



BANKS OF THE YELLOWSTONE RIVER NEAR CARTERSVILLE, MONTANA  
©: HANK SHIFFMAN

Montana State Council of the American Society of Civil Engineers  
[INFRASTRUCTUREREPORTCARD.ORG/MONTANA](http://INFRASTRUCTUREREPORTCARD.ORG/MONTANA)





# TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	4
GRADING METHODOLOGY .....	8
GRADING SCALE.....	9
RECOMMENDATIONS TO RAISE THE GRADE.....	10
MONTANA GRADE SUMMARY .....	11
MONTANA CATEGORIES .....	12
Bridges.....	12
Dams .....	18
Drinking Water .....	26
Energy.....	32
Rail.....	38
Roads.....	43
Schools.....	50
Solid Waste .....	56
Stormwater.....	61
Wastewater.....	68
GET INVOLVED & REPORT CARD COMMITTEE .....	74



# EXECUTIVE SUMMARY

## INTRODUCTION

Today, Montana is thriving from growth in the economy, a successful tourism industry, and grassroots entrepreneurship. A key component to our growth and future success is our infrastructure. Although the major cities in our state might be feeling these benefits more than other areas, it is important that we invest in infrastructure in all corners of the state to continue this upward trend. This includes investment in transportation, energy and clean water distribution systems, and wastewater collection. Infrastructure is the glue that holds our cities, towns and communities together and keeps their hearts beating.

Montana's vast expanse and low population density offers a unique challenge: more miles of infrastructure to fund with less taxpayers to do so. This often leaves less populated areas grappling with severe underinvestment, and aging and neglected systems. Investing in infrastructure will ensure economic stability in our rural areas and improve our residents' well-being.

Montana's 2018 Infrastructure Report Card is meant to ignite conversations and be a catalyst for action in our state. The Report Card provides a snapshot for residents and policymakers to engage in infrastructure conversations about sustainability, planned growth, resiliency in our communities, and continued economic success.





## BRIDGES

C

Montana oversees 4,471 public bridges with an average age of 44 years, including 2,484 state-owned structures and 1,987 locally-owned structures. Based on 2018 Montana Department of Transportation (MDT) data for National Highway Systems (NHS) bridges, Montana's total bridge deck area is 11,179,380 square feet, 7.3% of which is rated as poor/structurally deficient. The 2017 passage of a fuel tax increase bill has provided the state with additional funding for maintenance, preservation, rehabilitation, and bridge construction. The \$9.8 million annual increase in revenue allocated to the MDT will allow the State to fully match the funds apportioned to Montana through the Federal Highway Administration (FHWA). With this very recently increased revenue stream and the prioritization of deck-only projects to stretch the available funding, the worsening condition trend indicated in the 2018 Report Card should slow, if not reverse. However, additional revenue will be needed to restore the level of state-funded projects from years past.

## DRINKING WATER

C-

Montana's 2,162 water systems are operated by both public and private entities. Various water treatment, distribution, and storage systems support over 1 million residents, as well as the state's vital tourism and recreation industries. Several of Montana's large cities have made major upgrades to their water treatment plants and distribution systems in recent years. However, statewide, the Environmental Protection Agency reports that Montana will need \$1.15 billion in funding for identified immediate water infrastructure improvements over the next 20 years. Meanwhile, the total annual investment by both large and small communities for both water and wastewater projects in Montana is typically between \$160 and \$170 million. A significant increase, as much as 50% to 100% of the current level of funding, is needed to bring the water infrastructure replacement rate in line with its service life. Also of concern is the state's aging water certified operator workforce; approximately half of workers are over 55 years old and there is a need to focus on recruiting and training younger operators.

## DAMS

C-

Montana has over 64,000 reservoirs, although only 3,259 dams are large enough to be recorded in the National Inventory of Dams preliminary 2018 database. Montana's high hazard potential dams – dams that, should they fail, have potential for loss of life downstream – are generally in good condition, regardless of which regulatory agency provides oversight. The majority of high hazard potential dams are regularly inspected and have emergency action plans (EAPs) in place. Eighty seven percent of state-regulated high hazard dams have an EAP. However, smaller structures, which account for the vast majority in the inventory, are subject to fewer inspections and rarely have EAPs. It is exceedingly rare for a properly inspected and maintained dam to fail. Inspection frequency, condition, and attention to maintenance varies according to regulatory agency with oversight and dam ownership.



## **ENERGY** **C**

Montana's power generation comes from a number of different sources including, coal, petroleum, natural gas, hydro, and other renewables such as wind and solar. Montana produces approximately 27,800 MWh of electricity annually, while consuming only 13,900 MWh of electricity. The excess power is generally exported to the U.S. West Coast. Montana ranks 38th in the nation for residential electrical rates. Most of Montana's energy infrastructure is owned and operated by private entities and thus, is not reliant on government funding. However, there is still indirect funding needed through loans and bonds to support the maintenance of existing systems and prepare for future needs. Montana's transmission network suffers from a number of issues, including congestion and age; the state's main artery for power flow is almost 40 years old. Meanwhile, Montana's other energy resources that drive the economy, such as coal, oil, and gas, rely on public investment for many things including right of way and raw/processed material transportation.

## **RAIL** **B**

Montana is a large remote state with considerable distance between commodities, economic hubs, and manufacturing facilities. Montana's railroad system includes approximately 3,376 miles of track owned by Class I, Class II, and Class III railroads, and is essential to the state's economy. The rail system is primarily utilized for freight rail purposes. However, some of the track is used for both freight and passenger services. Considerable private and public investments have been made to Montana's railroad infrastructure in recent years and as a whole, the infrastructure is in good condition. Congestion along some of the main corridors is becoming an issue and the railroads are currently initiating projects to increase operational efficiencies.

## **ROADS** **C-**

Montana's roads are among the least crowded roadways in the country and efficiently move \$101 billion in goods by truck and millions of travelers by car each year. However, 46% of the major roads are in poor to mediocre condition. These rough roads cost each Montanan approximately \$385 per year in extra operating costs. It is estimated that \$15 billion is needed to maintain Montana's roadway system over the next 10 years, but projected funding can only meet 33% of those needs. Also concerning, Montana has the eighth highest fatality rate in the nation. In a move in the right direction, Montana legislature recently approved new revenue for roads, providing an additional \$30 million annually for the state's transportation network, helping to close the investment gap.

## **SCHOOLS** **D-**

Montana has more than 145,000 students attending public K-12 schools across the state. The average age of school facilities is 53 years and 68% of schools were built prior to 1970, creating an inventory of aging structures needing repair and renovation. While funding has been obtained to address serious safety issues, revenue for the Facility Reimbursement Program was reduced in 2010. Meanwhile, facility needs are growing, creating funding gaps for items such as damaged or worn out systems and facilities, codes and standard violations, and energy costs. As energy costs continue to rise and student populations grow, school facilities face even larger funding deficits while trying to provide safe, healthy, and productive educational environments for communities.



## **SOLID WASTE** **B-**

There are 32 Municipal Solid Waste Landfills (MSWLs) in Montana, handling approximately 1.6 million tons of solid waste annually. The state's facilities have approximately 38 years of capacity remaining. Additionally, since most of the MSWL facilities were either constructed or received significant upgrades in the last 25 years, the overall condition of the infrastructure at the landfills, including on-site roads, stormwater controls, and equipment buildings is relatively good. Should infrastructure improvements be required, customers are charged, typically through property taxes, monthly billing, or pay as you throw programs. One area of improvement is diversion rates; the state diverts 21.9% of the solid waste it generates, significantly below the national average of 34.3%. Another area of concern is the condition and safety of rural transfer stations.

## **STORMWATER** **D**

In the past five years, Montana has reached a stormwater "turning point," with seven regulated cities collecting and allocating millions of dollars toward infrastructure and staff investments to better manage their stormwater programs. For example, regulated cities have created over 15 dedicated positions tasked with developing and running stormwater facilities. As another example, the City of Bozeman is spending \$5 million to replace nine miles of pipes in its storm sewer system. However, Montana as a whole is trying to catch up after years of underinvestment. Increased funding, more quality-based projects, and broader regulations that cover all pollution contributors are needed.

## **WASTEWATER** **C-**

Municipalities and districts own and operate approximately 229 public wastewater systems in Montana, serving approximately 62% of the state's population of 1,050,000 people. The remainder of the population is served by private septic tanks and drain fields. Many of the largest municipalities in the state have recently completed major upgrades and approximately 25% of the state's population is benefiting from these improvements. However, other plants need equipment upgrades and pipe replacement. Montana needs \$363 million in funding for identified wastewater infrastructure improvements, but the current total annual investment is estimated to be between \$160 and \$170 million for both water and wastewater, leaving a significant investment gap. An increase from the current funding levels is needed to replace or update failing and substandard piping and treatment plant components and to reach a satisfactory replacement rate.



# GRADING METHODOLOGY

The *2018 Report Card for Montana's Infrastructure* was written by a committee of 12 civil engineers from Montana who volunteered their time to collect and analyze data, prepare and review their findings. The committee worked with staff from ASCE National and ASCE's Committee on America's Infrastructure to provide a snapshot of our infrastructure, as it relates to us at home, and on a national basis.

The Report Card Sections are graded based on the following eight criteria:

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

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

**FUNDING** What is the current level of funding from all levels of government for the infrastructure category as compared to the estimated funding need?

**FUTURE NEED** What is the cost to improve the infrastructure? Will future funding prospects address the need?

**OPERATION AND MAINTENANCE** What is the owners' ability to operate and maintain the infrastructure properly? Is the infrastructure in compliance with government regulations?

**PUBLIC SAFETY** To what extent is the public's safety jeopardized by the condition of the infrastructure and what could be the consequences of failure?

**RESILIENCE** What is the infrastructure system's capability to prevent or protect against significant multihazard 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



## **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.



# RECOMMENDATIONS TO RAISE THE GRADE

Montana's grades show that our infrastructure is in mediocre condition and requires attention. There is no one solution that can increase our GPA. Instead, we recommend a number of steps to raise the grades, which in turn, will strengthen our economy and prepare us for tomorrow.

- **INCREASE INFRASTRUCTURE INVESTMENT**

Montana must continue to make infrastructure a priority. This includes encouraging localities to raise additional revenue to support transportation funding and raising water rates to reflect the true cost of service. By proactively increasing investment, we will maximize other sources of funding to meet future need. The longer we wait to invest, the more costly it is to Montanans.

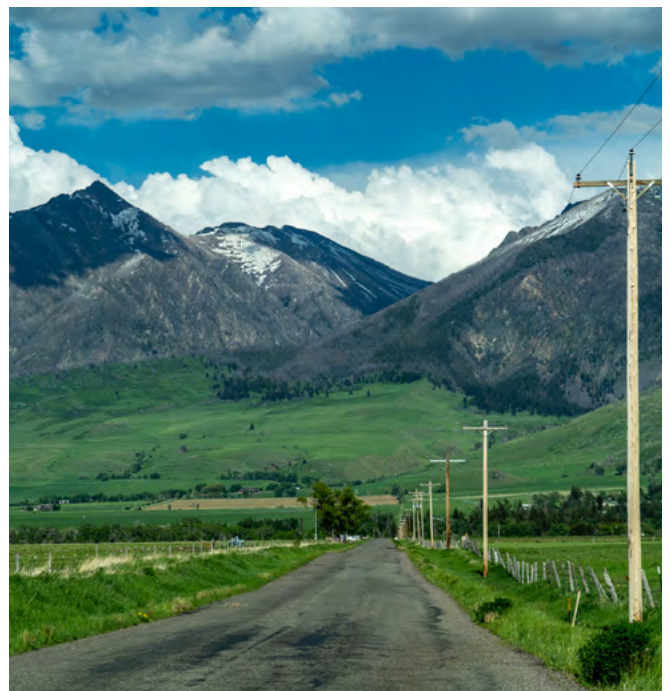
- **EXPLORE FUNDING SOLUTIONS**

Our leaders must be open to having hard conversations regarding more innovative approaches and different ways to pay for Montana's infrastructure as it is in the best interest of Montana's health, safety, and economic stability. Non-resident travelers outnumber Montanans 12:1, and we do not currently have a mechanism to collect revenue from these visitors to pay for the additional strain they put on Montana's infrastructure. A variety of options, including expansion of tax options and increases in user fees must be thoroughly explored and brought to the table to be discussed.

- **FORWARD THINKING**

The backbone of our state's infrastructure was built 50 to 100 years ago. Upgrades and modernization are necessary to build resilient infrastructure and to accommodate its changing users. We need to be mindful of our growing population, consider emerging technologies, and design our future infrastructure with clear economic, social, and environmental benefits in mind.

PAVED ROAD WITH POWER LINES LEADING INTO THE ABSAROKA MOUNTAIN RANGE IN MONTANA'S PARADISE VALLEY, LOCATED IN PARK COUNTY, MONTANA. ©: MKOPKA





# 2018 REPORT CARD FOR MONTANA'S INFRASTRUCTURE

Bridges



C

Dams



C-

Drinking Water



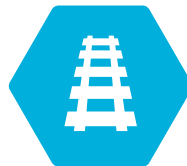
C-

Energy



C

Rail



B

Roads



C-

Schools



D-

Solid Waste



B-

Stormwater



D

Wastewater



C-







## BRIDGES



BLACK STEEL BRIDGE SPANS THE GALLATIN RIVER IN MONTANA. SIGN ON BRIDGE CALLS IT THE "GALLATIN GOLDEN GATE." GALLATIN RANGE OF THE ROCKY MOUNTAINS RISES BEHIND IT.  
© PUDDING



# BRIDGES

## EXECUTIVE SUMMARY

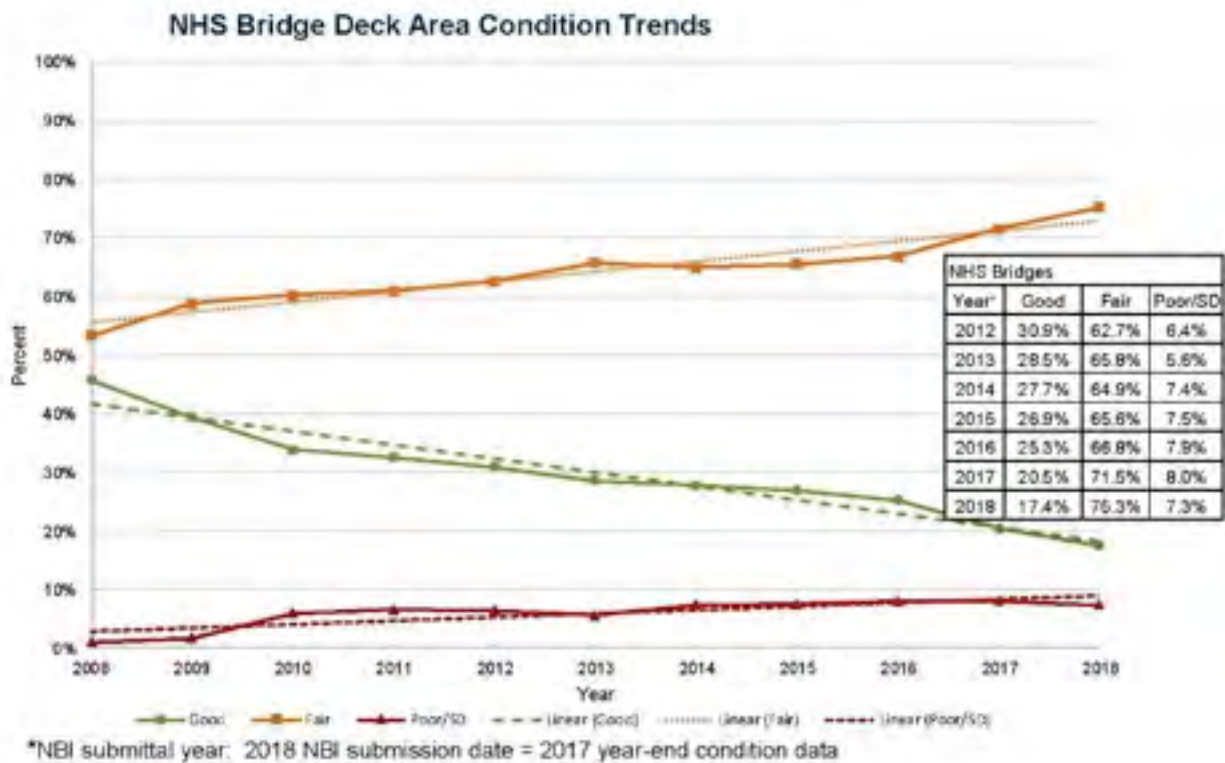
Montana oversees 4,471 public bridges with an average age of 44 years, including 2,484 state-owned structures and 1,987 locally-owned structures. Based on 2018 Montana Department of Transportation (MDT) data for National Highway System (NHS) bridges, of the total bridge deck area of 11,179,380 square feet, 7.3% of the deck area is rated as poor/structurally deficient. Passage of a fuel tax increase bill in early 2017 provides additional funding for maintenance, preservation, rehabilitation, and new construction of Montana's bridges. The \$9.8 million annual increase in revenue allocated to the MDT will allow the State to fully match the funds apportioned to Montana through the Federal Highway Administration (FHWA). With this very recently increased revenue stream and the prioritization of deck-only projects to stretch the available funding, the downward condition trend indicated in this year's report card in overall bridge condition should be slowed, if not reversed. However, additional revenue will be needed to restore the level of State-funded projects from years past.



## CAPACITY AND CONDITION

Bridges in Montana serve an important role of crossing the state's numerous waterways, roads, and railroads, linking the road systems. Montana oversees 4,471 public bridges with an average age of 44 years, including 2,484 state-owned structures and 1,987 locally owned structures. The MDT is responsible for inspecting all state and locally-owned public bridges and reporting their condition to FHWA. Based on 2018 MDT data for NHS bridges, of the total bridge deck area of 11,179,380 square feet, 7.3% of the deck area is rated as poor/structurally deficient. While a structurally deficient bridge is not unsafe for the traveling public, the rating indicates that a bridge needs maintenance, preservation, rehabilitation or full replacement.

In Montana, bridges on the NHS system rated as being in good condition are trending downward, with a corresponding upward trend in bridges in fair condition. Poor/structurally deficient bridges are stabilizing, after several years of upward trends.



MONTANA TRANSPORTATION ASSET MANAGEMENT PLAN

## OPERATION AND MAINTENANCE, FUNDING & FUTURE NEED

Funding for roads and bridges in Montana comes from two primary sources – from the Federal government through the Federal Highway Administration (FHWA), and from State special revenue funds, specifically fuel taxes and gross vehicle weight fees. 61% of MDT's total revenue in Fiscal Year (FY) 2016 came from FHWA, and the remaining 39% came from State funds. MDT receives no revenue from the State General Fund.

