### REPORT CARD FOR NORTH DAKOTA'S INFRASTRUCTURE



North Dakota Section of the American Society of Civil Engineers INFRASTRUCTUREREPORTCARD.ORG/NORTH-DAKOTA



# TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
ABOUT THE INFRASTRUCTURE REPORT CARD	2
GRADING CRITERIA	2
GRADING SCALE	3
NORTH DAKOTA'S GRADE SUMMARY	4
RECOMMENDATIONS TO RAISE THE GRADE	5
REPORT CARD CATEGORIES	

Bridges6
Dams11
Drinking Water16
Energy21
Levees26
Roads30
Transit35
Wastewater
GET INVOLVED46
REPORT CARD COMMITTEE46

Cover Photo: Garrison Dam Photo by Harry Weddington, USACE, used with permission



# **EXECUTIVE SUMMARY**

North Dakota's infrastructure is the backbone of our state's economy. Infrastructure provides our most important asset – our people – with the ability to effectively push our state and nation forward into the future. The condition of our state's infrastructure impacts our ability to be competitive in the national and international markets and provides the quality of life that all North Dakotans expect to have and be proud of. North Dakota, known for the unwavering work ethic of its people, can position its next generation of people by implementing changes in funding, asset management and innovative solutions for maintaining, improving and expanding the state's infrastructure.

This Report Card is the first of its kind for the state of North Dakota, providing a snapshot for eight categories of infrastructure: Bridges, Dams, Drinking Water, Energy, Levees, Roads, Transit, and Wastewater. Our state's infrastructure received an overall GPA of C, which is slightly better than the national GPA of D+. A GPA letter grade of C means the infrastructure in our state is in mediocre condition. Our networks show general signs of deterioration and require attention, and some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.

The individual category grades vary. One observation from our analysis is that there is a clear discrepancy between Roads and Bridges, receiving grades of B- and D+, respectively. Roads are graded the highest of all the infrastructure categories included in this Report Card, but Bridges are graded nearly the lowest. Both are critical and connected to one another but are not receiving the same level of funding.

Ultimately, this Report Card was created to increase awareness for the public and policymakers on the status of our state's infrastructure and encourage conversations about our goals for the continued success of our state, and what action can be taken to achieve those goals. We commend the effort of our state leaders to find temporary funding solutions, but more can be done. As this is the first Report Card for North Dakota's Infrastructure, the real test will be implementing those changes to improve the state's infrastructure, which will again be graded in the next Report Card. This can be accomplished by following the Overall Recommendations to Raise the Grade found on page 5, as well as the additional recommendations specific to each category of infrastructure found at the end of each section.

As civil engineers, our responsibility is to protect the public health, safety, and welfare of those who use our state's infrastructure. We hope the public and policymakers find this Report Card insightful so the important and difficult conversations can happen and action can take place.



# ABOUT THE INFRASTRUCTURE REPORT CARD

The 2019 Report Card for North Dakota's Infrastructure was prepared by a local committee of civil engineers from North Dakota. These civil engineers volunteered their time to collect and analyze data, prepare the facts and trends that assisted them in grading each category of infrastructure, hold meetings with the respective agencies overseeing the infrastructure to review their findings, and ultimately prepare the final reports and grades for each category of infrastructure. The grade for each category of infrastructure was determined based on the Grading Criteria as indicated below, which were graded on a letter scale from A to F, explained on page 3.

The local committee worked with the ASCE Committee on America's Infrastructure and ASCE Infrastructure Initiative staff to provide a snapshot of North Dakota's infrastructure.

The state's overall grade on the page 4 is based on the grades of the eight individual categories of infrastructure that are further discussed in the Report Card starting on page 6. As this is the first Report Card for North Dakota's infrastructure, the real test will be improving the state's infrastructure for the next Report Card. This can be accomplished by following the Recommendations to Raise the Grade found on page 5.

### CAPACITY

Does the infrastructure's capacity meet current and future demands?

#### CONDITION

What is the infrastructure's existing and near-future physical condition?

#### FUNDING

RADING

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?



# **GRADING SCALE**

# Individual Report Card categories were graded based on the following criteria:



# **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.



# 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.



# 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.



# **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 significant concern with strong risk of failure.



# 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.



# **NORTH DAKOTA'S** OVERALL GRADE SUMMARY







# OVERALL RECOMMENDATIONS TO RAISE THE GRADE

#### IMPLEMENT SUSTAINABLE FUNDING SOURCES

Our infrastructure requires sustained, proactive investment to support our economic competitiveness and quality of life. The longer we wait, the more expensive the cost of infrastructure repairs and replacements will be for North Dakotans. Further, it's up to us to solve our infrastructure investment gap, as federal funding is continually reduced.

• Increase the motor fuel tax to provide a sustainable transportation funding source and allow us to meet the local portion of the federal gas tax match. Currently, the North Dakota motor fuel tax is at 23 cents per gallon. This is the second lowest in the Midwest and it hasn't been raised since 2005. The North Dakota state taxes and fees per gallon of gasoline are lower than all neighboring states with Minnesota at 28.6 cents, South Dakota at 30 cents, and Montana at 32.25 cents per gallon. The national average fuel tax is 31 cents per gallon. Raising the gas tax will capture revenue from the non-resident travelers and goods that use our roadways. We should also implement fees for electric and hybrid vehicles that contribute to roadway wear and tear but currently pay little to nothing towards road maintenance user fees.

• Provide funds for programs that offer low interest loans for all types of infrastructure projects. The interest and principal generated from the North Dakota Legacy Fund can now be used. The Legacy Fund is perpetual source of state revenue from the natural resources of oil and natural gas. Investment in the state's infrastructure is an ideal use for these funds. Legacy Funds can be transferred to programs within the Bank of North Dakota (BND), such as the Infrastructure Loan Fund, to provide low interest loans for transportation and new development infrastructure improvements. This BND fund supplements the highly successful Clean Water and Drinking Water State Revolving Fund programs.

 Encourage and assist cities across the state with developing user rate structures that can fully support the local share of capital improvements for infrastructure, not just operation and maintenance (O&M). Many communities are collecting rates



Four Bears Bridge | Photo by Wendy Jordahl | Used with permission

that only cover O&M, which requires the local share of most capital improvements to be entirely funded by special assessments and/or a substantially increased user rate that typically shocks the financial status of its users. Rates should be adjusted to reflect the true cost of service for the infrastructure.

# ENCOURAGE INNOVATIVE DESIGN SOLUTIONS AND TECHNOLOGIES

Historically, our state has been cautious to implement new and innovative design solutions and technologies. Innovation can improve the efficiency of the infrastructure systems. Additional funds for planning, design and construction of innovative projects can support better deployment of new technologies, such as connected vehicles and infrastructure.

#### ENCOURAGE INFRASTRUCTURE OWNERS TO DEVELOP ASSET MANAGEMENT PLANS

Asset management plans help infrastructure owners anticipate future infrastructure needs. They support efficient management of infrastructure by allowing owners to make informed decisions on where to spend limited dollars and how best to complete timely maintenance and repairs. Infrastructure owners frequently need financial support to develop these asset management plans. North Dakota should consider providing financial assistance as asset management plans enable better ownership and save money down the line.

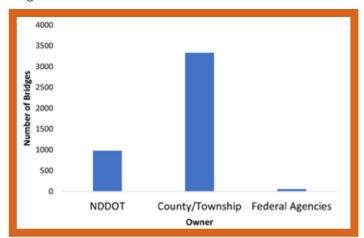
# BRIDGES

### **EXECUTIVE SUMMARY**

North Dakota is home to 4,377 bridges. Statewide, 14% of bridges are structurally deficient, compared with 8.9% nationally. While not unsafe, structurally deficient bridges require significant maintenance, rehabilitation, or replacement because critical load-carrying elements were found to be in poor condition. Meanwhile, 43% of North Dakota bridges are over 50 years in age, meaning they are past their initial design life. Most structurally deficient bridges are owned by local jurisdictions and there is a more than \$400 million backlog of necessary projects on the local bridge network. Another challenge in North Dakota is the weather; cold and snowy conditions with heavy freeze/thaw cycles increase bridge deterioration. Overall, North Dakota bridges are in worse shape than the national average.

### BACKGROUND

The 4,377 bridges in North Dakota are owned and maintained by three different entities: the North Dakota Department of Transportation (NDDOT), a local jurisdiction (county/township), or the Federal government (including US Park Service, Bureau of Indian Affairs, US Forest Service, etc.). In North Dakota, there are currently 982 NDDOT bridges, 3,339 county/township bridges, and 56 federal bridges (Figure 1).



# ANALYSIS

### Capacity:

The capacity of North Dakota bridges currently meets the traffic demand of the state, with exception of a few areas such as the Fargo-Moorhead and Bismarck regions. The oil region of North Dakota has returned to more normal traffic patterns with increased pipeline capacity and lower drilling activity. Compared to the nation-wide capacity needs, there are no current or future capacity issues on North Dakota bridges.

## Condition:

Compared to the rest of the nation, bridges in North Dakota are worse in condition and expected to decline. Currently, 89% of the state's bridges are considered in good or fair condition (Figure 3). However, 14% (614 bridges) of all state bridges are considered structurally deficient (Figure 2). Nationally, the rate of structurally deficient bridges is 8.9%. In North Dakota, most structurally deficient bridges are on locally controlled roads; only 20 of the structurally deficient bridges are on the state system managed by NDDOT.

Using both CALTRANS Bridge Health Index and FHWA Sufficiency Rating measurements, NDDOT bridges continue to be in better shape than the local jurisdictions. NDDOT bridges currently have an average Bridge Health Index of 93.5 (out of 100) and an average Sufficiency Rating of 91.7 (out of 100). However, the NDDOT owns and maintains only 22.4% of bridges in the state. Meanwhile, the local jurisdiction average Sufficiency Rating is 81.1 (out of 100) while maintaining 76.3% of the bridges in the state. There is no current local jurisdiction measure of the Bridge Health Index. Bridges in North Dakota are also older than the national average. The average age of all North Dakota bridges is almost 47 years, with 43% of all bridges in North Dakota over 50 years old (1,883). Nationally, 39% of bridges are over 50 years old. NDDOT bridges are

Figure 1. Bridge ownership/maintenance in ND

slightly younger than the state's bridges overall at an average age of 44 years, with over 46% of bridges over 50 years old (455). Local bridges have an average age of 48 years, with 44% of the bridges over 50 years old (1,463). Nearly one third, or 31% of all North Dakota bridges are 30-50 years old, and will age out of design life in next 20 years (Figure 3).

