ASCE
MONTANA SECTION

2014 Report Card for MONTANA'S INFRASTRUCTURE

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INTRODUCTION

Montana's aging infrastructure is approaching a critical state of disrepair. In this 2014 Report Card for Montana's Infrastructure it earned a mediocre cumulative grade of C-. From neighborhood roads and community schools to safe drinking water, from dams that produce energy and prevent flooding to waterways that irrigate our fields, this infrastructure is used by all Montana residents and is essential to our economic future. All citizens of Montana have an interest in solving our infrastructure problems because regular maintenance and improvements today will keep them working longer and ultimately save taxpayers money. The 2014 Report Card for Montana's Infrastructure shows us better stewardship is needed by our leaders to ensure that public health, safety, economic mobility, and welfare are maintained in the Big Sky State.

Our infrastructure and economy are linked together. A great example of this is our transportation system, which moves Montana's commodities such as grains, minerals, and lumber from producer to consumer. The basic delivery of commodities is jeopardized when transportation networks are disabled and inefficient, resulting in a cascading effect of unmet demands, increasing consumer prices, reduced producer incomes, and a falling GDP. All of these impacts can come about by ignoring something we take for granted every day when we jump in the car, but addressing them is essential to our state's economy.

Over the course of 2014, the Montana Section of the American Society of Civil Engineers (ASCE) compiled a team of more than 30 civil engineers from the public, private and non-profit sectors with wide-ranging industry expertise to prepare a school-style report card for Montana's Infrastructure. Using a familiar A to F grading system, the Report Card takes stock of eight specific infrastructure types in Montana – Schools, Wastewater, Dams, Drinking Water, Irrigation Canals and Waterways, Transportation, Transit, and Solid Waste. Not a day goes by when we don't each rely on these systems to maintain our quality of life.

This Report Card was prepared specifically for Montana's citizens and policy-makers to make sure everyone knows how our infrastructure is maintained and what its condition is today.

We expect our infrastructure systems to work when we need them, and we hope this Report Card will help us make good decisions about maintaining and upgrading our infrastructure so Montana will remain a viable home for future generations.

While current infrastructure conditions are concerning, we can find solutions. As civil engineers, we are obligated to share our knowledge and provide critical information about Montana's infrastructure deficiencies in a way that everyone understands. We are committed to protecting the health, safety, and welfare of the public, and it is our hope that this Report Card will help build support to address the state's infrastructure needs.

Montana's economy, environment, health, and safety are at stake.

REPORT CARD SUMMARY

MONTANA'S GRADES

D-	Schools
D+	Wastewater
C-	Dams
C-	Drinking Water
C	Irrigation Canals & Waterways
C	Transportation
C+	Transit
B-	Solid Waste

Montana's GPA:

C-

RAISING THE GRADES

4 KEY SOLUTIONS

1. Have a Plan and Fund For the Future: All infrastructure owners and operators should create and fund capital replacement plans for both immediate and long-term needs.
2. Support Federal Programs That Are Good for Montana: Montana should support federal efforts that provide direct financial assistance to the state for safe and efficient infrastructure, like the Highway Trust Fund and National Dam Safety Program.
3. Keep Up Infrastructure Education Efforts: State agencies should continue and encourage participation in education and outreach programs provided to infrastructure owners and operators.
4. Innovate As We Replace: Montana should support and encourage innovative solutions to infrastructure funding and capacity-building, including design/build project delivery and measures to increase waste diversion and recycling.

SCHOOLS D-

Summary

Montana has over 2,000 school buildings that 144,129 students attend. 68% of these schools were built prior to 1970, 40% have fewer than 50 students, and others range from remote, one-room schoolhouses to larger community schools that are stretched to capacity. A 2008 assessment reported that $903M was needed to bring all Montana facilities to good condition. A bottom-to-top, statewide school facilities review revealed that 66% of schools showed signs of damage and wear, and had environmental issues such as HVAC, roof, and electrical problems. Recent energy conservation efforts have begun to curb some energy costs. However, available grant funding has not been enough to address incomplete exterior wall insulation and incomplete roof insulation, a deficiency in 43% and 48% of schools, respectively. Montana's children deserve safe, healthy schools in which they can focus their efforts on learning.

