates supplies that violated a health-based standard in water samples collected either immediately after treatment or in the distribution system.

In 2017, over 2.65 million people regularly received water from Iowa systems that complied with all major monitoring and reporting requirements. Major monitoring and reporting requirements were met by 80.8% of the 1,841 regulated public water supply systems. There were 483 major monitoring violations in 2017 at 245 systems. At least one reporting violation was incurred by 185 systems, for a total of 349 reporting violations. The majority of these violations were for failure to collect coliform bacteria and nitrate samples.

Resilience and Innovation

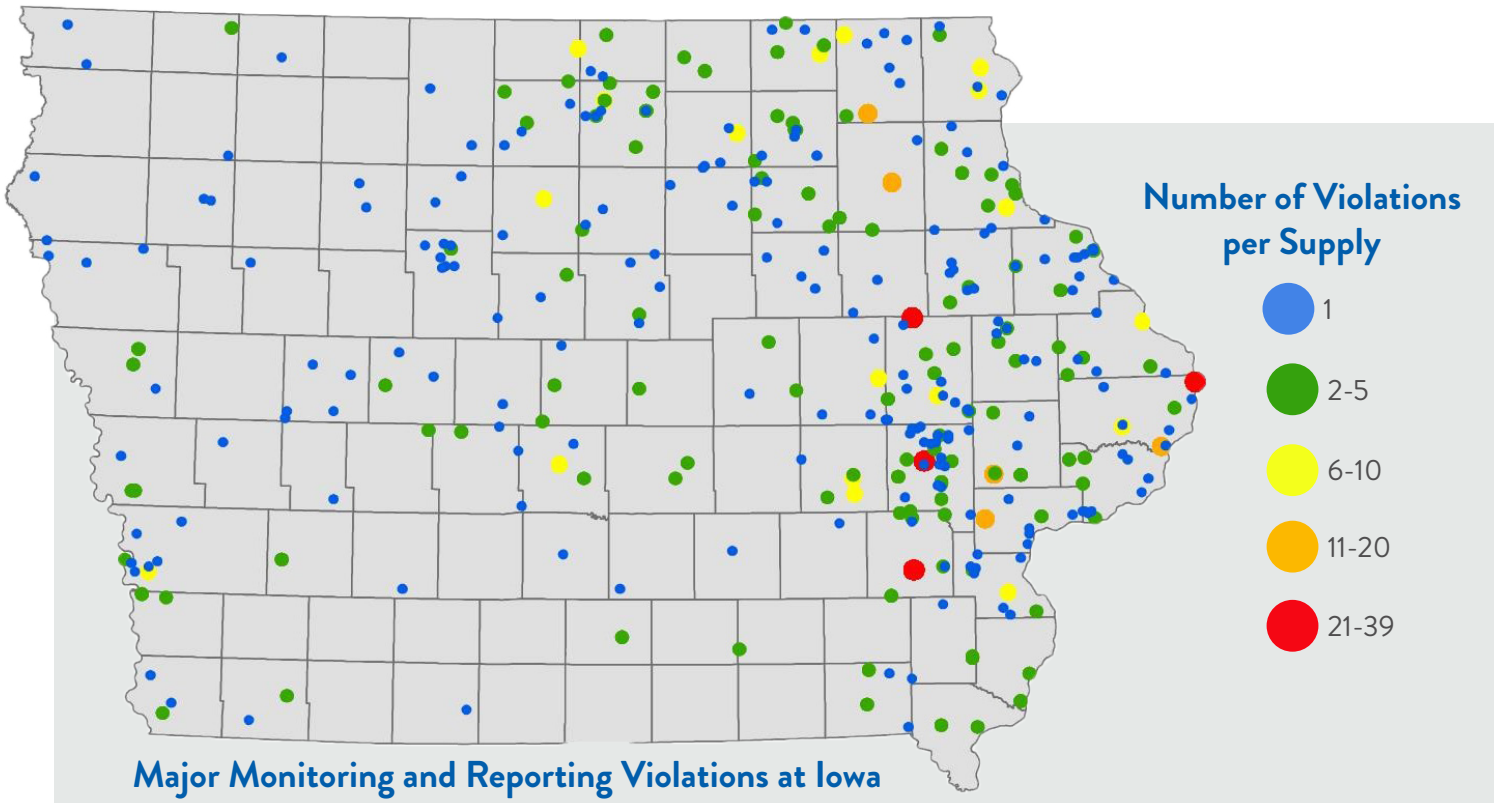
An important aspect of drinking water production and distribution is that water needs to be available without interruption. Iowa's water utilities can meet that requirement under most circumstances, but there are challenges that need to be met to prevent future disruption of service.

Recent droughts have revealed weaknesses in source capacity that need to be remedied by new wells, reservoirs, and groundwater recharging approaches. For instance, 12 of the City of Ames' 22 wells became restricted in 2011-12 as water table levels in their river valley aquifer fell due to lack of recharge.

Due to increasing flood crests, such as in Cedar Rapids where the 2008 peak stage was 11 feet higher than anything on record, or as experienced in Des Moines in 1993, water plants are finding themselves at risk of inundation and shutdown. The remedy for this requires investments in levees and flood proofing.

Increasing nutrient loads in surface water sources are threatening to exceed treatment plant capabilities, which could force some utilities to ration water until nutrient concentrations diminish and/or force plant expansions.

Rapid increases in water use from groundwater resources have led to localized shortages. The important Jordan Sandstone aquifer is at risk of overuse in certain parts of the state. This may lead the Iowa DNR to restrict future withdrawal permits, which would adversely affect communities that depend on this source.



Major Monitoring and Reporting Violations at Iowa Public Water Supplies in 2017

This map indicates supplies that violated a health-based standard in water samples collected either immediately after treatment or in the distribution system.

Recommendations

While our drinking water systems are performing adequately today, we need to continue investment in them to ensure their quality and dependable operation into the future.

- Additional funding programs should be made available for water main replacement programs and treatment plant upgrades. Many of these programs should be made available to smaller municipalities that struggle with funding issues. Water rate increases being made more frequently, while unpopular, will need to be considered as well.

- Contamination of surface waters with nutrients and chemicals resulting from agricultural activities will require investing in mitigation at the source or treatment options.

- Additional outreach programs to Iowa's students and available workforce to increase the number of certified operators are needed. This may also need to include financial incentives to for those who become certified.

- Water extraction and processing assets need to be improved so they can deliver adequate water during droughts and are strong enough to resist being compromised during floods. Additional groundwater protection and aquifer recharge approaches should be explored to increase the resiliency of current systems.

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ENERGY

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Executive Summary

Iowa's gently rolling plains and rich farmland lead to significant renewable energy resources. Following a nationwide trend, Iowa has experienced an energy revolution as alternative sources continue to decrease the growth rate in coal generated electricity consumption around the state. In 2017, wind provided 37% of Iowa's total electricity generation, a larger share than any other state in the country. And in 2017 alone, MidAmerican Energy and Alliant Energy, the state's two main utilities, announced nearly $5 billion in wind power investment between them in addition to hundreds of megawatts (MW) of other new wind projects planned by dozens of other developers. While Iowa is a clear leader in wind generation, many feel the state's solar potential is even greater. The ability of the electric grid to generate, transmit, and distribute a reliable supply of power at a constant voltage and affordable cost continues to be a key to our growth and development. However, supplemental production continues to help meet these demands.

Capacity, Condition, Operations, and Maintenance

Despite Iowa's small population, its significant industrial sector places the state fifth in the nation in energy use per capita. The state leads the nation in the production of ethanol and has the second-largest biodiesel production capacity, only behind the state of Texas. However, the state has few fossil energy resources and no crude oil or natural gas production.

Traditional models used to provide electricity typically involve the use of fossil fuel, hydroelectric, and nuclear base load plants to supply power continuously, while fossil fuel peaking power plants are run only as necessary to cope with high demand. This electricity is then transmitted through regional grids by way of transmission lines, towers, and substations connecting power to local distribution grids. The ideal formula results in the energy pulled from the grid equating to the energy supplied to the grid. When this equation does not balance, consumers may experience voltage drops or surges which can negatively impact facilities and devices connected to the grid that require a steady voltage to operate properly. The low cost of natural gas coupled with new emission regulations is pushing traditional coal-fired plants into retirement and

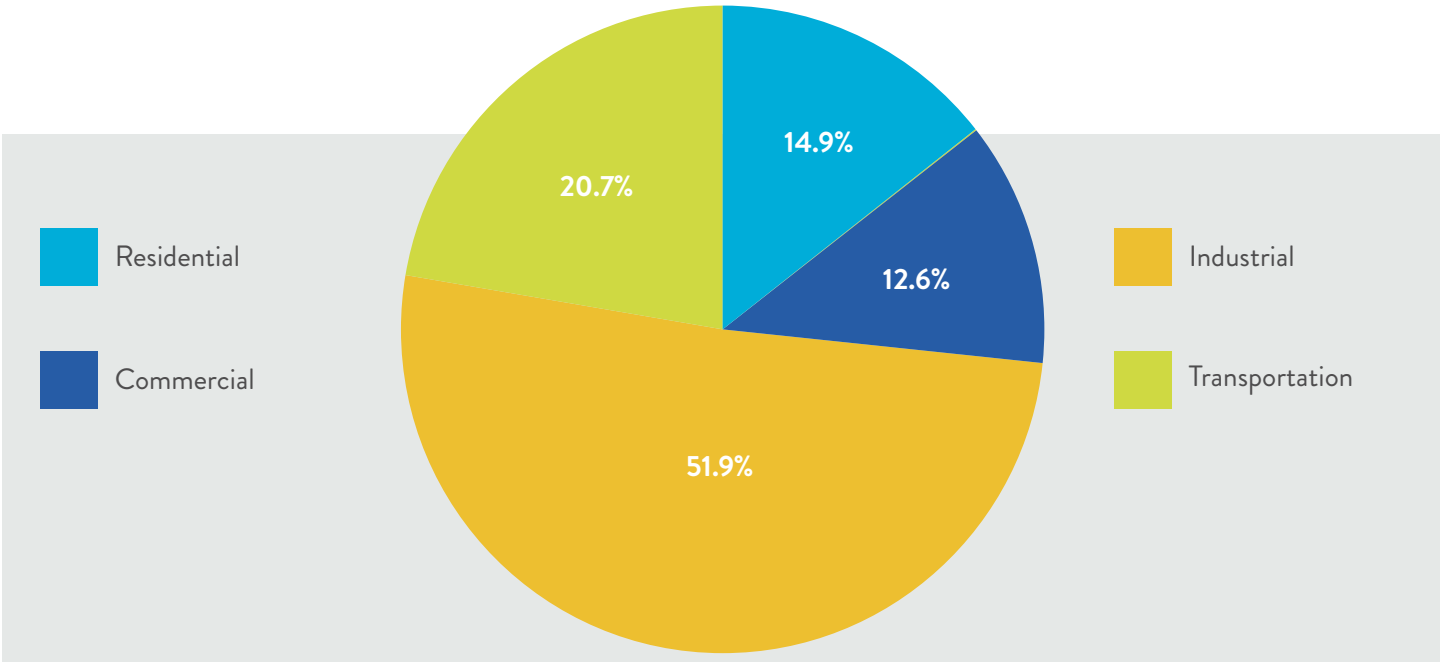


Figure 1: Iowa Energy Consumption by End-Use Sector, 2016

Source: Energy Information Administration, State Energy Data System

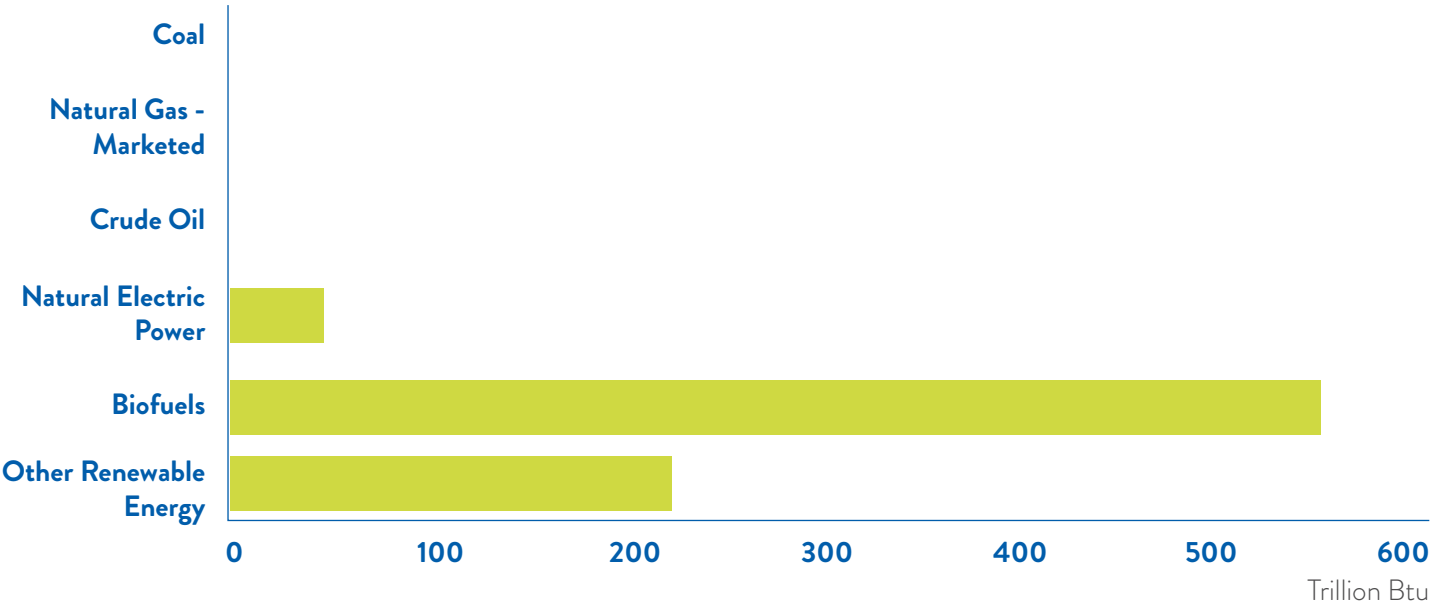
requiring retrofitting or replacement with natural gas generators. The demand for the integration of intermittent, or dispatchable, renewable power resources into the grid has presented new difficulties to the maintenance of the necessary grid balance when compared to traditional models.

Electric utilities in Iowa can be divided into three classes: Investor-Owned Utilities (IOU), Municipal Utilities (Municipal), and Rural Electric Cooperatives (REC). IOUs are for-profit, privately owned businesses that may own and operate generation, distribution, and transmission assets. IOUs will often contract with other organizations that provide any of these services. Municipals are publicly-owned utilities that distribute electricity locally and are not generally in possession of the high-voltage transmission lines used to carry electricity over long distances. Some municipalities own and operate generation equipment while many will contract with IOUs to supply power to their local municipal distribution grid. Rural Electric Cooperative utilities are customer-owned, not-for-profit organizations that generally provide power to rural areas that IOUs do not serve. RECs are divided into distribution, generation, and transmission cooperatives. Iowa is served by two IOUs (MidAmerican Energy, Alliant Energy's Interstate Power and Light), 136 Municipals, and 43 RECs who provide power for a total of 1,618,524 customers (2017).

Within the state, the Iowa Utilities Board (IUB) is responsible for regulating the rates and services of investor-owned electric companies. The IUB is independent from both the public and the utilities. All infrastructure projects undertaken by IOUs have the potential to cause price increases, as approved by the IUB, to recoup the costs associated with infrastructure investment. The IUB has limited jurisdiction over Municipals and RECs.

Interstate transmission and electric generation infrastructure is regulated by the Federal Energy Regulatory Commission (FERC). North America is separated into regions, each managed by an Independent System Operator (ISO). Iowa is part of MISO (Midcontinent Independent System Operator) which is a not-for-profit organization responsible for regional planning, reliability and maintenance coordination, market monitoring, and dispute resolution. MISO administers a network of more than 65,000 miles of transmission lines over 15 states and one Canadian province facilitating the purchase and movement of power throughout the grid to ensure dependable access to electricity produced by the utility companies. MISO's real-time market credits energy producers supplying power to the grid while charging consumers for their usage.