Local government entities – counties and incorporated cities and towns – have received annual distributions of fuel tax revenues of nearly \$27 million based on formulas in State statute. Beginning in July 2017, the State's tax on gasoline was increased for the first time since 1994 by 4.5 cents per gallon. 35% of this new revenue stream will go to MDT, and a projected \$20 million per year will go to local governments.

Local entities have also been eligible for a competitive grant program through the Montana Department of Commerce. In the latest two-year period, 15 grant applications in the amount of \$5.7 million for bridge projects were submitted; of those, nine grants were initially approved in the amount of \$3.7 million. During a subsequent Special Session of the Legislature, funding was reduced so that six grants in the amount of \$2.4 million are available in the current biennium.

It is estimated that in the next 10 years, funding for needed road and bridge construction and maintenance will outpace revenue by nearly three to one. Available funding will cover approximately \$5 billion of the projected \$15 billion in Montana transportation needs. Prioritizing how the funds will be spent between bridges and roads, and then between maintenance, preservation, rehabilitation or full replacement of bridges is a critical component of MDT's mission. In 2011, bridge deck projects were made a priority, but the condition of Montana's bridges continues to decline.

However, of the top 10 most-traveled bridges in Montana that have low ratings for various criteria, based on inspections in 2017, three of the ten are currently being replaced, or have been replaced since the inspection.

## RESILIENCE

Resilience refers to the capability to mitigate against significant all-hazards risks and incidents and to expeditiously recover and re-constitute critical services with minimum damage to public safety and health, the economy, and national security. When considering bridges in a rural state like Montana, if a bridge washes out during a flood or has reached its useful life and needs to be replaced or closed to be re-decked, the traveling public can be faced with very long detour routes. A recent bridge replacement project east of Townsend, Montana, presented the public with three options:

1. Very long detours, as illustrated below;
2. Temporary bridges with high environmental impacts and cost; or
3. The selected option - Accelerated Bridge Construction (ABC) techniques.



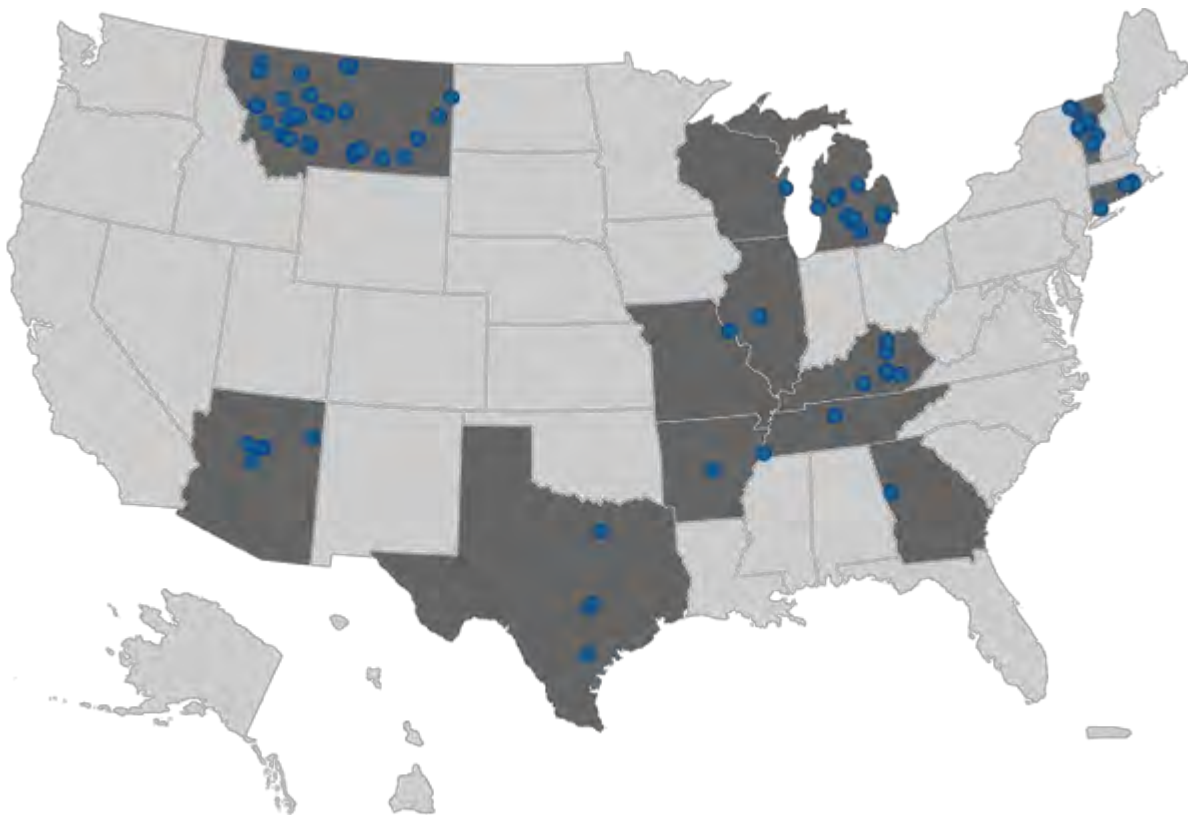
Bridge vulnerability to seismic (shaking) forces is a very real concern in Montana. MDT has developed a program to evaluate the existing bridges and proposed new bridges for seismic vulnerability and designs the appropriate seismic retrofit on a priority basis.

Over time, new bridges in Montana are being designed with longer spans than are minimally necessary to pass flood flows safely. The longer spans allow for a more natural creek or river channel through the bridge which provides distinct environmental benefits, decreases the risk of scour around the bridge foundation, and increases the resilience of the overall transportation system.

## RESEARCH AND INNOVATION

Current research and initiatives have resulted in innovation on bridges throughout Montana. Current bridge initiatives at MDT include finalization of the Bridge Asset Management System. In addition to managing the state bridge inventory, the Bridge Asset Management System assists with analyzing life-cycle costs and prioritizes funding for maintenance projects and replacements. Other examples of innovation include the use of Accelerated Bridge Construction (ABC) techniques, Ultra-high-performance concrete and automated de-icing systems on bridge decks.

Those innovative technologies and practices that accelerate construction, improve safety, and extend the service life of bridges are eligible for an increased share of Federal funding. MDT continues to lead the nation in receiving this increased Federal share, thus making Montana's special revenue funds go farther.





## RECOMMENDATIONS TO RAISE THE GRADE

- Montana should consider indexing state gas tax to inflation. Inflation continually increases construction costs, causing existing taxes to gradually lose their value over time. Automatically indexing existing taxes to inflation would cause taxes to retain their intended value without any political influence.
- Montana should evaluate and select a means of collecting revenue based on vehicle miles traveled, starting with a pilot program. It is recommended that Montana leadership maintain a good understanding of best practices as they evolve over time.
- Federal funding flexibility established with MAP-21 needs to be maintained to allow Montana to balance needs across the transportation network to match available funding, i.e. prioritize bridge project as necessary based on dynamic reviews of annual system-wide data.
- Provide additional or alternative long-term funding mechanisms for local governments.
- Continue to research and implement, as applicable, new techniques for design, new materials, and innovative construction methods for bridge preservation, rehabilitation, replacement, and new construction.



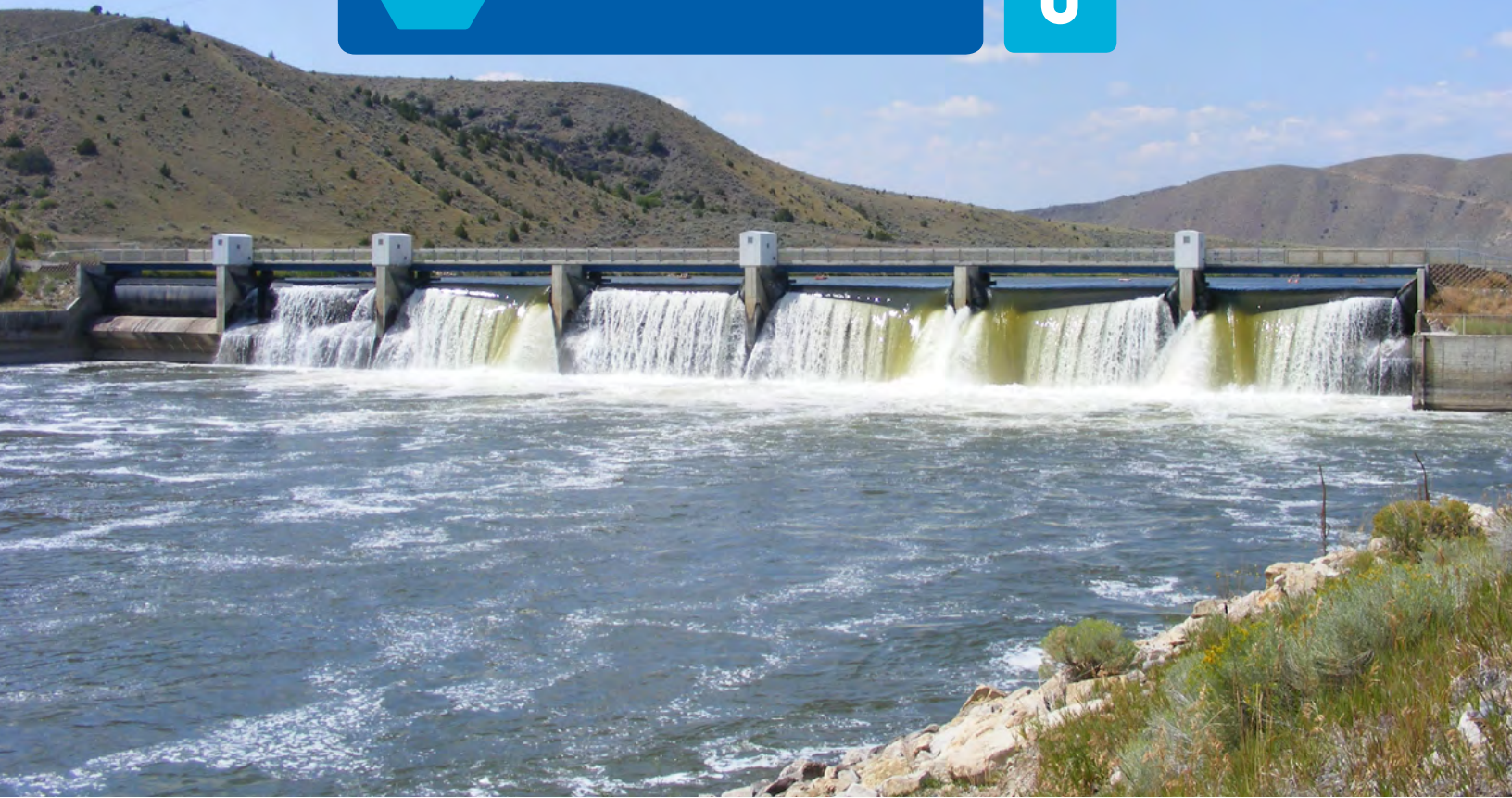


## SOURCES

- Montana Department of Transportation, *2016 Fact Book*, 2016. Available at <http://www.mdt.mt.gov/publications/docs/brochures/factbook.pdf>
- Montana Department of Transportation, *Transportation Asset Management Plan*, 2018. Available at <https://www.mdt.mt.gov/publications/docs/plans/2018-tamp-report.pdf>
- American Road & Transportation Builders Association, *2018 Deficient Bridge Report*, 2018. Available at <https://www.artbabridgereport.org/>
- Montana Department of Commerce, Community Development Division, *TSEP Reports and Resources*, 2019 Biennium, 2018. Available at <http://comdev.mt.gov/Programs/TSEP/Resources#TSEP-Reports-and-Resources-1212>
- U.S. Department of Transportation, Federal Highway Administration, Center for Accelerating Innovation. [https://www.fhwa.dot.gov/innovation/resources/increased\\_federal\\_share/](https://www.fhwa.dot.gov/innovation/resources/increased_federal_share/)



## DAMS



# DAMS

## EXECUTIVE SUMMARY

Montana has over 64,000 reservoirs, although only 3,259 dams are large enough to be recorded in the National Inventory of Dams preliminary 2018 database. Montana's high hazard potential dams – dams that, should they fail, have potential for loss of life downstream – are generally in good condition, regardless of which regulatory agency provides oversight. The majority of high hazard potential dams are regularly inspected and have emergency action plans (EAPs) in place. 87% of state-regulated high hazard dams have an EAP. However, smaller structures, which account for the vast majority in the inventory, are subject to fewer inspections and rarely have EAPs. It is exceedingly rare for a properly inspected and maintained dam to fail. Inspection frequency, condition, and attention to maintenance varies according to regulatory agency with oversight and dam ownership.

## BACKGROUND

Montana is an arid state, with much of the average annual precipitation occurring in the winter months from snow in the mountains. Without reservoirs to store water for use throughout the year, many of Montana's most important industries could not function. Specifically, Montana's dams provide agricultural irrigation, industrial applications, municipal water supplies, power generation, tourism, commercial endeavors, aquatic habitat enhancement, recreation, and flood risk reduction.

According to a database of Montana storage water rights, there are 64,000 reservoirs in Montana. Most of these reservoirs are small, well below 50 acre-feet. 50 acre-feet is the threshold considered by the State Dam Safety Program for regulatory attention. For reference, one acre-foot equals about 326,000 gallons, or enough water to cover an acre of land, about the size of a football field, one foot deep.

According to preliminary data submitted to the U.S. Army Corps of Engineers' National Inventory of Dams (NID) in June 2018, there are 3,258 inventory size dams in the State of Montana. Dams are included in the NID if they are at least 25' in height and greater than 15 acre-feet storage or store more than 50 acre-ft and are at more than 6 feet high.

Dams are classified based on their hazard potential or anticipated consequences in the case of failure. A high-hazard potential dam is a dam in which failure is expected to result in loss of life and may also cause significant economic losses. A significant-hazard potential dam is a dam in which failure or mis-operation is not expected to cause loss of life, but results in significant economic losses. A low-hazard potential dam is a dam located in a rural or agricultural area where failure may contribute minor damage to nonresidential areas. Dams classified as "High Hazard" or "Significant Hazard" are included in the NID regardless of height or capacity. In Montana, there are 197 high-hazard potential dams, 201 significant-hazard potential dams, and 2,861 low hazard potential dams of inventory size.

Dams in the State of Montana are owned and operated by various entities including private owners, districts, water user associations, cities, counties, state government, federal government, and tribal governments. Of the 3,259 dams listed:

- 2,488 are privately owned; (76%)
- 408 are federally owned; (13%)
- 152 are state owned; (5%)
- 88 are owned by local governments; (3%)
- 22 are owned by public utilities; (1%)
- 101 are reservation owned; (3%)

The Montana Department of Natural Resources and Conservation (DNRC) Dam Safety Program provides regulatory oversight for dams owned by state, local governments and private individuals/organizations. Dams regulated by federal agencies are exempt from DNRC oversight. Federal agencies include the Federal Energy Regulatory Commission (FERC), the U.S. Bureau of Land Management (BLM); the U.S. Fish and Wildlife Service (FWS); the Environmental Protection Agency (EPA); the U.S. Bureau of Reclamation (USBR); the Bureau of Indian Affairs (BIA); the U.S. Army Corp of Engineers (USACE) and the U.S. Forest Service (USFS). Note that for dams on USFS property, DNRC and the USFS are entering into an agreement to share jurisdiction. The Montana Department of Environmental Quality provides regulatory oversight for wastewater pond dams and active tailings dams.

Three clear categories of dams have been identified to facilitate the remainder of this discussion:

1. High Hazard Dams - regulated by both State and Federal Government
2. Significant and Low Hazard Dams - regulated by Federal Government Agencies
3. Significant and Low Hazard Dams - regulated by State Government Agencies

## CAPACITY

Montana's dams serve a variety of purposes. The majority of Montana dams are used for stock or small farm ponds. Irrigation provides the second largest use, followed by recreation, flood control and water supply. Many of Montana dams are multipurpose. Past calculations have shown Montana's dams hold roughly 34.5 million acre-feet (11 trillion gallons) of water, which is roughly the amount of water it would take to cover the states of Maine, New Hampshire, and Vermont in water one foot deep.

Demand for water is ever increasing as the population and the economy of the state grow. According to the U.S. Census Bureau, Montana's population increased from approximately 799,000 in 1990 to approximately 1,060,000 in 2018. Meanwhile, the value of agricultural products produced went from approximately \$1.5 billion in 1992 to \$4 billion in 2017, according to the United States Department of Agriculture (USDA). During this same time span, the overall area irrigated with reservoir water in Montana remained at approximately 2 million acres.

Despite the growing demand for water, there has been very little construction of new impoundment facilities. Most construction associated with Montana dams is focused on rehabilitation of existing structures. Many of the river basins in Montana are closed to additional water right appropriations. Montana has a significant amount of water stored in its reservoir system, but the storage capacity of the system is decreasing as reservoirs slowly become sedimented, while the demand for the water is increasing. Montana winters are becoming warmer and summers longer and hotter. The people of Montana will have to find new and better ways to use and conserve water.

## CONDITION

The condition of Montana's dams varies according to hazard classification and regulatory oversight:

### **High Hazard Dams – All Regulatory Agencies**

All high hazard dams are inspected according to stringent criteria. This criterion is similar, regardless of the regulatory agency or owner. Inspections identify developing problems long before they lead to an incident or failure. Inspections also identify maintenance needs and operational problems and provide dam owners guidance on how to address. Inspections help the dam owner and engineer become familiar with the dam and subsequently more aware of an unusual seep, slump or crack. It is exceedingly rare for properly inspected and maintained dams to fail.

Of the 119 state regulated high-hazard dams, 99 are in satisfactory or fair condition, meaning the dams exhibited no existing or potential major safety deficiencies.

For the remaining 11 high hazard dams with an unsatisfactory or poor condition assessment, risk reduction measures are in place until the dam can be repaired or rehabilitated. Risk reduction measures include reservoir level restrictions and increased monitoring and emergency preparedness. Note that nine dams do not have a rating yet.

The U.S. Army Corps of engineers is in the process of updating the National Inventory of Dams to provide more accurate information on the condition of federally-owned structures.

Across the country, the number of dams classified as high-hazard potential is growing, due to the development of areas downstream or the need to protect and support critical infrastructure such as public water systems. This is known as risk creep or hazard creep. Hazard creep is occurring in Montana as the state's population increases. This is mostly a concern in the western part of the state, where the population increases are most prevalent.

### **Significant and Low Hazard Dams – Federally Regulated**

Significant and low hazard dams with federal oversight have periodic inspection requirements. These inspections are less frequent than what is required for high hazard dams. Nonetheless, the benefits achieved from periodically assessing the dam condition are considerable. As a result, this group of dams are generally in reasonable condition. Dams with deficiencies commonly have risk reduction measures in place imposed by the federal regulatory agency.