### Funding:

Bridges are funded through several funding mechanisms. Federally, NDDOT receives nearly \$12 million yearly for bridge funding across the state. An additional \$2 million of state gas tax revenue for bridges across the state brings the total to \$14 million yearly. Over \$6 million of this total fund is used for only NDDOT bridges on the state system, with the remaining funds used on County/ Township and Federal Agency bridges. County bridge funding comes from a mix of state gas tax distribution, local property taxes, and over \$7 million in federal funding specifically for bridges. The federal funds are distributed on a cost share formula to counties for repairing or replacing bridges based on their Sufficiency Rating.

In the past three sessions, the North Dakota Legislature has allocated one time funding of over \$1 billion to transportation projects. This was sent as direct funding to counties across the state to complete transportation projects. Most of this funding went to repairing local and state roadways damaged by the oil boom traffic. However, some of the funding went to repairing or replacing structures outside the oil region. This one time funding has allowed for North Dakota to reduce the amount of bridges requiring rehabilitation or replacement by 4% over a two year period.

Currently, the NDDOT allocation of operation and maintenance funding is adequate to cover the operating and maintenance expenses of state bridges. The 2017 expenditure for the NDDOT is at the level of \$500,000/year. This level of funding is roughly at the national average. Operation and maintenance funding for the local bridges is varied by jurisdiction, but remains low due to local funding

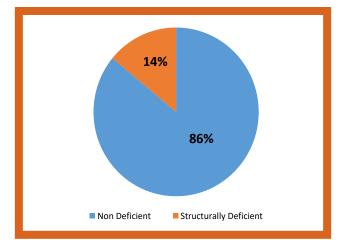


Figure 2. Bridge conditions in North Dakota (All jurisdictions)

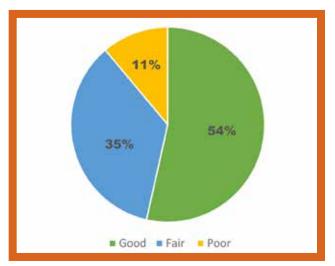


Figure 3. Bridge condition according to FAST Act condition based performance management system (All Jurisdictions)

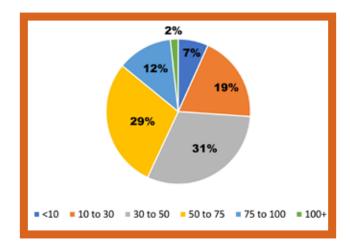


Figure 4. Bridge ages in North Dakota in 2018 (All jurisdictions)

levels and lack of maintenance personnel. An increase in maintenance funding and activity at the local and state level will result in increased lifespan of new and existing bridges.

### Future Need:

By 2020, nearly 45% of North Dakota bridges will be beyond their 50-year design life and by 2025 the portion of ND bridges beyond their 50-year design life will increase to 59%. Although the bridges that are being designed and built today have a design life of 75 years or greater, almost every bridge constructed prior to 1980 was designed to last 50 years. Without increasing the rate of rehabilitation and replacement of deficient bridges, the state and local bridge owners will continue to see the number of deficient bridges increase and bridge health indexes decline (BHI and SR). Additionally, there is a current \$400+ million in backlog on local bridges. With current local funding levels, this backlog will continue to grow, resulting in a reduced network with bridge closings and postings. Compared to the national trend, North Dakota shows tremendous needs for replacing and upgrading existing bridges.

### **Public Safety:**

Public safety concerns with bridges have improved in the past few years. In practice, the NDDOT follows a

Federal Highway required monitoring and inspection schedule of 24 months, and is willing to shut down lanes or bridges if safety issues are seen (Figure 5). State agencies also monitor bridges closely during extreme events, such as flooding. All of these practices are in line with national trends.

### **Resilience:**

North Dakota is located in a non-seismic and nonhurricane affected zone. The natural event most likely to impact bridges is flooding due to snow melting or significant rainfall. Most bridges are currently designed with consideration of maximum flooding from over a 50-year frequency for overtopping. Most North Dakota bridges are built with deep driven pile foundations, which resist scour issues that can result from flooding. Resilience is expected to improve as more existing bridges are replaced to meet current design standards. Additionally, due to the robustness of the local and state transportation system, there is very few long detour lengths for bridges in North Dakota.

#### Innovation:

Some innovations are being tested by NDDOT, such as Accelerated Bridge Construction and usage of polymer reinforced rebar. Compared to the national trends, North Dakota is lacking in research development and funding.

### DEFINITIONS

Structurally deficient

Bridges that require significant maintenance, rehabilitation, or replacement.

# Bridge Health Index

Single-number assessment of a bridge's condition based on the bridge's economic worth.

#### Sufficiency Rating

Single-number assessment of a bridge's condition based on the bridge's ability to remain in service.



Figure 5. Bridge shutdowns with lack of public safety. Bridge shut down due to vehicle collision (L) Bridge shut down due to poor maintenance (R)





# **RECOMMENDATIONS** TO RAISE THE GRADE

North Dakota needs a bold and aggressive plan to turn around its bridge infrastructure and improve the grade. Currently, the North Dakota motor fuel tax is at 23 cents per gallon, and hasn't been raised since 2005. The national average fuel tax is 31 cents per gallon.

• Significant increase in transportation and bridge funding is needed at the federal, state and local level.

• Focus on reducing the number of structurally deficient bridges to a manageable level (5% Structural Deficient).

• Significant increase in research funding and adoption of innovations in North Dakota bridges is needed. Smart techniques and innovative materials provide a safe, connected, intelligent next generation of infrastructures.

• Encourage replacement of current smaller, local bridges using proven cost saving technologies such as Reinforced Concrete Box Culverts (RCBC) and pre-fabricated bridges.

• Ensure the sustained sufficiency and reliability of the federal Highway Trust Fund by identifying and incorporating necessary additional revenue streams.

• In 2010, the state created a Legacy Fund consisting of 30% of the total revenue from oil and gas extraction. The principal and earnings could not be expended until after June 2017. Now that this deadline has passed, consideration of using portions of North Dakota Legacy Fund is encouraged.

NORTH DAKOTA 2019 INFRASTRUCTURE REPORT CARD | 9

# SOURCES • 2017 NBI ASCII data (FHWA)

 Assessment of ND County and Local Road Needs, 2017-2036 (UGPTI/NDSU)

Interview w/ NDDOT Bridge Division March 7, 2018

SOURCES

Documents from NDDOT Bridge and Local Division

North Dakota Statewide Transportation
 Improvement Program 2018-2021

NORTH DAKOTA 2019 INFRASTRUCTURE REPORT CARD | 10



### **EXECUTIVE SUMMARY**

North Dakota has approximately 3,153 intact dams, with a wide range of purposes from flood control to recreation. According to the National Inventory of Dams (NID), there are 49 high hazard potential (HHP) dams in the state (including federal and state-regulated dams). A HHP dam is a dam in which failure is expected to result in loss of life. Seventy-three percent of the HHP dams in the NID have a condition assessment rating and half of those are considered deficient and do not meet accepted safety standards in some way.

The condition of these dams is concerning; however, inspections are occurring regularly. Eighty-eight percent of HHP dams have emergency action plans (EAPs), which is higher than the national average of 77%. This is a positive but does not offset the overall concern with the condition of the HHP dams. The State Water Commission (SWC) has cost-share policies in place to assist owners in developing EAPs; however, commodity prices and legislatively directed funding priorities greatly influence available funding.

### BACKGROUND

Dams in North Dakota serve a variety of purposes, including for fire protection, fish and wildlife purposes, flood control, recreation, water supply, and irrigation. The vast majority of the 898 dams tracked by the U.S. Army Corps of Engineers (USACE) National Inventory of Dams (NID) are made of earthen materials. A limited number – 13 – are made of concrete, while 28 are masonry structures.

NID tracks all dams that are high hazard or significant hazard potential, meaning failure would cause either loss of human life or economic loss, respectively. The NID also includes all structures that are either:

- equal to or exceed 25 feet in height and 15 acrefeet in storage or
- equal to or exceed 50 acre-feet of storage and exceed 6 feet in height.

There are 898 North Dakota Dams in the NID.

Meanwhile, the North Dakota Office of State Engineer (OSE) is responsible for permitting and oversight of a larger inventory of dams within the State of North Dakota which do not meet the requirements to be tracked by the NID. Currently, OSE oversees approximately 3,153 intact dams within the state, with purposes ranging from water supply and irrigation to flood control and wildlife habitat.

Of the current state-regulated dams, 130 dams are considered medium or high hazard dams. Under N.D.C.C. § 61-03-25, medium and high hazard dams are required to have an EAP to reduce the downstream loss of life and property damage risk should the dam fail. However, 38 dams (29%) do not have an EAP in place. The dam safety program within the state is also overseen by the OSE.

Dam safety program staff have the responsibility to inspect the non-federally owned, high and medium hazard dams within the state on a rotational basis.

### **ANALYSIS**

### Capacity:

While a significant number of dams exist within the state, new dams continue to be permitted and constructed. In addition to traditional dams, the state is seeing an increase in the number of off-stream ponds constructed for water storage in oil producing areas of the state. Since the beginning of 2017, two construction permits have been approved for dams and three have been approved for off-stream ponds. In that same timeframe, applications were received for eight dams and 16 off-stream ponds for which it was determined that a construction permit was not required due to the size and hazard classification.

## Condition:

Seventy-three percent of the HHP dams in the NID have a condition assessment rating and half of those are considered deficient and do not meet accepted safety standards in some way. Additionally, the dam infrastructure within the state is aging. Approximately 38% of the dams in the state are at least 30 years old. Another 40% are 20 to 30 years old.

However, it is important to note that the majority of the newer dams are also smaller dams. For dams with a storage capacity of 1,000 acre-feet or greater, over 60% are more than 50 years old and 80% are more than 40 years old.

In addition to the increase in cost of operation and maintenance as dams age, the reality is that many of these dams may not meet current design standards. The current version of the North Dakota Dam Design Handbook was drafted in June of 1985. Currently, the SWC is in the process of updating the Dam Design handbook as it is out of date and does not reflect the state-of-the-practice in modern dam design.

## **Resiliency**:

The resiliency of existing dams is declining. The state of North Dakota began experiencing a wet cycle in the mid 1990s with a significant number of large flood events such as Red River (1997), Statewide flooding (2009), Missouri River & Souris River (2011). The repeated flooding is putting a strain on the existing dams resulting in many "close calls" for dam failures like Burlington Dam No. 1 in the western portion of the state and Clausen Springs Dam in the eastern portion of the state, to name a few. The SWC recently approved funding for a statewide Probable Maximum Precipitation (PMP) Study to update the PMP values used for dam design, recognizing the current wet cycle.

# Operation and Maintenance:

Maintenance is required for all dams as they age. Operation and maintenance costs for dams are the responsibility of the dam owners. Some dam owners, such as cities and local government entities, have established special assessment districts (taxing districts) to help pay for these costs. However, a majority of the dams within the state are privately owned and while the SWC does have funding available for dam safety and improvements, the SWC does not cost share in maintenance. This means all costs are born by the private owners.