Figure 2: Iowa Energy Production Estimates, 2016



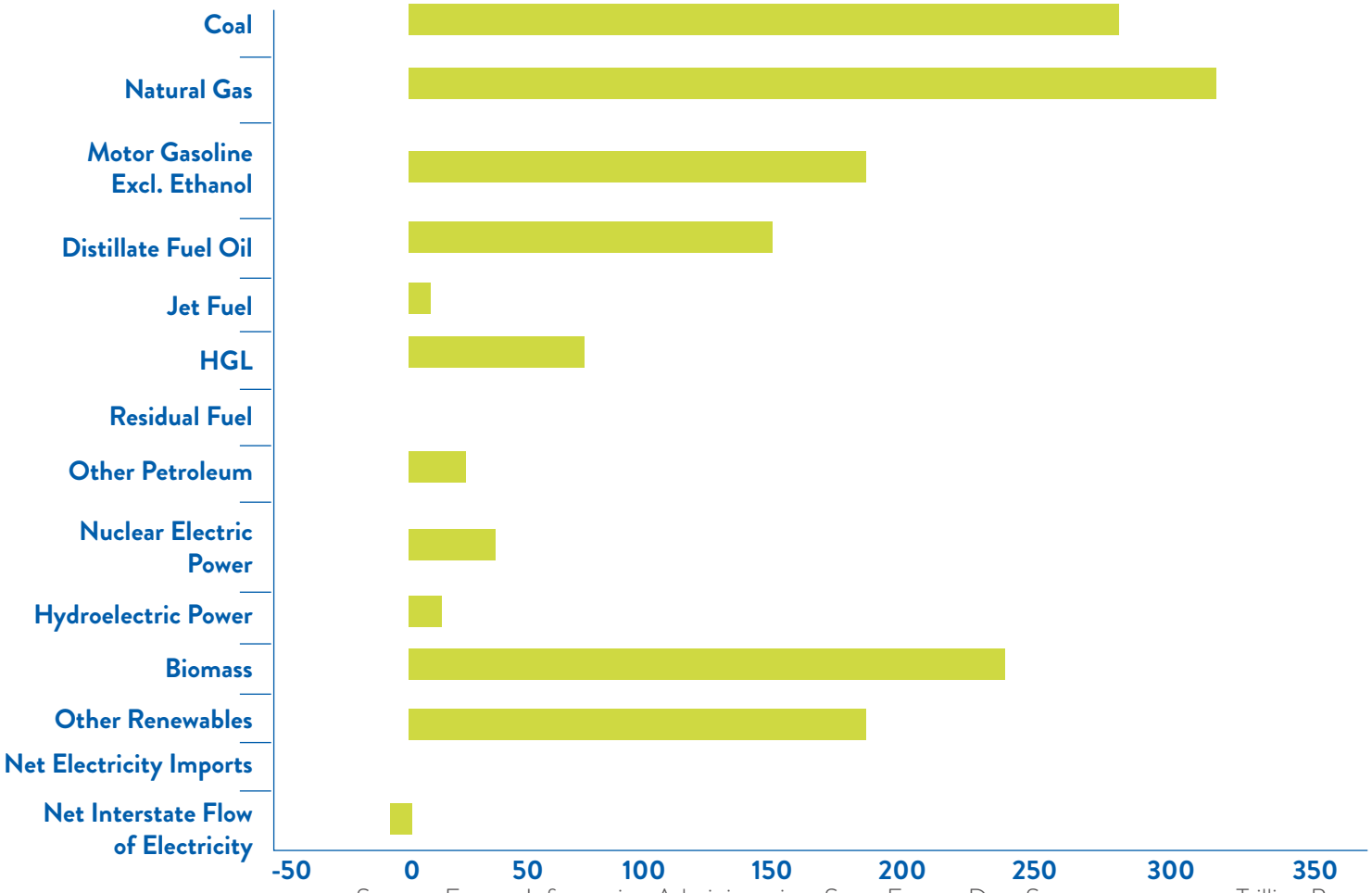
Source: Energy Information Administration, State Energy Data System

Electric Generation

Iowa has generated more electricity each year than the state has consumed since 2008. Coal is the primary fuel used for electricity generation in the state, with five of Iowa's six largest power plants being coal-fired. Iowa has 72 operating coal-fired units at 28 locations totaling 7215 MW of nameplate capacity (41.78%). As of 2017, Iowa relied heavily on coal-fired plants which produced 45% of all electricity generated in the state. The transition away from coal as a fuel source has already begun, with 2016 being the first time in decades in which coal-fired plants produced less than half of the electricity generated in the state. Natural gas generator nameplate capacity has increased to 17% of total capacity and continues to grow, but Iowa cannot currently afford to eliminate coal as a fuel source. Iowa is home to one nuclear plant, the Duane Arnold Energy Center, located nine miles northwest of Cedar Rapids. It has been operating since 1975. Duane Arnold is smaller than all but one other operating nuclear power plant in the nation, operating a single General Electric boiling water reactor with an output of 615 MW of power. The Duane Arnold Energy Center has been upgraded over time to enhance the reactor's ability to deal with significant events including floods, earthquakes, tornadoes, and terrorism.

Iowa has seen a huge increase in wind production in the last 10 years. In 2017 alone, MidAmerican Energy and Alliant Energy announced nearly $5 billion in wind power investment between the state's two main utilities —in addition to hundreds of megawatts of other new wind projects planned by dozens of other developers. Iowa's total wind potential reaches about 276,000 MW of wind, or 23 times the state's current power needs. Prior to 2011, wind and other intermittent renewable resources were treated differently than traditional generation resources and their dispatchability was not controlled by the ISOs. Since 2011, when FERC approved a new category of Dispatchable Intermittent Resources (DIR), wind generation has integrated rapidly into the grid, reducing wind curtailments (shutting down turbines

Figure 3: Iowa Energy Consumption Estimates, 2016



Source: Energy Information Administration, State Energy Data System

to preserve electrical balance in the grid). The addition of better weather forecasting technology has allowed wind to be utilized more dependably, but without a reliable, cost-effective, scalable storage mechanism for renewable energy, fossil fuel generators will remain the benchmark for dependable base-load generation. The integration of these intermittent resources is a delicate operation requiring the analysis of immense amounts of environmental and grid feedback to maximize production, allowing owners to recoup costs more quickly and further supporting investment.

Transmission

Iowa reflects the nation regarding the ongoing concern with aging transmission infrastructure. Iowa's IOUs have over 1,000 miles of transmission lines greater than 50 years old with approximately 10% of total miles reported. Nearly 60% of Iowa's reported lines are 30 years old or older. Aging lines may result in lower reliability and increased operating and maintenance costs. Unquestionably the weakest part of our electric delivery structure, local distribution grids are estimated to contain 10 times the line mileage of the transmission grid connecting them. A serious investment in analyzing and updating local grids is vital to overall grid health.

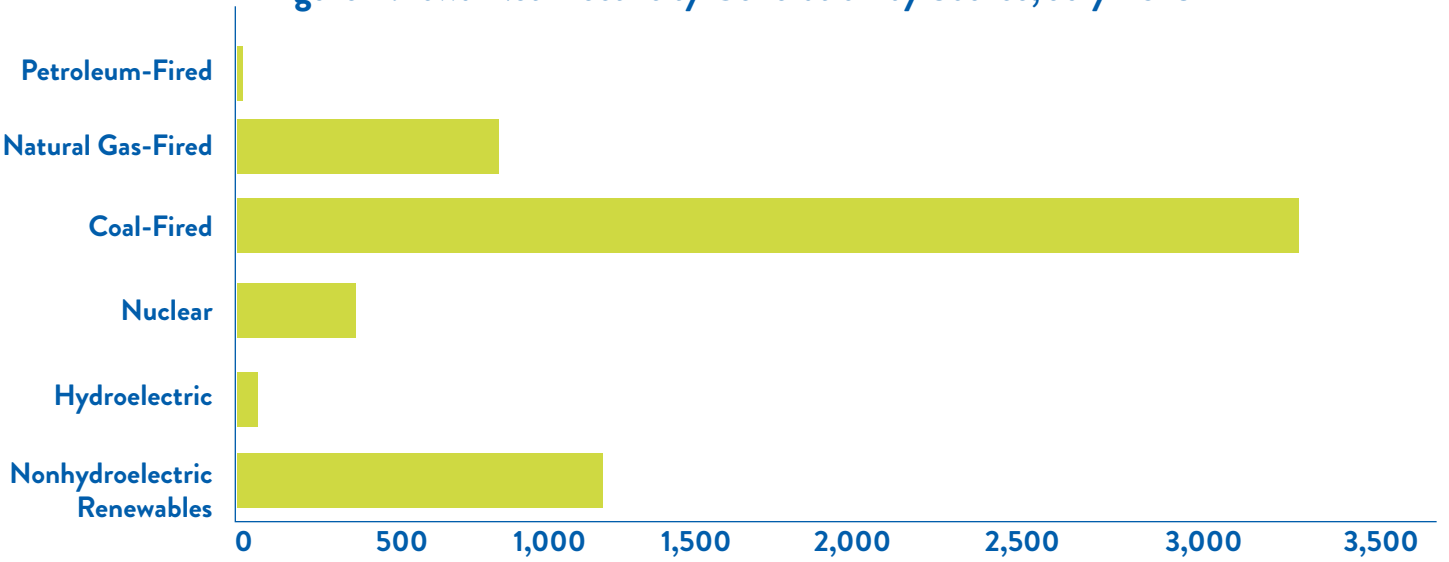
Iowa utilities consistently employ annual line inspection and maintenance programs with remediation as required by FERC. Several techniques to improve transmission reliability and capacity are utilized. In addition, Iowa utilities are adding new lines required to support new commercial opportunities and generation connection to the grid as well as major high-voltage projects to eliminate transmission constraints for wind generation.

The resilience of the power grid in Iowa is dependent on the quality of the transmission lines and towers making up the grid as well as the possible paths available to route electricity from one location to another without overloading any single line. The redundancy built into the transmission network is critical to the physical grid's ability to minimize the effect of localized damage from winds, ice storms, tornados, solar events, or terrorism to name a few.

Renewable Resources

Due to the terrain and land use in Iowa, unobstructed winds blow across the open prairie, giving the state significant wind energy resources. Wind was second only to coal as an energy source for electricity generation in the state and continues to grow as wind farms sustain growth and development. Roughly 2% of Iowa's net electricity generation comes from renewable resources other than wind, most of which is hydroelectric power. Though wind power continues to grow and has significant benefits to our state, there do continue to be concerns expressed: aesthetic eyesore to landscape, disturbance from noise and lights, viability without tax credits, consumption of farmland, and impact to birds and bats.

Figure 4: Iowa Net Electricity Generation by Source, July 2018



Source: Energy Information Administration, State Energy Data System

There are three hydroelectric plants in the state, all three of which are aging. The largest structure is over 100 years old and privately-owned. Additional renewable resources which have begun to gain popularity are biomass and wind. The state's biomass resources include landfill gas, agricultural biodigester facilities, and wood pellet plants. With its many days of sunshine each year, Iowa continues to develop and utilize the solar energy potential within the state. Though only a small amount of solar photovoltaic electricity is generated in the state, it continues to become more popular and prevalent, particularly with residential and commercial installations.

Other Resources

Though Iowa is not a petroleum-producing state, new exploratory wells are planned in the southwestern part of the state. Iowa continues to bring in thousands of miles of petroleum product pipelines across the state, ranking fourth among the states in liquefied petroleum gas consumption.

Today there are no active coal mines in Iowa; however, there are additional coal resources at greater depth in southwestern Iowa, with the potential of such resource still unknown. In addition, Iowa does not have any natural gas production or reserves, though the state is crossed by numerous interstate natural gas pipeline systems. Natural gas does provide 20% of the total energy consumed in Iowa.

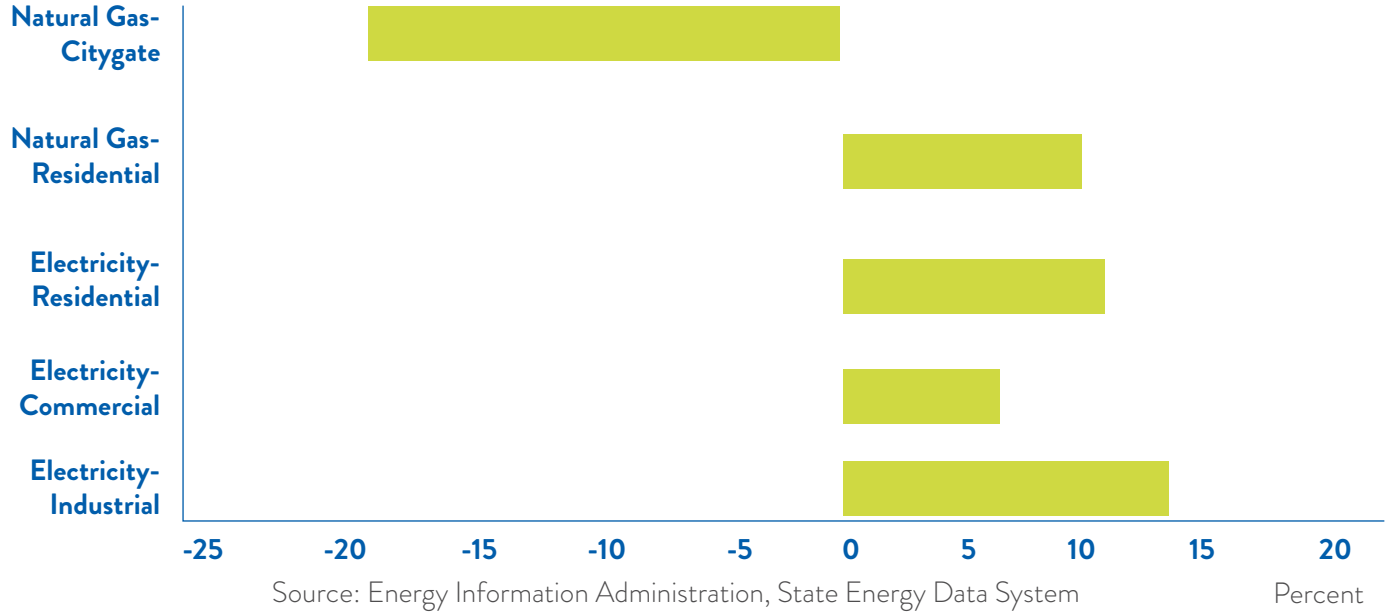
Funding

As of October 2017, the Iowa Energy Center was transferred to the Iowa Economic Development Authority (IEDA). The IEDA, in consultation with the Iowa Energy Center board, oversees and approves all programs, funding decisions, and annual budgets. Programs and initiatives of the Iowa Energy Center must align with the seven focus areas of the Iowa Energy Plan:

- Energy workforce development
- Technology-based energy research and development
- Support for rural and underserved areas
- Biomass conversion
- Natural gas expansion in underserved areas
- Electric grid modernization
- Alternative fuel vehicles

Annual funding is received from an assessment on the intrastate revenues of Iowa's gas and electric utilities.

Figure 5: Iowa Price Differences from US Average, Most Recent Monthly



Source: Energy Information Administration, State Energy Data System

Future Need

In 1983, Iowa became the first state in the nation to adopt a renewable portfolio standard (RPS). With state regulations requiring measurable goals of investor-owned electric utilities to own or contract renewable generating capacity, eligible renewable resources capacity has exceeded those goals. In 2008, at the direction of the state legislature, the IUB also established standards for each electric and natural gas utility in state regarding energy efficiency. Iowa requires specific amounts of renewable energy capacity rather than percentages for their RPS, with the requirement being 105 MW of generating capacity for IOUs.

Since 2000, several coal-fired power plants in Iowa have been retired and several proposed coal-fired projects have been suspended as a direct result of regulations and regulatory uncertainty. In 2016, for the first time in decades, coal-fired plants produced less than half of the electricity generated in the state. During the same period, wind-powered generation, now the state's second-largest source, grew from less than one-tenth of Iowa's net generation to more than one-third of state generation. Alliant Energy's IPL long-term plans include approximately $440 million in upgrades to existing power plants reducing air emissions, extending its agreement with the DAEC, and further investments in renewables and energy efficiencies. In addition, Iowa requires utilities to sell a certain amount of electricity from renewable sources and that new buildings must meet certain efficiency standards as defined by the 2006 International Energy Conservation Code (IECC).

Innovation

New monitoring and response technologies are critical to the efficient use of energy by limiting emissions and controlling costs. Smart grid technology investment can provide real-time feedback, thereby improving outage response. The ongoing growth and incorporation of renewable energy resources like wind and solar will benefit from the continued development of predictive modeling, market pricing integration, and the addition of resources for grid energy storage.

Recommendations

- Continue to diversify energy portfolio. The future of energy within the state of Iowa must continue to evolve and grow in using renewable energy and sustainable resources. This balance is critical to sustain growth in population and commerce.
- Upgrade aging infrastructure. Aging transmission and distribution lines in Iowa require upgrading. New transmission lines must be constructed to continue the utilization of Iowa's wind resources throughout the state and MISO.
- Harden the grid. Regional transmission lines and local distribution grids must be analyzed to ensure dependability in the face of weather events, terrorism, or cyber-crime.
- Modernize the grid. Investment into smart grid technology, better data analysis and response tools, more robust and repairable transmission structures, and energy storage technologies will lead to better response times, shorter outages, fewer emissions, better renewable energy usage, and a stronger more resilient power grid.

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INLAND WATERWAYS

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Executive Summary

The Upper Mississippi River (UMR) and Missouri River Inland Waterways are vital to Iowa's economy as they provide an economical transportation mode to export Iowa products to worldwide markets. Waterways and ports contributed more than $4.3 billion in revenue to the state's economy and supported an estimated 26,000 jobs. However, revenue and security of jobs are threatened by aging UMR navigation locks and dams and unpredictable water levels on the Missouri River system. The average age of the locks and dams in Iowa is 80 years old, or 30 years past their intended design life. Unscheduled lock closures for maintenance and repairs cause delays and congestion and ultimately increase shipping costs. In recent years, some progress has been made toward operation and maintenance repairs to the inland waterways system along Iowa's border. As of December 2018, three of the top five priority projects on the UMR in the Rock Island District have been completed. These projects addressed major deficiencies on locks in the Rock Island District and have reduced the risk for extended lock closures.

Background

Iowa is unique in that it is the only state bordered by two navigable waterways. The Missouri River on the western border provides 179 miles of navigable waters and the Mississippi River on the eastern border provides 312 miles of nine-foot navigation channel. There are 60 barge terminals (five on the Missouri River and 55 on the Mississippi River) and 11 lock and dams (all on the Mississippi River) along Iowa's borders. Lock and Dam 9 near Lynxville, Wisconsin, is the furthest upstream and Lock and Dam 19 in Keokuk, Iowa, is the furthest downstream on the Iowa border. As of 2013, waterways and ports support an estimated 26,000 jobs in Iowa and directly contribute $4.3 billion in revenue to the state's economy. This total revenue includes $2.3 billion in direct business revenue, $1.5 billion in personal income, and $478 million in local purchases. The total tonnage through Lock 19 in 2017 was 26.7 million tons, which is up 8.2 million tons from 2014. More than 60% of all commodities shipped along Iowa's border via barge are agricultural related products such as corn, soybeans, grains, and fertilizer. The 2015 annual tonnage of commodities shipped by barge to, from, and within Iowa was 7.3 million tons. This is up 13% from 2012. By 2045 the annual Iowa-based barge tonnage is expected to increase to more than 15.5 million tons.