About Montana's Schools

In Montana, it is estimated that there are 2,195 buildings related to schools. 68% of all schools in Montana were built prior to 1970. The majority of these buildings were built between 1950 and 1969, but 45 were built prior to 1910. The generation for whom these schools were built is now retiring. 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" (Schools Assessment). This inventory was completed in 2008 by 42 trained architects and engineers. 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

While overall enrollment has dropped by approximately 20,000 students in past 20 years, an increase in Kindergarten enrollment has made evident that this trend has begun to reverse.

For the 2013-2014 school year, there were a total of 824 public schools in Montana with a total enrollment of 144,129 students in the state's 415 school districts. It is estimated that 92% of Montana's children attend public school. School size for the 824 public schools is as follows:

- 48 schools (6%) have more than 500 students and account for 30% of total public school enrollment
- 163 schools (20%) have 250-499 students and account for 41% of total public school enrollment
- 160 schools (19%) have 100-249 students and account for 18% of total public school enrollment
- 120 schools (15%) have 50-99 students and account for 6% of total public school enrollment
- 333 schools (40%) have fewer than 50 students and account for 5% of total public school enrollment

There are 439 elementary schools, 214 middle schools, and 171 high schools. No consistent trend has emerged relating number of students to capacity of school systems to hold them; these trends are very location specific. For example, Montana still has several remote, one-room schoolhouses serving very small populations. Each year there is debate regarding whether specific schools should remain open or close their doors due to local population trends. In contrast, larger communities frequently experience the opposite situation¬ where increases in the number of students exceed optimal comfortable capacity.

Condition

The Schools Assessment uses categories outlined in the Facility Condition Inventory (FCI) by the Montana State University's Office of Facilities Services. This system is also used across Montana to evaluate state owned buildings. To compare the costs of repairing all deficiencies up to building a replacement facility, the FCI designates existing facility conditions on deficiencies identified by field observation in seven categories:

- Safety – immediate threat to life safety or building integrity
- Damage/Wear Out – broken or vandalized items, or those worn out to the point of being inoperable or lacking integrity
- Codes and Standards – extent that facilities meet the codes in place at time of construction
- Environmental – indoor environment issues like building shell and conditioning
- Energy – measures taken to reduce energy consumption
- Aesthetics – subjective measure of items that perform, but appear to be aging
- Other – items that are not in compliance with current code, but were in compliance at time of construction; these items would need to be addressed in the case of future renovations

If the cost of repair is 10% of total facility cost, the facility is considered in good condition. If the cost of repair is from 10% to 20% of total facility cost, it is considered in fair condition. If the cost of repair is more than 20% of the replacement cost, the facility is considered to be in poor condition.

Of the assessment criteria listed above, the most serious deficiencies were seen in the Damage/Wear Out and Environmental categories. 66% of all schools had damaged or worn out items. Of these, 37% were finish-related; including ceilings, walls and floors. Electrical system damage and wear comprised 15% of deficiencies. The environmental category review showed the following top three deficiencies:

- HVAC System - 39% of facilities were deficient
- Roof System –28% deficiency
- Envelope System (roof, exterior walls, windows, etc). – 31% deficiency

If left uncorrected, a failure in these systems would negatively impact other systems. Further, 43% of all schools have incomplete exterior wall insulation, and 48% have incomplete roof insulation.

Funding & Future Need

According to an independent 2008 report Building Minds, Minding Buildings, $903M was needed to bring Montana facilities to good condition at that time. Over the last 10 years, funding sources for Montana's schools have been fairly consistent, by percent:

- State Funding ~43%
- Local Property Taxes ~25%
- Federal Funding ~13%
- Local Non-Levy (Montana oil and gas tax, summer school revenues, interest earnings, coal gross proceeds tax, etc) ~10%
- County Funding ~9%

From 2009-2012, there were also small sums from federal American Recovery and Reinvestment Act (ARRA) funding, coming to 1% to 2% of total funding range. Total funding, in dollars, has trended upward over this time frame as well, with growth in overall funding ranging from 1% to 5% per year. The 2014 total funding for Montana's public schools is $1.57 billion, with approximately 65% ($1.02 billion) comprising the general fund budget. The general fund budgets finance instructional, administrative, and facility maintenance, as well as other school district operational costs that are not financed by funds created for special purposes. Therefore, in 2013-2014, school districts averaged a general fund budget of approximately $7,000 per student.