### **Significant and Low Hazard Dams – State Regulated**

Inspections are not required for State regulated dams that lack potential for loss of life downstream. As a result, many of these structures have not received significant maintenance or rehabilitation since their initial construction. Additionally, many of these structures were constructed to lower design and construction standards. These dams also commonly contain corrugated metal pipe conduits. Corrugated metal is subject to corrosion and deterioration and has been the cause of many small dam failures. Very limited data describing this group of dams is available.

## **FUNDING**

When discussing funding and dams, there are two categories: 1) funds made available for rehabilitation and repair and 2) funds available to support dam safety oversight.

In both cases, the funding varies according to the hazard classification, ownership and regulatory authority.

### **1) Funding for Dam Rehabilitation and Repair**

#### **High Hazard Dams – All Regulatory Agencies**

High Hazard Dams owned and operated by government agencies have access to a variety of funding options, including grants and loans, as well as budgetary or legislative funding from the State or Federal Government. Privately owned high hazard dams typically only have access to funding through loan programs. In some situations a local government agency can sponsor a private high hazard dam apply for grants and loans. This has been done when the private dam also provides multiple public benefits.

In most cases, no single funding source can cover the overall cost of high hazard dam rehabilitation project. For example, the \$11.5 million Flower Creek Dam Rehabilitation Project, which was completed in 2016, was paid for with a combination of Dept of Agriculture grants, a variety of state grants and loans, and increased user fees.

Recently, funds available to support the state operated grant programs have diminished, due to decreased revenue from oil, gas and coal production. As a result, less funding is available for dam rehabilitation as the cost of rehabilitation rises.

#### **Significant and Low Hazard Dams – Federally Regulated**

Federally owned significant and low hazard dams have resources available for repair and rehabilitation albeit at a lesser level than high hazard dams, depending on agency. Note that sometimes these federally regulated dams are privately owned, but are located on their federal property. These privately owned dams are typically on their own for locating repair and rehabilitation funding.

#### **Significant and Low Hazard Dams – State Regulated**

Significant and low hazard dams under state regulation are predominantly privately owned. The only funding source is loans. In rare situations, where a privately owned dam also provides multiple public benefits, a local government agency may provide grant sponsorship.

### **2) Funding for Regulatory Oversight Programs**

#### **High Hazard Dams – All Regulatory Agencies**

Federal agency dam safety support varies according to agency. In general, all federal agencies have at least one individual dedicated to administering their dam safety programs. Technical support is provided as needed from other sections of the federal agency.

The Dam Safety program budget for FY2017 is \$759,718, up from just over \$600,000 in 2010. According to the ASDSO (Association of State Dam Safety Officials) *Performance Report for the State of Montana (calendar year 2017)*, the Montana Dam Safety Program's budget per regulated dam is 35% of the national average. This includes support for five regional offices and regional engineers, who implement the dam safety program locally, important for a state the size of Montana. Even so, it is difficult for these five engineers to adequately cover the large state of Montana, as they have a number of responsibilities

besides dam safety. As a result, their focus is primarily on high hazard dams. Although there is room for improvement, funding for high hazard dam program oversight is at an acceptable level, providing a reasonable level of protection to the public.

### **Significant and Low Hazard Dams – Federally Regulated**

Federal agency program funding for significant and low hazard dams depends on the agency and ownership. In general, federally owned dams are provided resources, depending on agency priorities. For non-federally owned dams located on federal property, the federal agency still provides a reasonable level of oversight (for example, verifying required inspections are completed).

### **Significant and low hazard dams – State Regulated**

As mentioned above, the focus of state dam safety engineers is on the high hazard dams, and as time allows some of the larger significant hazard dams. The state has limited resources to provide guidance and assistance to the many not high hazard dams under state regulation. Thus, funding for program oversight and assistance to the vast majority of significant and low hazard dams is low.



## FUTURE NEEDS

The most important future need for Montana dams is continued dam safety awareness. Informed dam owners make wise decisions about operation maintenance, inspection and repair which ultimately results in safe dams. Another future need is adopting the many lessons learned as a result of the Oroville dam incident. The need is dependent on the hazard classification and regulatory agency.

### **High Hazard Dams – All Regulatory Agencies**

Multiple programs are available on both a state and federal level to provide education and outreach to high hazard dam owners, including dam owner workshops, educational bulletins and informational webinars. Training is also provided to high hazard dam owners during periodic inspections. A new program is underway at the state level to make sure dam owners understand the legal liability of dam ownership. Helping dam owners understand the consequences of negligence is proving to be a valuable form of outreach.

The State Dam Safety Program is currently reviewing the Oroville incident. Applicable lessons learned will be analyzed and if necessary a change in inspection procedures and review processes may need to be adopted. The majority of these lessons learned apply to high hazard dams, regardless of regulatory agency.

### **Significant and Low Hazard dams – Federally Regulated and State Regulated**

Additional resources and attention is needed to provide training to private dam owners, including those with dams located on federal lands. Education about rehabilitation, repair, operation and maintenance as well as the dangers of deteriorating corrugated metal pipe conduits is needed.

## OPERATION AND MAINTENANCE

Dams that do not have periodic safety inspections are significantly less likely to pay attention to operation and maintenance needs. Thus, the hazard classification and agency oversight both play a role in assessing this factor.

### **High Hazard Dams – All Regulatory Agencies**

Montana's high hazard dams are well aware of the need for maintenance and operation on their dams. Most dams are required to have an operation and maintenance manual. Attention to maintenance and operational deficiencies is noted in periodic inspections.

### **Significant and Low Hazard Dams – Federally Regulated**

Low and significant hazard dams with federal agency ownership or oversight have moderate attention to operation and maintenance, as they are periodically inspected.

### **Significant and Low Hazard Dams – State Regulated.**

Without reliable mechanisms in place to communicate with state regulated significant and low hazard dam owners, operation and maintenance is commonly neglected.



## PUBLIC SAFETY

Hazard classification is a key factor in assessing how public safety is addressed in Montana.

### **High Hazard dams – All Regulatory Agencies**

All high hazard dams in the state should have an Emergency Action Plan (EAP). The EAP is a plan that outlines who to contact and the protocols to follow in the event of a dam related emergency. Of the 119 state-regulated high hazard potential dams 104 have EAPs (87%). This is higher than the national average of 77% of high-hazard dams having EAPs. However, the state should strive for 100%.

### **Significant and Low Hazard dams – Federally Regulated**

Federally owned significant hazard dams often have EAPs. Some federal agencies have this as a requirement, but not all. As result, not all significant hazard dams have an EAP. Few low hazard dams have EAP's.

### **Significant and Low Hazard dams – State Regulated**

EAP's are not required by the State for dams without the potential for loss of life downstream. As a result, few of these dams have EAPs.

## RESILIENCE

As discussed, weather patterns in Montana are changing and dams are required to hold more water for a growing population. Montana needs to plan for the future, invest in maintenance of older dams, and provide funding to support new structures in appropriate places.

## INNOVATION

Montana has been adopting innovative techniques to reach out to dam owners, regardless of classification. On line webinars, instructional websites, bulletins, regional workshops, realistic emergency action plan exercises and support of a statewide association of dam owners all contribute to safe dams.



## RECOMMENDATIONS TO RAISE THE GRADE

- Montana should continue outreach programs to educate dam owners on the importance of inspection, operation, maintenance and emergency planning. Special attention is needed to reach significant and low hazard dam owners.
- Montana should continue to apply for funding under the National Dam Safety Program, which provides financial assistance to the states for strengthening their dam safety programs. Montana uses National Dam Safety Program funds for owner outreach and emergency action awareness discussed in this report.
- Montana should continue with its evaluation of the Oroville incident and incorporate lessons learned to provide strengthened dam safety programs.
- Montana's state legislature should create funding mechanisms for private dams that provide public benefits. Currently there are very few programs to help private dam owners pay for periodic safety inspections or dam maintenance, repair, and rehabilitation. Funding programs that bring public and private groups together to develop innovative ideas on how to maximize the use of these resources not only benefits the private dam owners, but the state as a whole.

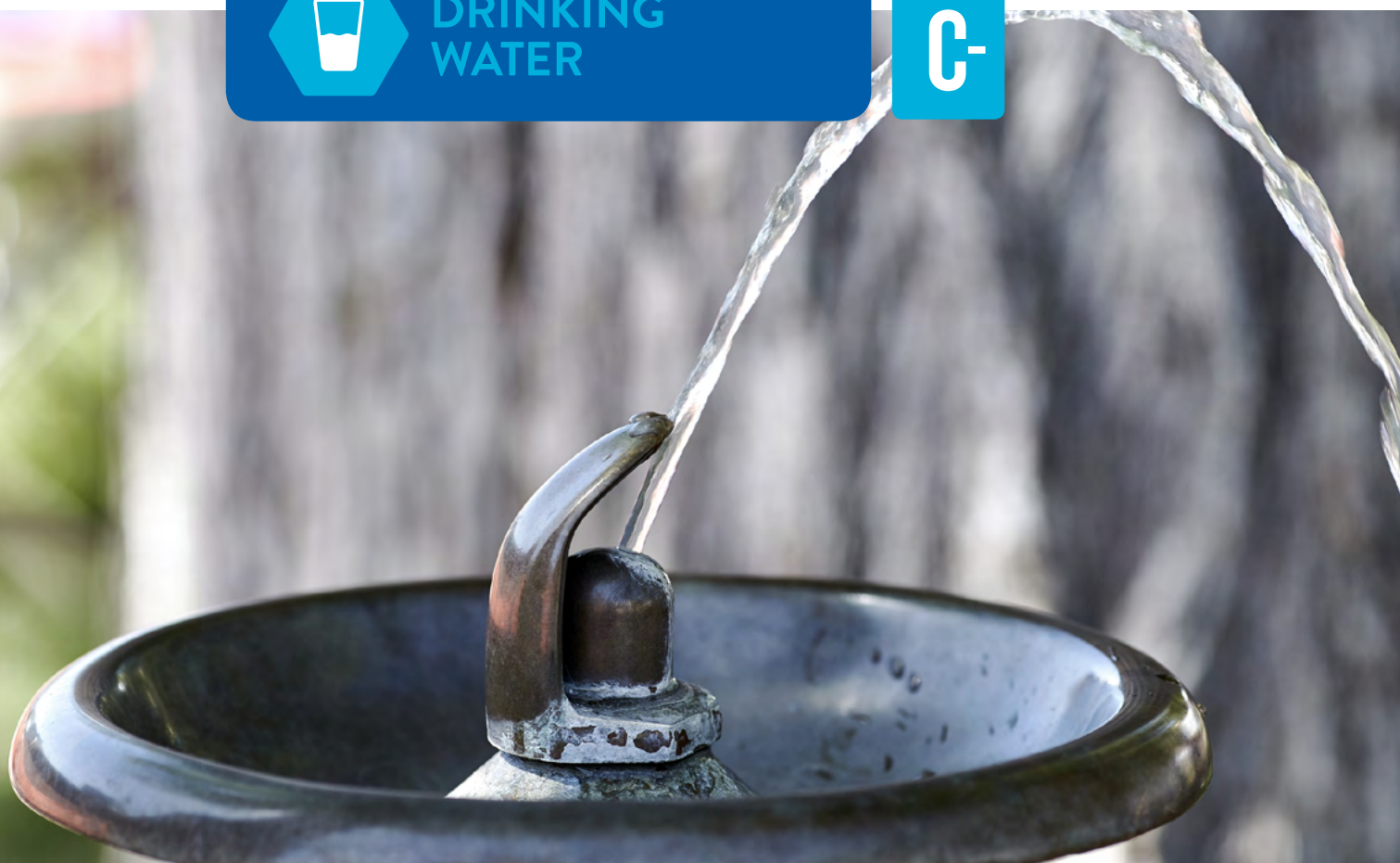
## SOURCES

- U.S. Army Corp of Engineers, National Inventory of Dams
- U.S.D.A, Census of Agriculture
- Montana DNRC Dam Safety Program
- ASDSO Performance Report for the State of Montana





## DRINKING WATER



©: PAMELA AU

# DRINKING WATER

## EXECUTIVE SUMMARY

Montana's 2,162 water systems are operated by both public and private entities. Various water treatment, distribution, and storage systems support over 1 million residents, as well as the state's vital tourism and recreation industries. Several of Montana's large cities have made major upgrades to their water treatment plants and distribution systems in recent years. However, statewide, the Environmental Protection Agency reports that Montana will need \$1.15 billion dollars in funding for identified immediate water infrastructure improvements over the next 20 years. Meanwhile, the total annual investment by both large and small communities for both water and wastewater projects in Montana is typically between \$160 and \$170 million. A significant increase, as much as 50% to 100% of the current level of funding, is needed to bring the water infrastructure replacement rate in line with its service life. Also of concern is the state's aging water certified operator workforce; approximately half is over 55 and there is a need to focus on recruiting and training younger operators.

## CAPACITY

High quality drinking water is critical to keeping the residents of Montana safe and healthy and helps supports tourism, recreation, and local businesses.

The Montana Department of Environmental Quality (DEQ) reports there are 2,162 water systems in operation in the State. The breakdown of those systems are as follows;

- 34% are communities (~737)
- 53% are transient systems (e.g., restaurants, motels, campgrounds)
- 13% are non-community/non-transient systems (e.g. schools, offices, businesses, and parks)

Over than 400,000 people (39%) are served by just 12 of these community systems. Another 210,000 people (over 20%) are served by another 100 of these community systems. The remaining 41% of the population is served by the remaining small community and individual private systems.

Over 359,000 (about 34%) of the State's population rely on surface water as their primary source of drinking water, typically from the Yellowstone, Missouri, and Milk Rivers. The remaining population relies on groundwater sources for their drinking water.

## CONDITION

To acquire information on the condition of Montana's water infrastructure, ASCE contacted Montana DEQ and the State Revolving Fund (SRF) for available data on water systems. In addition, a cross section of communities ranging in population from 350 to 110,000 people participated in a 2018 survey facilitated by the Montana League of Town and Cities. The survey represents a population of 270,000 people, or about 26% of the state's population.

Average water pipe age is estimated to be approximately 55-60 years in Montana communities, with inner core areas seeing ages of 75-100 years, and newer outer system areas seeing ages of 30-60 years old on average. Many pipes have reached or greatly exceeded their design lives and are due for replacement. Treatment plants in the state vary in age, but most have seen extensive upgrades in the last 20-25 years due to new regulations with water quality requirements. Many of these treatment facilities will need additional improvements in the upcoming years for general maintenance purposes as well as meeting any new water quality regulations that may be imposed. In general, most existing public treatment systems have additional capacity for growth.

The seven major cities in Montana (Billings, Bozeman, Butte, Great Falls, Helena, Kalispell, and Missoula) all have budgeted funds in their Capital Improvement Program (CIP) plans for regular pipe replacement of aging water mains. Most of these larger cities have also invested major funds into their water treatment plants in recent years. Substantial upgrades have been completed in these systems, but large cities still have additional pipe replacement needs that are not being met by current budgets. Meanwhile, the vast majority of the smaller communities in the state do not have annual water main replacements built into their budgets. These communities replace these pipes once problems arise, in some cases in emergency situations with unplanned water outages. Treatment upgrades are also usually constructed on a as needed basis, once problems have already developed.

## FUNDING

In Montana water infrastructure is funded using:

- Revenue Bonds (debt serviced with user rates);
- Voter Approved General Obligation Bonds;
- Federal or State Loan Program Bonds-State Revolving Fund (SRF) (debts serviced with user rates);
- State and Federal grants;
- User and Service charges;
- Reserve Funds; and
- Special Assessments (Special Improvement Districts, Tax Increment Financing Districts, etc.)

The most recent total capital investment in Montana, through various state and federal funding programs, is approximately \$122 million dollars on an annual basis for both water and wastewater projects. This estimate is based on information provided by each of the funding agencies. Since 2014, the total annual capital investment has increased by over 5%. The growth in spending comes from additional loan financing; the portion of projects funded through grants has decreased by over 10%. Data from research and development indicates that while the state-based allocation has remained steady in the last four years, federal pooling and leveraged funding has declined.

A majority of spending on water infrastructure is made at the local level, primarily through a rate-based system. Water rates vary across Montana. The 2016 Montana Rate Study and Assessment shows that the average monthly water rate is \$45.90, representing 1.5% of the median household income (MHI), which is above the affordability target rate of 1.4% of MHI determined by the Montana Department of Commerce (MDOC). Systems with population sizes between 500 and 7,500 people pay an average monthly bill of \$41.46 or 1.4% of the MHI. The smallest communities, with populations less than 500, pay the highest monthly average of \$49.98 with a MHI percentage of 1.5%. Many small communities have populations on fixed incomes or have a culture of maintaining low rates, making needed rate increases difficult.

## OPERATION & MAINTENANCE

Current records from the DEQ Operator Certification Program show there are 1,675 certified operators in the state. This includes operators certified in either water or wastewater operations (all classes) or both.

- Of the 1,675 certified operators:
  - o 31% of certified operators are 60 and older;
  - o 49% are 55 and older;
  - o The average age is 52.

Nearly a third of the operators in the state are nearing retirement age and over half will be there in the next ten years. These operators represent a huge amount of operational knowledge and experience that will need to be replaced in the near future. The DEQ is aware of this workforce challenge and is working with the Montana Environmental Training Center (METC) and water systems to provide additional training and recruitment efforts. Also, programs such as MSU-Northern have implemented associate degrees and certificates in water quality applied sciences to prepare future operators. With the potential shortages upcoming, programs like these should be supported and possibly expanded to other colleges and training centers. Efforts are also needed to increase compensation packages, especially with the labor market recently becoming tighter.

## FUTURE NEED

In recent years, Montana's population has grown by approximately 4%, with 25% of that growth occurring in the Gallatin County area (Bozeman). Continued population growth is expected to occur in the state, especially in the areas of Bozeman, Missoula, Kalispell, and Billings.

The U.S. Environmental Protection Agency (EPA) reports that Montana will need \$1.15 billion in funding for water infrastructure in the immediate future. The actual need is likely higher. EPA's report is developed based on identified problems with infrastructure that require attention in the short-term, and is not a measure of long-term needs related to aging infrastructure, increased demand, and regulatory changes.

Communities across the state have been raising their utility rates to keep up with funding demands, but as shown above in the funding section of this report, average rates have climbed above the median household income percentage goal set by the state. Further increases in utility rates to meet funding demands will put strains on the communities and the economic well-being of the populations therein.

## PUBLIC SAFETY

Under the requirements of the federal drinking water regulations, the EPA uses an Enforcement Targeting Tool (ETT) to track systems in violation and to identify those systems that require formal enforcement actions. A point value is assigned depending on the type of violation. Of Montana's 737 municipal or county water systems, 545 are in compliance, and 192 are on the ETT list. Of these 192 ETT listed systems, 119 are deemed not in serious violation, 69 are potentially at risk to be under enforcement action, and four are under enforcement action to correct the issue(s).