# Funding:

The SWC has a cost-share program that provides funding assistance for water-related projects within the state, including dams. The program is funded, in a large part, by a percentage of North Dakota's resources trust fund. Currently, the trust fund receives 20% of all Oil Extraction Tax collected within the state. According to the current costshare policy, dam safety repair, breach, or removal projects are eligible for up to 75% of eligible costs.

Funding for new dam construction varies based on the intended purpose of the dam. For instance, new flood control dam construction is eligible for up to 60% cost-share for projects without federal funding and 50% cost-share for projects with federal funding. Additionally, EAP development for a medium or high hazard dam is cost-shared at up to 80%. In the 2015-2017 funding biennium, the SWC approved approximately \$2.97 million in funding toward dams. Of those dollars, approximately 7% went towards the creation and updating of EAPs, approximately 6% went to feasibility studies for the repair, rehabilitation and improvements to existing dams, and the remaining 87% went to construction projects to repair, improve or remove existing dams.



Upper Maple River Dam, Photo by Vern Whitten, Vern Whitten Photography, used with permission

### Future Need:

While there is no current estimate for the funding amount necessary to bring dams into compliance with current design standards, the SWC does provide funding mechanisms to assist with dam safety repairs of existing dams.

### **Public Safety:**

As referenced earlier, the OSE has a dam safety program that includes inspections on a rotational basis. By law, medium and high hazard dams in North Dakota require Emergency Action Plans (EAPs). Those plans are there to help people get out of harm's way in advance of a catastrophe. EAPs include standard procedures such as a list of which agencies to alert, as well as flood inundation maps so officials know who needs to evacuate. North Dakota law also requires owners of medium and high hazard dams to develop, test, and update their EAPs. The SWC has provided guidance to assist owners in developing or updating EAPs. Of the 130 medium and high hazard dams, 38 do not yet have EAPs. Additionally, there has been an effort from the OSE to help inform residents about potentially dangerous low-head dams in their area.

Low-head dams are dams that typically span the entire river or stream and have flow passing over most or all of the spillway. Because of the generally small size and low drop, these dams do not appear to be dangerous. However, the opposite is true. These dams are dangerous due to the recirculating current and hydraulic forces on the downstream side of the dam which caused these dams to sometimes be referred to as drowning machines. The OSE provides free signs to dam owners to help warn the public about the potential hazard.

### Innovation:

The OSE is in the final stages of an initiative to update the dam hazard classification definitions and process. The OSE has also begun a multi-year process to bring outdated design guidance in line with current stateof-the-practice.





# RECOMMENDATIONS TO RAISE THE GRADE

• Stabilize funding sources and continue funding assistance for new dam construction and rehabilitation to bring existing dams into compliance with current design standards and to mitigate future flooding or water supply issues.

• Continue funding and assisting owners in developing, testing, and updating EAPs to bring the remaining high and medium hazard dams into compliance with North Dakota law.

•Continue public outreach to educate the public on the value and importance, their locations and emphasis on public safety.

# SOURCES

North Dakota State Water Commission Dam Database Downloaded 4-2-2018 http://mapservice.swc.nd.gov/index.phtml?active=Dams

North Dakota Dams, Dikes, and Other Devices Statutes & Rules (August 1, 2015 version) Downloaded 7-31-18 - http://www.swc.nd.gov/reg\_approp/ ConstructionPermits/

> North Dakota State Water Commission: Regulatory Program: Dam Safety http://www.swc.nd.gov/reg\_approp/damsafety/

SOURCES SOURCES

National Inventory of Dams (North Dakota) http://nid.usace.army.mil/cm\_apex/f?p=838:3:0::NO::P3\_ STATES:ND, (2016 NID Data)

2016 Dam Safety Performance Report North Dakota (ASDSO) https://damsafety.s3.amazonaws.com/s3fs-public/ND\_ PerfomanceReport\_v2.pdf

> National Weather Service https://www.weather.gov/safety/flood-states-nd

NORTH DAKOTA 2019 INFRASTRUCTURE REPORT CARD | 15

# DRINKING WATER

### **EXECUTIVE SUMMARY**

Public water systems provide potable drinking water to 98.8% of North Dakota's residents. Most of the state's public water systems are small, serving 3,300 residents or less. Major new drinking water infrastructure projects, such as the Williston Regional Water Treatment Plant expansion and the Western Area Water Supply Project, were completed in response to the oil boom's population growth. However, other portions of the distribution system are at the end of their service lives and require either rehabilitation or replacement. The North Dakota Drinking Water State Revolving Fund (DWSRF) Intended Use Plan indicated that in 2018, there were approximately \$594 million worth of DWSRF-eligible infrastructure projects state-wide. Fortunately, investments are being made. Approximately \$125 million will be available from the 2017-2019 biennium for water projects from the State Water Commission, while the DWSRF is funding approximately \$46 million in projects. Despite challenges associated with an aging system, the state has an excellent public health record.

### BACKGROUND

Public water systems, which serve at least 25 people or have at least 15 connections, provide water to 98.8% of the residents of North Dakota. Both surface water and groundwater are sources for these public water systems. Drinking water infrastructure includes surface water intakes, wells, water treatment plants, storage, pumping stations, and water mains. Residents that are not served by a public water system typically receive drinking water from private wells.

The state of North Dakota reported 325 public water systems during Federal Fiscal Year 2017. Public water systems are classified according to their population. Small systems are those that serve less than 3,300 people. Medium systems serve 3,300 to 100,000 people. Large systems serve more than 100,000 people.

1 1	Number of	
Population	Public Water Systems	
Small (<3,300)	283	
Medium (3,300 to 100K)	41	
Large (>100K)	1	

In addition to community water systems, 10 nontransient non-community public water systems and 84 transient non-community water systems were registered by the state.

North Dakota's primarily rural population presents challenges to serving residents that do not live within the boundaries of an incorporated city. Rural water systems have been able to assist with providing drinking water to customers that are widely spaced.

## ANALYSIS Capacity:

The eastern part of the state relies heavily on the Red River for its water supply. Concerns about the impact that a severe drought could have on water supplies in this part of the state has prompted an examination into alternative sources of water. The Red River Valley Water Supply Project, currently in the early planning stages, will convey water from Lake Sakakawea to the Red River Valley once completed. Up to \$30 million has been made available by the State Water Commission during the 2017-2019 biennium to support planning efforts. Three alternatives for the intake are being considered, as well as three alternatives for water treatment. The pipeline is currently expected to be 72" in diameter and 165 miles in length, but this may be modified depending on end user needs. The full cost of the project is unknown at this time.

The recent oil boom in the western part of the state left communities scrambling to accommodate their extreme population growth. In particular, Minot, Dickinson, and Williston experienced higher rates of population growth than the state average. This population growth results in an increased domestic water demand. In addition, the oil industry has increased industrial water demand which is primarily being met with water treated to drinking water standards.

	2000	2010	2015
North Dakota	642,200	672,591 (0.5%)	721,640 (1.4%)
Fargo	90,599	105,549 (1.5%)	113,464 (1.5%)
Bismarck	55,532	61,272 (0.1%)	66,980 (1.8%)
Grand Forks	49,321	52,838 (0.7%)	54,944 (0.8%)
Minet	36,567	40,888 (1.1%)	46,194 (2.5%)
Dickinson	16,010	17,787 (1.1%)	21,097 (3.5%)
Williston	12,512	14,716 (1.6%)	22,051 (8.4%)

Figure 1 - Population Growth

### **Condition:**

Records of drinking water infrastructure that was constructed more than 50 years ago are often inaccurate or incomplete, which presents a challenge to public water systems because it's difficult to properly assess the condition of underground utilities without having accurate records of what has been installed. Asbestos cement pipe and lead service lines are still in service in many systems. The presence of these materials in drinking water systems increases risks to public health. The condition of water mains is often assessed by the number of water breaks that are experienced. The City of Fargo has averaged 61 water main breaks per year for the period from 2011 to 2016. Many drinking water systems in the western part of the state have initiated infrastructure improvement projects within the past 5 to 7 years in response to the increased demand from population growth. Many of these improvements have the added benefit of replacing infrastructure that has exceeded its design life, which in turn raises the overall condition of infrastructure in the state.

### Funding

A common measure used to evaluate the affordability of drinking water is water bills as a percent of median household income. The EPA has established an affordability threshold of 2.5%. Data collected for the North Dakota DWSRF Intended Use Plan indicates that 12% of the systems have drinking water utility rates that are greater than 2.5% of their median household income.

In addition to user rates, public water systems typically obtain their funding in the form of grants and loans. One source of grant funding for water supply projects is the State Water Commission. Depending on the ranking of the project, the SWC may provide cost sharing at a 40% or 75% level. The remaining 60% or 25% of funding needs to come from a local funding source. Communities often obtain the remaining funding in the form of a loan.

Each biennium, the State Water Commission prepares a Water Development Report that describes the state's needs regarding flood control, irrigation, water supply, and general water management. The 2015-2017 biennium report indicates a total of \$645 million in water supply needs. State Water Commission funding is obtained from a variety of sources and is authorized by the state legislature. The proposal for the 2017-2019 biennium requests \$319 million in funding, which includes \$125 million for water supply projects.

The DWSRF program provides loans to communities at 2% interest and offer maximum loan terms of 30 years depending on the life cycle of the project. The DWSRF compiles a Project Priority List on an annual basis, which is a list of eligible projects that may seek DWSRF funding. The 2018 North Dakota Priority List contains 247 projects totaling \$594 million. More than half of the projects consist of improvements to drinking water transmission and distribution infrastructure.

Federal Fiscal Year	DWSRF Funds Disbursed
2009	\$23.6 million
2010	\$29.7 million
2011	\$34.9 million
2012	\$32.5 million
2013	\$17.9 million
2014	\$11.1 million
2015	\$21.4 million
2016	\$23.4 million
2017	\$45.8 million

Figure 2 - DWSRF funds dispersed by Federal Fiscal Year

At this time, the federal government continues to capitalize the DWSRF program by providing states with capitalization grants. North Dakota's 2018 grant was \$11,107,000.

The United States Department of Agriculture Rural Development office administers a program that provides loan and grant packages to communities for drinking water infrastructure. This program is intended for small, financially distressed communities. The Community Development Block Grant program, administered through the United States Department of Housing and Urban Development, provides grants for activities to address drinking water infrastructure threats to health and safety. The grant is to be used for projects that provide a direct benefit to low and moderate income persons. Small communities with a high number of residents employed in the agricultural industry often benefit from these programs.