Since there are no lock and dams along Iowa's border on the Missouri River, water levels in the Missouri River depend on flow releases from the mainstem reservoir system located in the upper Missouri River basin. Dredging of the Missouri River rarely occurs because reservoir release rates combined with an extensive system of stone dikes and revetments provide a continuous self-scouring navigable channel. Inconsistent water levels on the Missouri River have lead to a steady decline in barge shipments over the past 30 years. Even when water levels are sufficient for navigation, barge traffic typically only goes as far upstream as Council Bluffs. In 2014, barge traffic began traveling north to Sioux City to bring goods for building construction purposes; however, barge traffic decreased when construction was completed. When water levels are favorable, agricultural chemicals and fertilizers are shipped on barges to Sioux City.

Capacity

Traffic projections indicate the Upper Mississippi River lock system will be exceeding current capacity within the next 25 years. Of the 11 lock and dams along Iowa's eastern border, only one lock chamber, Lock 19, is long enough to accommodate modern barge tow lengths of 1,200 feet. All other locks have 600-feet chamber lengths, which require barges to uncouple and transit through the lock in two lockages. This increases processing and delay times which results in higher shipment costs, wear and tear on the locks, and the likelihood for an adverse incident to occur. The average delay time at Lock and Dams 9-19 ranged from 1.02 to 3.35 hours in 2017. The 2017 cumulative average delay time is more than 18 hours for Lock and Dams 9-19. These delays negatively

impact shippers, many of whom rely on the inland waterways to transport agricultural commodities and other time-sensitive products. Ultimately, these costs are passed onto the consumer.

Current US Army Corps of Engineers (USACE) economic studies support 1,200-foot lock chamber capacity improvements on UMR locks downstream of Iowa (Locks 20 – 25). However, construction funding has been appropriated by Congress for capacity improvement purposes. Even without this long-overdue reinvestment in navigation infrastructure, small scale rehabilitation and reliability improvements on Locks 9 – 19 must be made in order to meet current and future traffic demands.

Operation and Maintenance (O&M)

All of Iowa's inland navigation waterways are under USACE stewardship. On the Mississippi River, the USACE responsibilities include operation and maintenance of the locks and dams, dredging in the main channel to sustain the authorized nine-foot depth, and debris removal. On the Missouri River, nearly all of the USACE maintenance responsibilities are to preserve the stone dikes and revetment in and along the channel. Along the Iowa borders, the Rock Island District of USACE oversees Lock and Dams 11-19, the St. Paul District oversees Lock and Dams 9-10, and the Omaha District oversees the Missouri River. Barge terminals are owned and operated by private companies.

Condition

The average age of the locks and dams in Iowa is 80 years old, or 30 years past their intended design life. The oldest locks and dams in Iowa were put into operation in 1937 and the newest, Lock 19, was put into operation in 1957. The age of the system is resulting in deteriorating infrastructure that requires locks to be closed so maintenance and repairs can be completed. Lock closures can be either scheduled or unscheduled, with the latter being the most impactful to the barge industry. The 20 year average, from 1995 to 2014, of unscheduled repairs for locks 9-19 accounted for more than 50% of all repairs that were completed.

Photo 1: Waterway

A US Inland Waterway Modernization Reconnaissance Study Report, published by the Iowa Department of Transportation in 2013, identified a number of priority projects to improve the lock and dam infrastructure on the UMR Waterway. As of December 2018, three of the top five priority projects on the UMR in the Rock Island District have been completed. These projects addressed major deficiencies on locks in the Rock Island District and have reduced the risk for extended lock closures. Completed projects include lock miter gate replacements, bulkhead slot installations and Lock and Dam 18 concrete repairs. As for the two other projects, the dam gate repairs are partially funded while the Lock 19 concrete repairs are not funded. Project funding for these projects has been through the USACE Major Maintenance Program.

The dike and revetment structures on the Missouri River require continual maintenance. There is a substantial fluctuation in annual cost to maintain these structures and cost is typically dependent on peak water levels. The structures are considered to be in acceptable condition and provide a stable channel for the Missouri River.

Funding and Future Need

The USACE programs and projects are funded annually by the federal government. Federal funding from General Revenue sources fund 100% of routine operations and maintenance as well as major maintenance inland waterway costs, while capital improvement, major rehabilitation, and new construction projects are funded with a 50/50 split between the Inland Waterways Trust Fund (a 29 cent-per-gallon tax on barge fuel) and the federal government. Appropriated federal funds are not sufficient to support all of the current and future needs of the navigation system. However, federal funding for operations and maintenance as well as major maintenance in the Rock Island and St. Paul Districts has been steadily increasing over the last six years (2013-2018). In 2013, operations and maintenance funding for Rock Island and St. Paul districts was approximately $50 million (each) and in 2018 funding was approximately $90 million (each). The increased funding resulted in completion of priority projects in the UMR.

Public Safety

Waterborne freight transportation has the lowest fatality rate and is the most energy efficient when compared to other modes of transportation. A 2017 report by Texas A&M Transportation Institute showed that for every barge-related fatality, there are 21.9 rail-related deaths, and 79.3 truck related deaths. A modern barge can transport one ton of cargo 647 miles per gallon of fuel. By comparison, rail transport moves one ton of cargo 477 miles per gallon and only 145 miles per gallon if one ton of cargo is transported by truck. Unscheduled maintenance and decreased performance of the inland waterway system can lead to an increase in rail and truck transportation due to the loss of competition.

Recommendations

- User fees should be considered for the non-navigational beneficiaries of the inland river system such as water supply sources for municipal, industrial and farming purposes, as well as the recreation industry, to provide additional funding for the operations and maintenance needs of the inland river system.
- Encourage the USACE to use risk-based decision-making processes to prioritize inland waterway funding and advocate for increased funding to keep the existing system operating at or above acceptable levels of service reliability.
- Urge Iowa representatives and inland waterway interest groups (agriculture, barge operators, shippers, and environmental stakeholders) to drive legislation in Washington, DC, to address funding and legislative changes.
- Initiate a study to investigate the cost-benefit of providing more consistent and reliable navigation channel depths on the Missouri River to facilitate increased transportation utilization of the waterway.

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LEVEES

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Executive Summary

There are 747 miles of levees in Iowa documented in the National Levee Database (NLD), comprising 191 levee systems. Many urban areas have received funding over the past decade to improve levee resilience and their ability to withstand major storm events. However, rural areas have struggled to obtain state and federal grant dollars to make necessary improvements, in part because of an inability to raise the required local matching funds to access these grants. As a result, the condition of some levee systems and the protection they afford is beginning to improve, but the vast majority of improvements are occurring in urbanized areas. Adequate investment to improve the resiliency of levees is vital; between 1965 and 2017, Iowa's 99 counties experienced 1,120 presidential disaster declarations related to flooding. While most levees in Iowa are currently functioning adequately when exposed to normal storm flows, there are serious concerns about levee stability during major rain events, especially in rural areas. Recent record floods on the Missouri River in the southwest corner of the state are evidence of this.

Background

The Mississippi River forms the entire eastern border of the state of Iowa, while the Missouri River and Big Sioux River (a tributary of the Missouri River) form the western border of the state. The Missouri River flows into the Mississippi River at a point downstream from the state of Iowa, making all of Iowa a part of the Mississippi River Basin. A large portion of the levees within Iowa are located along these three rivers that border the state. Other levees exist in 18 interior counties of the state such as those in the Des Moines, Waterloo, Amana, Coralville, Marshalltown, Ida Grove, Red Oak, and Ottumwa areas.

By definition, levees are earthen embankments, floodwalls or similar structures built along water courses that are intended to reduce the risk of flooding or convey water flow. Historically the majority of the early levees built in the Midwest were constructed to protect agricultural interests.

Currently there is no single agency with responsibility for nationwide oversight of levees. However, federal regulatory interest in flood risk management has been established for over 100 years. The US Army Corps of Engineers (USACE) has been involved in the design and construction of levees that have federal interest since the 1920s. Many of these levees are typically found along navigable waterways. The Iowa Department of Natural Resources (DNR) regulates permitting of new levees or levee modifications that are located in a drainage area greater than 10 square miles for rural areas and in drainage areas greater than two square miles for urban areas. Some levees also require a permit from the local floodplain manager. At this time there is no single engineering standard for the design of levee systems or the amount of flood risk reduction a levee must provide. In the absence of a national standard, the 1%-annual-chance flood has become the de-facto minimum design standard for levees in many communities because of the savings on flood insurance it can provide to residents living behind the levee.

Capacity and Condition

There are currently 747 miles of levees in Iowa documented in the NLD. It has been estimated that there may be over 890 miles of levees in the state of Iowa, leaving potentially 16% of all levees within the state undocumented and likely not participating in any sort of maintenance or inspection plan. The NLD lists a total of 191 levee systems in Iowa with 94 systems under USACE authority (541 miles) and 97 known levee systems not covered by USACE authority (206 miles). The average levee age in Iowa is 52 years. Most concerning is that of the 191 levee systems in Iowa, 41 systems have a USACE designation of Unacceptable based on their most recent inspection being either a Periodic System Inspection or a Routine System Inspection. An Unacceptable rating indicates there are conditions which may cause the system not to perform as intended. A routine inspection is described by USACE as visible inspection to verify and rate the operations and maintenance of a levee system, while a periodic inspection is a comprehensive inspection

conducted by a multidisciplinary team.

As of January 2019, 64 of the levee systems in the NLD have been accredited by the Federal Emergency Management Association (FEMA) with an additional 17 systems being designated as a Provisionally Accredited Levee (PAL). PALs are existing accredited levees in areas where the floodplains are being remapped. Levees must be certified by FEMA in order for a community to be eligible for the National Flood Insurance Program.

In the larger urban areas of Iowa, the condition of levee systems and the protection they afford is beginning to improve. The improved conditions can be attributed to two major factors. First, USACE currently inspects a major portion of levees in Iowa, is more qualitatively assessing risk, and is improving communication of inspection findings to local sponsors so that they can take effective action. Secondly, municipalities are reinvesting to keep the condition of their levee system satisfactory, whether it be to keep their FEMA accreditation or their USACE Rehabilitation Program eligibility status.

Funding

After witnessing the devastation caused by Hurricane Katrina and the severe storms that have ravaged Iowa over the last decade, local municipalities are now prioritizing work on flood risk reduction systems. Due to the cost of building flood risk reduction projects, most work is occurring in urbanized areas where limited state and federal revenue streams can be leveraged to fund these expensive projects.

State funding in Iowa for levee infrastructure has been limited. In 2008, the state established an innovative flood mitigation program by establishing a base year of sales tax collections within a municipality, and as the sales tax collections grow in each successive year for up to 20 years (through inflation or economic development), a municipality can utilize up to 70% of the growth for flood mitigation projects. No single project can collect more than $15 million in one fiscal year, and statewide all projects cannot not exceed an allocation of $30 million per fiscal year. This allows available dollars to be used for levee projects that are tailored to each community's needs. With a steady stream of sales tax collections per year, each municipality is able to issue revenue bonds during initial years to fund an immediate change in flood risk reduction and mitigation. The sales tax distributions are then used to pay the debt from the newly built infrastructure. However only certain qualifying municipalities were authorized to access these funds, and this was a one-time program.

In response to the economic damages of Hurricanes Katrina and Rita in 2005, Congress passed legislation calling for the development of a National Levee Safety Program (NLSP). However, it was not until 2014 that Congress actually authorized the establishment of the NLSP. Through the passage of subsequent legislation, Congress has made significant improvements in authorizing USACE to be better able to measure the overall integrity of levees around the country. However, Congress has fallen short in appropriating adequate funding for programs which would allow municipalities to leverage federal funds for improving or expanding levee systems. To date, the NLSP has only received appropriations for the levee inventory portion of the program and has yet to be fully funded.

Currently, a select few municipalities in Iowa have been able to secure federal funds for levee construction, but only after a long and convoluted process. Because of the discontinuation of earmarking and limited availability of federal funds, Iowa projects have to compete nationally against other similar projects. On a national basis, only projects with the very highest benefit-cost analysis ratios tend to receive federal funds and it can take many years for funds to be secured. Such was the case for Cedar Rapids which was devastated when a flood in 2008 caused $5.4 billion in damages. It wasn't until 10 years after the flood event that the city received $117 million from USACE to support constructing a flood risk reduction system estimated to cost between $550 million to $750 million.

In addition to USACE funds, FEMA also offers funding through grant opportunities, such as the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation Program (PDM). Hazard

mitigation funds for HMGP are distributed on the state level but can only be accessed after a qualifying storm damage event. PDM funds are nationally competitive. Investment in mitigation projects now can save significant funding on future repairs. A recent study by the National Institute of Building Sciences concluded that mitigation funding can avoid $6 in future disaster recovery costs for every $1 spent on hazard mitigation. Despite this, use of FEMA grant funds for use in levee improvements or new construction continues to be restricted, in part due to FEMA policies and in part due to the USACE's historical role in regulating levee construction.

In 2018, Congress passed with bipartisan support America's Water Infrastructure Act. This act provides a two-year authorization for USACE which includes funding for flood risk reduction. Most importantly, the act creates a pilot program which allows previously authorized but unfunded projects to advance with non-federal funding. This will begin to allow local municipalities to advance the design of planned levee systems while waiting on full funding for the construction work.

Future Need and Innovation

The Fourth National Climate Assessment indicates annual precipitation in the Midwest has increased 5% to 15% from the first half of the last century (1901-1960) when compared with the present day. Additionally, winter and spring precipitation are an important flood risk factor and they are predicted to increase by 30% by the end of this century. Continued changes in precipitation patterns and events increase the importance of being able to accurately model flood flows for a given area so that levee systems can be designed to provide the intended flood risk reduction while accounting for future precipitation changes. DNR recently released data showing Iowa received 45 inches of average statewide precipitation in 2018, which is 10 inches above normal. This put 2018 as the second highest amount of average precipitation in state history, coming second only to the year 1993.

As communities across the state respond to threats of flood damage by improving local levee systems, it is important that national agencies such as USACE and FEMA continue to track and record the ongoing changes to physical floodplain properties and ensure modeling data is kept up-to-date.

With the improvements in flood modeling capabilities over the past several years, new types of reliable analysis are now possible such as levee breach studies. These studies are valuable in predicting rates of increasing water depth after a levee breach at specific locations behind the levee. This information can then be used to support emergency preparedness planning and predict the amount of time available to evacuate people living or working within the breach impact area. The data is also valuable to emergency management personnel who use it for pre-disaster planning such as creating more effective evacuation plans. Most importantly, accurate modeling data which can provide accurate risk assessments allow levee sponsors to make cost effective risk management decisions and more effectively communicate flood risk to the public.

Public Safety and Resilience

Levees are a vital piece to the success of our statewide economy. Valuable farmland, urban, and rural areas are protected by levees within our state. As we have seen from past experience, failure of these levees inevitably leads to property damage, crop damage, and loss of life. Vital types of infrastructure such as roadways, hospitals, schools, railroads, drinking and wastewater facilities, and power plants also depend on the successful performance of levees. In many cases levees were originally constructed to protect farmland, but over time these protected areas have been developed and the levees are now protecting large urban communities, making a levee breach and/or failure devastating. Behind the levee, local municipalities have responsibilities for building codes and land use planning. Past ill-informed residential and commercial development decisions have resulted in high density areas now being located immediately behind some levee systems. The presence of high-density populations and critical infrastructure being protected by levees heightens the importance of having robust levee maintenance program regulations established on a national level.

If recently released data on climate change patterns in Iowa holds true in the future, the state will be facing more intense rainfall events along with an annual increase in precipitation. This will create a moving target for municipalities working to keep their levee systems classified under FEMA as providing risk reduction from the 1-percent-annual-chance flood. The predicted changes in weather patterns will only further increase the importance of levee systems to municipalities and the extent to which they are relied upon for flood risk reduction.

Recommendations

- Standardize national inspection and design performance requirements for levees. The key to effectively spending limited financial resources so that municipalities can best reduce flood risk is to start with a clear understanding of the risks associated with a particular levee system. Risk assessment is best accomplished through a single set of national design standards and continuous levee assessment programs which would require period inspection of all levee systems in Iowa. Only after standardizing design performance and inspection data collection attributes can one type of levee system be evaluated against a different type of levee system. Through this process, the NLD becomes a critical asset management tool that needs to be financially supported and sustained on a national level. By leveraging the risk assessment information in the NLD, federal, state and local authorities will then be able to effectively prioritize the use of limited funding resources.

- Provide reliable funding sources for new construction and improvements to levee systems. Flood damage is something that impacts all Iowans and is worthy of a dedicated funding source that can be leveraged by municipalities. According to USACE, two levee systems in Des Moines and Council Bluffs protect over $5.4 billion in property value. In many locations for each dollar spent on flood mitigation in advance of a flood event, multiple dollars are saved that would otherwise need to be spent on flood damage recovery.

- Fund continued study of floodplain hydraulics to maintain accurate data sets that incorporate impacts from climate change and infrastructure activities which can cause variations in runoff rates and stormwater volumes. Iowa municipalities have no capacity to analyze changes in regional weather patterns, nor measure impacts to floodplain profiles due to infrastructure improvements that change the hydrologic characteristics along flood corridors. USACE and other federal agencies have the most extensive resources available to be able to integrate regional data collection assets such as those maintained by the Iowa Flood Center and Iowa State University's climate science programs. Successful integration of all available data sources on a regional and national level provides the best opportunity for civil engineers to access data sets that will produce the most accurate floodplain models.

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PARKS & RECREATION

C

Executive Summary

Over the past 100 years, since legislation was passed in Iowa to create a state park system, Iowans saw the creation and designation of numerous recreational areas. Today, there are 72 state parks, 1,840 county parks, 1,866 miles of multi-use trails, 132 natural and man-made lakes, and over 1,000 city owned parks and other outdoor areas. But even as progress has been made in Iowa, the state falls short on a national scale for public areas. As of 2010, only 2% of Iowa's 56,239 square miles was available for public use, putting the state 49th in the nation. Additionally, the Iowa Association of County Conservation Boards reports that there is a $664.4 million backlog of infrastructure, maintenance, expansion, and resource protection needs for parks and recreation entities across the state. More specifically, the demand for trail expansion continues to grow statewide, based on surveys and public listening sessions of recreation users conducted by the Iowa Department of Natural Resources (DNR). Unfortunately, limited funding from federal, state, local, and even private sources, is available to address pressing needs.