This shows the majority of Montana's water systems are meeting federal drinking water regulations, with a handful of systems working towards addressing system violations. However, as systems continue to age and regulation requirements increase, additional funding will be needed to maintain the same levels of compliance.

Also, as systems and piping age, fire flows and adequate system pressures become a concern. Corrosion in the pipes can reduce flows and pressures. Low pressures result in lower levels of service (showers, faucets, sprinklers, etc.). Reduced flows can limit fire protection and cause insurance rates to go up. Along with pressures and flows, aging pipe can cause more difficulty with chlorination and keeping residual disinfection in the system. This increases the chance of contamination as well as disinfection by-products if additional chlorine is needed to maintain the system.

Another major health and safety concern, as seen nationally in recent news, is lead services in water distribution systems. Lead services are present in Montana systems and some systems are known to have an active lead service replacement program, with other communities replacing lead services as they encounter them through other water main replacement projects. Great care must be taken to limit the lead exposure during these service replacements. Testing programs should be implemented before and after replacement.

## RESILIENCE & INNOVATION

Public water distribution and treatment systems are designed to be resilient and flexible for day to day operations, when built to current design standards. Maintenance and small repairs can usually be accomplished with little or no impact to system users. Larger issues like equipment failure and large main breaks can have significant but usually short-term effects on water users. Other major issues that have significant effects on water systems could include flooding, droughts, forest fires, or earthquakes, all of which stand to impact communities in Montana. These occurrences can degrade source water quality, making treating these waters more difficult and possibly limiting capacity and quality.

As well as dealing with minor and major issues that can affect the ability to treat and deliver water, systems must also be very cognizant of water rights and their ability to have enough water capacity for current and future needs. As more and more users vie for the same water sources, limitations and conflicts may occur. Systems will have to improve efficiency and reduce use through conservation.





## RECOMMENDATIONS TO RAISE THE GRADE

- Much of water treatment, distribution, and storage infrastructure in Montana has reached or is approaching the end of its service life and needs to be replaced. The current level of reinvestment to replace infrastructure is too low and additional local, state and federal funds are needed to increase investment levels. This is necessary to maintain the same level of public health and environmental protection provided by water infrastructure and to avoid higher costs at a future date. Rate increases as well as additional state and federal allocations are recommended to bridge the funding gap.
- Increase public education and awareness of the public health and environmental value of water treatment and distribution systems and the long-term cost of deferred maintenance to ease the way towards rate increases and increased financing. Water conservation benefits and methods can be included with public education as well. Promote additional state and federal funding of water infrastructure by providing better information to policy makers on the value of water and wastewater infrastructure investment.
- Increase grant funding for communities with demonstrated limitations in debt capacity (exceed target rate) to afford loan or capital funds to pay for infrastructure improvements.
- Plan for operator transition as older operators retire. Increase interest and salaries in water/wastewater operator occupations.
- Improve operator education and ongoing training opportunities to maintain a pool of well trained and highly skilled operators.
- Continue and expand programs that maximize the effective use of existing infrastructure through technical assistance and outreach.
- Increase security for water facilities and take full advantage of security training available through agencies such as Homeland Security, Montana Rural Water, and METC.



DRINKING  
WATER



## SOURCES

- Rate Study and Assessment, Montana DNRC, 2016. Available at: <http://dnrc.mt.gov/divisions/cardd/news/2016-statewide-water-and-wastewater-rate-study>
- Survey of communities facilitated by Montana League of Cities and Towns
- EPA Clean Water Needs Survey, 2012. January 2016. Available at: <https://www.epa.gov/cwns> Montana ASCE 2014 Infrastructure Report Card
- US EPA, Enforcement and Compliance History Online: <https://echo.epa.gov/>
- Montana DEQ, Operator Certification Program



## ENERGY



MONTANA WINDMILL FARM  
©: PHOTOELITE

## ENERGY

### EXECUTIVE SUMMARY

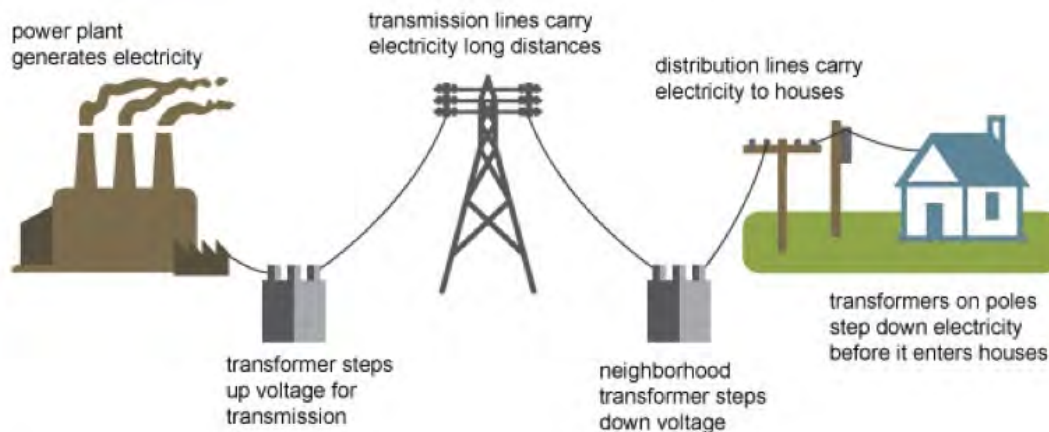
Montana's power generation comes from a number of different sources including coal, petroleum, natural gas, hydro, and other renewables such as wind and solar. Montana produces approximately 27,800 MWh of electricity annually while consuming only 13,900 MWh of electricity. The excess power is generally exported to the West Coast. Montana ranks 38th in the nation for residential electrical rates. Most of Montana's energy infrastructure is owned and operated by private entities and thus, is not reliant on government funding. However, there is still indirect funding needed through loans and bonds to support the maintenance of existing systems and prepare for future needs. Montana's transmission network suffers from a number of issues, including congestion and age; the state's main artery for power flow is almost 40 years old. Meanwhile, Montana's other energy resources that drive the economy, such as coal, oil, and gas, rely on public investment for many things including right of way and raw/processed material transportation.

## BACKGROUND

### Electricity

The transmission network in Montana developed over time as the localized need for power grew where generation was available. The earliest generation sources in Montana were small hydro generators and coal fired steam plants built at the end of the 19th century. One of the earliest lines from Great Falls to Anaconda was (at the time of construction) the longest 100 kilovolt transmission line in the country. A diagram of a basic power network is shown in Figure 1 below.

**FIGURE 1. BASIC ELECTRIC POWER GRID (Source: U.S. Energy Information Administration)**



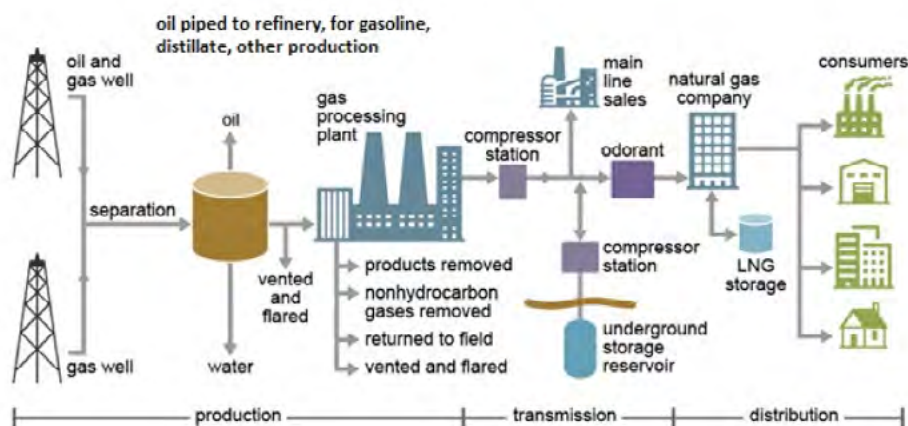
### Coal

Coal deposits have been documented all the way back to the Lewis and Clark expedition by Captain William Clark through what is now Montana. Federal statistics compiled for the western states and territories for 1873 and 1875 indicated limited seasonal coal extraction in the Big Hole Valley, Mullan Pass west of Helena, Fort Benton, and Belt, along the Missouri River. Much of this coal exploration was driven by the railroad industry as the need for coal to power steam locomotives was growing.

### Oil and Gas

Oil and gas exploration in Montana dates back to at least 1889 near Red Lodge and in the area that is now Glacier National Park. The state's first oil boom was in an area geologists refer to as the "Middle Mosby Dome" at Cat Creek east of Lewistown around 1920. As with the development of coal in Montana, railroads were influencing oil exploration as locomotives moved from coal-fired steam to oil. A diagram of basic petroleum and natural gas processing is shown in figure 2 below.

**FIGURE 2. PETROLEUM AND NATURAL GAS SUPPLY (Source: U.S. Energy Information Administration)**





## CONDITION AND CAPACITY

### Electricity

Montana's power generation comes from a number of different sources including coal, petroleum, natural gas, hydro and other renewables (wind and solar). Montana produces approximately 27,800 MWh of electricity annually, while consuming approximately 13,900 MWh of electricity each year. The excess power is generally exported to the U.S. west coast. Montana's transmission network suffers from a number of issues, from age to congestion. Montana's main artery for power flow is the double circuit 500kv line from Colstrip to Spokane, Washington. These circuits were built in the mid-1980s and are almost 40 years old. However, it is relatively new compared with much of Montana's electrical infrastructure, which dates back to the World War II era.

The congestion of this network is largely related to reliability requirements for power flow as well as the economic opportunity surrounding the demand for Montana's electricity outside the state. Capacity needs to be added to the network to expand sales. Fortunately, several transmission projects are underway to facilitate the export of electricity to other states and parts of Western Canada. A new transmission line between Montana and Alberta, Canada was completed in 2013 and other major projects are under construction.

### Coal

Approximately 25% of the entire nation's demonstrated coal reserve base is in Montana, and the state is a substantial supplier of coal energy to the rest of America. In 2016 Montana had five major coal mines operating, producing 26,727 short tons of coal. Of these five mines, four are surface and one is an underground mine. Total coal production has declined by 24.6% for surface mines and 12.6% for underground mines from 2015 to 2016.

### Oil and Gas

Montana produces 214,700 barrels of oil per calendar day. There are 29 registered companies operating pipelines and four operable refineries. The four operating oil refineries produce more than 200,000 barrels on an average day.

## FUNDING

### Electricity

Funding for energy in Montana is primarily controlled by private utilities, which own and operate the transmission lines. These utilities periodically raise rates to cover rising operation, maintenance, and renewable contract costs. The increased costs will be passed on to the consumers directly, as needed, after approval by the Montana Public Service Commission. Montana law also allows utilities to pass a portion of their tax burden on to consumers without the PSC approval, though there have been a number of house bills proposed to close these loop holes. Montana's largest investor-owned utility, which serves approximately 360,000 residents, has one of the highest rates in a four state region. Even with this higher tax rate, Montana ranks 38th in the nation for residential electricity rates.

### Coal

Funding for mining in Montana is primarily controlled by private companies that own and operate the mines. Montana has a Coal Tax Trust Fund that was created to compensate future generations for the loss of a valuable and depletable resource and to meet any economic, social, and environmental impacts caused by coal development not otherwise provided for by other coal tax sources. Funding for Montana's Coal Tax Trust Fund comes from these mines at different rates depending on the type of mining activity and the contract sales price. In 2017 the rates were between 3% and 4% for underground mines and between 10% and 15% for surface mines. While this trust fund does not directly support infrastructure, it does provide funding for Montana's economy by maintaining and improving a clean and healthful environment, with emphasis on energy efficiency.

### Oil and Gas

As with electricity and coal, oil and gas funding in Montana is primarily controlled by private companies that own and operate refineries. Revenue from oil and gas production makes up 5.6% of Montana's General Fund Budget, providing funds for state and local programs. Total 2015 value of oil production in Montana was \$1.15 billion, with Richland County accounting for more than half of Montana oil. Total value of natural gas produced in the same year was \$86.8 million.

## FUTURE NEED

### Electricity

Two of the major issues facing electrical infrastructure improvements are cost and siting. New transmission lines are very costly to build. A 500kv double circuit transmission line may cost \$1.5 million per mile or more to construct. Substations to control these lines can cost anywhere from \$50 to \$100 million, depending on configuration. Siting is another major issue. Transmission line routes can be very difficult to site due to terrain, landowner concerns, right of way issues, and environmental impact.

### Coal

Montana consumes approximately 9,300 tons of coal annually. Most of the coal mined is exported. Total coal production has declined by 24.6% for surface mines and 12.6% for underground mines from 2015 to 2016.

### Oil and Gas

Montana produces about 214,700 barrels of oil per day. While some of this oil is transported by rail, the majority of it is transported by pipelines. A lack of pipeline export capacity has limited new production in the state. A number of new pipeline projects are in development to move crude oil to refineries in the Midwest and on the Gulf Coast.

## OPERATION AND MAINTENANCE

### Electricity

As the existing transmission network ages and regulations change, it is becoming more difficult to maintain the infrastructure condition while maintaining regulatory compliance. Montana's utility companies generally maintain their existing infrastructure through prioritized maintenance and capital improvement programs. Utilities also develop and invest in new technologies to help maintain existing infrastructure. From new computer software to UAV (drone) inspections of existing equipment, technology helps utilities keep their systems maintained and safe.

## PUBLIC SAFETY

Public safety is one of the most important factors in the transportation and delivery of energy. Montana faces a unique challenge in the fact that the state covers an area of more than 147,000 square miles. With the state experiencing all four seasons, extreme weather can be an issue. With over 10,000 miles of high and low voltage power lines and nearly 11,000 miles of pipelines, outages and breaks are inevitable. The companies that own and operate these lines often rely on the public to maintain the safety of the infrastructure by reporting issues.

## INNOVATION

### Electricity

Distributed Energy Storage (DES) refers to a system that can store electrical energy for a period of time and transfer it to the electrical grid as required. Current technology uses batteries as the means for this energy storage. DES systems can operate at partial output levels with fewer losses and can dynamically respond to adjustments in electricity demand very quickly. DES systems can store energy during low demand (off-peak periods) and resupply that energy during high demand (on-peak periods).

Many renewable energy options, such as wind and solar, provide intermittent power. DES systems can enable these technologies to store excess energy for times when the sun is not shining and the wind is not blowing.



## RECOMMENDATIONS TO RAISE THE GRADE

- Adopt a state energy policy that assesses alternative energy sources, such as renewables, and provides a balance between economic growth, consumer needs, and environmental impact.
- Expand incentives for renewable power, including the opportunities for job creation associated Montana's environmental resources from hydro, to solar, to wind.
- Decrease the burden associated with permitting by streamlining the process, while still protecting our environment.
- Update existing infrastructure. New technologies can make existing infrastructure more efficient as technology progresses.
- Promote the use of new technologies to increase reliability and decrease the maintenance costs associated with existing infrastructure.



## DEFINITIONS

**CONGESTION:** Flow of electricity or fluid in an energy system that is restricted or constrained below desired levels, either by the physical capacity or operational policies designed to preserve security and reliability.

**DISTRIBUTED ENERGY STORAGE SYSTEMS (DES):** Systems which capture energy produced via mechanical, electrical, and electrochemical means to enable energy dispatch at a later time when demanded.

**POWER GENERATING PLANT:** Facility that uses a conventional fuel source (e.g., coal, natural gas, oil, uranium), or that captures a renewable energy source, to produce electricity.

**RENEWABLE ENERGY:** Energy generation using biomass, hydroelectric, geothermal, wind, and solar sources (for electricity or fuel manufacture)

**UAV:** Unmanned Aerial Vehicle commonly known as a “Drone” is a vehicle the is piloted by a remote control or onboard computers

## SOURCES

- [www.energy.gov](http://www.energy.gov)
- [www.epa.gov/energy](http://www.epa.gov/energy)
- <http://deq.mt.gov/Energy>
- <https://www.eia.gov>
- <http://psc.mt.gov>
- [www.electricitylocal.com/states/montana](http://www.electricitylocal.com/states/montana)
- <https://leg.mt.gov/bills>
- <http://cordilleramontana.worldnow.com>





RAIL



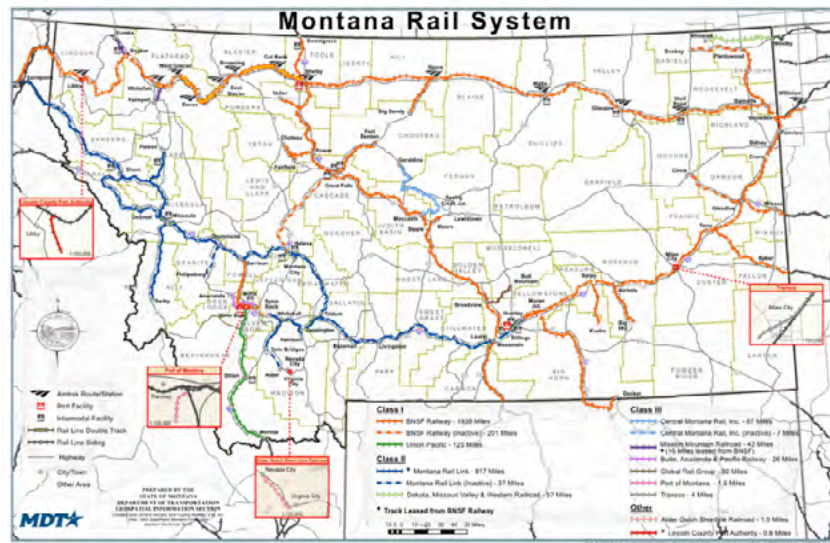
## RAIL

### EXECUTIVE SUMMARY

Montana is a large remote state with considerable distance between commodities, economic hubs, and manufacturing facilities. Montana's railroad system includes approximately 3,376 miles of track owned by Class I, Class II, and Class III railroads, and is essential to the state's economy. The rail system is primarily utilized for freight rail purposes. However some of the track is used for both freight and passenger services. Considerable private and public investments have been made to Montana's railroad infrastructure in recent years and as-a-whole, the infrastructure is in good condition. Congestion along some of the main corridors is becoming an issue, and the railroads are currently initiating projects to increase operational efficiencies.