### **Future Need**

The future need for drinking water infrastructure can be determined from the DWSRF Intended Use Plan. Each year, public water systems and their consulting engineers are solicited to provide a list of infrastructure projects that may seek DWSRF funding. A preliminary estimate of the project's costs and its impacts on residents' water utility rates is provided. The 2018 North Dakota Intended Use Plan lists 247 projects totaling \$594 million that are eligible for the DWSRF program.

Population Served	Number of Projects on	Amount of Projects
	Priority List	on Priority List
<501	81	71.7 million
501-3,300	107	233.8 million
3,301-10,000	22	70.0 million
10,001-100,000	27	141.3 million
>100,000	10	77.2

### **Operation and Maintenance & Public Safety**

Communities often find that recruiting and retaining certified drinking water system operators is a challenge. Many of the existing certified operators have served their communities for an extended period of time and have obtained a level of institutional knowledge that is difficult to replace. As certified operators retire, replacing them with younger, less experienced operators is difficult, especially for small communities whose populations are shrinking.

For many small systems, the care of the system is not the operator's primary employment. Out of 131 community water system in North Dakota that require a water treatment operator, only 99 have a certified operator (76%). Out of 336 community water systems that require a water distribution operator, only 250 have a certified operator (74%). Many systems only require a distribution operator because they purchase their treated water from another system.

Despite the challenges associated with retaining certified drinking water system operators, North Dakota has exceeded goals established by the EPA for compliance with national primary drinking water standards. In 2017, 98.8% of the population that is served by public drinking water systems receives drinking water that meets all applicable health-based drinking water standards. The goal established by EPA was 85%. In 2017, no mandatory boil water orders were issued and no maximum contaminant level exceedances were reported. Eleven system assessments were performed as a consequence of total coliform positive test results. Ninety-three violations associated with failure to monitor or reporting requirements were reported in 2017. As drinking water rules change or new rules are developed, the state's Public Water Supply Supervision program provides education and technical assistance to operators. Despite the program's increased workload, federal funding has remained flat.

### Resilience

One of the most significant threats to resilience of drinking water systems in North Dakota is flooding. The Red River Valley has experienced numerous flooding events. In particular, the city of Grand Forks was significantly impacted by a flood in 1997. Grand Forks chose the site of their new regional water treatment plant to minimize impacts from future floods. The city of Minot completed a project consisting of floodwalls and levees to protect their water treatment plant as a response to a 2011 flood event.





# **RECOMMENDATIONS** TO RAISE THE GRADE

 $\cdot$  Continue to provide funding for drinking water infrastructure projects through the DWSRF program and the State Water Commission.

• Continue efforts to encourage operators to become certified and maintain their certification. Increase funding for the Public Water Supply Supervision program to provide operators with education and resources on drinking water regulations.

• Provide education to systems to assist them with developing an asset management plan that will help to anticipate future infrastructure needs.

• Provide education to systems to assist them with developing a rate structure that will support future infrastructure investments and gain support from users.

• Encourage systems to incorporate regionalization alternatives and triple bottom line into cost-benefit analyses. In many cases, regionalization can be a viable alternative that allows systems to benefit from economies of scale. SOURCES

SOURCES

• Drinking Water State Revolving Fund 2018 Intended Use Plan

•2017-2019 Water Development Report, State Water Commission

• ND Drinking Water Annual Evaluation Report, Summary of State Drinking Water Program-Federal Fiscal Year 2017

·Rrvwsp.com

·Census 2000

·2010 Demographic Profile Data

·2015 American Community Survey 5-Year Estimates

 http://fargond.gov/city-government/departments/publicworks/water-mains-hydrants

•US Environmental Protection Agency, "Affordability Criteria for Small Drinking Water Systems: An EPA Science Advisory Board Report", December 2002

NORTH DAKOTA 2019 INFRASTRUCTURE REPORT CARD | 20

# ENERGY

### **EXECUTIVE SUMMARY**

North Dakota's 65,000 miles of transmission and distribution lines transmit about twice the amount of electricity the state uses on average. Most of the electricity is generated by coal, but recently wind has made a considerable addition to the market, up to 1/4 of the total generation. This has impacted the way the coal industry needs to look at daily demands and long-term planning. Meanwhile, hundreds of miles of transmission line were planned during the early 2000s oil boom, but portions of projects were canceled when oil prices declined. Rates are capped at investor owned utilities and increasing fees to pay for transmission line land acquisition, permitting and routing has proven difficult. North Dakota's electric rates are relatively low, averaging \$0.12 per kwh.



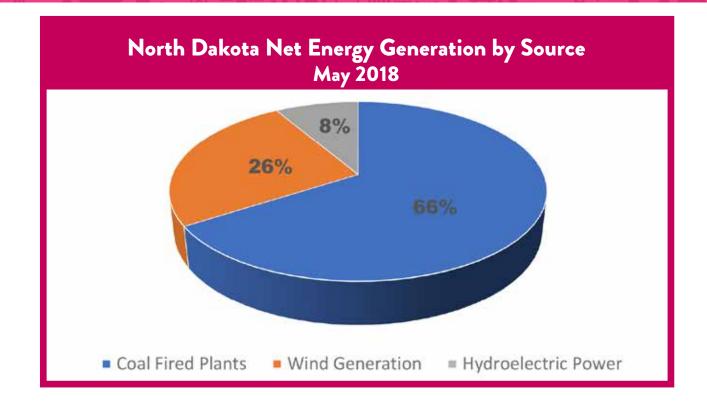
### ANALYSIS Capacity & Condition

Electric cooperatives provide electricity to mostly rural areas, while investor owned utilities predominantly supply electricity to the cities and more urban areas in North Dakota. Small municipalities and Western Area Power Administration (WAPA) make up the remaining portion. North Dakota Century Code is written such that public utilities cannot extend beyond city limits. With changing boundaries over the years, this has caused some constraints as utilities plan for future growth and reliability projects.

Much of the transmission infrastructure in the state was constructed in the 1950s with a 50-year life span. However, over the last 10 years, there has been more than 500 miles of new transmission line constructed in North Dakota.

The current capacity correlates to a demand structure that is ever changing. With the oil boom in the early 2000s, 190 miles of 345kV transmission line was planned in Western North Dakota. However, with the declining oil prices, the final segment of the line was not immediately needed and has not been constructed. Additional buildouts have taken place across the western side of the state to respond to demand increase from the oil boom, but the oil boom has since declined.

Electricity generated in North Dakota exceeds the state's current needs. About half of the electricity generated in the state is moved into the regional grid. About 66% of the electricity generated is from coal fired plants. The remaining 34% comes from wind, hydroelectric power and other sources. While demand for electricity remains steady, there is a lot of new renewable generation being added. As of May 2018, wind generation accounted for 26% of the state's net generation. North Dakota is a great wind resource with about 3,000 megawatts of current capacity with additional projects under development.



The additional wind generation has changed the approach of coal generation in the state. Coal fired plants are designed to produce a steady supply of electricity. Comparatively, wind generation has ups and downs depending on the weather patterns. Coal fired plants and wind generation, taken together with the highs and lows of electricity demand, impacts the amount of energy capacity the state's infrastructure can support at any given time.

Long-term demand is dependent on many variables, including the Clean Power Plan, which sets emission guidelines for electric generation facilities, and other state-adopted renewable energy initiatives. Another variable is the ebbs and flows of the oil market on the western side of the state. Oil wells added to increase production of oil require pumps and associated infrastructure. A few select areas have capacity needs but most of the oil transmission infrastructure has caught up to current demand. Maintenance of the transmission systems is up to date but sub transmission and distribution across the state do not get the same attention.

## Funding & Future Need

Investor Owned Utilities (IOUs) have capped rates. Requests for increases must go through board approval processes before they are passed on to members. Right-Of-Way (ROW) costs have increased everything from land acquisition to permitting and routing. The amount of funding for transmission lines varies between utilities and by year. The average electric rates in the state are \$0.12 per kwh, deeper detailed financial information is not publicly available. Electric rates in North Dakota are relatively low in part because the state currently does not have renewable mandates.

Some industries are starting to produce their own power through wind and solar options. The preference for personal power production over purchasing the commodity from the marketplace has become another variable for utilities to take into consideration as they prioritize necessary projects and consider requesting rate increases. Independently-generated electricity still requires infrastructure for support, capital construction and



operation and maintenance. It should be noted that wind and solar farms pay for facility upgrades needed for project interconnections.

### **Operation & Maintenance**

With multiple utilities and within the boundaries of two Regional Transmission Organizations (RTOs), some efficiencies may be lost in nonproductive redundancies that have occurred along the urban/ rural boundaries. A statewide asset management plan with complete information about the state's electric infrastructure could enable utilities to plan and manage upgrades and future growth. This information would also help populate a statewide asset management plan.

### **Public Safety & Resilience**

With about 65,000 miles of line traversing across a low population state, redundancy in North Dakota's electric transmission system increases reliability. Weather related events are still the largest threat to the system in terms of power outages. Icing events are not as common as they are in other states, but when an icing event occurs in conjunction with high winds, it can cause catastrophic line failures, particularly for aging lines that were designed to old standards.

### Innovation

One area of innovation is in dynamic line rating, which uses real time thermal ratings to determine actual loads rather than using calculated maximum. Existing lines that were rated with maximum capacity on a calm day are now getting new wind power. Some of these lines are being cooled by the same wind that is generating the electricity carried by the line. With dynamic line rating, the cooling power of the wind on the conductor is considered to determine the actual capacity of the line as added growth is considered.

Microgrids have been entertained but are not currently incorporated into the system as they have been in adjacent states. Some of the reasons are attributed to the territory laws protecting the electric cooperatives and possibly the fear of losing control of the customer base.

### **DEFINITIONS**

- Regional Transmission Organizations (RTOs)
- Investor Owned Utilities (IOUs)
- Right-Of-Way (ROW)





# RECOMMENDATIONS TO RAISE THE GRADE

There are many ways the state of North Dakota can raise the grade for energy:

• A statewide asset management plan with compiled information of all the existing electrical lines should be developed.

• Utilities and cooperatives should prioritize the maintenance of sub transmission and distribution infrastructure.

• Continue the rehabilitation and replacement of transmission lines across the state reaching the end of their service life.