Background

Like many other infrastructure networks in Iowa, the outdoor recreation system consists of multiple components controlled by various jurisdictions and organizations. National, state, regional, county, and local municipalities each have systems of parks, lakes, playgrounds, trails, etc. These pieces can be independent of each other, or fit into the system as a whole, both physically and economically.

In 2012, a comprehensive study performed by economists at Iowa State University showed that in Iowa "...expenditures on travel to recreation sites and participation in recreation activities has resulted in more than $3 billion of spending, which in turn helps support approximately 31,000 jobs and $717 million of income in the state." This total takes into account revenue generated from state and county parks, lakes, rivers, streams, and multi-use trails. As the authors of the study explain, visitors to recreation areas in Iowa spend money on goods and services. This money then ripples through the state economy, impacting not only those directly involved in the recreation industry, but people employed in other sectors. Another study published in 2012 by the Iowa Bicycle Coalition and the University of Northern Iowa found recreational riders on Iowa's trail network had a direct economic impact of $170.27 million.

Table 1: Recreation Facilities and Trails

Main Category	Recreation Facilities	Trails
Definition	Recreation areas can be outdoor spaces, parks, nature preserves, or other outdoor public areas that are used for recreation purposes. These areas may include facilities such as shelters and restrooms, or contain amenities such as ballfields and playgrounds. Does not include larger built structures such as concert or sports complexes unless they are directly tied to activities aimed at using outdoor spaces for public purposes (such as an outdoor amphitheater).	Trails are defined as a pathway for walking and bicycling that is separated from motor vehicle traffic. Routes are included in trails, but are defined as a bicycle or pedestrian route that predominantly utilizes a paved shoulder or shared roadways.

Secondary impacts felt as revenue trickled through additional sectors resulted in a total of $364.84 million in sales and $227.19 million in income. This spending also supported over 6,000 jobs. The study goes on to state savings in health care costs for Iowans who bike recreationally is over $73 million.

A cursory review of recreation opportunities in Iowa results in a large list of types. Because of the variance between types, this report will focus on two main categories: recreation facilities and trails, as defined in Table 1. For the purpose of this report card, federally owned lands in Iowa were not considered due to funding and control mechanisms beyond state jurisdiction.

Table 2 lists a sampling of the outdoor recreation opportunities available in Iowa. Due to the varying management agencies and differences in monitoring and assessment programs, data points on usage, infrastructure condition, economic impacts, and other characteristics can often be difficult to find. As such, multiple sources from public, private, and non-profit institutions were analyzed in order to identify commonalities in the needs of Iowa's recreation system.

Table 2: Outdoor Recreation Opportunities Available in Iowa

	System Total*	State	County	City
Parks		72	1,840 (193,000 acres)	39,096 acres
Forests		10 (43,917 acres)		
Preserves		95		
Natural and Man Made Lakes	132 (324,000 acres)			
Trout Streams	105			
Ponds on Public Lands	308			
Bike and Pedestrain Facilities (excluding standard sidewalk)	3,000 miles			
Trails			1,536 miles	932 miles
Identified On-Road Bikeways	870 miles			
Hunting Land			145,932 acres	
Campgrounds		71	302	31
Campsites			10,500	
Cabins, Cottages, Yurts		114	172	
Boat Ramps, Fishing Piers, Docks		124	809	
Beaches		40	64	
Picnic Shelters		147	699	857
Nature Center		5	75	
Playgrounds			349	915
Community Gardens				44
Other Outside Amenities such as Golf Courses, Soccer Fields, Skate Parks, Dog Parks, Splash Pads			117	>3400

*system total may not be a reflection of the sum of state, county, and city totals due to the overlapping nature of the system, and the definition of each type as found in differing sources.

Capacity

Capacity at parks can be measured in part by usage rates. The availability of usage rates for parks throughout the state can vary based on how agencies track visitors, if at all. Day and overnight visits are well documented at 55 of Iowa's 72 state parks. Between 2007 and 2010, attendance topped 14 million, with over 690,000 groups camping at least one night. Although county recreation areas do not track visitors as systematically as state parks, multiple sources have derived numbers by examining larger county holdings that track attendance and assuming similar patterns. One estimate, by the Iowa Association of County Conservation Boards, states the county park system sees 24 million visitors a year. Parks and recreation areas in municipalities are even more difficult to estimate, but some examples stand out that represent the growing popularity of outdoor recreation. Ashby Park and splash pad in Des Moines has seen attendance top over 14,000 people. Cedar Rapids has reported attendance at its multiple recreation and aquatic centers has reached over 300,000 people per year. And in its opening season, Cone Park in Sioux City, which features an outdoor rink and sled park, exceeded expectations with an attendance of 20,525 people during the winter season (4,500 more than originally expected).

For trail usage, the story becomes one of tracking usage patterns on local and regional scales. The Iowa Department of Transportation (DOT) notes that since 64.3% of Iowa's population lives in urban areas, and the majority of pedestrian and bicycle traffic happens within cities. Most residents utilize bike trails close to their home (within one mile or closer). However, trail usage for long distance recreational biking, specifically, is growing in popularity, taking users more than a mile from their residence. Between 2008 and 2010, the Iowa DOT collected user counts at 29 static locations on multiple trails. This data was then used to model estimates in long distance biking on Iowa trails. The results suggest that between Memorial and Labor Day, close to 150,000 trips were made by bicyclists. In 2017, Iowa DOT began work a statewide bicycle and pedestrian long-range plan as a standalone document that builds upon the State Transportation Plan.

Condition and Future Need

The Iowa DNR's surveys and public listening sessions indicated a desire for consistent and increased funding for recreation. The Iowa Water and Land Legacy (IWILL) has identified $44.5 million in shovel ready recreational projects in Iowa that are stalled due to lack of funding. IWILL estimates it will take $23 million per year for 22 years to erase the backlog of maintenance, renovation, and growth projects in Iowa's County Conservation System. Similarly, the Iowa Natural Resource Commission (NRC) notes in their 2016 annual report that the DNR faces increasing capital costs related to construction and land improvement.

Like the DNR, many local and regional recreation agencies continually call for additional funding for long-term maintenance. A report by the Outdoor Industry Association notes that "...as states add new outdoor recreation infrastructure and as visitation increases, demand for long-term operations and maintenance can overwhelm state resources and make it hard to care for what is already acquired." This situation is similar for trails, as although there are multiple sources of financial support for planning, design, and construction, the burden of maintenance costs usually rests on local agencies.

As long-distance biking and walking along Iowa's trails increases in popularity, breaks in the system become more noticeable and challenging for recreational users. While trails that are separated from motor vehicle traffic are preferred, existing road networks are utilized by bicyclists when no alternatives exist. Users face challenges when a road's bicycle level-of-service (BLOS) decreases due to high traffic volumes or lack of shoulders or lane space. See Figure 1 for a basic outline of BLOS methodology used by the Iowa DOT.

Figure 1: Generalized Bicycling Condition for Rural Roadways

Source: Iowa Department of Transportation, 2018

BLOS for Iowa's primary and secondary state and county roads is, on average, rated as "good." This rating is due to low levels of traffic and indicates they are compatible with bike traffic. On the other hand, the majority of rural roads that stretch from the periphery of cities' limits to up to two miles outside of a metropolitan planning organization boundary are rated as "poor." The consequence is a disconnect in the system. Users traveling from metropolitan trails and "good" rated roads in a city have very few safe and compatible routes that connect to the "good" rated rural roads.

Innovation

Although examining user data for parks and recreation areas in Iowa can inform agency managers on the future need of the system, physical conditions of natural areas are often times hard to monitor and quantify. For established trails especially, monitoring trail surface conditions can be problematic. With budgets and personnel already at a shortfall, walking and recording data on numerous trails can be time-consuming and expensive. The Des Moines Area Metropolitan Planning Organization (MPO), the Iowa Department of Public Health, and the Iowa Natural Heritage Foundation have partnered together on the Iowa Data Bike initiative to streamline this process. Iowa Data Bike is an electronic bike using an app and two cameras to collect imagery and pavement roughness data as a user rides along trails. The data collected "...will help inform a long-term maintenance strategy for Central Iowa's Trail Network."

IOWA DATA BIKE

The Data Bike is a proof-of-concept initiative by the Des Moines Area Metropolitan Planning Organization in partnership with Iowa Department of Public Health and Iowa Natural Heritage Foundation. Using an app that senses the roughness of pavement, the Data Bike will generate data scoring the condition of trails. The DataBike will also collect 360-degree imagery along trails for Google Street View.

1. Using a Yuba Spicy Curry electric bicycle, the rider will maintain a steady speed to collect consistent data on the trails.

2. A Samsung Gear 360-degree camera uploads imagery for Google Street View.

3. An iPhone running the rRuf App will measure the roughness of trails and helps score condition of pavement.

4. A rear-facing GoPro camera will take geo-referenced photos of the trail conditions.

Funding

Funding sources for recreation consist of multiple sources, and can vary based on both the granting and receiving agency. Federally, Community Development Block Grants (CBDGs) provide funds for community-based needs, primarily in low income or underserved areas, and can be leveraged for parks, trails, and other recreation infrastructure. Between 2005 and 2013, $864 million in CBDG funds were allocated to parks and recreation projects. The Land and Water Conservation Fund (LWCF), another federal source of recreational funding, was created in 1964 and has provided matching funds totaling $3.9 billion to local agencies for outdoor recreation. For trails specifically, a major contributor of funds on a federal level is the Recreational Trails Program (RTP). The RTP is an assistance program overseen by the Department of Transportation's Federal Highway Administration (FHWA). Between 1993

and 2017, Iowa was obligated $17.9 million for the construction and maintenance of recreational trails and related facilities.

On a state level, the Iowa DNR not only manages the majority of state recreation holdings but is a major source of recreation investment funds for local agencies. The Iowa DNR itself is funded by a combination of revenue streams. The state general fund provides 7% of its $228 combined annual budget, while the balance originates from multiple sources such as fees and federal funds. The DNR, in turn, administers multiple funds and grants, including the Recreational and Resource Enhancement Program (REAP). REAP provides funds through eight programs, some of which are grants that can be used by county and city agencies for park expansion, land acquisition, and other multi-purpose recreation developments (see Figure 2).

Like the DNR, the Iowa DOT is similarly poised to administer funds to any state or local agency, municipality, county, or non-profit organization for trail infrastructure. Primarily funded by the Rebuild Iowa Infrastructure Fund (RIIF), the DOT manages the Recreational Trails Program (RTP) which is directed at the acquisition, construction, or improvement of public trails. The program also can be used for construction or improvement of trail amenities such as lighting, restrooms, and information centers, but cannot be used for routine maintenance. The Surface Transportation Block Grant - Transportation Alternatives Set-Aside (STBG-TA) is another Iowa DOT administered fund that, according to the DOT, is generally used for street and road projects, but "...some MPOs and Regional Planning Authorities (RPAs) also fund bicycle and pedestrian accommodations with STBG funding, either through standalone projects or as part of larger roadway projects."

Local sources of recreation infrastructure funding can include private donations, local referendums, property taxes, public-private partnerships with local businesses, special assessments, charitable community groups, grassroots fundraising, or leveraging of local general funds. Although multiple funding sources are available on a local level, committing funds for recreation is often a second level priority due to other infrastructure needs.

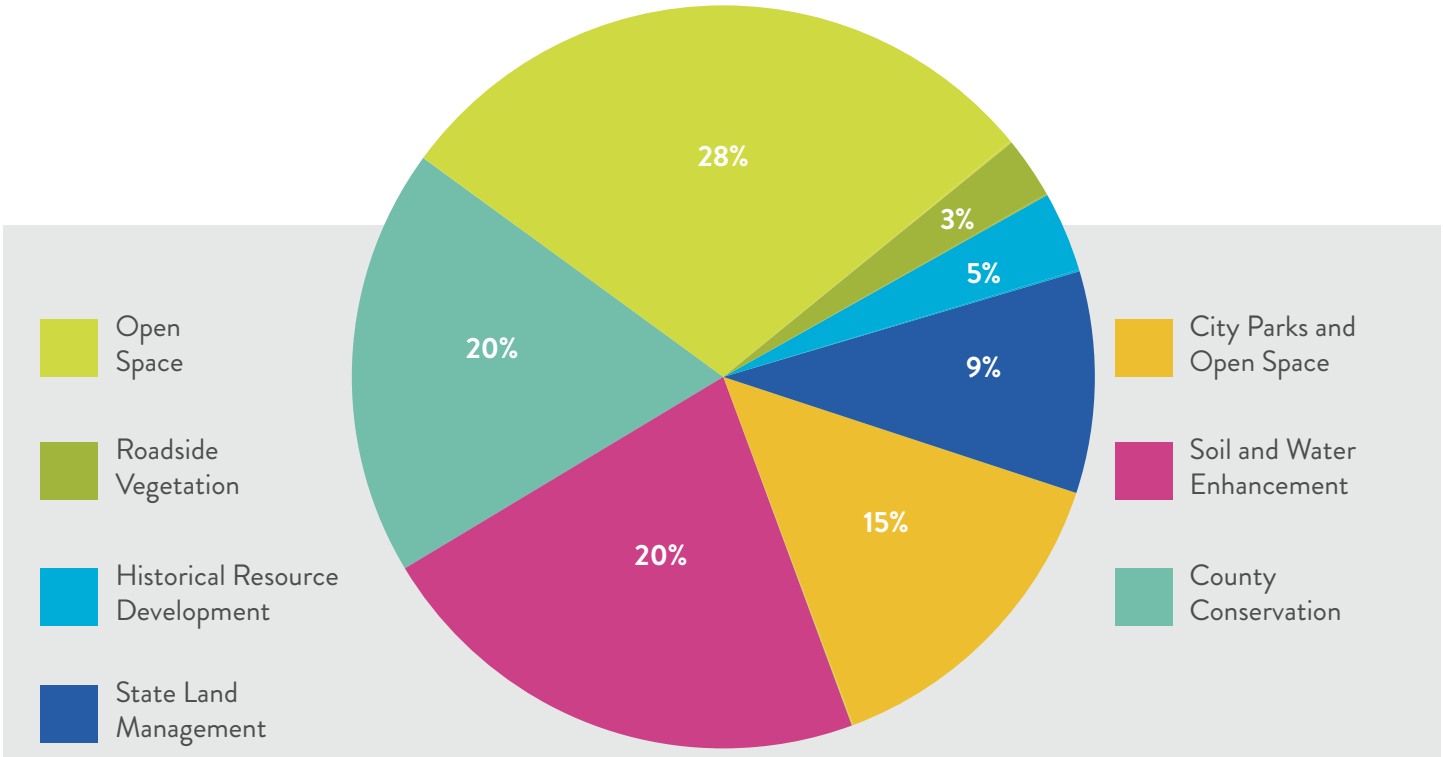


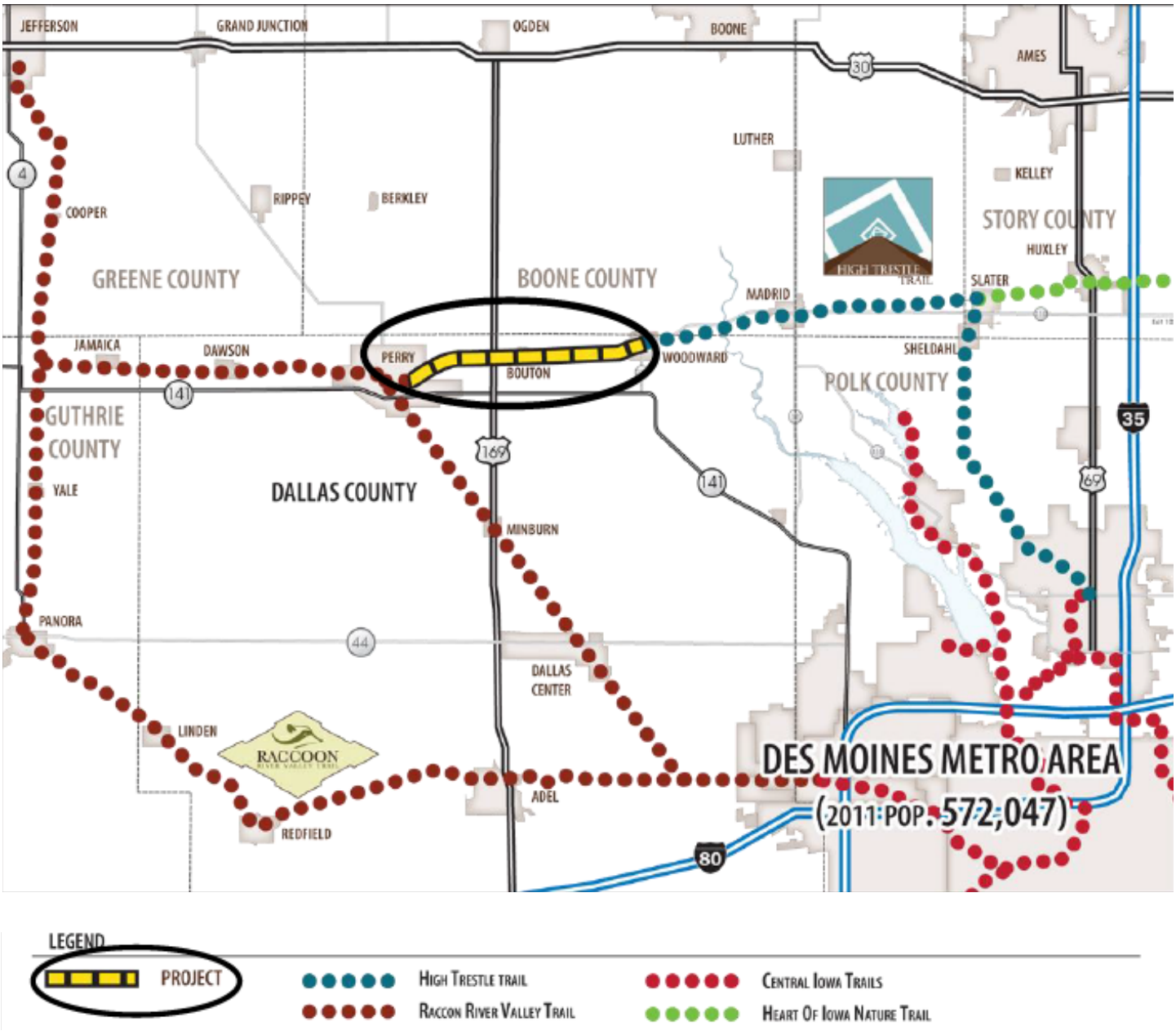
Figure 2: Resource Enhancement and Protection Program

Source: Iowa Department of Natural Resources

However, even with budgets and staff stretched thin, many small communities have taken steps to invest in recreation opportunities by gathering funds through multiple channels.