## INTRODUCTION

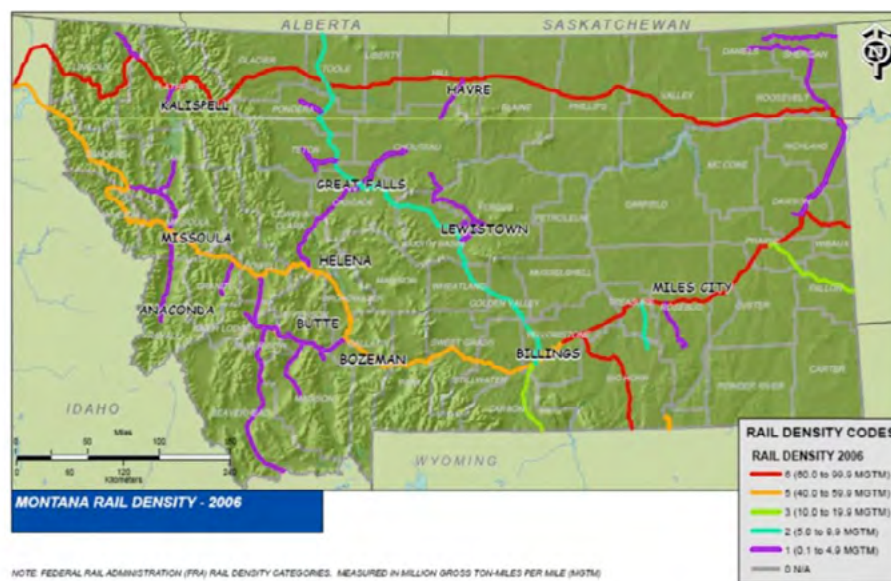
The State of Montana is served by multiple railways, ranging in size from Class I to Class III. The Class I railroads include BNSF Railway Company (BNSF) (~2,140 miles) and Union Pacific (~125 miles). A portion of the BNSF system along the “Hi-line” from Montana’s eastern border to its western border is also used by Amtrak Empire Builder passenger trains. There are two Class II railways in the State: Montana Rail Link (MRL) (~854 miles) and Dakota Missouri Valley and Western Railroad (~57 miles). Montana Rail Link operates on a track lease from BNSF. Six Class III railroads constitute the remaining 200 miles of rail in Montana. The following “Montana Rail System” map from the 2010 Montana State Rail Plan shows the active and inactive railways throughout the State of Montana:



## CAPACITY

Montana is situated in a trade corridor linking the midwestern and West Coast port markets. As a result, approximately 54% of shipments by tonnage pass through the state. Trips originating in Montana account for approximately 42% of all traffic and the remaining 4% constitutes intra state trips and trips terminating in Montana.

The following Montana Rail Density map from the 2010 Montana State Rail Plan shows the rail density for Montana’s rail system measured in Million Gross Ton-Miles Per Mile (MGTM) in 2006. Based on conversations with railroad operators, rail usage distribution has not changed considerably from the time the map was prepared. As shown in the map, the areas of heaviest use are the BNSF mainline across the northern portion of the state and the BNSF mainline through the southeast portion of the state. Rail operated by MRL from Billings, Montana to Sandpoint, Idaho also sees considerable use.





BNSF is currently focusing on two key projects that will have a considerable effect on the operational efficiency of Montana's rail system. Ventilation improvements are being completed in a seven mile long tunnel near Kalispell, Montana. Currently, locomotive exhaust must be cleared out from the tunnel between each train pass to make it safe for employees and passengers. This process takes time and causes delays. The project will improve ventilation and provide backup power, reducing delays for both freight and passenger trains. The second project is in Sandpoint, Idaho, where the BNSF track across northern Montana and the MRL operated track across western Montana meet. The area is currently referred to as "The Funnel" because there is only a single track crossing Lake Pend Oreille. The project will include construction of a new bridge, alleviating congestion in both the north and south rail lines across the State of Montana. The number of trains utilizing Montana's rail system is dictated by freight transportation demand, therefore these projects are not expected to immediately increase usage. However, the projects will decrease congestion and allow for increased capacity as needed in the future. Amtrak's passenger service capacity along the BNSF hi-line track is dependent on combined passenger/freight usage and requires continued scheduling and coordination between BNSF and Amtrak.

MRL has also invested in increased capacity, including improvements to staging yards in Laurel, Livingston, and Helena and addition of new and extended sidings in Belgrade and Austin. Missoula is becoming a bottleneck, and MRL is completing improvements to their infrastructure in the area.

## CONDITION/OPERATION AND MAINTENANCE

Railroad companies have invested heavily in Montana's rail system in recent years, and the overall system is in good condition. The railroad companies maintain and inspect their infrastructure regularly. The Federal Railroad Administration (FRA) also sends inspectors to audit equipment, track, and other infrastructure to ensure it meets federal standards. There are some segments of track in Montana that have not been used for a long period of time. This track will either be abandoned or require repair prior to use.

## FUNDING

The majority of Montana's railroad infrastructure is privately funded by the railroads. BNSF invested \$600 million in the past four years and plans to spend \$135 million in 2018. The Union Pacific Railroad invested \$8.2 million in the past five years and plans to spend \$2.1 million in 2018. MRL plans to spend \$60 million in 2018 and has spent a similar amount in recent past years.

Montana has also been very successful in recent years in receiving federal grants for rail related projects. BUILD Grants, formerly the Transportation Investment Generating Economic Recovery (TIGER) Grant Program, recently contributed \$9.9 million to the Port of Northern Montana Multimodal Hub in Shelby and \$10 million to the Glacier Rail Park in Kalispell. The Port of Northern Montana Multimodal Hub provides a fully functional inland port capable of accepting and delivering unit trains, containerized cargo, and large industrial equipment and materials. Construction of the Glacier Rail Park is nearly complete and will provide streamlined transportation and direct access to national and international markets. A second phase of the project will include abandonment of track in Kalispell and improvements to City infrastructure; which will improve safety, relieve congestion, and enhance the "downtown" area. Montana communities have also recently received federal funding through the FRA's Rail Infrastructure and Safety Improvements Program. The State of Montana provides support to freight rail projects through the "Montana Essential Freight Rail Loan Program," which is a low-interest revolving loan targeted at projects that enhance freight rail service in Montana. The Amtrak Empire Builder is funded through passenger ticket sales along with federal grants and expenditures as needed.

## FUTURE NEED

Freight volumes are expected to grow considerably over the next decade. It is anticipated that the railroads will continue to invest as necessary to properly maintain existing infrastructure, improve safety, and improve operational efficiencies. There is a continued need for rail-served industrial parks in strategic locations to promote rail utilization. Additional state and federal grant opportunities focused toward these types of facilities is needed in Montana. Installation of additional passenger rail infrastructure to serve the more southern areas of the State has been considered and may be needed at some point, but is not planned for the near future.

## PUBLIC SAFETY AND RESILIENCE

Data from the Federal Railroad Administration (FRA) documents that railroad related accidents in Montana fell from 198 in 2008 to 98 in 2017, a decline of 55%. During the same time, railroad employee on duty injuries also dropped 63%, from 100 in 2008 to 37 in 2017. The Public Service Commission (PSC), BNSF, and Montana Rail Link attribute the considerable safety improvement to steps taken to improve safety by the railroads, improvements in technology, investment in maintenance, and safety improvements. State regulators and railroads also credit improved accident records to safety education programs such as Operation Lifesaver, a nonprofit organization focused on reducing collisions at highway rail crossings.

One of the key safety improvements completed by BNSF in 2017 is Positive Train Control (PTC). PTC involves an onboard computer system that receives and analyzes track data from base-station radios and wayside towers along a train's route, giving the locomotive engineer advanced warning of speed limits and track conditions as well as information to head off collisions. PTC devices have also been installed and are being used on Amtrak Empire Builder equipment. Class II and Class III Railroads are not required to install PTC at this time. PTC and many other systems and protocols are utilized by the railroads to improve safety and also protect and warn against potential multi-hazard threats.

## INNOVATION

BNSF is leading an Unarmed Aerial Vehicle (UAV) program to utilize drones for inspection of railroad systems. Drones can safely inspect bridges in locations inaccessible by other means, inspect track for problem areas, and even inventory track infrastructure such as ties.





## RECOMMENDATIONS TO RAISE THE GRADE

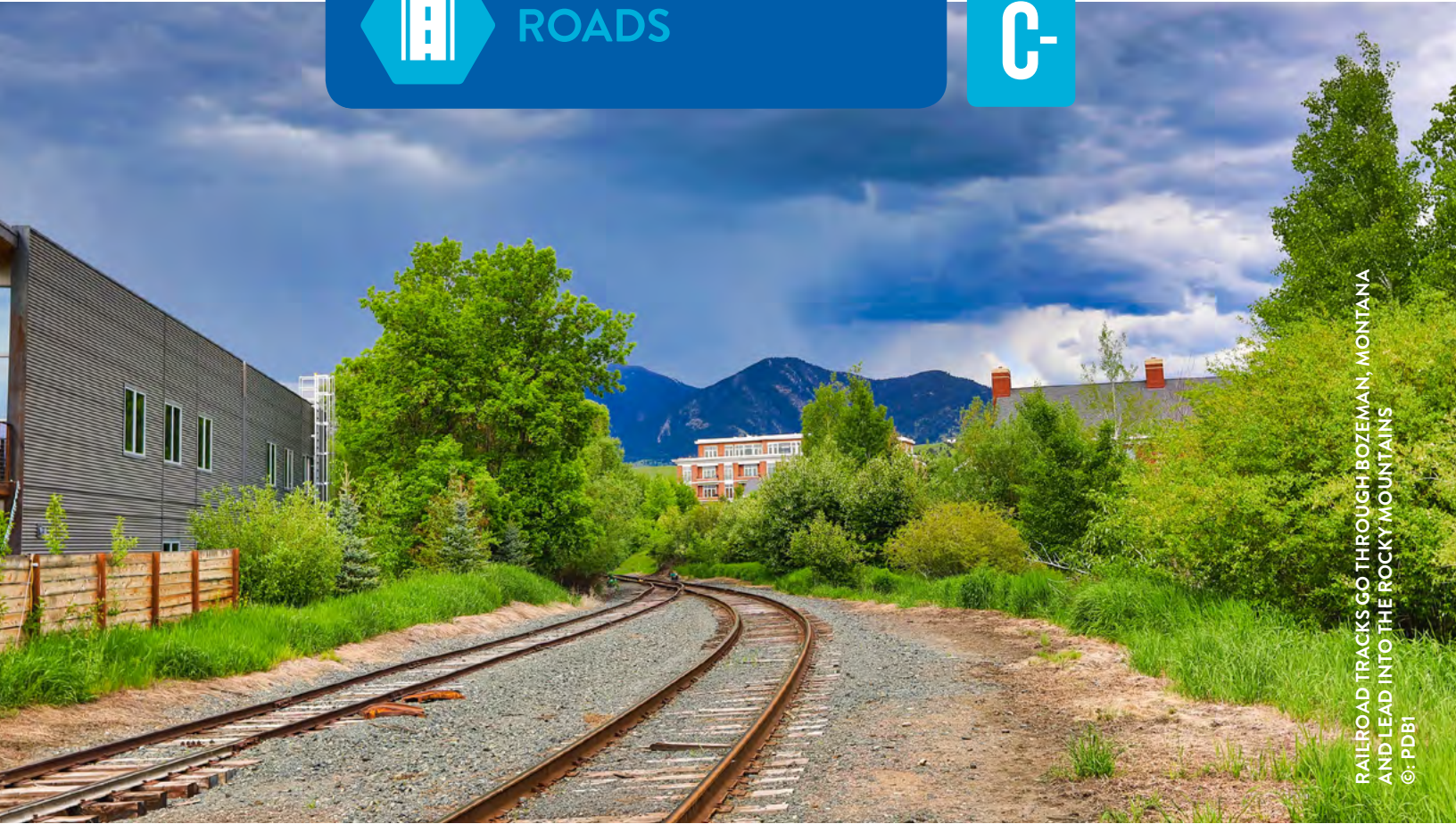
- Establish additional state and federal grant opportunities focused toward rail served industrial parks.
- Dedicate additional funding to improve at-grade crossing safety.

## SOURCES

- Montana Department of Transportation (MDT), *2010 Montana State Rail Plan*, December 2010. Available at [www.mdt.mt.gov](http://www.mdt.mt.gov).
- Montana Department of Transportation (MDT), *2017 Montana Freight Plan*. Available at [www.mdt.mt.gov](http://www.mdt.mt.gov).
- *U.S. Department of Transportation National Freight Strategic Plan*
- Briggeman, Kim. Montana railroads aren't panicked over nationwide freight recession. *Missoulian*, January 30, 2016.
- Briggeman, Kim. Working on the railroad: Montana Rail Link workforce expands as train traffic rises. *Missoulian*, January 26, 2018.
- Briggeman, Kim. Railroad safety measures paying dividends in Montana; Positive Train Control is costly wave of the future. *Missoulian*, February 9, 2018.
- Drake, Phil. Rail accidents down 55 percent, Montana says. *Great Falls Tribune*, F.
- Jacobs, Justin (Union Pacific Media Contact). Montana Transportation Infrastructure Receives \$2.1 million Boost from Union Pacific. *Roseville, Calif. News Release*, April 23, 2018.



## ROADS



RAILROAD TRACKS GO THROUGH BOZEMAN, MONTANA  
AND LEAD INTO THE ROCKY MOUNTAINS  
©: PDB1

# ROADS

## EXECUTIVE SUMMARY

Montana's roads are among the least crowded roadways in the country and efficiently move \$101 billion goods by truck and millions of travelers by car each year. However, 46% of major roads are in poor to mediocre condition. These rough roads cost each Montanan approximately \$385 per year in extra operating costs. It is estimated that \$15 billion is needed to take care of Montana's roadway system over the next 10 years, but projected funding can only meet 33% of those needs. Also concerning is that Montana has the eighth highest fatality rate in the nation. In a move in the right direction, Montana legislature recently approved new revenue for roads, providing an additional \$30 million annually for the state's transportation network, helping to close the investment gap.

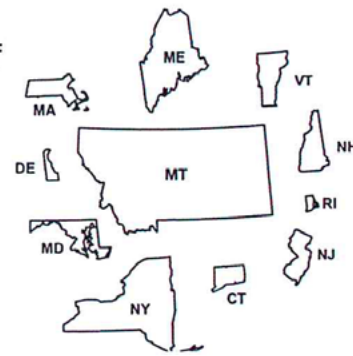


## BACKGROUND

As the lifeline to travel, recreation, and commerce, Montana's highway system plays a critical role in the economic health and freedom of mobility to the state's citizens, tourists, and businesses. The backbone of the state's economy is the ability to move goods, services, and visitors across the extensive network of roads, bridges, and highways. Well-maintained roads enhance the network's ability to provide efficient and reliable mobility for motorists and businesses, thereby sustaining our level of economic competitiveness and propelling our economic growth. Given the investment already made in developing our road network and its importance to our commerce and lifestyle, Montana must continue to invest in this valuable asset.

Montana is larger than the combined area of 10 North-Atlantic states, yet it has only **2%** of the combined population of those states.

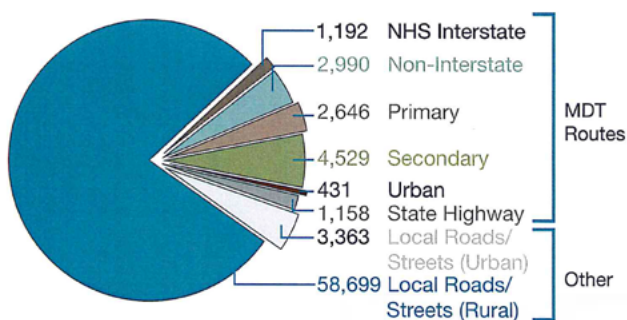
It is farther by highway from Yaak, MT to Alzada, MT (774 miles) than it is from Washington D.C. to Chicago, Denver to Las Vegas, Seattle to Reno, Atlanta to Chicago, Jacksonville to Washington D.C., or San Francisco to Salt Lake City.



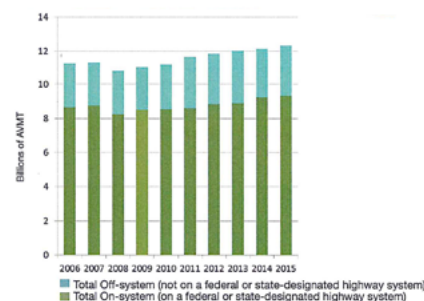
## CAPACITY

Montana enjoys some of the least crowded roadways in the country, with a very low ratio of population to number of lane miles in the state. There are a few rural routes that are slowed by congestion, including portions of Highway 93 in western Montana, Highway 191 near Bozeman, Highway 16/200 near Sidney and Fairview, Highway 87 in Billings Heights, and US 310 south of Laurel, but the wide-open spaces of Montana provide plenty of room for motorists to move quickly along the transportation network. The current capacity of the roadways should serve Montana well into the future. However, a few urban routes and several routes in the Bakken region of eastern Montana, where oil exploration is booming, are in desperate need of capacity upgrades.

Centerline Road Mileage 2015



Source: Geospatial Information Section



2014	Centerline Miles	AVMT
MDT Routes	12,947	9.2 billion
Other	62,037	2.9 billion

2015	Centerline Miles	AVMT
MDT Routes	12,946	9.3 billion
Other	62,062	3.0 billion

AVMT = Annual Vehicle Miles Traveled

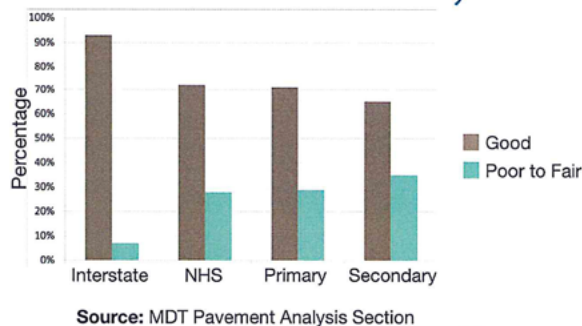
The efficiency of Montana's transportation system, particularly its highways and bridges, is critical to the health of the state's economy. Businesses are increasingly reliant on an efficient and reliable transportation system to move products and services. A key component in business efficiency and success is the level and ease of access to customers, markets, materials, and workers. Annually, \$101 billion in goods are shipped to and from sites in Montana, mostly by truck.

## CONDITION

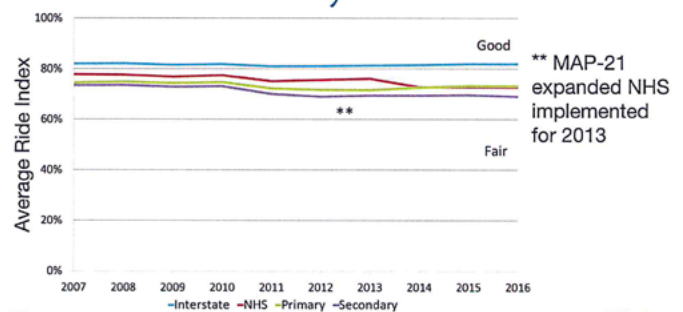
The Montana Department of Transportation (MDT) uses asset management systems and the most cost-effective pavement preservation methods. A lack of adequate state and local funding has resulted in a drop in the condition rating of MDT's National Highway System (NHS) routes. In 2014, 79% of pavement was in good condition and 21% was in poor to fair condition. In 2016, the condition of NHS routes dropped to 71% in good condition and 29% in poor to fair condition. MDT's primary and secondary routes have generally maintained their ratings over the same period. The Ride Condition Summary has generally maintained its rating since the 2014 Report Card.