### SOURCES

 North Dakota State Government, https://www.business.nd.gov/energy/Transmission

• North Dakota Studies, Energy: Powered by North Dakota, https://www.ndstudies.gov/energy/level2/module-3-coal/ transmission-and-distribution

 North Dakota Transmission Authority, North Dakota Transmission Authorities Annual Report, July 1st, 2016
 June 30th 2017, http://www.nd.gov/ndic/ic-press/taannualreport-17.pdf

 U.S. Department of Energy (D.O.E), Staff Report to the Secretary on Electricity Markets and Reliability, August 2017, https://www.energy.gov/sites/prod/files/2017/08/ f36/Staff%20Report%20on%20Electricity%20 Markets%20and%20Reliability\_0.pdf

SOURCES

 U.S. Department of Energy (D.O.E.), Wind Vision: A New Era for Wind Power in the United States, https://www. energy.gov/sites/prod/files/WindVision\_Report\_final.pdf

 U.S. Energy Information Administration, North Dakota, https://www.eia.gov/state/analysis.php?sid=ND

 U.S. Energy Information Administration, North Dakota, State Profile and Energy Estimates, https://www.eia.gov/ state/?sid=ND#tabs-4 LEVEES

### **EXECUTIVE SUMMARY**

The North Dakota State Water Commission (SWC) has issued permits for 627 flood control levees, totaling 325 miles. Heavy flooding across North Dakota in 2009, 2010 and 2011 exposed deficiencies in the levee systems, and major investments are now underway to improve the condition and capacity of levees to reduce flood damage in the future. Over \$1 billion has been spent, from all funding sources, on flood-related projects along the Red River alone since 1997. Residents in Fargo, Grafton, Valley City and Minot approved sales tax increases to pay for the local share of various flood mitigation project costs.

The state and local governments have done a commendable job of prioritizing investment in levees in recent years and great strides have been made. The United States Army Corps of Engineers (USACE) periodically inspects 94.19 miles of North Dakota levees, 21.54 miles of which are presently rated as unacceptable, but these bad marks are sometimes the result of incomplete paperwork rather than reflective of the actual condition of the structures. North Dakota does not require periodic levee inspections nor reports on levee conditions after their construction.

### BACKGROUND

North Dakota is a relatively flat state; any elevation is the result of small rolling hills. North Dakota is also a sparsely populated state, with agriculture being the largest part of the state's economy. Most of North Dakota's population lives along a few main rivers: the Souris, Missouri, James, Sheyenne and Red Rivers. The state's levees mainly protect urban areas where flooding would cause the largest financial losses and threaten the most lives.

### ANALYSIS

### Capacity

There are existing capacity issues with levees, such as not being able to accommodate a 100-year flood event, but the state and local water jurisdictions are in the process of addressing them. Multiple cities, such as Minot, Grafton, Valley City, Lisbon, and Fargo all presently have flood risk reduction projects under construction or are planning projects in the near future. The cities are either building new levees or raising existing levees. Diversion channels are also a main feature included in the Fargo and Grafton projects.

### **Operation & Maintenance**

Operation and maintenance (O&M) is the responsibility of the local levee owner, usually water resource districts or cities. Overall, local levee O&M funding amounts are unavailable. However, water resource districts and cities have the ability to special assess maintenance costs or implement utility fees to benefited landowners.

### Funding & Future Need

State and local government spending on flood mitigation projects has improved substantially since the floods of 2009, 2010 and 2011. Over \$1 billion dollars has been spent, from all funding sources, on flood related projects along the Red River alone since 1997. The Fargo-Moorhead Area Diversion Project has an estimated cost of \$2.75 billion. North Dakota has already appropriated \$304 million of their \$570 million share. While this project is not 100% levees, the project will work in conjunction with levees and will provide flood protection for a sizable portion of the Fargo-Moorhead area. Local taxpayers in Fargo and in Cass County approved sales tax increases to pay for the local share of the project costs. Other large projects are in the works along the Missouri River and the Souris River, in the cities of Bismarck and Minot respectively. Due to record flooding in 2011, levees in the Minot area are expected to be improved over the next 20 years. The North Dakota State Water Commission had almost \$250 million in spending approved for the 2017-2019 biennium.

For flood mitigation projects, voters in the City of Fargo approved a city sales tax increase of 0.5% in 2009 and an additional 0.5% in 2012. Cass County voters approved a county sales tax increase of 0.5% in 2010. In 2016, both Fargo and Cass County voters approved the extension of these sales taxes until the year 2084. The cities of Grafton, Valley City and Minot have also added a 0.5% sales tax to help fund the local share of levee projects.

### Public safety:

22.9% of USACE inspected levees are presently rated as unacceptable. It is important to understand that an unacceptable rating can be the result of incomplete paperwork and not necessarily because the levee is defective.

North Dakota does not require inspection reports on permitted levees. North Dakota requires levee permits, so they are able to record their existence, possible impacts and the levee owner.

Most levee owners are cities or water resource districts, which typically have levee inspection programs as part of their levee maintenance program. They may also enter the projects into the U.S. Army Corps of Engineers Levee Safety Program if minimum design criteria are met, which provides annual inspections to levee owners.

### **Resilience:**

There are no seismic or hurricane issues in North Dakota. Levees are typically designed with freeboard above a certain flood recurrence interval, which provides for an additional factor of safety. If a flood event is larger than what the levee was designed to handle, areas where the population is larger could have sandbagging operations to support and supplement levees.

Grand Forks and Minot had severe floods in 1997 and 2011 respectively. These events caused billions of dollars in damages and proved the need for robust flood risk reduction projects. The damages in Grand Forks alone have been estimated between \$1 billion and \$2 billion. Grand Forks' project was designed and constructed by the U.S. Army Corps of Engineers and included levees and floodwalls, as well as the English Coulee Diversion. Several projects are underway to increase flood resiliency in the Minot area, part of an innovative approach to provide projects to many communities along the Mouse River, not just Minot.

Fargo is in the process of building a diversion in conjunction with improving its levees. Fargo's diversion project will include upstream retention to avoid increasing flooding problems to communities downstream of the city.

### Innovation:

Most levees are earthen levees with some floodwalls supplementing the earthen levees. These projects also include upgrades to stormwater infrastructure and pumping stations, as well as adding resiliency to other utilities and infrastructure. The Fargo-Moorhead Area Diversion Project is the first USACE project in the nation using P3 funding (Public Private Partnership). This is where a private company pays for the design and construction of the project, while tax dollars are used to reimburse that company over time. This allows a project to be constructed sooner, providing quicker benefit and a savings in cost over the long term.





# **RECOMMENDATIONS** TO RAISE THE GRADE

• Continue funding of projects to which North Dakota has already committed.

- Congress should fully fund the National Levee Safety Program.
- Continue levee permitting requirements.
- Continue leveraging state cost sharing with local government entities as needs arise.

• Establish reporting requirements for the periodic inspection, rating and acceptability of levee systems to the Office of the State Engineer. The USACE Levee Safety Program can be a basis for the inspections, rating and acceptability criteria. SOURCES

SOURCES

• Minot News, Temporary Levees for Flood Protection, Jim Olson, 9-20-2017

 MPR News, 20 Years After Epic Flood, Red River Towns No Longer Dread the Spring, Dan Gunderson, 4-20-2017

 FM Area Diversion Project, About the Project, www.fmdiversion.com/

# ROADS

### **EXECUTIVE SUMMARY**

North Dakota ranks among the highest-spending states per capita on highways. Currently, 67% of urban roads and 77% of county and township roads are in good or very good condition. However, looking ahead, significant work will need to be done to address roadside safety, find alternative sources of funding, and ensure equitable assignment of resources among high growth areas.

Should funding remain stagnate, estimates show that state-maintained roads in poor condition will nearly double between 2018 and 2021, from 443 miles to 872 miles. And while capacity remains adequate across the state, despite a 64% increase in vehicle miles traveled over the last 20 years, the state has major challenges during winter months responding quickly to snow removal and de-icing.

### BACKGROUND

Continued growth in North Dakota's key industries of agriculture, energy, manufacturing, and tourism have placed immense importance on the state's highway system. Growth combined with rising transportation costs have placed an emphasis on the effective allocation of North Dakota's resources to maintain and rebuild its key infrastructure.

State and local roadways form the backbone of North Dakota's transportation system, connecting smaller cities and key industries to the interstate and interregional roadway system. Of the total 106,966 miles of public roadway, state and county account for more than 25.3% (27,018 miles) of roadway mileage and 64% of total vehicle miles traveled. Over half of North Dakota's roadways - 52% (56,008 miles) - are classified as 'other rural roads' consisting of township and tribal roads. Federal highways only account for 3% (3703 miles) of total centerline miles with interstates accounting for less than 1% (571 miles). Approximately 17.7% (18,884 miles) of North Dakota roadways are eligible for Federal Aid. City streets only account for 3.8% (4,103 miles) of total roadway miles.

# ANALYSIS

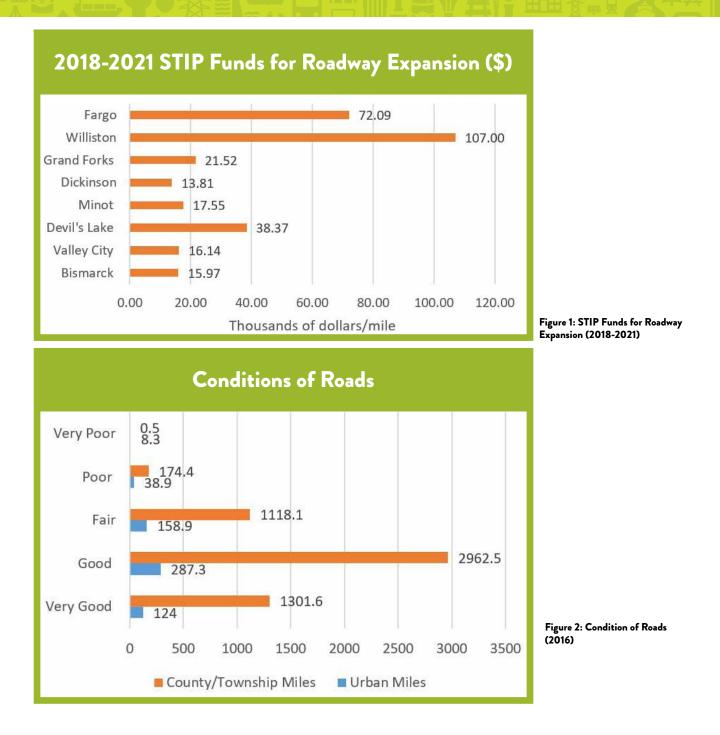
# Capacity

Statewide Vehicle Miles Traveled (VMT) has steadily increased between 2008 and 2016 by about 28% and reflect a broader upward trend seen over the last two decades. Though VMT has jumped over 64% over the last 20 years, the percentage of roadways that are congested remains less than 5%, well below the national average. In the two most densely populated cities, Bismarck and Fargo, traffic is projected to increase at less than 5% in the coming years. Growth in North Dakota from 2010 to 2015 was concentrated in Williston (+8.4%), West Fargo (+5.2%), Dickinson (+3.5%), and Minot (2.5%).

Though there has been significant growth in urban areas across North Dakota, the state has frozen revenue sources and cut spending in previous budget cycles rather than raise taxes. Transportation funds for increasing roadway capacity were well proportioned to meet this growth as outlined in the 2018-2021 Statewide Transportation Improvement Plan (STIP) as shown in Figure 1. North Dakota's roadways generally operate under capacity and even congested urban areas are not ranked on nationwide congestion lists.