One notable funding source has historically been the Rails to Trails program. Administered by the Rails to Trails Conservancy, national nonprofit organization, Rails to Trails grants have been used in numerous Iowa communities to transform abandoned rail line to recreational trails. For example, in May 2018 the Dallas County Conservation Board received one of nine nationwide grants to put towards its effort to connect the High Trestle Trail from Woodward to Perry, Iowa, thus linking it to the Raccoon River Valley Trail (See Map 1). According to the "Let's Connect Trail Project" website for Dallas County, other funding sources include private donations, most notably one from a 10-year old local boy whose $350 birthday donation turned into an online donation campaign that raised $7,000 in two weeks.

Map 1: Trail Connection from Perry to Woodward, Iowa (Dallas County Iowa)



Public Safety

One notable area of concern when it comes to the safety of recreational users in Iowa focuses on the condition of lakes and rivers in the state. The Iowa DNR manages routine water testing and monitoring for all of Iowa's state beaches as well as many of those managed by local agencies. According to Iowa Environmental Council, swim advisories issued by the DNR for E. coli levels has shown an increasing trend annually from 2000 to 2017. Advisories for microcystin, a toxin produced by blue-green algae (or cyanobacteria), follow this same upward trend from 2006 to 2017. A 2018 report by the Iowa Policy Project notes that "...fresh analysis confirms that this serious problem is expanding. Cyanobacteria already affect recreational use of Iowa water," but is also "...a looming threat to drinking water systems that draw source water from surface waters."

Resiliency

Parks and green spaces can help protect and restore the health of local streams and rivers. Green buffer zones placed between waterways and agricultural land, for example, is an effective way to reduce pollutant loads in runoff. These buffers can also be utilized as recreation areas when managed properly.

Recommendations

ASCE encourages communities in Iowa to adopt a Complete Streets Policy either as an independent policy or included in an overall comprehensive or long-range transportation plan. As of 2016, 16 cities/towns in Iowa had adopted a Complete Streets Policy, and 22 have included them in a long range or comprehensive plan. Local jurisdictions should also continue to work with the Iowa DOT and similar organizations to ensure that all modes of transportation be considered on a context sensitive basis.

WHAT ARE COMPLETE STREETS?

"Complete Streets Policy"

Complete Streets refer to the practice of planning, designing, operating, and maintaining roadways with all modes of transportation and all users in mind. Not only are drivers considered, but also those who walk, bike, or use public transit. Complete Streets support pedestrians and bicyclists of all ages and abilities. Streets that are "complete" move all people conveniently and safely. Over time, a network of Complete Streets can be established in a community providing safe transportation options and opportunities for physical activity.

Source: City of Windsor Heights Complete Streets Policy, City of Windsor Heights, 32017

Table 3: Natural Resources and Outdoor Recreation Trust Fund Allocation

Lake Restoration	Trails	REAP	Local Conservation Partnership Program	Watershed Protection	Soil Conservation Water Protection	Natural Resources
7%	10%	13%	13%	14%	20%	23%

- On November 2, 2010, 63% of Iowa voters approved the creation of a constitutional amendment that created the Natural Resource and Outdoor Recreation Trust Fund. In order to fund the Trust, a 3/8 of a cent sales tax increase must be approved by the Iowa Legislature. To date, no increase has been approved, and the fund remains empty. ASCE joins many private and public groups by supporting the call to "Fund the Trust". The Trust will serve as a permanent revenue source for natural resources and recreation in the state of Iowa, being split among seven categories as noted in Table 3.

- In order to keep up with the growing desire for public recreation areas, ASCE recommends that local and regional agencies develop data collection and monitoring efforts of already established recreation areas. By collecting usage data, local agencies and recreation departments are better equipped to monitor the success of past investments, and plan for future needs.

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RAIL

C+

Executive Summary

Rail transportation is important to Iowa's economy, helping to deliver agricultural products and other commodities to world markets at competitive prices. Iowa's rail capacity and condition are improving, in part thanks to investments in rolling stock and associated rail infrastructure. In 2017, railroads operating in Iowa spent an estimated $205 million to maintain and improve Iowa rail infrastructure. Meanwhile, implementation of safety programs, technology, and rail crossing upgrades have decreased rail-related accidents. Iowa's short line railroads, including Iowa Interstate and Iowa Northern, have undertaken several projects and investments to improve capacity. And while passenger rail service is limited to two long-distance routes through the state, Iowa and Illinois are working together on planning for a new line, to run from Chicago to Council Bluffs. Though funding for this project is not sufficient for implementation. However, limited freight and passenger access to the entire state may inhibit rail's long-term growth. Additionally, the ability of Iowa's rail infrastructure to sustain current service levels through asset renewal and replacement, while also adding capacity and service to serve future demand, will require increased investment by private, federal, state, and local funding sources.

Background

Railroads have played an important role in Iowa's economy since the state was founded in 1846. While they originally served as general purpose carriers serving all citizens and businesses in nearly every community, freight railroads have since evolved to shipping large quantities of goods to and from high volume terminals.

At its peak from 1911 to 1917, 10,500 miles of rail lines crisscrossed Iowa and handled almost all freight movement plus a large volume of passengers. Due to competition from other modes of transportation, regulations, labor efficiency, and changes in the agricultural economy, many lines became uneconomical, leading to a general decline of the rail system and service. Track facility maintenance was deferred, tracks speeds slowed, and many railroad

Photo 1: Boone Scenic Valley Railroad, Boone, Iowa

companies became at risk of bankruptcy. These trends culminated in the 1980s with the collapse of the Rock Island and Milwaukee railroads in the Midwest and the near shut down of major eastern carriers.

In response, Congress deregulated the remaining railroads of many constraints preventing efficient operation and adequate revenue generation. Iowa's surviving railroads then aggressively right-sized their systems and adopted a focus on carrying large volumes of freight in unit trains. Rail line mileage fell drastically to 3,800 miles, but operational factors, such as track and rolling stock utilization, improved substantially. Long deferred maintenance work was completed and most remaining lines were actually improved with ribbon rail and revamped yards.

The rail industry, having too many miles of underused track and small, weak corporations, consolidated. The top lines – including UP, BNSF, NS, CN, and CP – took over Iowa lines of national importance. New regional and local carriers, like Iowa Interstate, Iowa Northern, and Burlington Junction Railway, were created to keep the remaining lines of state/local significance in service. These new carriers have been vital to products by transporting products to Class I railroads.

Capacity and Condition

Iowa's rail capacity and condition are improving. Iowa rail remains at 3% of the total freight network in the state but accounts for 17% of Iowa's freight tonnage. Although total miles of track since 1985 have fallen by 18%, ton-miles have increased due in part to rail line density tripling since the 1980s. Improved rolling stock (locomotives, carriages, wagons, and other vehicles used on railroads) has also accounted for the increase with locomotives pulling 31 cars (up from 23) and car capacity up 18% since the 1980s.

In 2017, rail movement in Iowa rose to 349 million tons. Approximately 70% of the freight moving on Iowa rails is pass-through traffic that both originates and terminates out of state. Iowa originates 61.8 million tons (mostly farm, food, and chemical products) per year and receives 34.3 million tons (mostly coal, farm, chemicals, and food products). By 2040, rail movement is expected to increase to 442 million tons, a 27% increase, with similar directional composition.

Map 1: Passenger Rail Service in Iowa

Of Iowa tracks, 70% are rated at 40 mph or better, with key transcontinental routes on the BNSF rated up to 79 mph - although freights usually travel at no more than 60 mph maximum. The high speed tracks improve the appeal of passenger rail to commuters by decreasing travel times.

Two long distance Amtrak lines run though Iowa. Boarding continues to average around 60,000 passengers at six depots each year. Unfortunately, the lines cross through the state's less populated southern counties and the once per day schedules preclude using the service for business trips. New passenger rail routes have been studied, including a Chicago to Council Bluffs-Omaha route. A potential phased implementation has been proposed with the Chicago to Iowa City portion being the first phase. Illinois is working on implementing the Chicago to Moline portion and Iowa is planning the Moline to Iowa City portion. This first phase has received some federal monies to partially fund it.

Operations and Maintenance

Six Class I (national scale), one Class II (regional), and 11 Class III (local) firms operate Iowa's rail network. The Class I firms hold 83% of the trackage and carry 93% of the rail ton-miles and revenues. Operations are not uniformly distributed.

Table 1: Track Maintenance and Improvement Cost per Mile

Year	Cost	Cost Adjust for Inflation
1987	$23,400	$50,500
2017	$62,000	$62,000

In 2017, railroads operating in Iowa spent an estimated $205 million to maintain and improve Iowa rail infrastructure. The 23% increase from 1987 to 2017 has been halted by a recent break in the cost for maintenance. Class I railroad maintenance costs are estimated at 9% of total operating revenues.

The two Amtrak routes include one daily route going across southern Iowa to link Chicago and San Francisco (California Zephyr). The other runs from Chicago, across the desert southwest to Los Angeles (Southwest Chief). These trains usually have two coaches, two sleepers, a lounge car, and a dining car. The full-length trips take about 36 hours. Westbound trains stop at Iowa stations in the evening; eastbound in the mornings.

Public Safety and Resilience

Recent years have been the safest for the rail industry. Some of the causes for improved safety include safety improvements at, and the reduction in number of, rail-highway grade crossings, investments in better track maintenance and inspection, and the Federal Railroad Administration (FRA) standards for railroads to have a Bridge Management Program with inspection of in-service bridges occurring annually.

The railroad industry has been adopting and installing a system called Positive Train Control (PTC) to prevent train accidents. PTC could eliminate over speed, train-on-train collision and other mishaps caused by train-crew error or equipment failure. Iowa's rail industry has been heavily investing in PTC in the past five years. In August 2018, the FRA awarded $200 million for PTC implementation in 15 states, with $1.8 million to be used in Iowa.

Implementation of PTC will not eliminate vehicle-train crashes where the roadway driver is at fault. Low speed crossings on local municipal streets and secondary roads account for 95% of all railroad collisions. Several methods of reducing these collisions have been used by the Iowa Department of Transportation (DOT) including education, enforcement, engineering (studies on railroad safety devices), and funding programs. The Iowa DOT estimates spending $5.7 million annually to upgrade crossings and another $1.4 million annually to repair railroad crossings.

Rail's resilience has been tested during a number of flood events over the last 10 years that have revealed weaknesses in its infrastructure. Bridges are the largest vulnerability, as most bridges in operation were built around 100 years ago. Class I railroads have been addressing this issue proactively, with new structures over the Missouri and Mississippi either planned or built. In September 2018, a bridge on the Union Pacific rail line in Alton, Iowa, collapsed causing 37 cars to derail. Freight traffic was rerouted until a new bridge became operational 12 days later. Though there have been several investments to mitigate risk by improving the rail infrastructure, some areas may still be vulnerable to floods.

Photo 2: Train Derailment in September 2018, Alton, Iowa

Funding and Future Need

Iowa's rail industry employs over 3,000 people and annually grosses $2.1 billion in operating revenue. Rail has many cost advantages when shipping sizable quantities or commodities in bulk. Average annual freight rail project costs from 2017 to 2045 are estimated to be $105 million while average annual Iowa DOT revenues over this period are estimated to be only $16 million, only 15% of the total anticipated costs. Focus areas for these projects includes enhanced access to the state's rail network, fixing rail service gaps, improving the infrastructure and capacity, safety and efficiency of rail service, and operations. The remaining 85% would be divided by federal and local funding sources as well as railroad or other private funding sources. Operating ratios (cost of train operations as a percentage of total revenue) have been steady for Class I firms, but Class II and III firms have been rising, putting their long-term viability into question.

Table 2: Freight Costs per Pound

Air	Truck	Rail
$15.50	$0.30	$0.08

Iowa freight volumes are expected to increase, from 1.1 billion tons in 2015 to 1.4 billion tons in 2045. Increased grain yields and ethanol production make Iowa's freight transportation increasingly important.

To meet increased demand, the Iowa rail industry has been upgrading lines to carry heavier cars and increase rail capacity. It is expected additional measures will need to be taken in order to meet future demand including: upgrading more lines to accommodate heavier cars, adding spur tracks and establishing "shuttle train terminals" for increased rail access, and potentially adding a second or third track along main lines.

As the economy is greatly affected by volatile oil prices, passenger rail can offer an energy efficient and cost effective alternative to automobile and air travel. Iowa's population has grown by 12% from 1990 to 2015, yet travel across all passenger modes has increased nearly 43%. Iowans are also traveling farther to work from rural/small town residences to large population centers. Additional passenger rail studies have been proposed across Iowa in addition to the already planned Chicago to Council Bluffs line. Passenger rail funding is inadequate to provide more than marginally acceptable continuance of existing service, let alone future passenger rail expansion. Ticket sales alone are unlikely to be able to directly pay the full cost of capital and operating needs. Other funding sources from the state, communities, and benefitting businesses may be necessary to help with initial capital improvements and ongoing costs. Should the financial resources be found, in Iowa and in surrounding states, it would be possible to expand routes and services.

Recommendations

- Continue to promote and enhance rail safety through continued public education programs and enhancements to the public grade crossing improvement programs in the state.

- Increase the movement of freight rail by supporting the development or enhancement of rail industrial spurs, transload and intermodal facilities, rail storage capacity, and other infrastructure projects needed to both maintain a state of good repair and expand rail service to enhance economic development.

- Preserve, protect, improve, and expand, as necessary, existing intercity/long-distance passenger rail service in Iowa through station facility and access improvements, and continue to study the potential for implementation of new intercity passenger rail services in the state where demand, transportation, and other public benefits merit.

- Further collaborate with neighboring states on regional issues and solutions to passenger and freight rail needs through regional multi-state coordination and organizations.

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ROADS

C+

Executive Summary

Iowa has over 114,800 miles of public roadway, ranking 13th in most lane miles in the nation. The 10 cent gas tax increase implemented in 2015 has provided much needed additional funding to address short term critical needs in the state's infrastructure network. Pavement conditions have improved across all route types and the number of fatalities and serious injuries have decreased. In most places, congestion is not a major concern and Iowa has one of the lowest average travel times to work for commuters. However, despite progress, funding gaps and challenges remain. Today, 29% of Iowa's major roads are in poor or mediocre condition, costing each Iowa motorist $397 in annual vehicle operating costs and 15% of Iowa's rural roads are in poor condition, the 20th highest rate in the nation. Looking ahead, growth trends in population, freight traffic, and urbanization, combined with the advancing age of most Iowa roadways, will stress the system, particularly in urban areas and key interstate corridors. Over the next 20 years, a funding shortfall to meet all current and future needs of Iowa's city, county, and state roadway systems is projected to be $32.5 billion, or $1.6 billion annually.

Background

Iowa's economy relies on a robust transportation system to move products to a global marketplace. The highway system has long provided our state's businesses a competitive advantage moving goods and services in today's global economy and we are uniquely positioned at the crossroads of two major transcontinental interstate highways in I-35 and I-80. Iowa has over 114,800 miles of public roadway, ranking 13th in the nation. Of the state's total miles of roadway, 8% are on the primary road system (Iowa DOT jurisdiction), 79% on the secondary road system (Iowa counties), and 13% on the municipal road system (city). The support required to maintain our roadways is a combined effort between federal, state, county, and local levels of government.

Capacity

In Iowa, there are approximately 9,600 miles of primary (interstate, U.S. routes, and state routes) roadways, 89,800 miles of secondary roadways, and 15,200 miles of municipal roadways. Although

Table 1: Iowa Lane Mile Jurisdiction and VMT

	Mileage	Percent of Total Mileage	Total VMT (millions)	Percent of VMT	Large Truck VMT (millions)	Percent of Total Large Truck VMT
Primary (Iowa DOT)	9,595	8%	24,461	65.7%	2,719	90.8%
Secondary (County)	89,745	79%	5,569	15.0%	255	8.5%
Municipal (City)	15,243	13%	7,193	19.3%	20	0.7%
Total	**114,583**					

Source: Iowa Department of Transportation VMT = Vehicle Miles Traveled

Iowa ranks 13th in the nation in miles of roadway, the state ranks 36th in population density. The primary road system carries 63% of the state's overall travel and 92% of the state's freight traffic. Iowa's primary system is divided into five classifications according to priority.

Interstate: Comprised of 1,059 center line miles, the Interstate Highway System provides connections to the national transportation network and major metropolitan areas.