When it comes to urban roads, Montana's pavement conditions have decreased over the past four years. 34% of major urban roads in Montana to have pavement surfaces in poor condition, 40% in mediocre condition, and the remaining 26% are in good condition. The City of Great Falls has the worst rating with 52 % of their urban roadways in poor condition.

### 2016 State Highway Overall Pavement Condition Summary



### MDT Ride Condition Summary



Driving on rough roads costs each Montana motorist \$385 annually in extra vehicle operating costs. Higher costs have been recorded in the larger urban cities. The average driver in Billings loses \$592 annually with Great Falls drivers recorded the highest losses of \$872 annually. In addition, rough road conditions cost all Montana motorists a total of \$170 million annually in extra vehicle operating costs. Costs include accelerated vehicle depreciation, additional repair costs, increased fuel consumption and tire wear.

## FUNDING

Given the economic and safety impacts of Montana's road network, adequate funding for maintenance and expansion is of vital importance. Roads are funded through a combination of federal, state, and local funding.

The federal government remains a critical source of funding for Montana's transportation system and provides a significant return to Montana in funding based on the revenue generated in the state by the Federal motor fuel tax. The federal motor fuel tax is currently 18.4 cents-per-gallon and the federal diesel tax is 24.4 cents-per-gallon. Neither of these rates have been raised since 1993 and inflation has significantly decreased the spending power of the gas and diesel taxes. As a result, federal funding has mostly remained stagnant in recent years. The current surface transportation reauthorization, the FAST Act, provides funding assistance to MDT for upcoming projects. However, this is not a permanent funding solution as the FAST Act is a five-year program and is set to expire in 2020.

Montana also collects a gas and diesel tax to support transportation-related improvements. In 2017, the Montana Legislature passed House Bill (HB) 473 to increase Montana's Gas Tax by 6 cents per gallon of gasoline and 2 cents per gallon of diesel fuel by 2023. Currently, the rate increase is 4.5 cents per gallon of gasoline sold. This increase will provide approximately \$30 million annually. It should be noted that of the funds raised from HB 473, \$9.8 million is allocated to MDT with the remaining revenue equally shared between Cities and Counties for roadway infrastructure improvements.



Prior to passing HB 473, MDT was looking at an estimated \$874 million average annual shortfall through 2021 in the investment level needed to make further progress in improving road, highway and bridge conditions, improving traffic safety, and, completing needed modernization improvements to enhance economic development opportunities. The estimated shortfall will decrease once the final effect of HB 473 has taken place.

## FUTURE NEED & OPERATION AND MAINTENANCE

Montana has made significant investments in roadway infrastructure and must be cognizant of protecting that investment through ongoing maintenance of roads. Over the next 10 years, MDT reports it will need a total of \$15 billion; expected revenue over this time is estimated to be \$5 billion, or approximately one-third of the need. It should be noted that HB 473, once fully implemented, will help with the shortfall but it will not close the gap entirely.

Funding available to Montana counties from all sources for road and bridge maintenance may be characterized as adequate to maintain the status quo but is insufficient to improve current conditions. Unfortunately, over time, roadway maintenance costs can only be expected to increase, hindering the counties' abilities to make any gains or even maintain status quo.

## PUBLIC SAFETY

In addition to economic growth, transportation improvements are needed to ensure safe, reliable mobility and quality of life for all Montanans. Montana's traffic fatality rate is the third highest in the nation. Improving safety features on Montana's roads and highways would likely result in a decrease in the state's traffic fatalities and serious crashes. In 2014, MDT announced a new campaign for highway safety named Vision Zero. The plans' interim goal is to reduce fatalities and serious injuries in Montana by half in two decades, from 1,704 in 2007 to 852 by 2030.

Since the 2014 Report Card, Montana's traffic fatality rate is on a downward trend, but has fluctuated from 1.58 fatalities per 100 million vehicle miles in 2014, to 1.81 fatalities per 100 million vehicle miles in 2015, to 1.44 fatalities per 100 million vehicle miles in 2016. Major factors contributing to the high fatality rates are the distances to medical help and miles of highways that need upgrades to modern standards.

In conjunction with Vision Zero, MDT has begun placing centerline rumble strips on all its two-lane highways. This measure is being utilized to help prevent head-on collisions from crossing the centerline.

## RESILIENCE

The resilience of the transportation network in Montana is important because alternate routes for closed highways can involve several hundred miles of detour. Natural disasters in transportation corridors not only have the potential to seclude portions of the state, but also create costly detours for major trade routes such as the Can-Mex route along I-15, east-west along I-90 and I-94, and the hi-line of US-2. Being a large state with varying terrain and weather patterns results in exigency actions being needed somewhere in the state each year. Due to these frequent small practice runs, MDT has some response funds built into its budget and staff experienced in dealing with these difficult situations. To supplement this funding, FHWA, at times, has funding available through a fast track process for emergency transportation needs. In addition, MDT, FHWA, the U.S. Forest Service, U.S. Army Corps of Engineers, Montana Department of Environmental Quality, and Montana Fish, Wildlife and Parks have an agreement in place to expedite permitting and project responses during emergencies. These agencies have participated in disaster response drills with the National Guard and local governments. This working relationship greatly enhances cooperation and responses to keep the transportation system open.

With transportation professionals and cooperating regulatory agencies in Montana thoroughly recognizing the importance of the transportation network and possessing a demonstrated ability to work together, transportation emergencies are met head-on and resolved as quickly as possible.

## INNOVATION

Given the difficulty of obtaining funding for roadway construction and maintenance, providing innovative solutions to the challenges facing Montana's roads is an important aspect of providing a top-notch transportation system. It is important for Montana to embrace new ideas and programs that will stretch the transportation funding dollars.

MDT is in the process of applying new Computer Aided Design and Drafting (CADD) standards and updated Comprehensive Road Design standards. These standards include the use of 3-D design projects. The projected goal is to provide 3-D surface models to contractors and MDT staff for all construction projects by 2022. This will provide more efficient construction methods and deliver construction projects faster than ever before.

In conjunction with Vision Zero, MDT has begun placing centerline rumble strips on all its two-lane highways. This measure is being utilized to help prevent head-on collisions from crossing the centerline.



## RECOMMENDATIONS TO RAISE THE GRADE

Despite being underfunded, the state's highways are in fair to good condition, and the system efficiently moves its citizens and goods from place to place. This speaks well of MDT's and local counties' efforts to manage the project mixes and innovation efforts, while maximizing benefits with a tight budget. Yet, even as the state's highways perform efficiently and safely, the aging infrastructure and transportation assets that make up the network will inevitably require ongoing maintenance. The following recommendations have all either been rolled out in other states or are being investigated. The ideal combination is one involving several recommendations to fairly balance impacts to all road users.

- Montana should capitalize on new technologies to advance the overall design, construction, and operation and maintenance of its transportation network. This includes following through with its intended use 3-D CADD software and using remote sensing technologies and automated systems to accurately and efficiently obtain data for all aspects of transportation network operation.
- Montana should encourage agencies responsible for roads to use alternative project delivery methods when a given project is a good candidate for design/build or other unconventional methods of delivery. Utilizing innovative project financing for roadway construction could include public/private partnerships. New financing methods allow for the private sector to be more assimilated into a traditional construction project.
- Montana should consider implementing a state infrastructure bank to help increase the funding available for all infrastructure projects, including roadways. An infrastructure bank would be backed by the State of Montana and provide an avenue for lending money to agencies responsible for funding construction. The FHWA estimated that state banks could leverage almost \$4 of private investment for every \$1 in taxpayer investment.
- Montana cities and counties should consider all alternatives to funding roadway improvements, including Tax Increment Funding (TIF) districts, Special Improvement Districts/Rural Improvement Districts, and other local taxes. These alternatives could generate revenue to improve not only streets, but all infrastructure housed within that roadway.



## RECOMMENDATIONS TO RAISE THE GRADE (CONT.)

- **Montana should continue analyzing the roadway network to determine critical connections, areas where unusable roads will cause the most economic damage. Those routes should be evaluated for likelihood of natural disasters and analyzed for ways to improve their resilience. Highway routes that are especially susceptible to closure should have viable detour routes in good condition.**

## SOURCES

- Montana Department of Transportation Fact Book – 2016
- MONTANA TRANSPORTATION BY THE NUMBERS: Meeting the State's Need for Safe and Efficient Mobility, TRIP A National Transportation Research Group, January 2017
- Insurance Institute for Highway Safety – Highway Loss Data Institute: Population, fatal motor vehicle crashes, motor vehicle crash deaths and motor vehicle crash death rates per state, 2016





## SCHOOLS



©: MIKEAUBRY

# SCHOOLS

## EXECUTIVE SUMMARY

Montana has more than 145,000 students attending 821 K-12 public schools across the state. The average age of school facilities is 53 years, and 68% of schools were built before 1970, creating an inventory of aging structures in need of repair and renovation. While funding has been obtained for addressing serious safety issues, revenue for the Facility Reimbursement Program was reduced beginning in 2010. Meanwhile, facility needs are growing, creating funding gaps for items such as damaged or worn out systems and facilities, codes and standard violations, and energy costs.. As energy costs continue to rise and student populations grow, school facilities will face even larger funding deficits while trying to provide safe, healthy, and productive educational environments for communities.

## BACKGROUND

Of Montana's 821 public schools, there are 436 elementary schools, 214 middle schools, and 171 high schools. Many of these facilities have multiple buildings. The average age of Montana school facilities is 53 years. In 2005, House Bill No.1, of the 59th Legislature Special Session, authorized a statewide facility condition inventory for all schools in Montana, which is summarized in State of Montana, K-12 Public Schools Facility Condition Assessment A/E Project #26-30-03 (Facility Assessment Report). This inventory was completed in 2008 by 42 trained professional architects and engineers. A follow-up assessment has not been conducted, and the state does not currently track this type of information. Additional revenue and expense information, as well as interviews with school superintendents, facility managers, and financial administrators is available through the Montana Office of Public Instruction.

## CAPACITY

Enrollment in Montana schools continues to steadily increase. For the 2017-2018 school year, the total enrollment was 146,772 students in the state's 409 school districts. It is estimated that 92% of Montana's children attend public school. Enrollment for the 821 public schools breaks down as follows:

- 51 schools (6%) have more than 500 students and account for 31% of total public-school enrollment;
- 163 schools (20%) have 250-499 students and account for 41% of total public-school enrollment;
- 163 schools (20%) have 100-249 students and account for 18% of total public-school enrollment;
- 112 schools (14%) have 50-99 students and account for 5% of total public-school enrollment; and
- 330 schools (40%) have fewer than 50 students and account for 5% of total public-school enrollment.

No consistent pattern has emerged relating number of students to school system capacity, and any trends identified are limited based on location. For example, Montana has several remote, one-room school houses serving very small populations. By contrast, in some larger Montana communities, the number of students exceeds optimal capacity. Each year, the debate continues about whether specific schools should remain open or be closed due to local population trends.

## CONDITION

The 2008 Facility Assessment Report uses categories outlined in the Facility Condition Inventory (FCI) by the Montana State University's Office of Facilities Services. The FCI was developed for facility condition assessment and is based on a national facility audit model. This system is now used in many State agencies and was recognized for its value and impact by being awarded the Leadership in Education Facilities 2008 Effective and Innovative Practices Award by APPA, the industry association for education facilities officers.

The FCI is used to compare the cost of repairing a building to that of replacing a building.

The worst and most pressing deficiencies identified for Montana schools were in the Damage/Wear Out and Environmental categories. 66% of all schools had damaged or worn out items, which include:

- 37% finish-related items, including ceilings, walls, and floors;
- 15% electrical system damage, including outdated wiring and a shortage of outlets; and
- 14% for other categories such as plumbing systems, roofs, building envelopes, and foundations.

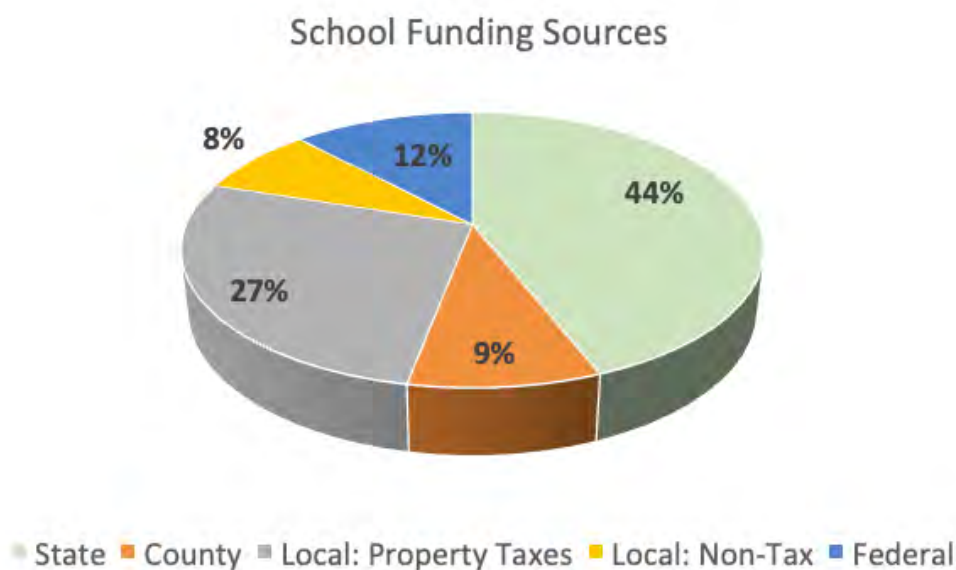
The top three environmental category deficiencies are as follows:

- 39% HVAC systems;
- 28% roof systems; and
- 31% envelope systems, which is comprised of the roof, exterior walls, and windows.

If uncorrected, a failure in the systems above could affect other systems within the schools and potentially spread to the community, state, and overall economy.

## FUNDING

According to a 2008 independent report, Building Minds, Minding Buildings, \$903 million was needed to bring Montana school facilities up to good condition at that time. Roughly a decade later, funding sources remain fairly consistent: 44% state, 9% county, 27% local property taxes, 8% local non-tax sources, and 12% federal.



In February 2016, a five-part series on Montana school facilities appeared in newspapers around the state, reinforcing the crisis associated with a lack of school funding. For the 2015-2016 school year, the average general fund budget was \$7,433 per student. In August 2017, a \$19 million school funding cut took effect for the following two years, which dropped per-student funding levels to approximately \$7,300. Many school districts were already at the minimum staff required to meet federal accreditation standards based on a student to teacher ratio, and in other areas federal requirements require services regardless if the state funds those programs or not. As a result, many districts are cutting supplies and maintenance along with relying on local funding through levies.

A report entitled K-12 Funding: A 10 Year Review (K-12 Report) was prepared in September 2016 for the 65th Legislature. The K-12 Report, written by the 2015-2016 School Funding Interim Commission, surveyed the public for input on where to focus attention relating to school funding in Montana. The K-12 Funding report identified that funding to the Facility Reimbursement Program was prorated at 39%, the largest reduction of reimbursements in program history. This program was fully funded for eight years between 2000 and 2010, but since 2010, revenue has decreased by about \$6 million, and the program is now only funded at 61%. The K-12 Report recommends further study to ensure unequal tax burdens on districts do not impede equality of education opportunity. The commission provided guidance on future efforts of BASE mill equalization.

A report entitled *State of our Schools: America's K-12 Facilities* (State of our Schools) was prepared in 2016 based on data from the National Center for Education Statistics. This report compares data reported by schools of each state and allows a direct comparison from state to state. The data shows that from 1994-2013, Montana is the third lowest in capital construction spending compared to the standard. Appendix A of the report shows various statistics for all states. Many of Montana's statistics are at or near the bottom for all states. One of the most telling is the percentage being spent on maintenance and operation and on capital construction compared with the standard. Montana is spending only 50% of the standard 7% on capital construction and maintenance and operation.

## OPERATION AND MAINTENANCE

The Facility Condition Inventory (FCI) report identified Montana's long-term planning of facilities (for operation and maintenance) as being very poor. Montana has no long-term plan to address aging school infrastructure, nor has the financial capability to operate and maintain facilities. Facility operation is hampered by outdated and aging systems and deferred maintenance due to lack of funding. Further, Montana schools do not have the means or methods to determine if infrastructure complies with current government regulations.

## FUTURE NEED

While current conditions of school facilities leave much room for improvement, localities are beginning to act to close the investment gap. In October 2016, voters in Great Falls approved nearly \$100 million in bonds to support elementary and high schools across the school district. In May 2017, voters in Helena supported a \$63 million bond that will go toward school infrastructure, as well as safety and security technology. Most recently, East Helena approved a \$29.5 million bond in May of 2018 to build a new high school. These initiatives come on the heels of a successful ballot measure in 2013 in Billings, where voters passed a \$122 million bond measure to address deferred maintenance and build new facilities. Students in these school districts stand to benefit from additional funding and new facilities once they are completed and open.

## PUBLIC SAFETY

The FCI report reviewed safety issues of each facility. Safety issues were only reported in two categories: (1) immediate threats to life safety and (2) building integrity. School site visits discovered few safety issues, but once school officials were made aware, safety repairs began as soon as possible to eliminate any threatening issues.

Many additional public safety issues outside of urgent life-safety and structural integrity do exist. Most of these safety issues remain unchanged and are often due to the age of the infrastructure and building codes that have changed over time. A majority (68%) of Montana's schools were built prior to 1970 and at that time lead paint and asbestos insulation were common building materials. These hazardous materials are only removed when renovations force schools to be brought into current code compliance and funding is available. Often these renovations and removal of hazardous building materials are reliant on grant funding or bond levies, so they are deferred for long periods. When grants are not awarded and bond levies not passed, these safety issues go unresolved.

## RESILIENCE & INNOVATION

Due to Montana's size, schools are often more than learning centers for students; they function as community hubs. Schools not only shape future minds and leaders during their sub-adult life, they serve as meeting locations and emergency shelters in times of natural disaster. These facilities are paramount in ensuring communities have a safe place to recover from incidents. Deteriorating facility infrastructure will ultimately fail if it is not maintained. This type of failure is never acceptable, and especially not during times of crisis, which are often when the most demanding circumstances are placed on infrastructure.





## RECOMMENDATIONS TO RAISE THE GRADE

Ultimately, undersupplying schools and deferring maintenance of facilities are not long-term solutions. We need to identify stable funding sources and develop facility plans to provide ongoing care of these important resources.