## Condition

During the height of the oil boom (2011 – 2015), oil rigs and vehicles had a massive impact on roadway conditions. After the collapse of oil prices in 2014, oil related traffic normalized to a level higher than before the boom. Additionally, the Dakota Access Pipeline reduced the amount of outgoing oil by trucks significantly, resulting in better roadway conditions.



Roadway condition is measured using the Present Serviceability Index (PSI), which is a combination of the International Roughness Index (IRI) and the Pavement Condition Index (PCI). IRI is an indicator of overall roadway ride quality experienced by the user. PCI represents the pavement distress such as cracking and rutting. The combined ride and condition score on a scale of Very Good to Very Poor for Urban, County, Township, and Tribal roads for 2016 is summarized in Figure 2.

Figure 2 shows that 20% of urban roadway miles are in very good condition, 47% are in good condition, and only 8% is poor condition or less. Over 23% of county and township roads are in very good condition, 54% are in good condition, and only 3% are rated as poor condition or less. About 30% of roads are posted with load restrictions during spring months to limit damage to the highway system. NDDOT uses temperature probes and weather forecasts to monitor pavement conditions. TRIP, a national transportation research group, estimated that miles of state-maintained roads in poor condition will nearly double between 2018 and 2021, from 443 miles to 872 miles. TRIP also estimated that driving on roads in need of repair costs North Dakota motorists \$250 million annually in extra vehicle repairs and operating costs of \$449 per motorist.

### **Operations and Maintenance**

North Dakota's 2018-2021 STIP allocated approximately \$506 million for maintenance and operations of highways, representing between 18%-27% of total transportation expenditure. North Dakota ranks second in the United States in Transportation spending per capita with \$1300 second only to Alaska with \$2100.

Major challenges to North Dakota drivers occur during winter months. Due to the rural nature of the state, snow removal and deicing presents a major challenge with average response times of two to three hours. Due to funding challenges, NDDOT recently considered closing several rural service stations to handle snow removal and other maintenance services in those areas. Longer response times for snow removal and deicing could result in more weatherrelated roadway incidents and reduced productivity for residents of rural locations. To address this challenge, it was reported that NDDOT planned to invest in 32 technologically advanced 'Toe Plows' capable of covering twice the area of current plows while also being able to monitor air temperature, road temperature, and dew points.

### **Public Safety**

It is estimated that roadway features are likely a contributing factor in approximately one-third of

traffic fatalities. A total of 643 people died on North Dakota's highways from 2013 through 2017 with an average of 128 fatalities per year. North Dakota's 2016 traffic fatality rate of 1.16 fatalities per 100 million vehicle miles of travel was below the national average of 1.18. However, the fatality rate on the state's rural non-Interstate roads is disproportionately higher than that on all other roads in the state with 1.79 fatalities per 100 million miles of travel versus 0.42. In 2017, North Dakota's preliminary traffic fatality rate of 1.20 is above the national rate of 1.17 as of May 2018. When compared to neighboring states, North Dakota has shown a significant reduction in fatalities between 2012 and 2016 but trails Minnesota by almost a factor of 2. Motor vehicle crashes in which roadway design was likely a contributing factor cost North Dakota motorists \$319 million per year in medical costs, lost productivity, travel delays, workplace costs, insurance costs and legal costs. According to a study conducted by the Federal Highway Administration, \$100 million spent on highway safety improvements will save 145 lives over a 10-year period.

## Innovation

NDDOT's Transportation Innovations Program (TRIP) has advanced the use of several new technologies for design, construction, maintenance, and management technologies. Some of the ideas being explored including the study of advanced materials and improved construction methods. Metropolitan Transportation Organizations in the Bismarck-Mandan and Fargo-Moorhead Metropolitan regions update their regional Intelligent Transportation System (ITS) architectures every 3-5 years. NDDOT allocates most of its ITS budget towards Environmental Sensor Stations, Highway Advisory Radio, and the ND 511 emergency alert system.



Figure 3: Regional Fatalities per VMT





# RECOMMENDATIONS TO RAISE THE GRADE

• Significant increase in funding is needed at the state level to address the current shortfall. Several options could be explored including raising the state fuel tax, introduction of a VMT fee structure, raising oil/energy taxes, and raising vehicle registration fees.

• Consider allocating a percentage of vehicle sales excise taxes towards transportation system improvements

• Explore Public-Private Partnerships on a larger scale to finance transportation system improvements.

• Where appropriate, highway improvements such as removing or shielding obstacles, adding or improving medians, widening lanes and shoulders, upgrading roads from two lanes to four lanes, and improving road markings and traffic signals can reduce traffic fatalities and accidents and improve traffic flow to help relieve congestion.

 Allocate additional funds towards planning for connected vehicles and infrastructure.

NORTH DAKOTA 2019 INFRASTRUCTURE REPORT CARD | 33

### SOURCES

Chantrill, C. (2016). State Transportation Spending Rank.
 Retrieved from www.usgovernmentspending.com: https://www.usgovernmentspending.com/compare\_state\_spending\_2016h60s

 Evans, B. (2017, Marck 02). Proposed NDDOT budget could include cuts to rural snow removal. Retrieved from www.kfyrtv.com: https:// www.kfyrtv.com/content/news/Proposed-NDDOT-budget-couldinclude-cuts-to-rural-snow-removal-415274513.html

 NDSU Upper Great Plains Transportation Institute. (2016).
 Infrastructure Needs: North Dakota's County, Township and Tribal Roads and Bridges: 2017-2036. Bismarck: NDSU UGPTI

SEOS DOS

 NDSU Upper Great Plains Transportation Institute. (2017).
 Infrastructure Needs: North Dakota's Urban Corridor Roadways and Bridges: 2017-2036. Bismarck: NDSU UGPTI

- North Dakota Department of Transportation (NDDOT). (2018). Transportation Funding Options. Bismarck: NDDOT; UGPTI
- North Dakota Department of Transportation. (2012). TransAction III: North Dakota's Statewide Strategic Transportation Plan. Bismarck: Planning/Asset Management Division.
- TRIP. (2018). Modernizing North Dakota's Transportation System.
  Washington, D.C.: TRIP.

NORTH DAKOTA 2019 INFRASTRUCTURE REPORT CARD | 34

# TRANSIT

#### **EXECUTIVE SUMMARY**

Public transportation plays a major role in improving livability for transit-dependent populations in the state of North Dakota. Three of the 29 transit agencies in the state are classified as urban transit providers, four are tribal transit providers, and the remaining 22 are rural operators. Three modes of public transportation are available in North Dakota: Fixed-Route Bus, Demand Response Transit, and Demand Response Taxi. Public transit ridership in North Dakota dropped 6.5% from 2015 to 2016 and 4.9% from 2014 to 2015, mirroring a national trend of decreased ridership. The farebox recovery rate (percent of trip's operating costs recovered through passenger fares) for all transit operations across the state is observed as 8.4%, which is close to the national average (9%) for rural transit agencies. Meanwhile, with operating expenses totaling over \$34 million, increased funding is needed to improve accessibility and public transportation services and facilities.

#### **ANALYSIS**

#### **Condition & Capacity**

Across the state of North Dakota, 30 transit agencies/operators provided public transportation services to transit-dependent populations and the general public in 2016, according to National Transit Database. Since North Dakota is predominantly a rural state, the majority of the providers are rural transit operators. Among 29 transit providers, three providers are categorized as Urban Transit Agencies, four providers are classified as tribal Transit Agencies, and of the remaining 22 are categorized as Rural Transit Agencies.

Generally speaking, there are many modes of public transportation, but only three modes of public transportation are offered by transit agencies across the state; they include Fixed-Route Bus, Demand Response Transit, and Demand Response Taxi. Cities of Fargo, Bismarck, Grand Forks, Minot, and Belcourt have operational Fixed Route Bus service, while the remaining cities have transit agencies operating Demand Response Transit, Demand Response Taxi, or both.

According to 2015 national transit database summaries provided by American Public Transportation Association, total active fleet of transit agencies in North Dakota is reported as 162 vehicles, while the average age of the transit vehicle fleet is reported as 5.95 years. The average age of the transit vehicle fleet for North Dakota is lower than the national average for rural transit agencies (6.2 in 2013, 6.4 in 2015, and 6.6 in 2015). However, the average age of transit vehicle fleet in North Dakota is comparatively higher than some of the rural states such as Wyoming (5.54), Oklahoma (5.21), Mississippi (4.53), etc. The average age of transit vehicles in North Dakota cannot be compared to national average for transit vehicles as states with more urban cities also account for rail locomotives, light rail passenger cars, and heavy rail passenger cars which can be operational for many more years compared to fixed-route vehicles, and demand response vehicles.

Transit ridership for all the transit agencies in North Dakota in 2016 is reported as 2,859,639 unlinked passenger trips. North Dakota transit ridership contributed to a very minimum percentage (0.027%) of the national transit ridership. Most (71.4%) of the North Dakota transit ridership for 2016 were made with Fixed Route Bus trips, 27.6% of the transit ridership are made with Demand Response Transit trips, and 1% of transit ridership are made with Demand Response Taxi trips. Public transit ridership in North Dakota dropped by 6.5% from 2015 to 2016 while the operating expenses remained almost the same for the two years. Public transit ridership also decreased by 4.9% from 2014 to 2015, demonstrating a downward trend of ridership in the state. This mirrors the national trend, which has seen transit ridership decrease across the country in recent years. While the reason for decline in ridership is unknown, possible explanations could include the strong economy and the growing popularity of rideshare programs.

#### **Operations, Maintenance, Funding & Future Needs**

Operating expenses for all transit operations conducted in 2016 for the state of North Dakota was reported as \$34,227,553, while the revenue generated by transit operations in the state was \$2,867,138. Apart from fare revenue, a portion of the operating expenses come from federal funding. For example, the North Dakota Department of Transportation (NDDOT) administers Federal Transit Administration grants, which are awarded to operators around the state. In FY19, available funding through this grant program was approximately \$2.5 million. Additionally, funding for transit comes from state, local, and other directly generated funds. The amount of state aid for public transit is determined biennially by the North Dakota state legislature and distributed through a formula.

Interviews conducted with transit agency contacts in the state have shown that some transit agencies have problems with insufficient funding for operating expenses and capital costs. Additionally, some agencies have expressed the need for more administrative assistance for conducting various transit related operations in rural setup.

The farebox recovery rate for all transit operations across the state is observed as 8.4% which is close to national average for rural transit agencies (9%).

#### **Public Safety**

According to National Transit Database for the year of 2016, only one incident with injuries is reported by Bis-Man Transit Board. As a comparison, a total of 711 incidents were reported among all transit agencies in United States with 10 fatalities and 476 injuries.