University of Montana Steam Tunnel

Source: WGM Group, Inc.

Energy is one of schools most significant facility costs. In 2000, their combined energy bill was $18 million, and by 2007, their combined energy bill jumped to $27 million, a 46% increase. According to the U.S. Energy Information Administration, the average retail price for the commercial sector increased from 5.6 cents/kilowatt hour (kWh) to 8.1 cents/kWh in this time period; an increase of approximately 45%. Therefore, it appears that this increase is directly related to the increase in electricity cost. Given that energy costs historically trend upward and will likely continue to, to lower their energy bills schools must work to manage the many factors at play. The simplest and cheapest ways are behavioral measures (i.e., lower the thermostat, turn off lights and equipment when not in use, choose Energy Star rated products for new equipment, etc). More comprehensive efforts, such as roof and wall insulation and window improvements, are more costly and will require funding.

The School Assessment predated the Governor's 20x10 Energy Tracking program for State of Montana facilities and the related energy grants that have since expired. Schools that participated used the funding primarily on light bulbs and windows. Many of the schools supplemented the grants with loans from the Montana Board of Investments INTERCAP Program and financed the loans for 15 years. A number of the upgrades were completed by 2013, but it is still too early to determine the true impacts of the energy saving measures. However, it is important to note that most schools in Montana were not able to participate in these programs. Further, the energy grants were not large enough to address incomplete exterior wall insulation, a deficiency for 43% of all schools or incomplete roof insulation, a deficiency for forty-eight percent 48% of all schools.

SCHOOLS

Operation & Maintenance

Regular, systematic operation and maintenance (O&M), characterized as Long Term Planning in the FCI evaluation, was assessed as being very poor. Montana has no long-term plan to address aging school infrastructure. Bonding is the primary means for a school district to finance larger projects and must be voted on and approved by local citizens. However, the public is typically unaware of the cost associated with maintaining or upgrading school systems. Lack of public support in bond issues has led to circumstances where needed bonds may not be sought by localities due to prior failures.

Public Safety

The onsite FCI evaluations specifically reviewed safety issues. Safety issues identified were limited to immediate threats to life safety or building integrity. The site visits revealed relatively few safety issues, which were immediately reported to school officials. In all cases, repairs began immediately to eliminate these severe hazards. If they could not be eliminated, they were mitigated to the point that there was no longer an imminent hazard. Montana school staff continues to be responsive in addressing the worst safety concerns in their schools as they arise.

Other public safety issues, outside of urgent life-safety and structural integrity, do exist and unfortunately tend to be more persistent. Many of these issues relate to the age of the infrastructure and how building codes change over time. Montana's older schools were built before current accessibility standards and may prove a challenging environment for some students to navigate. Further, 68% of schools were built prior to 1970, when lead paint and asbestos were common building materials. These materials are being removed as schools become aware of their existence and when funding is available.

School Sidewalks, Florence, Montana

Source: WGM Group, Inc.

Resilience & Innovation

In Montana, schools are more than simply the buildings where students learn for eight to nine months of the year; they often also serve as the hub of a community. Schools are where future generations spend the majority of their day, where community meetings are held, and most significantly, they are often a gathering place in times of natural disaster. However, 93% of Montana schools have had no seismic inspection by a structural engineer within the last five years. Six of Montana's seven largest cities (Missoula, Kalispell, Butte, Helena, Bozeman and Great Falls) lie in elevated seismic zones. Given the average facility age, it is unlikely that seismic considerations were taken into account in the structural design.

Recommendations

Assessing schools was the first step in identifying needs. To build on that momentum, it is recommended that a capital plan be developed to determine how to improve schools by using a life-cycle analysis. The capital plan should develop a method for determining if renovation or replacement is necessary for each school. Programs, such as Quality Schools, have been helpful in preventing some schools from deteriorating, but these programs have not been large enough to affect the statewide system. A committee should be formed to review other state methods for funding school systems. Finally, a formal funding program similar to the state of Montana's Treasure State Endowment Program, which funds public water, wastewater, storm water, solid waste, and bridge infrastructure projects, should be reviewed to determine if a similar mechanism could assist with the need for schools.