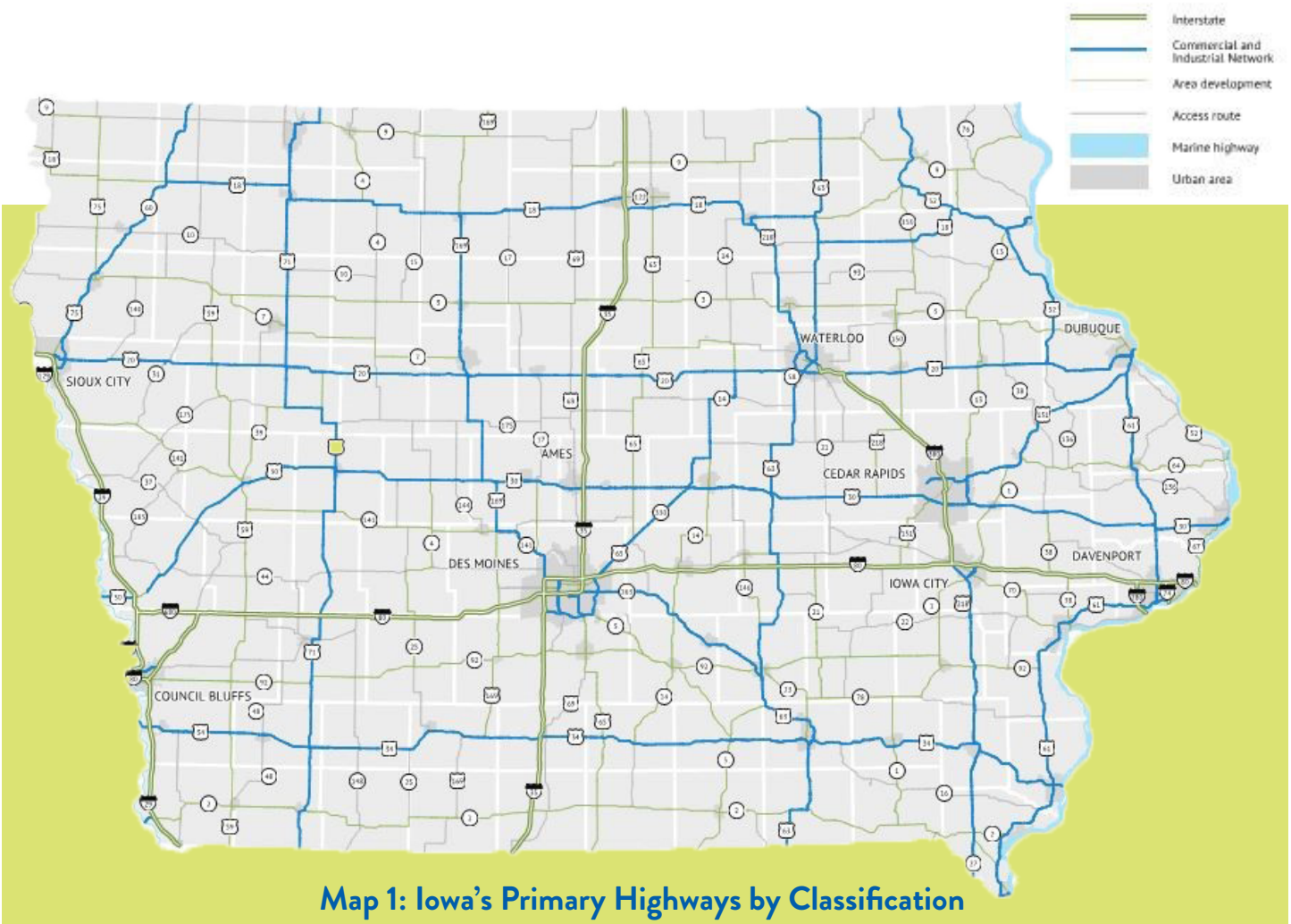
Commercial and Industrial Network (CIN): Comprised of 2,521 center line miles, the CIN provides connections for Iowa cities with a population greater than 20,000 to major metropolitan areas and was identified by the state legislature to enhance opportunities for the development and diversification of the state's economy.

Other primary highways comprise the remaining 5,829 miles and include the following routes.

Area development: Provide connections for cities with populations greater than 5,000 to the CIN and major commercial and industrial centers.

Access route: Provide connections for cities with populations greater than 1,000 to employment, shopping, health care, and education facilities.

Local service: Provide connections for cities with populations less than 1,000 to local commercial and public service.



Map 1: Iowa's Primary Highways by Classification

Source: Iowa Department of Transportation

Between 2000 and 2017, Iowa's population grew by 7%, and is undergoing generational shifts and urbanizing. From 2000 to 2016, vehicle travel on Iowa's highways increased by 13%. The results of recent capacity analysis on Iowa's transportation network show there is currently limited congestion on Iowa's primary network and that Iowa has one of the lowest average travel times to work for commuters. The state also gets high marks for its overall low levels of congestion statewide. However, while congestion is generally limited, in certain locations bottlenecks are becoming more common, costing Iowans $380 million annually in lost time and fuel.

Over the next 20 years, capacity challenges will become more prevalent, especially in urban areas and key interstate corridors. Growth in global trade and overall economic activity in Iowa will lead to increased freight movements on Iowa's network; truck volumes and freight flows are predicted to grow over 40% by 2040. Additionally, increased population in and around metropolitan areas will create congestion.

Condition

The Iowa DOT analyzes the condition of the state's Primary Highway System using the Infrastructure Condition Analysis (ICE) tool. This tool evaluates the overall structure and service condition of roadways by evaluating seven criteria into a single composite rating. The following criteria are used in the composite rating.

- Pavement Condition Index (PCI)
- International Roughness Index (IRI)
- Structure Inventory and Appraisal (SIA) sufficiency rating
- Annual Average Daily Traffic (AADT) combination truck count
- AADT single-unit truck count
- AADT passenger vehicle count
- Congestion index value

Projected Congested Interstate Corridors

I-80 between Des Moines and Davenport

I-35 from Des Moines to Ames

I-380 from Iowa City to Cedar Rapids

This tool helps identify deficiencies in the network and corridors that should be considered for further study. Iowa's primary road system has an average score of 75 from the ICE methodology. Segments that were located within urban areas continued to hold the lowest average ICE composite rating at just above 70. The primary and urban highway system were both below the system wide average while rural highways, interstates, and non-NHS system were all rated above the system wide average. Based on a typical pavement life cycle, each year, approximately 5% of the system's surface would need improvements of some type to keep up with deterioration. Iowa DOT has flagged the lowest-rated 25% of primary road system corridors based on ICE composite rating as having condition improvement needs.

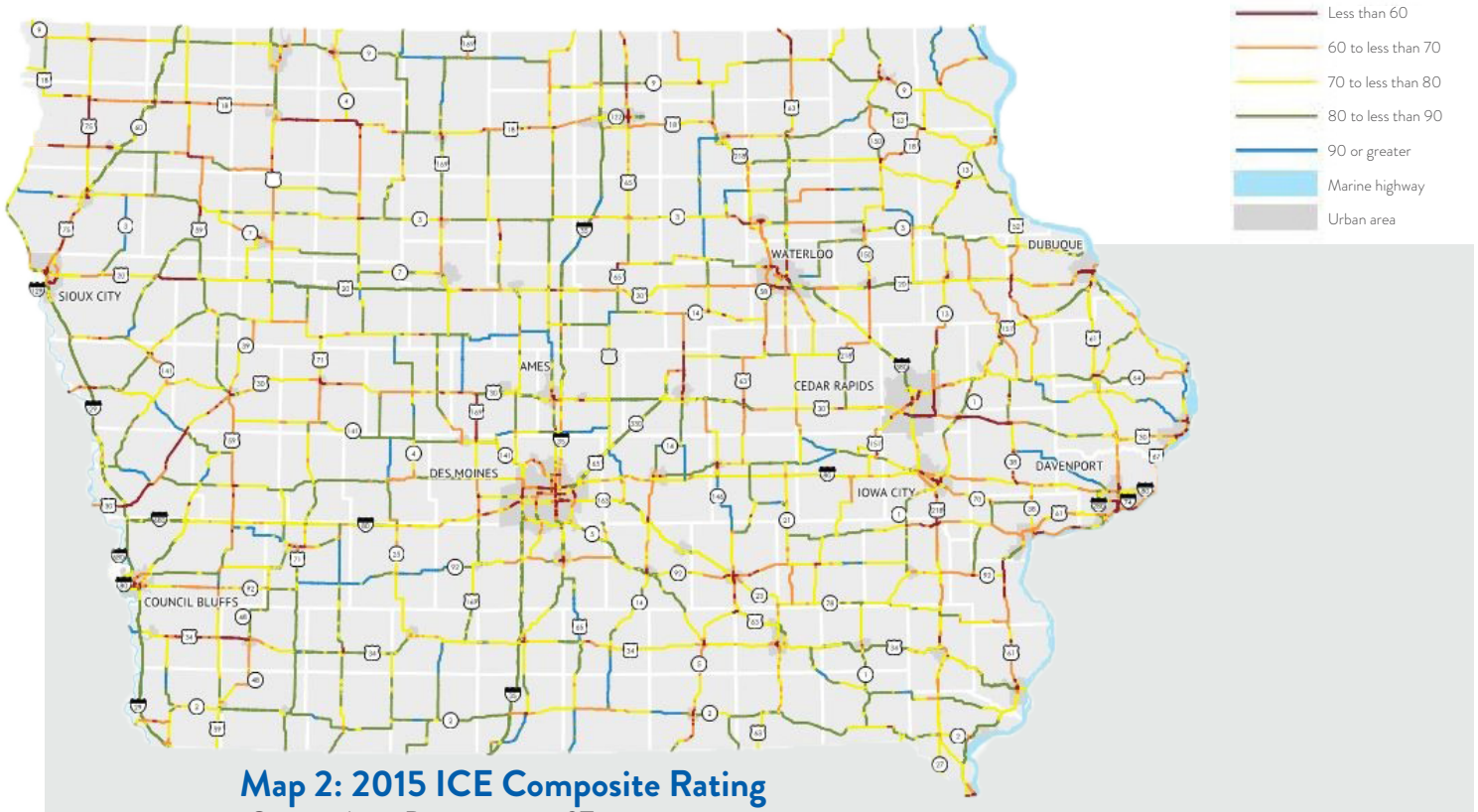
Over the past three years, system wide ICE composite ratings across different route types has experienced positive change. The interstate system has seen the largest increase in average ICE composite rating since 2015.

According to the most recent 2018 TRIP information available, 29% of Iowa's major roads are in poor or mediocre condition, costing Iowa motorists $891 million annually in vehicle operating costs, or $397 per motorist. Of Iowa's major interstates, 22% experience congestion during peak hours. Iowa's rural roads have significant deficiencies. Of Iowa's rural roads, 15% rated in poor condition, which is the 20th highest rate in the nation, and 19% rated in mediocre condition. While the 10 cent increase in the gas tax provided much needed funding for critical projects, future needs are significant. Iowa DOT expects the overall condition of the primary system will get worse over the next 10 years based on projected funding levels.

Table 2: Condition by ICE Rating and System Designation

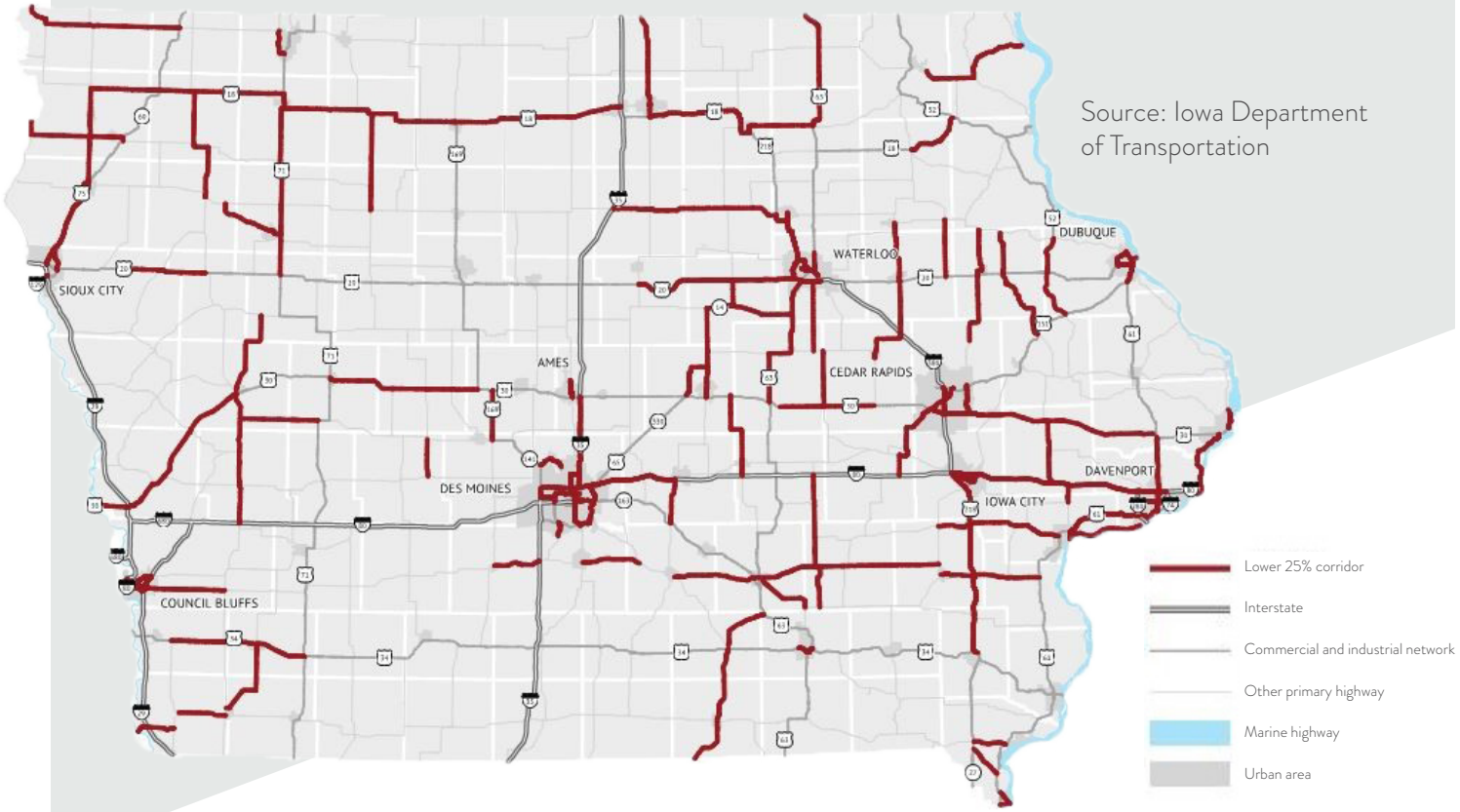
		Percent of Network by ICE Rating				
	Percent of System	<60	60-70	70-80	80-90	>90
Interstates	14%	1%	9%	42%	43%	6%
Commercial and Industrial Network	35%	8%	20%	43%	29%	1%
Other Primary Highways	51%	5%	20%	37%	30%	8%
Overall Primary Highway System	100%	5%	16%	41%	34%	5%

Source: Iowa Department of Transportation



Map 2: 2015 ICE Composite Rating
Source: Iowa Department of Transportation

Map 3: Bottom 25% of Primary Highway Corridors Based on ICE Composite Rating



Source: Iowa Department of Transportation

Operations and Maintenance

Iowa DOT has developed a Transportation Systems Management and Operations (TSMO) program as a guide to operate Iowa's existing infrastructure at its optimal, full service potential. The purpose of TSMO is to provide coordinated resources and strategies to realize the full capacity of the existing transportation system, increase reliability of freight and auto, improve safety and reliability through traffic incident management, and target safety and operational problem locations to deliver performance driven improvements to the existing system.

Iowa's TSMO Program Plan provides strategic direction, program development, and specific steps for systems management and operations in Iowa. The performance based plan focuses not only on the performance of the surface transportation system, but also on the strategies and business processes that will help improve overall system performance and safety.

Iowa faces challenges associated with harsh winter conditions and the movement of people, goods, and services that extend beyond traditional construction and maintenance functions. With projected traffic growth and system demand, advancements in technology, and limitations in funding, Iowa's transportation system must be managed and operated in a manner responsive to constantly changing conditions. TSMO is intended to provide guidance and direction to Iowa DOT and public officials responsible for making strategic decisions about effectively managing and operating the transportation system with limited resources to meet changing conditions and travel demand in Iowa.

With an annual operating budget of $65 million, the Iowa DOT Office of Maintenance has a significant role in the TSMO in the context of weather management, traffic incident response, and emergency transportation operations. With over 900 snow plows and 30 plus snow events, Iowa has one of the biggest snow removal fleets in the country. Iowa has been at the forefront of using

snow fighting technology and in sharing information with the public through the use of onboard cameras, GPS, automated application systems, and the state's Track-A-Plow program—which is a website that shows the public where plows are in real-time, live photos of the plows, and the treatment.

Public Safety

Iowa's Strategic Highway Safety Plan (SHSP) examines crash history, lays out safety strategies, and discusses an overall vision of zero fatalities on Iowa's public roadways. Between 2008 and 2017, there were 3,586 fatalities and 15,755 serious injuries on Iowa roadways. In 2013, Iowa set a goal of reducing fatalities and serious injuries 15% by 2020. The current five year moving averages of 338 fatalities and 1,498 serious injuries are on track to meet that goal. In 2017, the fatality rate per 100 million vehicle-miles traveled (VMT) has declined to 0.98, below the national average of 1.16.

While a reduction in overall fatalities and serious injuries has been achieved, an analysis of crash data reveals areas of concern. Examining the 10 years of crash data between 2008 and 2017 leads to several important notes to consider.

Iowans under the age of 25 and Iowans over the age of 65 represented over 35% of drivers involved in fatal and serious crashes. These two demographics have drastically different driving behaviors and transportation safety needs.