#### Innovation

Innovative ideas and practices in public transportation and shared use mobility are being practiced in the state at the same pace observed in bigger urbanized communities. Practices include operational rider sharing services, bike sharing services, using technology to conduct bus transit operations, and pursuing potential automated driving technologies.

Uber currently operates in Fargo, Bismarck, and Grand Forks. In 2017, WDAY reported that ridesharing applications such as Uber and Lyft have resulted in a marked decrease in DUI arrests for the State of North Dakota. In 2016, there were over 5,400 DUI arrests; by 2017, DUI arrests decreased by 800 thanks to ridesharing and stiffer penalties.

A bike share program called Great Rides Bike Share has operated in Fargo since 2015, and has been very successful. While the bike share system is small with 11 docking stations, rides per bike is observed as 5.3 trips per day which is higher or similar to larger bike share systems that are operational in Minneapolis, New York, and Chicago.

Cities Area Transit in Grand forks, Capital Area Transit in Bismarck-Mandan, and Metro Area Transit in Fargo utilize automated vehicle location (AVL) technology to provide real-time updates on the location of buses.

The city of Bismarck is considering the exploration and testing of driverless buses for the year 2019. US News and World Report suggests that the pilot program to test autonomous vehicle technology would run a fixed route between downtown Bismarck and the State Capitol. The driverless bus would become part of the Capital Area Transit fleet.





## **RECOMMENDATIONS** TO RAISE THE GRADE

• Determine strategies for increasing transit ridership which has been decreasing over the last few years.

• Determine ways to increase funding for capital expenses, operating expenses, and administrative support for transit agencies lacking these resources.

• Provide transit services to rural communities that do not currently have any available transit services, or transit services with less frequency of operation.

# SOURCES

#### SOURCES

 Identifying and Satisfying the Mobility Needs of North Dakota's Transit System https://www.ugpti.org/resources/reports/details.php?id=795

 2015 NTD Data Tables, APTA website https://www.apta.com/resources/statistics/Pages/NTDDataTables. aspx

 National Transit Database, 2014, 2015, 2016, Federal Transit Administration https://www.transit.dot.gov/ntd/ntd-data

 Rural Transit Fact Book, 2017, Small Urban and Rural Transit Center, Upper Great Plains Transportation Institute https://www.surtc.org/transitfactbook/downloads/2017-ruraltransit-fact-book.pdf

 Chicago Tribune Article
 http://www.chicagotribune.com/news/nationworld/chi-northdakota-train-bus-crash-20150105-story.html

 WDAY Article http://www.wday.com/news/4308433-duis-decline-ride-sharingapps-gain-popularity-north-dakota

 Evaluation Study of Bike Share Program in Fargo, North Dakota https://www.ugpti.org/resources/reports/details. php?id=875&program=surtc

• US News Article

https://www.usnews.com/news/best-states/north-dakota/ articles/2018-01-26/bismarck-might-add-driverless-bus-to-cityfleet-in-2019

 North Dakota DOT Grant Application Request https://www.dot.nd.gov/divisions/localgov/docs/transit/5339/5339advertisement-for-funding.pdf

# WASTEWATER

#### **EXECUTIVE SUMMARY**

North Dakota's 755,000 residents are served by over 350 municipal wastewater systems. Rapid population growth associated with the oil industry resulted in many recently completed or ongoing upgrades and expansions of municipal wastewater treatment facilities (WWTFs).

Over the last 10 years, more than \$265 million was spent to improve and upgrade the mechanical WWTFs in the larger communities. Approximately \$180 million is expected to be invested in the WWTFs of Fargo, Grand Forks, Bismarck, and Minot over the next 10 years. However, per capita spending on wastewater operations and maintenance has remained flat and older communities struggle with stormwater infiltration and inflow issues as the collection systems age. Additionally, communities served by wastewater pond treatment systems are challenged by storage volume needs, dike erosion protection, seasonal odors, and delayed discharges due to pollutant variability.

#### BACKGROUND

Nearly 60% of North Dakota's 755,000 residents are served by 11 larger (serving 4,000+ populations) and 16 small mechanical WWTFs. The remaining residents are served by 306 wastewater (WW) pond treatment systems (facultative and/or aerated, approximate population 275,000) or septic systems (approximate population 170,000).

The majority of the mechanical WWTFs are relatively new or have recently undergone significant improvements. Rapid population growth, efforts to provide regional WW treatment, energy sector growth, and efforts to provide reclaimed water for industrial use are typical in larger population centers (notably Bismarck, Dickinson, Fargo, Grand Forks, Jamestown, Minot, Watford City, and Williston). Mechanical WWTFs are in better condition than has historically occurred.

North Dakota is subject to boom and bust population cycles. Residential, commercial, and industrial construction activities in the larger population centers, especially Fargo, Grand Forks, Bismarck, Williston, Watford City, and Minot, have experienced rapid population growth in recent years. In the western communities, volatility in the energy sector economy leads to population fluctuations (rises and declines) creating a more complex planning environment.

Communities served by WW pond treatment systems often face difficulties related to the intemperate climate of ND. These include storage volume needs for long winters when discharge is not possible, dike erosion protection to minimize shifting ice damage, seasonal odors, and delayed discharges due to pollutant variability. Communities with WW ponds are typically small rural facilities that have not seen recent population growth or as many upgrades as mechanical WWTFs.

North Dakota has not adopted formal nutrient limits, but narrative (non-numeric) limits are being prepared by the Department of Health and will be implemented in the next several years. Phosphorus and total nitrogen limits will place a financial burden on mechanical WWTFs for additional treatment or optimization. Nutrients and other issues will continue to create capital improvement needs for the communities served by mechanical WWTFs.

With the exception of public water systems (25 or more persons or 15 or more connections), on-site septic systems in rural areas are managed at the county level in ND, without state agency oversight or guidance. In a number of instances septic system management has been combined into a multi-county health service agency. Typically, septic system management involves review of plans and designs for new septic systems, issuing permits and construction inspection for new systems, and licensing septic system operators. There is no ongoing oversight of septic systems which may be failing. Several regional septic system management agencies are beginning discussion on state-wide, uniform requirements for septic systems.

#### Capacity

Fargo, with a 2% annual population growth rate and its focus on providing regional WW service to West Fargo, Horace, Harwood, Mapleton, and other nearby communities, faces significant challenges in providing new and maintaining existing capacity for WW collection and treatment. In addition, the Fargo WW reclamation facility, which provides 1.4 MGD of industrial water supply, was commissioned in 2007 and will likely soon need some level of upgrading. Grand Forks, with a 1% annual population growth rate and an established, but potentially-growing regional service area, faces fewer challenges, with the exception of biosolids management and nutrient removal. Both Fargo and Grand Forks have pond systems capable of serving as emergency wet weather flow storage to reduce wet weather impacts on the treatment facilities.

Larger western communities, such as Bismarck, Mandan, Dickinson, Williston, Watford City, and Minot have invested significantly in WW infrastructure during the recent oilfield play, which spurred rapid population growth. The population growth expected to accompany the return of oilfield activity will likely be more gradual and less volatile than experienced during the time leading up to 2013.

Where rural WW treatment is provided by lagoons, the capacity has been holding relatively steady with some deferred maintenance for which there is no data to estimate a dollar value. The capacity of sanitary sewer systems are staying about the same, but populations are rising except in rural areas. Rural areas generally have surplus sewer capacity to serve their stagnant or slightly decreasing populations, but large communities have sewer capacities below their projected growth needs.

#### Condition

Sanitary sewer system corrosion is becoming a problem because of age, especially with lift stations and smaller communities. Replacement or repair of sewer mains due to deteriorated pipe materials, off set joints, and protruding service lines is common. Older areas of large and small cities have storm water infiltration and inflow (1&1) issues, as the collection systems age, reducing capacity available for WW treatment during wet periods. Downtown Fargo still has significant 1&I and roof drain/parking lot connections into the sanitary system. A Fargo ordinance that allows homes older than 1971 to discharge sump pump water into the sanitary system year round remains in effect. The city has undertaken several projects recently to evaluate the sources of I&I and rehabilitate aging sanitary sewer mains.

Over the last 10 years, more than \$265 million was expended to improve and upgrade the mechanical WWTFs of the larger communities. Over 10 million gallons per day (MGD) of additional treatment capacity was built into the mechanical WWTFs of many of the nine larger cities. Approximately \$180 million is expected to be invested in the WWTFs of Fargo, Grand Forks, Bismarck, and Minot over the next 10 years.

#### Stormwater

Precipitation that falls on impervious surfaces, such as streets, drains to storm sewers and eventually to lakes and rivers. Pollutants such as sediment and phosphorus are carried with the runoff water. Management of stormwater runoff entails preventing the stormwater from becoming polluted or intercepting and treating the runoff water prior to its discharge to a stream or lake. Many municipalities and industries are required to implement a variety of management measures to protect receiving waters and treat stormwater prior to discharge.

There are 18 municipal National Pollution Discharge Elimination System (NPDES) stormwater (MS4) permits in North Dakota, held by 10 communities, four counties, three universities, and the Department of Transportation. These permits require the communities to implement six minimum control measures, which are overall thought to be effective at managing stormwater pollution. Some improvements to municipal stormwater management are still needed. For instance, implementation and maintenance of erosion and sediment control measures by contractors at construction sites needs improvement.

Almost all of the combined sewer overflow issues in ND communities have been or are currently being addressed by capital improvements, such as Fargo's \$22 million Broadway Avenue project. Combined sewer overflows (CSO) have been largely eliminated in North Dakota since 2009.

The Natural Resources Conservation Service (NRCS) is involved in partnerships with ND farmers and ranchers aimed at reduction of nonpoint source stormwater runoff and related pollutants, soil and ecosystem health, and improving energy efficiency. Among the NRCS partnership tactics aimed at nonpoint source stormwater pollution are the encouragement of no-till, strip till and similar nonpoint source pollution reduction farming practices. Additionally, at the request of North Dakota congressional representatives, NRCS has worked with farm and conservation groups to pool funds to hire eight new Farm Bill specialists in the state to support the installation of farm practices to reduce nonpoint source pollutants. In their first year of employment, the specialists helped farmers and ranchers with 542 grant applications for the installation of nonpoint source control practices, prepare 257 conservations plans, and attend 59 workshops on nonpoint source stormwater pollution management.

#### **Operation & Maintenance**

Common needs in many North Dakota community WW collection and treatment systems are maintenance upgrades, treatment upgrades related to anticipated nutrient discharge limits, and collection system improvements to address new service area expansion and repair, including maintenance, or replacement of aging components. Many aging WW pond systems, some initially installed in the 1950s to 1970s, are in need of maintenance and upgrades.