The first step to solving a problem is recognizing it. The FCI that was developed by the Montana University System for facility condition assessment is based on a national facility audit model. It is now used by nearly all of the State agencies and was recognized for its value and impact by being award the Leadership in Education Facilities 2008 Effective and Innovative Practices Award by APPA, the industry association for education facilities officers.

Sources

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WASTEWATER D+

Summary

Montana has approximately 180 public wastewater treatment systems. Of those, 20% of the publicly owned wastewater treatment facilities have significant effluent violations and another 20% are under formal enforcement actions to correct system deficiencies to achieve compliance. Many of the collection systems date back to the early 1900s, and some of this original piping has never been replaced. It is not uncommon for the pipelines in originally established areas to have vitrified clay tile pipe that has cracked or failed. The majority of agencies report replacing little or no wastewater piping on an annual basis. Based on the current rate of replacement, it could take 70 to 90 years to replace Montana's water and wastewater infrastructure. Many communities have completed system additions since the 1950s, but over 60% reported a remaining capacity of less than five years. Current estimates to completely replace Montana's entire water and wastewater infrastructure are estimated to range between $12 billion and $15 billion.

About Montana's Wastewater

Montana has approximately 180 public wastewater treatment systems. These public systems, owned by both public and private entities, operate the state's sewer infrastructure. Public wastewater systems range in size from those that service as few as 50 people to those that service over 100,000 people. Public wastewater systems may be:

- an incorporated community
- a water and sewer district (an elected local board)
- a rural improvement district (political subdivision of a County)
- a sewer users association (non-profit corporation)
- privately owned

There are also a number of tribally owned systems within Montana. However, they do not fall under the jurisdiction of the Montana Department of Environmental Quality (MDEQ). These systems are recognized, but not considered, in the statistical review and statements herein. The size of MDEQ-regulated public sewer may be generally grouped into three categories:

1. Large communities consisting of the seven largest cities in Montana (Billings, Missoula, Great Falls, Bozeman, Butte, Helena, and Kalispell)

2. Medium sized communities consisting of medium sized Cities, Towns and Sewer Districts. This category includes approximately 60 communities with a population greater than 1,500 persons

3. Smaller communities including Towns, Sewer Districts, and Rural Improvement Districts. This group represents approximately 110 publicly owned sewer systems. There are also several privately owned sewer systems, but the exact number of these systems is not known.

Wastewater system infrastructure typically consists of:

- a pipe collection system
- sewer pump station(s)
- wastewater treatment
- disposal

Wastewater collections systems typically consist of gravity flow pipelines. Pump stations and associated discharge piping, as well as force mains, are installed if the pipeline would otherwise be too deep, often at the treatment facility. Montana has approximately 5,000 miles of collection system piping. Historically, most small communities utilize wastewater lagoons for treatment. Larger communities use mechanical treatment plants. Wastewater disposal is by evaporation, discharge to a surface water, or irrigation. Disposal is regulated via a discharge permit issued by MDEQ with EPA oversight.

Three Forks, Montana Pump Station

Source: Great West Engineering, Inc.

Capacity

Communities were surveyed about the capacity of their wastewater collection and treatment system. They were asked to estimate if the capacity of their system could accommodate 20 years of growth, 5 years of growth, zero growth, had insufficient capacity, or was failing. Half of the communities that responded reported their wastewater treatment systems had zero additional capacity or worse. Over 60% reported less than five years of remaining capacity. As might be expected, the more rapidly growing communities are experiencing more difficulty with capacity. Approximately 55% of the systems reported that the capacity of their collection system is zero or less.