- The statewide Facility Reimbursement Program has seen drastic reductions in available funding. The state legislature should reauthorize the program and increase available funding. Additionally, localities should levy funding and financing for school facilities.
- The FCI report and K-12 Report were both good starting points in identifying the needs of Montana schools. Taking from those reports, it is recommended that long-term facility plans be created for each school and district to determine how to improve school facilities and offer guidance for the spending of their limited budgets. Each facility plan should develop a process of evaluation to determine if renovation or replacement is the more cost-effective solution for each school.
- Grant programs have been successful and helpful for some schools that received aid, however, these programs are not a long-term solution and are not large enough to affect the school system across the entire state. A follow-up Facility Condition Inventory analysis should be conducted, which can be tied to a continuation of the funding crisis resolution as recommended by the K-12 Report committee.

## SOURCES

- 2015-2016 School Funding Interim Commission, K-12 School Funding: A 10-Year Review, 2016. Available at <http://leg.mt.gov/content/Committees/Interim/2015-2016/School-Funding/Meetings/Aug-2016/SFC-FINAL-REPORT.pdf>
- 21st Century School Fund, Inc., US Green Building Council, Inc., and the National Council on School Facilities, State of Our Schools: America's K-12 Facilities, 2016. Available at <https://kapost-files-prod.s3.amazonaws.com/published/56f02c3d626415b792000008/2016-state-of-our-schools-report.pdf?kui=wo7vkgV0wW0LGSjxek0N5A>



## SOURCES (CONT.)

- Council of the Great City Schools, Reversing the Cycle of Deterioration in the Nation's Public School Buildings, 2014. Available at <https://www.cgcs.org/cms/lib/DC00001581/Centricity/Domain/87/FacilitiesReport2014.pdf>
- DLR Group, Inc., K-12 Public Schools Facility Condition Assessment, 2008. Available at <http://www.mtk12facilitysurveys2008.com/Montana%20Final%20Report%207-1-08.pdf>
- Leachman, M., Albares, N., Masterson, K. & Wallace M., Most States Have Cut School Funding, and Some Continue Cutting. 2016. Available at <https://www.cbpp.org/research/state-budget-and-tax/most-states-have-cut-school-funding-and-some-continue-cutting>
- McCracken, Pad, Montana K-12 Funding from 50,000', 2015. Available at <http://leg.mt.gov/content/Committees/Interim/2015-2016/School-Funding/Meetings/Sept-2015/Montana-school-funding-50,000'.pdf>
- Montana Office of Public Instruction, Facts About Montana Education 2016, 2016. Available at [http://gallatincomt.virtualtownhall.net/public\\_documents/gallatincomt\\_schfinance/EdFacts2016.pdf](http://gallatincomt.virtualtownhall.net/public_documents/gallatincomt_schfinance/EdFacts2016.pdf)
- Montana Office of Public Instruction, Facts About Montana Education 2017, 2017. Available at <http://opi.mt.gov/Portals/182/Page%20Files/Superintendent%27s%20Folder/Facts-about-Montana-Ed2017.pdf>
- Montana Office of Public Instruction, History of Federal Grants Distributed to School Districts and Special Education Cooperatives by OPI, 2016. Available at <http://leg.mt.gov/content/Committees/Interim/2015-2016/School-Funding/Meetings/Jan-2016/OPI%20Presentation%20Federal%20K-12%20Funding%2001%2011%202016.pdf>
- Montana Office of Public Instruction, Summary Enrollment Report, <https://gems.opi.mt.gov/StudentCharacteristics/Pages/SummaryEnrollmentReport.aspx>
- Montana Office of Public Instruction, Understanding Montana School Finance and School District Budgets, 2017. Available at [https://gfps.k12.mt.us/wp-content/uploads/2013/08/Understanding%20Montana%20School\\_Finance\\_FY16\\_KS%20Adjusted%2012-16.pdf](https://gfps.k12.mt.us/wp-content/uploads/2013/08/Understanding%20Montana%20School_Finance_FY16_KS%20Adjusted%2012-16.pdf)
- Montana Quality Education Coalition, School Funding History. Available at <http://www.mqec.org/school-funding-history/>
- National Council on School Facilities: Center for Green Schools at USGBC, Montana K-12 Public School Facilities, 2016. Available at [http://www.bestfacilities.org/best-home/docuploads/pub/302\\_MTFacilitiesProfile2016.pdf](http://www.bestfacilities.org/best-home/docuploads/pub/302_MTFacilitiesProfile2016.pdf)



## SOLID WASTE



# SOLID WASTE

## EXECUTIVE SUMMARY

There are 32 Municipal Solid Waste Landfills (MSWL) in Montana handling approximately 1.6 million tons of solid waste annually. The state's facilities have approximately 38 years of capacity remaining. Additionally, since most of the MSWLFs were either constructed or received significant upgrades over the last 25 years, the overall condition of the infrastructure at the landfills, including on-site roads, stormwater controls, and equipment buildings is relatively good. Should infrastructure improvements be required, customers are charged, typically through property taxes, monthly billing, or pay as you throw programs. One area of improvement is diversion rates; the state diverts 21.9% of the solid waste it generates, significantly below the national average of 34.3%. Another issue of concern is the condition and safety of rural transfer stations.

## BACKGROUND

The State of Montana generates approximately 1.6 million tons of solid waste annually which must be handled by the solid waste infrastructure. Approximately 1.3 million tons of this waste is landfilled annually with the remainder being diverted. The solid waste infrastructure in Montana consists of landfills, transfer facilities and recycling/waste diversion facilities. A variety of wastes are generated in the State including:

- Municipal solid waste,
- Construction and demolition wastes,
- Yard waste,
- Industrial wastes,
- Oil and gas wastes,
- Hazardous wastes, and
- Other special wastes like asbestos, agricultural, sludge, electronic waste (e-waste), etc

The large majority of wastes generated in Montana are placed in Municipal Solid Waste Landfills (MSWLF). Licensed MSWLFs in Montana can accept most wastes generated in Montana except hazardous waste. Strict Federal criteria called Subtitle D was adopted in 1993 regulating the proper design, operation, and closure of MSWLFs in the U.S. The Montana Department of Environmental Quality (DEQ) took primacy for the enforcement of the Subtitle D regulations in 1993. With adoption of the federal criteria in Montana, most small landfills were no longer financially feasible. As a result, the number of facilities accepting municipal solid waste in Montana decreased from over 300 in the 1980's to the 32 which operate today. In Montana MSWLFs are regulated under Class II Landfill licenses.

Modern MSWLFs are engineered facilities which are sited, designed, constructed, operated and monitored to comply with federal/state requirements and also protect the environment. All MSWLF facilities must comply with the following standards:

- Siting Restrictions (landfills cannot be constructed near faults, wetlands, floodplains or other geologically unsuitable areas)
- Liner Requirements (landfills need to be constructed with composite lining systems or alternative equivalent lining systems to protect groundwater from contamination).
- Leachate collection and removal systems (underdrain systems to remove landfill leachate from top of liner system)
- Operations requirements (daily compaction and cover of waste, stormwater control)
- Groundwater and gas monitoring (ensures that groundwater is not being contaminated nor dangerous landfill gas is leaving the facility)
- Closure and Post-Closure Care requirements
- Financial Assurance (insures adequate funding is available to pay for closure and post closure care)

Montana currently has 32 licensed Class II landfills spread across the State which accept between 1,500 and 350,000 tons/year. The majority of these facilities are operated by local government entities but there are also several private Class II facilities in the State. Other solid waste facilities licensed and regulated by the State include:

1. Class III Landfills (inert wastes);
2. Class IV Landfills (Construction and demolition waste);
3. Large Transfer stations;
4. Composting facilities;
5. Industrial waste landfills;
6. Landfarms; and
7. Recycling facilities.

There are also solid waste facilities which the State does not regulate such as roll-off container sites and small transfer stations.



## CAPACITY & FUTURE NEED

The primary asset of MSWLFs is air space. MSWLFs manage their air space by compacting waste within the landfill prior to covering it. Due to high costs associated with liners, leachate collection systems and other required environmental controls, the air space is very valuable. In addition, it is becoming more difficult to license new landfills. It can take between five and 10 years to license a new facility in the State, depending on the public acceptance of the new facility.

Montana has approximately 5 million tons of capacity licensed for waste disposal. At current disposal rates this is approximately 38 years of capacity remaining. Local governments need to monitor their capacity and plan long-term for expansion of their landfill licenses or new landfill sites so that capacity is maintained for the future.

## CONDITION

Since most of the MSWLFs were either constructed or received significant upgrades over the last 25 years, the overall condition of support infrastructure at the landfills is relatively good, including on-site roads, stormwater controls, equipment buildings, etc. The one component of the solid waste infrastructure which is in relatively poor condition is rural transfer stations and container roll-off sites. Many of these facilities were constructed over 40 years ago. In addition, the design of the facilities presents significant safety concerns for users and employees.

## PUBLIC SAFETY

MSWLFs are licensed, designed, constructed, and operated to protect public health and the environment. Improperly sited, designed or operated landfills can cause a wide range of environmental and safety concerns including groundwater pollution, landfill gas migration, litter, and stormwater run-off into surface waters.

Only a handful of Montana Class II landfills have significant environmental issues. In most cases, the facilities with environmental issues were open prior to the implementation of Subtitle D. These facilities usually have grandfathered unlined areas and sometimes questionable operational history which make them more susceptible to environmental pollution than new facilities which were originally sited, designed and operated in accordance with Subtitle D. Most of the 32 existing MSWLFs were designed and constructed in compliance with Subtitle D or were significantly upgraded since the implementation of Subtitle D.

The most common serious environmental issues with solid waste facilities are groundwater pollution and landfill gas. Existing facilities with environmental issues are taking corrective measures to remedy those issues. Another common but less serious environmental issue at these facilities is windblown litter. Litter control is primarily an operational issue rather than infrastructure related. The majority of the solid waste facilities in Montana are providing good environmental protection and are largely in compliance with State and Federal requirements.

Transfer stations and container sites in Montana remain one of the biggest safety issues for the public. In many cases access to these facilities is uncontrolled, meaning the public has unsupervised access 24 hours a day, seven days a week. There have been numerous accidents the last twenty years involving individuals falling off the top of container site walls into containers or onto concrete slabs. Some of these accidents have been very serious including death. The Montana Association of County Officials (MACO) whom insures most of the County facilities has asked their membership to make safety improvements at facilities including installation of fall barriers, warning signs, and parking bumpers. The most significant of these improvements is a 42-inch barrier at the top of any drop greater than 30-inches. This is required under the current building code for these facilities. However, the building code requirements are only enforceable for new construction. Existing facilities are not regulated by the building code requirements. MACO has also suggested that facilities be supervised and access be controlled with regular hours of operation.

Several operators in the State have voluntarily made safety improvements at their container sites and transfer stations. Many others continue to operate without the suggested safety improvements and accidents continue to occur. Safety improvements and upgrades are needed at over 100 container sites in the State. ASCE recommends that these facilities have regular hours and be staffed so the public use is supervised.

## RESILIENCE & INNOVATION

The national trend is to increase the percentage of solid waste being diverted rather than landfilled. This includes recycling, composting and other measures to divert wastes from the landfill. This increases the life of landfills and is the environmentally responsible approach. The viability of recycling programs in the U.S. and Montana have been challenged by the crash of recyclable commodity value due to actions taken by China in the acceptance of these materials. Recycling in Montana is even more challenging than other areas of the country because of limited economy of scale and distances to markets. However, Montana has steadily increased the amount of wastes diverted. Diversion of metal, green wastes and cardboard is common in Montana. Some facilities recycle paper, plastics, tin, e-waste, batteries, glass and other materials. A few of the larger operators have household hazardous waste collection facilities or dedicated days for the public to bring their hazardous waste into the facility for proper handling and disposal. According to the Montana Integrated Solid Waste Management Plan published by the Montana DEQ in 2013, the State is currently diverting 21.9% of the solid waste it generates. This is significantly below the national average and Montana needs to improve its diversion rate.

There are some innovative approaches being taken by some of solid waste operators in Montana. Examples include active gas collection and energy generation at Flathead County and active gas collection and processing for supply at the City of Billings Regional Landfill.

Although some facilities are progressive with their waste diversion and recycling programs, there are many others that have very limited programs in-place. This is clearly an area in which Montana needs to improve.

## FUNDING

There are a wide range of methods used to charge customers including property taxes, monthly billing, pay as you throw, etc. In addition, some entities do not provide curbside pickup and that is billed through another provider.

The Montana Department of Commerce has determined that 0.3% of the median household income (MHI) is a reasonable target rate for residents to pay for solid waste services. At or above this rate public entities in Montana are eligible for low interest loans for infrastructure projects. Each County and local government has its own published MHI. For the purpose of simplifying the analysis we used the State of Montana MHI of \$47,169 for 2015 as cited by the American Community Survey (ACS). Rates paid by users include disposal fees and curbside pick-up of waste. In some cases, the landfill and pick-up service may be operated by different entities. In some jurisdictions, curbside pickup is not available or the resident has the option of declining curbside pick-up and self-hauling their own waste. The annual cost for comprehensive waste services inclusive of curbside pick-up is between \$180 and \$350 per year. Therefore, the household cost for solid waste services in Montana varies from 0.4% to 0.8% of the statewide MHI.



## RECOMMENDATIONS TO RAISE THE GRADE

- Local governments and private organizations should continue to develop measures to increase waste diversion and recycling percentages in their communities. This will increase landfill life and improve environmental protection.
- Efforts need to be made to educate the public, businesses and institutions on ways to reduce, reuse and recycle their waste stream.
- Local governments need to improve access control and safety measures at container sites particularly those in rural areas. This should include regular hours of operation with staffing for oversight of the public using these facilities.
- The State should continue to encourage education of landfill operators and managers to improve operations practices in the State.
- The State should continue to enforce solid waste regulations and work with operators to ensure full compliance.
- Local governments need to continue to pursue additional landfill capacity, because landfills will continue to be the single largest component of solid waste management for at least the next 30 plus years in Montana.

## SOURCES

- Montana Department of Environmental Quality, Integrated Waste Management Plan, 2013. Available at <http://deq.mt.gov/Portals/112/Land/Recycle/Documents/pdf/IWMPFinal2013.pdf>
- U.S. Census Bureau, American Community Survey, 2011-2015. Available at <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>



## STORMWATER



ALONG I-95 IN PHILADELPHIA, PA. ©: AECOM

## STORMWATER

### EXECUTIVE SUMMARY

In the past five years, Montana has reached a stormwater ‘turning point,’ seeing its seven regulated cities collect and allocate millions of dollars toward infrastructure and staff investments to better manage their stormwater programs. For example, regulated cities have created over 15 dedicated positions tasked with developing and running stormwater utilities. As another example, the city of Bozeman is spending \$5 million in pipe replacement and replacing nine miles of its storm sewer system. However, Montana is trying to catch up after years of underinvestment, and increased funding, more water quality-based projects, and broader regulations that cover all pollution contributors is needed.



## BACKGROUND

Water resources are the backbone of Montana's multi-billion-dollar tourism and recreation industry, and a fundamental reason why many people call the state home. A growing threat to this invaluable resource is stormwater runoff, which is rainfall and snowmelt that flows over developed surfaces, such as yards, roadways, parking lots, and rooftops and does not soak into the ground. Stormwater picks up sediment, nutrients, floatables, and metals, before entering conveyance infrastructures, such as storm drains, pipes, and ditches, and eventually discharges into Montana's waterways. Stormwater runoff may result in property damage, public health threats, and environmental degradation if not proactively managed.

The Montana Department of Environmental Quality (MDEQ) regulates stormwater runoff from 14 permitted small Municipal Separate Storm Sewer Systems (MS4s), numerous industrial facilities, and hundreds of construction sites. The MDEQ does not regulate most agriculture-based pollutant sources nor communities with populations less than 10,000 people.

**IMAGE 1: EQUIPMENT COMPLETING STORMWATER INFRASTRUCTURE MAINTENANCE**

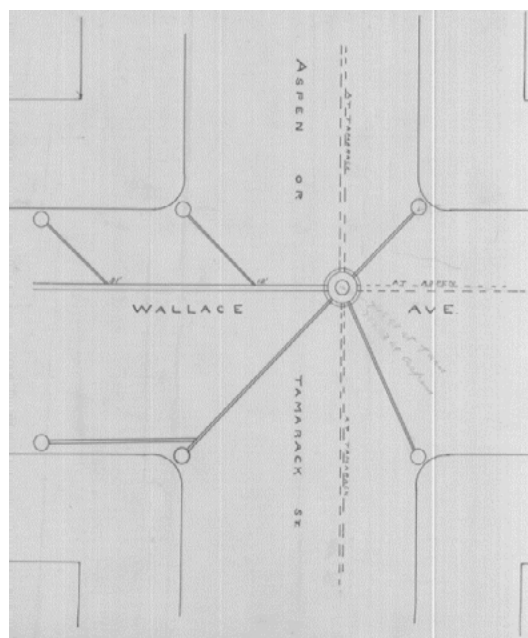


## CAPACITY AND CONDITION

State and local capacity regulations have been in place to address stormwater conveyance infrastructure for many years. Cities typically require drainage systems designed to provide a minimum of 10-year conveyance capacity during rain events. The existing capacity-based regulations and design criteria are consistent with national standards and are intended to offer an acceptable balance between capital cost and 'level of service'.

A comprehensive assessment of Montana's stormwater infrastructure condition is not available. Public Works personnel from communities greater than 4,000 per capita were surveyed to better understand the condition and functioning of some Montana's larger systems. The survey supports a general finding that the state's stormwater infrastructure is not posing a significant public safety or large-scale property damage risk; however, frequent small-scale nuisance flooding is systemic. A continued lack of maintenance and further degradation has the potential to increase the severity of frequent nuisance flooding to the point that property damage becomes more prevalent, especially in historic districts where cities have miles of degraded and undersized pipes comprised of antiquated materials, such as clay, brick, and treated wood.

**IMAGE 2: HAND-DRAWN STORMWATER INFRASTRUCTURE RECORD DRAWING.**



## FUNDING & FUTURE NEED

A growing trend across the country is for cities to charge ratepayers utility service fees to fund stormwater-related work. Common billing methods include the use of impervious area data, land use type, and parcel size, and often require sizable budgets, in some cases exceeding a million dollars annually. Standalone stormwater utilities generally range from \$5 to \$15 per month for typical residential properties and provide a stable funding source and allow for short and long-term planning.