Per capita spending for operations and maintenance (O&M) for all sizes of municipalities has remained flat. Where there has been more spending, it is because of growth and the associated increase in user accounts.

Several communities are pursuing the regionalization of WW management. For instance, the Cities of West Fargo and Horace will begin to pump their sewage to the Fargo WWTF in the near future.

Lagoon systems have relatively limited O&M needs, typically related to maintaining lift stations, riprap protection along shorelines, control of vegetation and infrequent removal of accumulated primary lagoon biosolids. O&M needs typically increase when a community changes from a lagoon to mechanical treatment system due to the increased process complexity. Often a portion of the pond system is retained for short-term or longer-term emergency use in transitioning to contracted regional service. All North Dakota municipal WW systems with mechanical treatment have WW utilities that collect utility fees to cover O&M costs for the mechanical plants. It can be a challenge for municipalities with mechanical systems to raise utility rates to pay for new O&M needs and/or pond decommissioning.

One way municipalities can improve the management of WW systems is through the creation of asset management plans. An asset management plan (AMP) will provide the roadmap for achieving the wastewater treatment value from a WW system assets by identifying the balance for spending between cost, risk and performance throughout the WW systems lifecycle. AMPs define the O&M activities necessary to realize a municipalities asset management objectives. There are relationships and interdependencies between asset management policy, strategy, objectives, and planning that municipalities must consider when preparing AMPs.

#### Funding

Funding for O&M and some capital needs comes in part from revenue generated through user fees. Although the 2017 base rate and usage rate structures of the communities served by mechanical WWTFs are variable, the revenue generation for a typical 6,000 gallon per month per user connection for the larger systems seem to be fairly consistent, ranging from \$25 to \$31.30. The 2018 residential WW utility rates for reporting ND communities serving populations of 5,000 or larger ranged from \$8.30 to \$40.09 per month and averaged \$23.22. For communities served by mechanical plants, the 2018 residential average WW rate was \$25 per month. These monthly rates are lower than the \$45 monthly average rates (2013) of the 50 largest cities in the United States for similar user volumes.

The \$190 million in new WWTFs and \$48 million in existing WWTF upgrades constructed to address the rapid population growth in western North Dakota during the recent oilfield play has alleviated some of the secondary WW treatment needs. Recycled water distribution is usually approached on a caseby-case basis with the potential of payback in a reasonable time frame and industrial participation in the cost of the project. Conveyance system, advanced WW treatment (nutrient removal), and biosolids management are among the greater needs in WW systems serving ND communities. The wide distribution of population and rapid growth of some urban areas in ND poses challenges related to WW collection infrastructure.

#### **Future Need**

The majority of WW infrastructure projects completed in North Dakota rely at least in part on

the Clean Water State Revolving Fund (CWSRF) loan funding. The Clean Watershed Needs Survey for North Dakota (2012) provided the following table of WW needs.

The CWSRF program is a federally funded program that provides low interest loans to local units of government for wastewater treatment, sanitary conveyance systems, and stormwater management. The funding is provided through the US EPA and is managed by state agencies. In North Dakota, the Department of Health provides CWSRF oversight.

The North Dakota CWSRF Project Priority List (2018) lists approximately \$345 million in project needs and provides insight into the statewide distribution of WW infrastructure needs. Collection system related needs include: \$42.3 million for 1&I reduction, \$106.4 million for sewer system rehabilitation, \$42.5 million for new sewers, and \$50.85 million for storm sewers. Treatment plant related needs include: \$99.73 million for secondary treatment facilities and \$2.4 million for advanced treatment facilities. Collection system related needs account for approximately 70% of project funding requests, while treatment facilities related needs account for only 30% of project funding requests. This is a significant increase from the needs distribution suggested by the 2012 Clean Watershed Needs Survey. Recent project bidding results have shown a tendency toward rising material costs, and therefore, rising construction costs for projects currently in the design stage.

#### Public Safety

According to the EPA Enforcement and Compliance History Online (ECHO) website, which has NPDES

Category	\$M	Percent
Secondary Wastewater Treatment	100	45.7
Advanced Wastewater Treatment	2	1
Conveyance System Repair	72	32.9
New Conveyance Systems	17	7.8
Combined Sewer Overflow Correction	0	0
Stormwater Management Program	26	11.9
Recycled Water Distribution	3	1.4
Total	219	100

compliance data for the United States from 2013 through 2016, the percent of major WW discharges in ND without significant noncompliance was 88%. Noncompliance means that one or more NPDES permit requirements was not met. The most common cause of noncompliance was failure to meet a permit schedule requirement and typically a facility in noncompliance has more than one violation. Information is not available that indicates significant discharge of untreated WW is occurring. This fact in combination with CSOs largely being eliminated indicates the public is infrequently exposed to untreated WW. Insufficient information is available to determine the level of exposure of rural populations to failing septic systems.

#### **Resilience & Innovation**

In recent history, flooding has threatened WWTFs and other infrastructure. Flood events in Fargo and Minot have highlighted the need for increased resiliency of essential municipal infrastructure. There has, however, been a significant amount of recent work on flood control, including providing protection of WW infrastructure. More work is needed to provide backup power sources for weather related or other electrical outages. Several communities are working on resiliency plans.

Innovation in North Dakota largely involves asset management and reclamation of water for industrial reuse. Most WW systems are conventional in nature, though ultraviolet disinfection is common for mechanical plants. The Dickinson Water Resource Recovery Facility (WRRF) provides treated effluent to the Dickinson Andeavor Refinery and for other industrial uses. The Fargo WWTF includes an Effluent Reuse Facility (ERF) that provides treated effluent to the Tharaldson Ethanol Plant. The Williston WWTF produces Class A biosolids that are land applied for use as a fertilizer.

For Major Cities				
City	Collection System Needs	Treatment Facility Needs	Other	
Fargo	\$1,000,000 Immediate Need	\$140,000,000 Between 2018- 2022 (28,000,000 annually)	Collection System needs did not include projects in conjunction with street rehabilitation & water main replacements.	
Grand Forks	\$20,000,000 Need vs. 2018-2023 CIP of \$8,600,000	\$23,600,000 In 2018-2023 CIP (\$4,720,000 annually)	High Debt Service Payments	
Williston	\$25,000,000 Desirable over next 10 years	\$1,200,000 Annually (new facility)	\$1,000,000 MS4 need	
Dickinson	\$12,000,000 est. or \$2 million annually	Minimal (new facility)		
Bismarck	\$2,200,000 annually	\$8,500,000 annually		
Mandan	\$430,000 annually	\$250,000 annually		
Minot	\$1,550,000 annually	\$13,100,000 annually	Significant MS4 needs	
Watford City	\$5,000,000	Minimal (new facility)		
Jamestown/Cavendish Farms	\$672,000 in 2018 budget	\$307,000 in 2018 budget	Industrial financial support of treatment	
Mayville	\$1,000,000 est.	\$1,000,000 est.	Based on facility size	

# **Estimated Future Wastewater Capital Improvement Funding Needs**





## RECOMMENDATIONS TO RAISE THE GRADE

• Cities should strive to develop asset management plans. An asset management plan is an inventory of municipal assets, their condition, and a program for maintenance activities. These plans will allow managers to more effectively anticipate future infrastructure needs.

• Cities should evaluate their user rate structure to determine if it is adequate to fund capital improvements, as well as operation and maintenance. Rates should reflect the true cost of service. City leaders should be prepared to make adjustments to user rates, if necessary.

- Cities should pursue additional opportunities for wastewater reuse including agriculture, irrigation, industry and oil well development.
- An oversight role for septic system design, specifications and construction requirements should be established for the North Dakota Department of Environmental Quality by the North Dakota Legislature.
- Greater implementation and maintenance of construction site NPDES erosion and sediment control measures is needed.
- Congress should continue to fund the Clean Water State Revolving Fund.

#### SOURCES

Clean Watershed Needs Survey (2012),USEPA, cwns\_fs-nd epa needs 2004-2012, www.epa.gov/CWNS

• North Dakota Utilities Survey, 2017, AE2S, Inc.

 Communication with North Dakota Department of Environmental Quality, February 2018

 Capital Improvement Plans and Communications with Cities of Fargo, Grand Forks, Bismarck, Williston

 Capital Improvement Plans posted on City Websites by Cities of Minot and Mandan

CWSRF Project Priority List (2018)

 • 50 Largest Cities Water/Wastewater Rate Survey, Black and Veatch, 2012/2013 Report

SOURCE

City of Minot, 2012 Comprehensive Plan, Stantec

· City of Jamestown, ND 2018 Final Adopted Budget, October 2, 2017

· City of Bismarck, Dickinson, Mandan or Minot ND 2018 Budget

City of Dickinson, ND 2013-2014 Capital Improvement Plan

 https://www.ae2snexus.com/2018-rate-survey-results-for-systemsserving-5000-or-greater

City of Mayville, ND Audited Financial Statements, 2016

https://echo.epa.gov

https://www.nrcs.usda.gov/wps/portal

https://css.umich.edu/sites/default/files/css\_doc/Ch5.pdf



## **GET INVOLVED**



Use your zip code to find your Elected Officials.



Check the ND Legislative Tracker to find legislation that you care about (hint...infrastructure).



Now that you know who your Elected Officials are, email them and let them know that you care about North

Dakota's infrastructure.



Use our hashtag #ASCENDReportCard or tag us to show your support of North Dakota's Infrastructure on Facebook, Twitter and LinkedIn

## **REPORT CARD COMMITTEE**

#### **AUTHORS FOR CATEGORIES:**

#### Bridges

Mijia Yang, PhD, PE Andrew Wrucke, PE

**Dams** Josh Hassell, PE

**Drinking Water** Shannon Fisher, PE

**Energy** Vicki Schneider, PE

> **Levees** Brett Bailly, PE

**Roads** Miguel Andrews, PE Andrew Wrucke, PE

**Transit** Ranjit Godavarthy, PhD

Wastewater Roger Clay, PE Harvey Gullicks, PhD, PE Shannon Fisher, PE

#### **COMMITTEE MEMBERS:**

**Report Card Chair** Brandon Oye, PE

#### Release Event

Alexa Ducioame, PE Miguel Andrews, PE Tom Klabunde, PE

**Legislative Day** Daba Gedafa, PhD, PE, , ENV SP

> Advisory Review Matt Kinsella, PE

ASCE Staff Anna Denecke Emily Castellanos Aaron Castelo

Graphic Designer Laura Stoneburner, Stoneburner Studios

#### **ASCE ND SECTION BOARD:**

**President:** Daba Gedafa, PhD, PE, ENV SP

President Elect: Alexa Ducioame, PE, CFM

> Vice President: Tom Klabunde, PE

**Treasurer:** Yaping Chi, PE

Secretary: Nick Kalenze, PE

Past President: Murali Vegi, PE