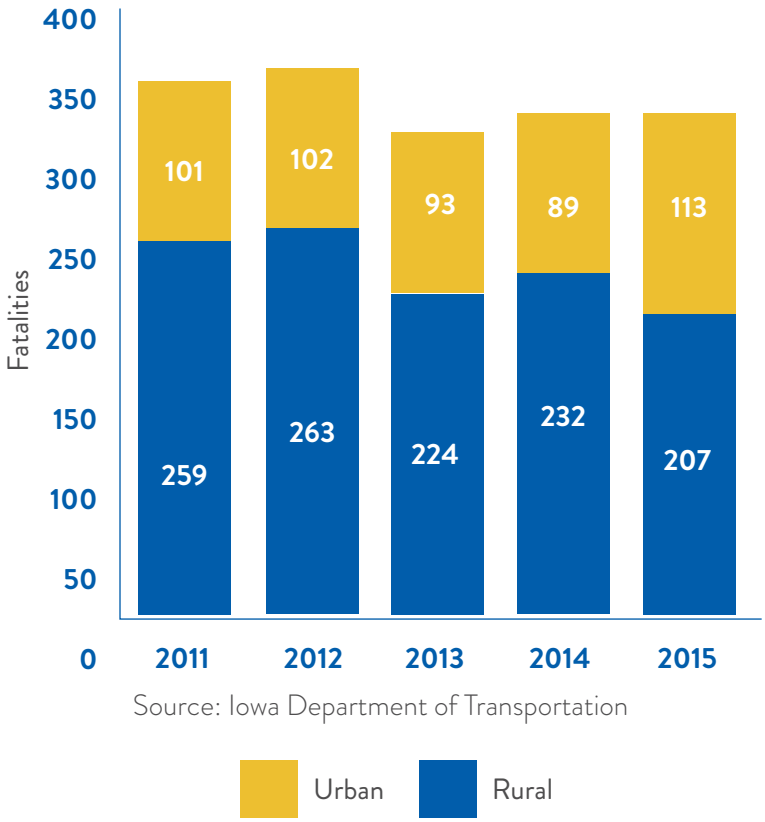
Iowa's population is projected to continue to urbanize; however, a larger proportion of Iowa's fatal and serious vehicle injuries are occurring in rural areas as opposed to urban areas. Consideration should be given to Iowa's high-risk rural roads.

Even though more travel occurs on the primary system, more fatalities and serious injuries occur on the county and city systems.

In Iowa, male drivers are over-represented in fatal and serious injury crashes, often two to three times their female counterparts. In the 2019 SHSP, Iowa has identified eight emphasis areas to continue reducing severe and fatal injuries.

- Lane departures and roadside collisions
- Speed-related
- Unprotected persons
- Younger drivers
- Intersections
- Impairment involved
- Older drivers
- Distracted or inattentive drivers

Figure 1: Fatalities on Iowa Highways



Source: Iowa Department of Transportation

Funding

Funding for roads is provided by federal, state, and local funding. Federal surface transportation funding is allocated through the Fixing America's Surface Transportation (FAST) Act with revenue provided by the Federal Highway Trust Fund. This funding is set to expire in late 2020.

State road funding comes from the Road Use Tax Fund (RUTF) and the Transportation Investment Moves the Economy in the 21st Century (TIME-21) fund which are funded through fuel taxes, registration fees, and other miscellaneous fees. Per Iowa law, 96% of all revenues that flow into the RUTF and TIME-21 funds are required to be spent on Iowa's public roadways. Iowa's FY2019-2023 Highway Program provides $3.4 billion in highway investments. Over $1.8 billion is programmed over this same period for modernization of Iowa's existing highway system and enhancing safety features.

Prior to 2015, Iowa's revenue stream for its roadways had remained stagnant for two decades while construction costs increased by 140%. In 2015, Iowa passed a 10 cent increase to the state gas tax, providing an additional $215 million annually for Iowa's roads and bridges. All of the gas tax revenue is dedicated to road and bridge projects critical to Iowa's transportation infrastructure. The new revenue has provided a significant boost and addressed critical needs of the highway system; however, Iowa's transportation costs continue to outpace revenues and our transportation network remains in need of additional funding.

For FY 2019-2023, Iowa DOT has identified a total funding gap of $102 million and $580 million in projects developed but not programmed over the five year period.

Photo 1: Spot Patching
(Photo Credit: Iowa County Engineers Association

Future Need

Iowa has a comprehensive transportation plan, Iowa in Motion 2045, identifying the vision, investment areas, action plan, and strategies for the state's transportation system.

Iowa DOT has assessed the total 20 year needs for Iowa public roadway system. Over this period, the total funding shortfall to meet all current and future needs of Iowa's city, county, and state roadway system is projected to be $32.5 billion, or $1.6 billion annually.

Iowa has Identified Four Principal Investment Areas to Achieve the System Vision

1. **Stewardship**
2. **Modification**
3. **Optimization**
4. **Transformation**

Iowa DOT and other stakeholders on both the state and federal level are moving towards thinking about streets, and transportation networks, not just as means for motorized traffic, but all types of traffic (motor vehicle, public transportation, bicycle, and pedestrian modes). Iowa DOT recently finalized a Complete Streets Policy for Iowa as part of the Iowa Bicycle and Pedestrian Long-Range Plan, which requires all state projects to consider accommodations for all users in the planning, design, and construction of projects.

Iowa State Gas Tax

CENTS PER GALLON	LAST RAISED IN
31.7	**2014**

Resilience

Iowa DOT has developed preparedness, response, and recovery strategies for designing resilient primary network routes and development of Emergency Transportation Operations (ETO) as part of their TSMO program.

Innovation

Iowa DOT, University of Iowa, Iowa State University, local jurisdictions, planning agencies, and the private sector, will develop an implementation ready platform for connecting and guiding automated vehicles. This platform will be based on high-definition dynamic mapping, predictive travel modeling, and a cloud-based communication network. The effort will initially deploy technologies supporting autonomous vehicles regionally in the Iowa City-Cedar Rapids transportation network. Additional deployments are planned for the Des Moines-Ames metropolitan areas, as well as I-35 and I-80 across Iowa.

Recommendations

- Advance priority projects on key interstate system corridors.
- Index fuel tax rates to inflation to create a more sustainable, long-term funding source.
- Implement Alternative Fuel Vehicle Registration Fee to capture an alternate means of funding beyond the gas tax so electric and hybrid vehicles pay their fair share of the transportation infrastructure burden.
- Address congestion through policies and technologies that maximize the capacity of the existing road network and create an integrated, multimodal transportation system.
- Implement Iowa DOT Complete Streets Policy.
- Provide leadership in planning, transitioning, and implementation of connected and automated vehicles.

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Photo 2: Iowa 58 and Viking Road Interchange Project

SOLID WASTE

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Executive Summary

The solid waste management system provides an essential public service to the citizens of Iowa. There are 47 active landfill sites across the state, with one site in the process of closing. Average individual landfill capacity is estimated to be adequate until 2044. In general, Iowa's solid waste infrastructure is performing adequately, although per capita waste generation rate is increasing. In 2017, Iowans generated an average of 0.96 annual tons per capita, well above the national average of 0.82 annual tons per capita. Additionally, while Iowa's diversion rates are above average, market threats to recycling programs present significant challenges that will need to be addressed immediately to maintain long-term viability. Looking ahead, several new techniques and technologies have the opportunity to further enhance solid waste management in the state.

Background

There are three basic components in the solid waste management system: collection, diversion and processing of recyclable and compostable materials, and disposal of non-recyclable waste. These three components, coupled with the implementation of waste reduction and recycled material market development programs, ensure the integrity of the solid waste management system for the citizens of Iowa.

In Iowa, the types of waste recognized by the applicable regulations are listed below.

Residential Solid Waste: Any solid waste (including garbage, trash, yard trash, and sludges from residential septic tanks and wastewater treatment facilities) from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

Commercial Solid Waste: All types of solid waste generated by stores, offices, restaurants, warehouses and other nonmanufacturing activities, excluding residential and industrial solid wastes.

Industrial Solid Waste: Solid waste generated by a manufacturing, industrial or mining process, or that is contaminated by solid waste generated by such a process. This includes, but is not limited to, waste resulting from electric power generation, fertilizer/agricultural chemicals, food and related products, byproducts, inorganic chemicals, iron and steel manufacturing, leather and leather products, nonferrous metal manufacturing/foundries, organic chemicals, plastics and resins manufacturing, pulp and paper industry, rubber and miscellaneous plastic products, stone, glass, clay and concrete products, textile manufacturing, and transportation equipment.

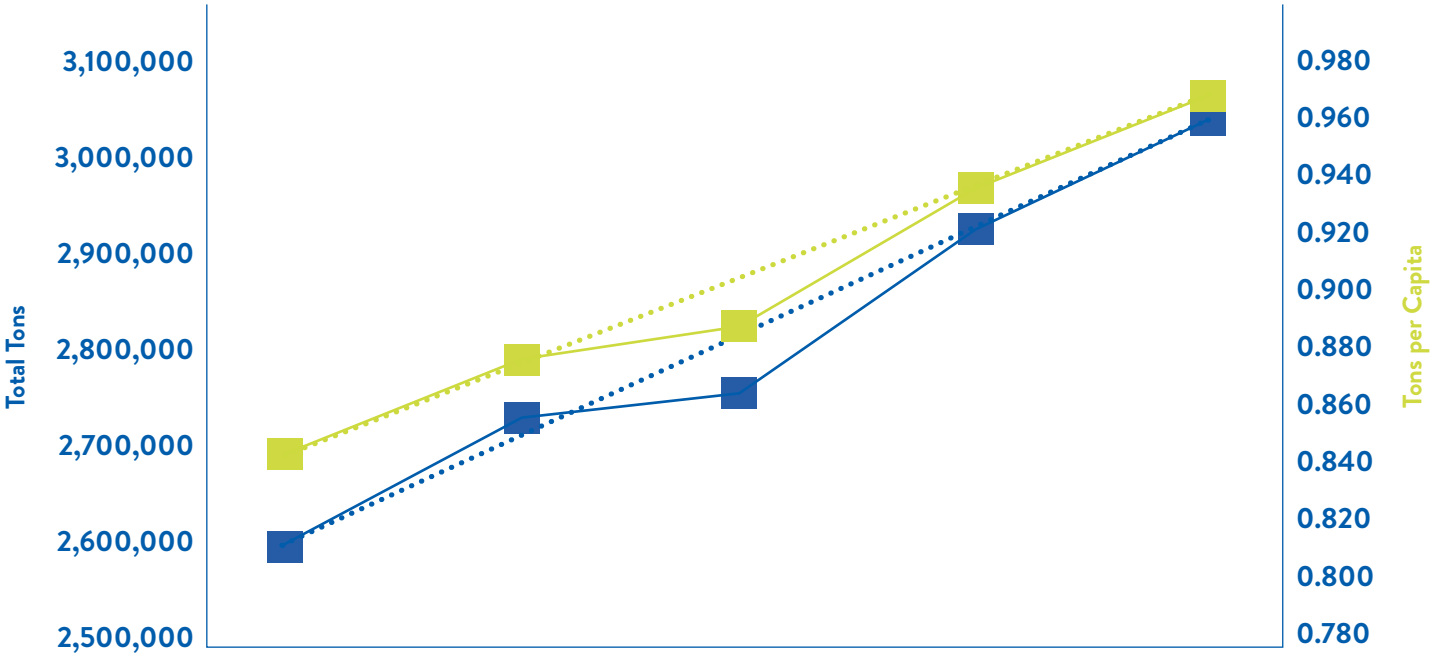
Construction/Demolition (C&D) Debris: Nonhazardous waste generally considered not water-soluble that is produced in the process of construction, remodeling, repair, renovation, or demolition of structures, including buildings of all types (both residential and nonresidential).

Condition

Iowa produced 3.04 million tons of municipal solid waste in FY 2018 (July 1, 2017 - June 30, 2018). These most recent years continue an increasing trend of about 108,000 tons of growth per year. See Figure 1 showing the near-term trends. This gently increasing output correlates with the low population growth of the state and slightly increasing per capita generation rates. It should be noted that this trend was actually decreasing at the time of the 2014 Report Card, however, it appears that has changed. Additionally, Iowans have an average waste generation rate that is higher than the nationwide average (0.82 tons per capita) and is increasing at a rate of approximately 60 pounds (0.03 tons) per capita per year. See Figure 1.

As of September 2018, the Iowa Department of Natural Resources (DNR) reports there were 47

Figure 1: Annual Waste Production, State of Iowa



	2014	2015	2016	2017	2018
Tonnage	2,603,612.60	2,736,750.41	2,781,565.54	2,935,669.08	3,043,696.60
Per Capita	0.843	0.881	0.892	0.938	0.968

Source: Iowa Department of Natural Resources and US Census Bureau

active landfill sites with future capacity while one site is in the process of closing. In total, over 400 individual entities are granted permits by the DNR for waste disposal or handling.

The most recent recycling data available reveals that, in 2005, Iowans generated 2.68 million tons of trash, and of that, an estimated 1.13 million tons were recycled or composted. This represents a 42% recycling rate, which is similar to the rate from 1999 and well above the 2005 national average of 31.4%. The national average has since increased to 34.7% and it is likely that the statewide rate has also increased over that time. More current information is not available because the Iowa DNR does not require recycling operators to report statistics. However, by way of the most recent Waste Characterization Study, it is "...estimate(d) that nearly 70% of the MSW disposed of in Iowa is divertible through increased reuse, recycling, and composting."

Passed in 1979, Iowa's Beverage Containers Control Law, also known as the "Bottle Bill," helps reduce and clean up litter by recovering beverage containers for recycling. Consumers pay a five cent deposit when purchasing a plastic, glass, or aluminum beverage container and receive a five cent refund when returning the container to a store or redemption center. Iowa still enjoys a high level of participation, with a 71% recycling rate for glass bottles and aluminum cans. However, several factors have combined to reduce this rate since 2014. The number of redemption facilities has dwindled because the handling rate of 1 cent per container is not profitable enough. Also, the growing market of water and sports drink style beverages are not included in the program.

Organic materials continue to be the largest component of solid waste at 31.6% with paper a close second at 25.5%. Plastic comes in third at 18.3% while the "other" category is fourth at 11.4%. Construction/demolition and metal waste are the next major contributors at 5.4% and 3.9%, respectively. The remaining classifications comprise 2.1% or less, each, and consist of glass, durables, and Household Hazardous Materials (HHMs). Table 1, on the next page, compares the waste distribution with that from the 2011 Waste Characterization Study.

Table 1: Waste Distribution Compared to the 2011 Waste Characterization Study

Study Year	Organic Materials	Paper	Plastic	Construction/ Demolition	Other	Glass	Durables	HHMs
2017	31.6	25.5	18.3	5.4	11.4	2.1	2.1	2.1
2011	25.5	25.2	16.7	13.5	10.1	1.5	2.1	2.1

Current Policies

The jurisdiction of the DNR is described in Iowa Code Chapter 455B and includes Solid Waste Disposal. Additional regulations regarding solid waste disposal are included in Iowa Administrative Code Section 567, Chapter 101, which designates the DNR as the regulatory authority. These rules set the waste management priorities as such, in descending order:

1. Volume reduction at the source;
2. Recycling and reuse, including composting;
3. Combustion with energy recovery;
4. Other approved techniques of solid waste management including, but not limited to, combustion for waste disposal and disposal in sanitary landfills.

Chapter 455D.3 of the Iowa Code describes the waste diversion goals and the increased or decreased fees associated with performance measured against said goals. Landfills will be charged an additional fee of $0.50 per ton if they cannot meet the 25% diversion goal but will be able to reduce the fees by $0.60 per ton if they exceed it. Additionally, another reduction in fees of $0.50 per ton is enacted if a landfill is able to divert over 50% of their waste.

Capacity

In 2007, the Iowa DNR reported the average projected remaining capacity was 37 years. If the underlying trends hold, the current projection is 30 years per each site or, in other terms, until 2044. It is important to emphasize that "remaining capacity" as defined by Iowa DNR includes only that which is currently permitted. Many sites have significantly greater capacity available but will not complete permitting efforts for this volume until it is actually needed. More current information is not available as Iowa DNR staff indicated that they don't regularly request or track this information.

Operations and Maintenance

New sites are inspected by the Iowa DNR upon substantial completion of construction for compliance with the approved design plans and then granted an operating permit. Periodic inspections occur during the five year duration of the permit.

One of the bigger issues in Iowa is the performance gap between the larger landfills, which are industry leaders in their commitment to stakeholders, environmental performance, and innovation, and several of the smaller landfills, which, to a degree, have operated the same way for the last 20 to 30 years. The minimal amount of income derived from dumping fees leave little excess capital for smaller landfills to invest in some of the initiatives the larger sites have implemented.

Public Safety

Solid waste facilities do not typically pose a threat to public safety as long as cell liners, leachate conveyance, and leachate treatment systems are maintained. If those items are not functioning properly, the biggest threat is contamination of ground or surface water sources by leachate. A search of public records was able to find only one example where a nearby property was damaged by uncontained leachate.

Resilience

Solid waste landfills are subjected to the same issues that face Iowa's other infrastructure – floods, storms, and other weather events. However, the determination of the location and design of the sites themselves are done in such a way to avoid adverse

impacts due to natural disasters. A consistent challenge is managing soil erosion caused by lack of ground cover and precipitation events. Areas of the landfills that are not part of active cells are typically covered with temporary erosion control measures until permanent vegetative cover is established. Continued observation and maintenance is required to address situations in a timely manner.

Funding

Each landfill charges tipping or dumping fees that appear to be sufficient for maintaining operations. There are a few reports of fee increases and/or cost-cutting measures being necessary to balance the books. DNR recycling programs are funded by tipping fees where the more a landfill diverts via recycling efforts, the less funding recycling programs receive. Some operators see this as counterproductive and suggest a model based on Minnesota's recycling system where a solid waste management tax is applied to garbage fees of residents and businesses, while no tax is charged for recycling waste. All Iowa landfills are required to build and maintain a dedicated reserve fund for closure and post-closure care.

Future Needs

Iowa's projected population growth is well below the national average as well as those of several surrounding states. It is likely that the current and future expanded capacity will be more than enough for the foreseeable future. However, potential new regulations from the EPA may require significant capital investment in programs designed to decrease environmental impacts, including reductions in greenhouse gas emissions. Several individual sites have begun implementing a program called Environmental Management System (EMS). The six categories EMS tabs for achievement are: recycling services, greenhouse gas reduction, water quality improvement, yard waste/composting management, hazardous household waste management, and environmental education. Contributing landfills submit to the DNR yearly reports that show efforts being made in each category, set future goals, and ways the landfill can meet them. The Iowa DNR has an extensive library of information on the implementation of this program, including reports from the various participants on the execution of their individual EMS plans. Unfortunately, adoption of EMS has been slow with only 14 of Iowa's 47 landfills participating. Operators seem to reject the amount of documentation associated with adoption of the program.