Bozeman, Montana, a once sleepy cow town turned high-tech hub, offers a solid example. Storm sewer work was historically neglected; however, in the last three years, City leaders have taken a new approach, asking their ratepayers to play catch up and support the funding of over \$5 million of deferred pipe replacement. Bozeman generates \$1.2 million annually by charging single-family households a monthly stormwater service fee of \$5.91, with \$3.23 of the total paying for deferred pipe projects and \$2.68 paying for the operation and maintenance of the utility. The City charges commercial properties using an impact-based approach determined by an individual property's total impervious area. Charges for these customers can range from \$5.00 to \$500.00 per month. Today, work includes the replacement and upsizing of over nine miles of its crumbling downtown storm sewer built at the turn of the 20th century. Storm sewer repair deference is common across Montana, and its negative impacts will plague cities until more sustainable and proactive funding approaches are available.

**IMAGE 3: INSTALLATION OF A MECHANICAL SEPARATION STORMWATER TREATMENT SYSTEM.**



Few regulated and non-regulated Montana cities feel their current funding level is adequate and most Montana cities do not have dedicated stormwater funding sources. Instead, they rely on general tax funds, street assessments, and other utilities to pay for necessary work. This model has been historically insufficient due to competing priorities, funding barriers, and inability to plan, resulting in response-based efforts and growing deferred maintenance backlogs statewide. Further, no consistent state or federal funding exists to help offset local costs.

The most recent EPA Clean Water Need Survey, dating back to 2012, identifies \$18 million for stormwater capital costs, including the need to plan and implement structural and nonstructural measures to control runoff water. However, based on discussions with MS4 managers and budget estimates, \$18 million is substantially lower than actual system-wide needs to address deferred maintenance and MS4 permitting requirements.



## OPERATION AND MAINTENANCE

Regular maintenance is necessary to ensure stormwater infrastructure effectively carries water away from roads, homes, and businesses. Maintenance also benefits water quality by removing pollutants from the system that would otherwise contribute to waterway impairments.

Most cities have a general understanding of their storm sewer infrastructure; however, less than half know its physical condition or complete regular maintenance. This lack of attention is worrisome, especially as infrastructure continues to clog and deteriorate to the point of failure. Components of an effective maintenance program include a consistent budget, personnel, equipment, facilities, and overarching management strategies.

## PUBLIC SAFETY

Most cities in the state do not experience frequent detrimental stormwater flooding that threatens life, safety, and property; however, cities do recognize that growing footprints, development in unfavorable areas (high groundwater, floodplains, etc.) and degraded infrastructure are increasing risk. Further, the chance of transportation network failure is likely to increase as more sinkholes and cavities form beneath roadways due to scouring from broken and collapsed storm sewer pipes.

Water quality impacts also present public safety challenges due to the concentration and varied nature of pollutants released into waterways. Threats, such as spills, sanitary cross connections, pathogens, and floatables exist and can impact the well-being and quality of life for those using affected waterways.

From a water quality standpoint, the majority of Montana's assessed rivers and streams do not fully support aquatic life. Additionally, unregulated communities, counties, and industries, such as agricultural land and golf courses, largely treat stormwater runoff as an afterthought, offering little to no prevention of downstream impairments. Fortunately, Montana can still be proactive in protecting its waterbodies. Industry and urban sprawl have not yet rendered the streams and rivers unfishable or unswimmable, whereas in many parts of the nation impacted waterways are beyond the point of comprehensive repair and, in some cases, require billions of dollars to restore.

**IMAGE 4: FLOODING RESULTING FROM UNMAINTAINED STORMWATER INFRASTRUCTURE**



## RESILIENCE

To date, climate change across Montana has not shown to have a significant impact on total annual precipitation; however, climate change is increasing the intensity and frequency of rainfall events. Cities have not completed adequate planning to identify whether or not stormwater standards need to be updated to adapt.

Cities should consider design code changes and broader strategies when completing proactive planning. Some example practices include strategically selecting green space to function as redundant storage, or shifting design philosophies to broadly infiltrate runoff to minimize flooding, pollution pulses, and downstream erosion.

## INNOVATION

Montana's waters remain in a relatively natural, and often pristine condition as a result of its geographic location and the fact that it is a headwaters state. Montana cities, counties, and state agencies should look holistically at water issues and further understand the connection between stormwater and the health of its waterbodies. Montana has numerous impaired waterbodies; however, many of these issues are of a scale that state leaders can still mitigate or reverse if proactively addressed. The cost of pollution prevention compared to full-scale restoration is significantly less, as evident by the extensive amount of restoration work being completed on many of the nation's most degraded waterbodies (e.g. Chesapeake Bay, and Puget Sound Watersheds).

Some cities have retrofitted existing developed areas and implemented new growth standards that raise the bar of stormwater design. Standards in the areas that have done this successfully have shifted away from historic detention approaches, and pushed for more modern infiltration, filtration, and decentralized treatment strategies. A few examples include permeable pavers, bioretention, rain harvesting (where allowable), and inline treatment systems. Utilizing lessons learned from other states, planning on a watershed scale, and responsibly managing growth will help preserve Montana's pristine waterbodies as future threats arise, and maximize citizen investments.

**IMAGE 5: TROUT REPRESENTING THE CONNECTION BETWEEN WATER AND MONTANA'S ECONOMY**







## STORMWATER



# RECOMMENDATIONS TO RAISE THE GRADE

- Increased implementation of asset management strategies to optimize the allocation of limited resources. Cities should, at a minimum, consider the following questions: (1) What do I own, where is it located, and what condition is my infrastructure in? (2) How do I maintain and repair my infrastructure? (3) What assets are most critical? (4) What funding level will my community support/level of service? (5) How do I track progress to ensure I maintain an accountable and economical path forward?
- Identify mechanisms to generate alternative and consistent funding to alleviate financial burdens placed on cities, such as state and federal funding, stormwater user fees, a tax that allocates money towards stormwater initiatives, corporate or foundation sponsors, and reoccurring grant programs.
- Explore the broader use of infiltration and retention strategies to address more restrictive water quality standards and create resiliency towards climate change, including green infrastructure, regional systems, and public/private partnerships.
- Identify innovative solutions to aid in the mitigation of non-point source pollution. Pollution from agriculture and livestock grazing in riparian zones is a prevalent cause of impairment. A lack of regulations governing runoff currently leaves the industry unaccountable and places un-proportional burden on regulated entities. Opportunities such as credit trading, incentive structures, grant programs, conservation, and watershed-based coordination require exploration.
- Formalize a statewide stormwater organization that initiates and participates in local, regional, and national conversations and disseminates knowledge to stakeholders.
- Complete a statewide condition assessment of stormwater infrastructure that allows for a better understanding of current and future challenges.
- Develop new or expand current stormwater utilities, authorities, or districts that provide stable and adequate local or regional funding sources.
- Break infrastructure maintenance barriers for small communities by exploring resource sharing and equipment pooling, such as street sweepers and pipe condition assessment equipment.



## SOURCES

- Montana Department of Environmental Quality, Draft 2018 Water Quality Integrated Report. February 19, 2018.
- Montana Economic Development Report. 2015. [http://business.mt.gov/Portals/49/GOED\\_2015EcoDevReport\\_FNLScreen.pdf](http://business.mt.gov/Portals/49/GOED_2015EcoDevReport_FNLScreen.pdf)
- Stormwater Survey presented to Montana communities with 4,000 or more people during the spring of 2018.
- Whitlock C, Cross W, Maxwell B, Silverman N, Wade AA. 2017. 2017 Montana Climate Assessment. Bozeman and Missoula MT: Montana State University and University of Montana, Montana Institute on Ecosystems. 318 p. doi:10.15788/m2ww8w.
- UNISDR. (2015). Global Assessment Report on Disaster Risk Reduction - Economic Approach to Support Public Investment Planning and Financing Strategy for DRR2015. UNISDR.
- Center for Watershed Protection. <http://www.cwp.org> Environmental Protection Agency (EPA). <http://www.usepa.gov>
- Polluted Runoff: Nonpoint Source Pollution. <https://www.epa.gov/nps/nonpoint-source-agriculture> Environmental Protection Agency (EPA). <http://www.usepa.gov>



## WASTEWATER



# WASTEWATER

## EXECUTIVE SUMMARY

Municipalities and districts own and operate approximately 229 public wastewater systems in Montana serving approximately 62% of State's population of 1,050,000 people. The remainder of the population is served by private septic tanks and drain fields. Many of the largest municipalities in the state have recently completed major upgrades, and approximately 25% of the state's population is benefiting from these improvements. However, other plants need equipment upgrades and pipe replacement. Montana needs \$363 million in funding for identified wastewater infrastructure improvements, but the total annual investment is estimated to be between \$160 and \$170 million for both water and wastewater. An increase from the current funding levels is needed to replace/update failing and substandard piping and treatment plant components and to reach a satisfactory replacement rate.

## BACKGROUND

Approximately 62% of Montana's population is served by public wastewater systems owned and operated by municipalities and water and sewer districts, distributed per population groupings shown in the table. Other types of wastewater systems, mostly septic tanks and drain fields, serve the remaining 38% of Montana's population.

NO. OF SYSTEMS	POPULATION SERVED	% OF STATE POPULATION
12	>7500	39%
99	500 – 7500	20%
118	<500	3%
Unknown	Varies	38%

More specifically, the above wastewater systems consist of 229 public wastewater treatment and collection systems. They include 149 public lagoons systems, 41 public mechanical treatment plants, and 26 lagoon systems owned by tribal governments or other organizations. Lagoon systems are pond-like basins or bodies of water that are designed specifically to treat wastewater. Treatment can occur naturally, and lagoons should be lined with material that will prevent leaks into the groundwater below. These 26 lagoon systems are not regulated by the State.

## CONDITION AND CAPACITY

Montana has thousands of miles of collection system piping, some of it originally installed over 75 years ago. Some of this older pipeline has been replaced, but much of it remains. As a result, most Montana communities have very old pipelines (75 to 100 years).

Similar to the collection systems, treatment plants typically have adequate capacity but many of the individual equipment components are approaching the end of their 20-year service life. Some of the high growth areas and larger municipalities are currently or have upgraded their plants in the last five years; these include Missoula, Butte, Kalispell, Billings, and Great Falls, serving a combined population exceeding 25% of the State's population. However, many other plants have not been recently upgraded. Approximately 19 of these plants (46%) have not been upgraded in the last 10 years. Approximately 24% of these plants have not been updated in 20 years and equipment components are near the end of their service life. Because wastewater discharge permits have become increasingly more stringent, some plants need to address wastewater discharge permit compliance issues that may require plant enhancement. A review of the Environmental Protection Agency (EPA) Enforcement & Compliance History Online (ECHO) data reveals that over 25% of the current discharge permits for both plants and lagoons have compliance issues, ranging from monitoring violations to permit limit exceedances.

Similar to mechanical plants, most of the lagoons have adequate capacity, however many are fairly old. Approximately, 132 of the lagoon systems (89%) have not been upgraded in the last 10 years and 83 of the lagoons (56%) have not been upgraded in 20 years. A total of 44 lagoons (30%) have not been upgraded in 30 years. Several of the lagoon systems are in poor condition, including control valves, aeration systems, sludge accumulation, embankment structural concerns, and leaking or no liners. Many also do not consistently satisfy current Montana Pollution Discharge Elimination System (MPDES) permit limits.



## FUNDING

Montana's seven largest cities typically use revenue bonds, the SRF Loan program, impact fees, reserves, grants and user rates to finance infrastructure improvements. Information from the seven largest municipalities for 2014 showed sewer system capital outlay of \$28 million, whereas capital outlay for 2018 is projected to be \$37 million, a \$9 million or 32% increase.

The overall investment in water and wastewater for small to medium communities is estimated to be \$92 million (\$30 million to \$122 million) annually. The total annual investment by both large and small communities is estimated to be \$172 million annually. One level of comparison is the EPA's estimate of \$363 million in immediate needs for wastewater only, a deficit exceeding \$100 million.

## FUTURE NEED

The EPA reports that Montana will need \$363 million in the immediate future to bring wastewater systems up to EPA standards.

Montana infrastructure funding considers combined water and wastewater costs. The 2014 report card estimated a combined overall sewer and water infrastructure replacement cost to be in the range of \$12 billion to \$15 billion. The rate of annual reinvestment has only slightly increased from 2014 to \$172 million. Based on the above numbers, the current replacement rate is between 1.1% and 1.4% of the estimated replacement value of water and wastewater infrastructure. Accordingly, it will take 70 to 90 years to replace Montana's water and wastewater infrastructure at the current level of reinvestment. A reasonable goal is to replace pipe on a 50-year schedule and treatment equipment components on a 20-year schedule.

## OPERATION AND MAINTENANCE

The most common problems with older sewer collection systems include cracked or crushed pipe, leaking and offset joints, pipe sagging, root penetration, undersized pipe, lift station plugging, obsolete and failing lift station equipment, pipe and manhole wet weather infiltration and groundwater inflow. These deficiencies in pipe condition result in sewer backups in homes, excessive operation and maintenance costs, odor, expensive emergency repair, service disruptions, human exposure to raw sewage due to sewer manhole overflows, excessive flows and associated higher pumping and treatment costs.

Wastewater systems have increasingly become more complex as regulations have become more stringent, resulting in higher O&M costs; there is a need for highly skilled operators and a larger number of operators. It is commonly believed that the lack of operators is due to insufficient compensation. Other factors include the currently tight labor market and a general lack of interest in this field. In addition, the average age of existing operators in Montana continues to increase and the need to train new, younger operators is essential to the future of properly operated systems. Of the 1,675 certified operators (all classes of water and wastewater) in the state:

- 31% are 60 and older
- 49% are 55 and older
- The average age is 52

With the average operator age at 52 and nearly half of the operators older than 55, many operators will soon retire. This prompts the need to soon backfill these positions. This backfill could be accomplished with increasing salaries, promoting the profession, and promoting the attractive training opportunities already available.

Community surveys conducted in 2018 suggest that O&M funding is sufficient for larger communities and increasingly less adequate as the community size gets smaller, continuing a trend reported on in 2014.

## PUBLIC SAFETY

Approximately 70% of Montana wastewater systems have MPDES permits. EPA ECHO data indicates that over 25% of permit holders have had violations in the last three years. Violations result from a treatment facility's failure to comply with pollutant limits or monitoring requirements, both of which can result in poorly treated sewage and other pollutants leaking into surface water and groundwater.

## RESILIENCE

Resilience is a measure of how well wastewater infrastructure performs and continues to provide its intended service in the face of threats such as floods, earthquakes, severe wind, extreme cold, ice jams, fire, and sabotage. Collection systems are buried infrastructure and generally not as vulnerable to these effects as treatment and pumping facilities. However, collection systems could experience significant inflow during floods and break during an earthquake. Treatment and pumping facilities are vulnerable to all the above-mentioned threats.

In most cases, communities are aware of their vulnerabilities and have acted to mitigate threats. For example, communities have added sealed manhole lids and have developed backup pumping provisions for lift stations. Typically, new infrastructure designs include access during flooding events and generators for backup power.

New plant and retrofits are being designed with cybersecurity in mind, yet additional technical training is required. Security improvements are especially needed for small systems.

## INNOVATION

There have been many technological advances in both collection and treatment. For example, smart pumps reduce pump plugging frequency, improvements to cast-in-place pipe (CIPP) lining systems, and closed-circuit television (CCTV) innovations to improve pipeline assessments. There have been many advances in treatment processes and controls.

Innovation does not have to be limited to system operation, maintenance, and technology, it can also be considered with respect to management, specifically service area management. There are regions in the State where two or more wastewater systems are located adjacent to each other, each with its own treatment facility. Consolidating such systems would increase efficiency and reduce costs.



## RECOMMENDATIONS TO RAISE THE GRADE

- Increase funding for infrastructure upgrades and replacement. Said funding should address immediate needs as well as maintaining ongoing funding for continuous replacements. Funding should come from user rates, state funding, and federal funding.
- Increase public education and awareness of the public health and environmental value of wastewater collection and treatment to ease the way towards rate increases.
- Increase public education and awareness of the long-term cost of deferred maintenance to ease the way towards rate increases and increased financing.
- Promote additional state and federal funding of wastewater by providing better information to policy makers on the value of water and wastewater infrastructure investment.
- Increase grant funding for communities with demonstrated limitations in debt capacity.
- Private systems should seriously consider consolidating with neighboring systems (centralize) and form Districts to qualify for funding options when it is cost effective to do so.
- Plan for operator transition as older operators retire. Increase interest and salaries in water/wastewater operator occupations.
- Improve operator education and ongoing training opportunities to maintain a pool of well trained and highly skilled operators.
- Continue and expand programs that maximize the effective use of existing infrastructure through technical assistance and outreach.
- Increase security for wastewater facilities via security training.



## SOURCES

- Rate Study and Assessment, Montana DNRC, 2016. Available at: <http://dnrc.mt.gov/divisions/cardd/news/2016-statewide-water-and-wastewater-rate-study>
- Montana Department of Environmental Quality State Revolving Fund Wastewater System Database
- Survey of communities facilitated by Montana League of Cities and Towns
- EPA Clean Water Needs Survey, 2012. January 2016. Available at: <https://www.epa.gov/cwns>
- EPA, Enforcement and Compliance History (ECHO) Outline: <https://echo.epa.gov>
- Montana ASCE 2014 Infrastructure Report Card
- Montana DEQ, Operator Certification Program





## GET INVOLVED



### FIND

Use your zip code to find your Elected Officials.



### KNOW

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



### DISCUSS

Now that you know who your Elected Officials are, EMAIL THEM and let them know that you care about Montana's infrastructure



### BE SOCIAL

Use our hashtag #ASCEMTReportCard or tag us to show your support of Montana's Infrastructure



## ACKNOWLEDGEMENTS

### AUTHORS FOR CHAPTERS

Dams – Russ Reed, Michelle Lemieux  
Roads – Bryan Vanderloos  
Rail – Brad Koon  
Bridges – Phillip Forbes  
Drinking Water – Mike Kynett  
Wastewater – Craig Nowak  
Solid Waste – Bob Church  
Stormwater – Lance Lehigh  
Energy – Scott Wolverton  
Schools – Dustin Hover

### ADDITIONAL ACKNOWLEDGEMENTS

Release and Outreach Chair – Dan Karlin  
Report Card Chair – Shari Eslinger

### THE COMMITTEE ON AMERICA'S INFRASTRUCTURE

ASCE Staff – Anna Denecke





The Montana Society of Civil Engineers is a professional society dating back to 1884. We are the local branch of the American Society of Civil Engineers. Members are civil engineers working in many different capacities, including designers, contractors, facility managers, town and state engineers, and in many different disciplines, including structural, geotechnical, hydraulic, environmental, survey engineering. We all share a common passion for designing, building and maintaining the structures and systems that allow our society to function. At monthly meetings we discuss topics that cover the gamut of civil engineering. We host day-long seminars to allow members to learn new methods and industry trends. We support the student chapters at the civil engineering schools in the state.

[infrastructurereportcard.org/Montana](https://infrastructurereportcard.org/Montana)  
[reportcard@asce.org](mailto:reportcard@asce.org)