As has been true recently, lower oil prices and other economic factors may have significant impacts on the market for recyclable materials. This could have the disastrous effect of drying up demand for these products and needing to return to putting them in the landfill or store them, if appropriate, until conditions improve. On a related note, China, which is a major importer of U.S. recycling materials, has recently begun putting restrictions on certain recyclables, including most plastics and many kinds of paper. The impacts of that decision are still unfolding, but it is likely Iowa's municipalities will need to begin making tough choices on whether to pay higher rates to remove recycled materials, or throw recyclable goods away.

Innovation

Several Iowa landfills have implemented gas-to-energy systems where captured methane from decomposing waste mass is burned to generate electricity, to produce heat, or transporting it via pipelines for use in manufacturing kiln or burn operations.

In the 2015 report card, we mentioned a repurposed ethanol plant in Blairstown being reused to become a bio-refinery that processed organic waste into ethanol. Fiberight, the company behind this initiative, instead chose to process waste at a Marion facility but the final chapter has yet to be written. The City and Fiberight have gone back and forth over the last few years to find a suitable location for their facility amid changing operational goals.

In an effort to evaluate recycling efforts in rural areas of Iowa, the DNR commissioned a study to evaluate the viability of a hub and spoke recycling system. The hubs of the network benefit from the value of the recovered materials they sell but they must operate and assume liability for a processing

center. The spokes benefit by diversion of material from their local landfills and they don't have to invest in and operate a processing center. This study found that private, public, and public-private-partnership (P3) recycling facilities are actually widespread throughout Iowa and implementation of a DNR-incentivized hub and spoke system could actually harm the existing entities. One surprising finding of the study is that the state does not currently track the amount of recycled materials. Many of the operators are private and the state does not require a license with associated reporting requirements. This makes it difficult for planning areas to know if they are meeting the state mandate to reduce landfilled waste by 50%, through various means, including recycling.

Two innovations mentioned in the 2015 Report Card, recycling of asphalt roofing shingles and electronics demanufacturing, have expanded to other facilities. However, an internet search did not reveal that industrial waste composting has expanded beyond the Cedar Rapids Linn County Solid Waste Agency. The fluctuating price of crude oil has an effect on the market for recycled asphalt shingles which has caused at least one facility to suspend this practice.

It remains to be seen if these technologies will expand, but they do have the potential to greatly reduce the amount of organic and paper materials that are interred in landfills, more efficiently use the available capacity, and improve many operational aspects.

Recommendations

The following recommendations are nearly identical to the 2014 Report Card but are still valid.

- **Reconsider funding mechanism:** Current funding models are self-defeating as more recyclable waste is diverted. We recommend a change to something similar to Minnesota's recycling system where a solid waste management tax is applied to garbage fees of residents and businesses, while no tax is charged for recycling waste.

- **Expand EMS to other sites:** Currently 14 landfill sites are participating in this program. Incentives should be implemented to get more participation from the remaining sites.

- **Continue waste reduction education:** Education of consumers on the value of recycling and the proper disposal of waste needs to continue. The Iowa Recycling Association has promoted several major recycling programs in recent years that are beginning to show tangible results in consumer awareness and waste diversion.

- **Increase diversion opportunities:** Waste generation needs to be reduced and more waste needs to be diverted from landfills through recycling programs. An increase in the bottle bill redemption fee and expanding the program to non-alcoholic and soft drink beverages would bring more entrepreneurs to this market. Focus should be placed on publicizing innovative practices resulting in increased use of landfill materials for waste to energy purposes.

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WASTEWATER

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Executive Summary

Adequate prioritization of Iowa's wastewater infrastructure is vital to protecting our abundant water resources and providing a safe and clean resource for all users. Unfortunately, Iowa's aging wastewater infrastructure poses a threat to our water resources. Many of the pipes in Iowa's oldest cities were constructed at the turn of the 20th century and are made of brick or clay. The Environmental Protection Agency (EPA) determined in 2012 that a total of $2.4 billion is necessary for wastewater related infrastructure improvement in Iowa over the next 20 years. While significant funding resources are still needed to improve the treatment of wastewater and accomplish nutrient reduction in Iowa, some investments have been made in the systems. From 2008 to 2012, approximately $896 million was invested through various federal and state loan and grant programs and by individual utilities to complete significant improvements to the wastewater infrastructure in Iowa.

Background

The ability to safely dispose of wastewater (sewage) from homes, industrial, and commercial facilities is a basic necessity for the health of our state and its citizens. Under the 1972 Clean Water Act (CWA), dramatic improvements have been made in:

Number of wastewater treatment plants.

Percentage of the population served by wastewater treatment plants.

Quality of effluent treatment from wastewater treatment facilities.

Iowa has 768 public wastewater treatment systems serving approximately 84% of the state's 3.1 million residents. The remainder of the population is served by private septic systems. Based on the 2012 EPA Clean Watershed Needs Survey (CWNS), Iowa's centralized wastewater treatment services at the secondary treatment level has essentially remained the same as in 2008.

Photo 1: Des Moines Metro Wastewater Facility

In Iowa, small community (< 10,000 population) wastewater systems serve 39% of the population and comprise 96% of the total communities for wastewater treatment and collection needs. Table 1 shows a significant portion of the wastewater infrastructure needs will come from communities with less than 10,000 in population.

Table 1: Count of Communities (incorporated cities and census designated places) Sewered and Unsewered in 2018

Community Population	Count of Sewered Communities	Count of Unsewered Communities (no centralized treatment)	Total Count of Communities by Population (sum of sewered and unsewered)	% of Total Communities in Iowa
0-999	577	151	728	72%
1,000-3,499	167	0	167	17%
3,500-10,000	67	2	69	7%
>10,000	41	7	48	5%
Total	**852**	**160**	**1,012**	**100%**

Condition

A large portion of the nation's wastewater pipe network was installed in the 1940s through the 1970s. Many of these systems have suffered from underinvestment, leaving communities they serve with deteriorated infrastructure.

Operational conditions at these treatment facilities are routinely inspected. However, conditions of buried pipes conveying sewage to these facilities is much more difficult to determine. Many of the pipes in Iowa's oldest cities were constructed at the turn of the 20th century and are made of brick or clay. There is no requirement for sewer system operators to inspect and assess the condition of their pipes and to be able to quantify total length of pipes needing rehabilitation.

Many wastewater systems in Iowa are approaching or have surpassed their 50-year design life. Aged facilities require constant operating and maintenance resources along with regular replacement of machinery, pipe, tanks, and other critical components. Many of these systems have suffered from lack of maintenance and/or funding to upgrade to current water quality standards.

The need to upgrade and rebuild wastewater infrastructure is growing with the lack of maintenance and growing population within some areas of the

state. Some communities have become proactive by implementing additional fees to pay for the millions of dollars in required improvements. Many communities simply do not have the resources.

Under Section 305(b) of the CWA, Iowa is required to assess the quality of its surface waters every two years. Based on available monitoring data, Iowa's 2016 list of impaired waters contains 608 waterbodies with a total of 768 impairments. An impaired water is a stream or lake that does not fully meet the water quality standards designed to protect its designated beneficial uses. Impairments are identified for all classes of beneficial uses designated for Iowa surface waters: recreation, aquatic life, drinking water, fish consumption, and general uses.

Although existing water quality information has clearly indicated the existence of water quality impairments, the majority of Iowa's water quality impairments are in the slight to moderate categories. Streams, rivers, and lakes with slight to moderate impairments can, and do, continue to support their beneficial uses for water contact recreation, aquatic life support, and other uses, although at times at a reduced level. Severe impairments do, however continue to occur.

Funding

The majority of funding for wastewater infrastructure needs comes from rate payers. Residents and businesses in Iowa pay various prices for wastewater services, based on rates set by local wastewater utilities and other bodies of government. In Grinnell, for example, most customers pay $5.93 per 100 cubic feet of usage. In Iowa City, minimum usage rates paid by most customers is $3.47 per 100 cubic feet. In Clinton, domestic users are charged $8.96 per 100 cubic feet, based on metered water use.

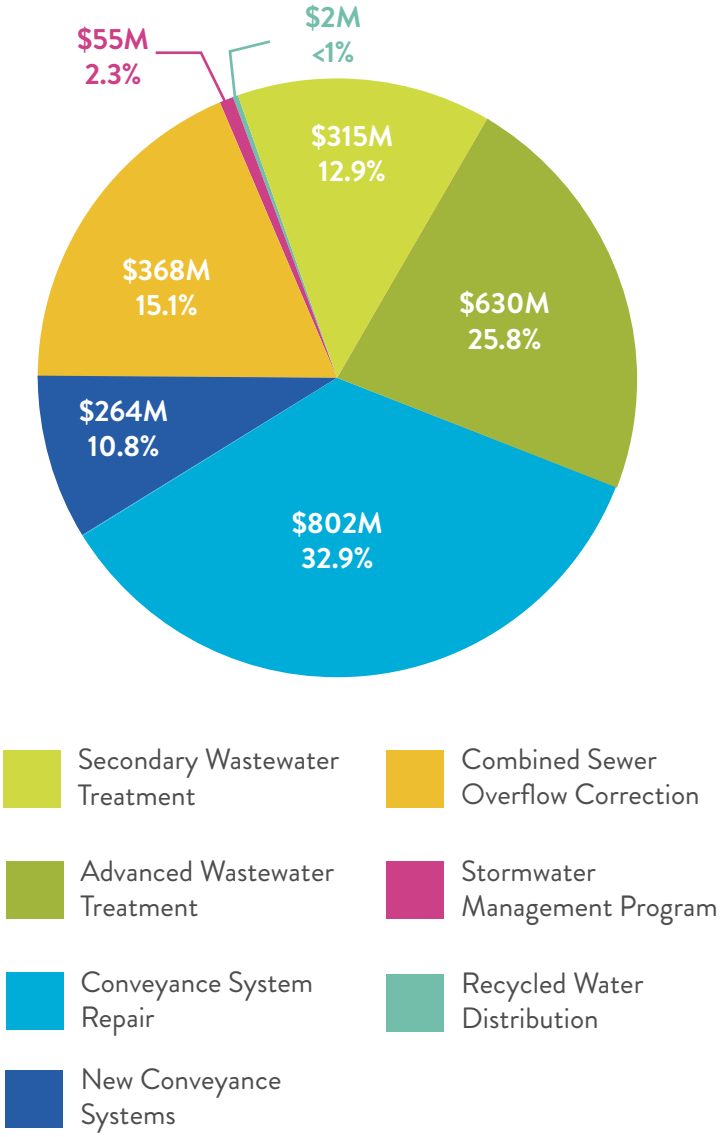
Funding for wastewater infrastructure also comes from local governments, through grants and loans. Funding and financing programs include Iowa's Community Development Block Grant (CDBG) program, Iowa's Clean Water State Revolving Fund (CWSRF), or the United States Department of Agriculture (USDA) Rural Development (RD) funding. Iowa's CWSRF provides in excess of $200 million per year in loan funding, the CDBG program provides grants totaling about $7 million a year, and the USDA Rural Development program averaged $23.1 million awarded in loans and grants for wastewater related projects over the past five years. CDBG grants totaling $7.7 million for 19 projects were funded to support wastewater related infrastructure projects in 2018. The CDBG funding amount is comprised of 2018 CDBG funds and 2017 CDBG funds that were rolled into the Water and Sewer fund from other CDBG programs. These programs are funded through federal resources.

The Iowa Legislature passed a Water Quality bill in 2018 to create a Wastewater and Drinking Water Treatment Financial Assistance Fund and Water Quality Financing Program with total funding of $109.8 million to provide financial assistance to projects during fiscal years 2019 through 2029.

The State Revolving Fund (SRF) has awarded Iowa communities and municipalities approximately $2.375 billion in construction loans and $139 million through planning and design loans since program inception in 1987. More than 500 Iowa communities have recognized the SRF as their best choice for low cost financing of their water quality initiatives. The SRF is an important resource for Iowa communities as they face a wide array of water quality improvement needs. The Iowa Department of Natural Resources (DNR) has been able to fund all applications requesting SRF funding through Clean Water SRF loans. Some local governments instead provide for capital improvements through bonding referendums or sewer rate increases.

No matter where the funding sources come from, the CNWS has identified over $2.4 billion in wastewater infrastructure needs for Iowa over the next 20 years. Based on current funding sources and the limited amount of grant funds available, many small and disadvantaged communities will struggle to meet their wastewater needs. Lacking resources and the economies of scale that larger communities enjoy, small towns will need to take advantage of the recently passed water infrastructure bill, America's Water Infrastructure Act.

Table 1: CWNS 2012 Iowa Documented Needs by Category (January 2012 dollars in millions)



Category	$M	Percent
Secondary Wastewater Treatment	315	12.9%
Advanced Wastewater Treatment	630	25.8%
Conveyance System Repair	802	32.9%
New Conveyance Systems	264	10.8%
Combined Sewer Overflow Correction	368	15.1%
Stormwater Management Program	55	2.3%
Recycled Water Distribution	2	<1%
Total	2,438	100%

Future Need

According to the EPA CWNS, the total reported water quality needs for the nation are $271 billion. More than 73% of the nation's needs are for wastewater treatment, pipe repairs, and new pipes. In Iowa, a total of $2.4 billion in needs was identified in the 2012 CWNS, ranging from wastewater treatment to conveyance system repairs.

It should be noted that Iowa's wastewater infrastructure benefited from significant funding made available through the American Recovery and Reinvestment Act (ARRA), State of Iowa I-Jobs Water Quality Fund, and ongoing CWSRF. From 2008 to 2012, approximately $896 million was invested to complete significant improvements to wastewater infrastructure in Iowa. This amount does not include the additional funds provided by CDGB and USDA-RD during the same time period. As a result, it is possible many needs identified in the 2012 CWNS have been met, but it's difficult to quantify current existing needs without the latest CWNS.

Based on the 2012 CWNS, Iowa's cost is approximately $344 per capita to rehabilitate and replace pipes, interceptor sewers, and pumping stations. This high per capita cost can be attributed to the age of the systems as well as the environmental conditions of soil conditions and high water table. The study shows communities in Iowa are continuing to plan for the correction of problems related to sanitary sewer overflows and ensuring reliability of existing collection system infrastructure with $368 million in combined sewer overflow correction needs. It's also important to emphasize the CWNS is voluntary and only 50% of Iowa's communities responded to the EPA in 2012. It's possible the per

capita costs differ from what was reflected in the survey, both because of the voluntary nature of the data submission process and because of the age of the survey.

Operation and Maintenance

The operation and maintenance of many wastewater collection and treatment systems tends to be a lower priority than for other types of infrastructure because it is out-of-sight, out-of-mind for citizens. Most communities provide little or no maintenance on sewer lift stations or collection systems until they witness fish kills or develop system failures of pump stations or treatment plant equipment. Many communities do not make operation and maintenance a priority in their budgets. This lack of awareness leads to a very reactive situation when it comes to wastewater maintenance.

Resilience and Public Safety

The capability for a wastewater collection and treatment system to prevent or protect against significant multi-hazard threats is difficult to assess but important. Many treatment facilities are located on the floodplain of streams which may put them at risk from significant flooding. Most systems have some pump station generators and capability to run treatment plants under extreme weather conditions. Agencies such as the Iowa DNR and EPA monitor effluent limit violations and other water quality issues. The actual threat could be significant should certain types of pollutants be released to the environment without proper treatment. The threat of a significant health issue resulting from poor performing systems or the lack of a system to recover from a critical interruption in operation only occurs in rare instances. In general, Iowa is focused on reducing nitrate and phosphorus levels in our waters. In 2018, the Iowa Legislature passed a bill providing limited investment toward conservation infrastructure on agricultural land and investment in locally led water quality projects in targeted watersheds. In the years ahead, aggressive action on non-point and point sources of pollution from agriculture, urban storm water runoff, sanitary and combined sewer outflows is needed to ensure public safety and continued prosperity.

Recommendations

Clean and safe water is no less a national priority than an adequate system of interstate highways. Many other highly important infrastructure programs enjoy sustainable, long-term sources of federal backing, often through use of dedicated trust funds. Under current policy, water and wastewater infrastructure unfortunately does not.

The case for increased federal investment to assist Iowa and other states is compelling. Needs are large and unprecedented; in many locations, local sources cannot be expected to meet this challenge alone, and because water is shared across local and state boundaries, the benefits of federal help will be enjoyed by the entire nation.

The goal of the Iowa DNR is to protect public health, safety, and quality of life by protecting the state's natural environment. However, resources to accomplish this are very limited and could be improved.

The 2012 CWNS has documented Iowa's total needs for the next 20 years at over $2.4 billion. In the short-term, the state needs a commitment to bring all wastewater infrastructure into a state of good repair and in the long-term, the state must modernize and build new facilities in a targeted and strategic manner. In order to improve water quality for Iowa, the CWA should be revised and authorized to:

- More aggressively address non-point and point sources of pollution from agriculture, urban storm water runoff, sanitary, and combined sewer outflows.
- Include advances in scientific and engineering knowledge about non-point source and point source pollution and new treatment approaches.
- Allow alternative compliance strategies and innovation to achieve healthy and robust ecosystems in lieu of strict compliance with water quality standards.

- Employ strategies to use every dollar resourcefully and deploy creative solutions to infrastructure development that can implement the right projects in an efficient and economical manner.
- Recommend Congress provide funding to implement the CWA on a consistent basis.
- EPA needs funding to authorize and initiate the CWNS which has been suspended since 2012.
- Incorporate redundant systems to improve resiliency and provide capacity improvements to reduce effluent violations.

Public outreach and education are keys to improving the nation's infrastructure and its impact on the environment and quality of life. This effort can also serve to promote and generate public support for sustainable funding sources dedicated toward wastewater improvements. Investing now in infrastructure helps improve quality of life, mobility, economics, and opportunity for Iowa's future.

Sources

United States Environmental Protection Agency, Clean Watersheds Needs Survey 2012, Report to Congress. http://water.epa.gov/cwns

Iowa Nutrient Reduction Strategy. http://www.nutrientstrategy.iastate.edu/

Iowa's 2016 List of Impaired Waters [Section 303(d)]. https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Impaired-Waters

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