Condition

Some of the older and more established communities in Montana have wastewater pipes that date back to the late 1800s. Many of the small to medium sized communities in Montana were platted in the early 1900s and much of the wastewater pipe has never been replaced. Many communities saw additions built in the 1950s, 1960s, and

1970s, and again in the last 10 to 15 years. Approximately 80% of the communities responding to the survey replace little or no wastewater piping on an annual basis. The exception to this is the larger communities, most of which have more developed annual replacement programs that budget for pipeline replacement every year. In many communities, wastewater pipes in the original Town or City Plat are 75 to 100 years old. Much of the pipe in the outer edges of the city or town limit will range from 30 to 60 years old. The structural service life of most wastewater pipe is approximately 75 years. However, this estimate does not consider the need to upgrade due to growth. It is not uncommon for the pipelines in the originally platted area to be vitrified clay tile pipe that have experienced some cracking and failure. In areas of high groundwater, this type of pipe may allow too much ground water to leak in, because each length of pipe is only three feet long (versus 10-20 feet for PVC pipe), allowing more leakage through the more numerous joints. This reduces the capacity of the pipe and increases the cost of treatment and wastewater pumping. While these older wastewater mains may still be providing an adequate level of service, they are very near the end of their useful service life. Those pipes allowing ground and surface water to leak and flow in are operating at a reduced level of service.

Communities were asked to assess the condition of their wastewater treatment and pipe collection systems relative to their current ability to protect public health/safety, comply with MDEQ requirements, and minimize service disruptions. Approximately 35% of respondents rated the condition of their treatment system as fair to failed condition. Eight percent reported a failed condition, such as not being in compliance with their State discharge permit. While many communities have come into compliance through recent upgrades, there are many others that are not yet compliant with current regulations. As regulations continue to increase the number of regulated contaminant, and as the treatment systems age, significant investment in wastewater treatment infrastructure will continue to be necessary. Approximately 20% of the publically owned wastewater treatment facilities have significant effluent violations and another 20% have received formal enforcement actions to correct system deficiencies.

While pipes may be performing adequately now, an emerging concern is that aging issues have been neglected to allow communities to address pollution control and State discharge permit issues with treatment facilities. Approximately 40% of the surveyed communities report the collection system to be in fair to poor condition.

Funding

To sustain the condition of wastewater treatment and collection systems to at least a fair to good level of performance, and accommodate future growth and regulatory pressure, the level of investment in pipeline infrastructure should be increased.

Wastewater infrastructure is financed 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 and special appropriations
- User and Service charges
- Reserve Funds
- Special Assessments (Special Improvement Districts, Tax Increment Financing Districts, etc.)

Montana's seven largest cities typically use revenue bonds, the SRF Loan program, impact fees, reserves, grants and user rates to finance infrastructure improvements. The level of infrastructure investment is best measured by a review of the Capital Improvement Plans (CIPs) for each community.

Sewer Lift Station, Fort Benton, Montana
Source: Great West Engineering, Inc.

Based on a review of the CIPs for the largest seven cities over a five year period, the estimated annual budgets for their water and wastewater infrastructure investment range between $65 million and $120 million, with an average annual investment of $80 million dollars. The smaller and medium sized communities rely more heavily on state and federal grants and loans. The total capital improvements budget for small to medium communities is well represented by a review of the Treasure State Endowment Program (TSEP), Renewable Resource Grant and Loan (RRGL), Community Development Block Grant (CDBG), State and Tribal Assistance Grant (STAG), USDA Rural Development (RD) and State Revolving Fund (SRF) Programs. Often times the grant and loan packages include the community share provided through reserves, special assessment, and other sources of funding. The loans are typically either RD or SRF loans and paid back through user rates.

The total capital investment through various state and federal funding programs is $115 million dollars. This estimate is based on information provided by each of the funding agencies. The total SRF funding in 2014 was $64 million. It is estimated that approximately half of the total SRF funds went to the largest communities, or approximately $30 million. Subtracting this subtotal from the $115 million total presented previously, suggests that the total annual reinvestment for medium to small communities is approximately $85 million. Combining the large community subtotal ($80 million) to the small to medium sized community sub-total ($85 million), the total reinvestment in water and wastewater infrastructure by all communities in Montana is estimated to be $165 million.

Communities were asked to rate if their budgets were sufficient for upgrades, maintenance, and regulatory requirements. Approximately 40% of the communities somewhat disagreed to strongly disagreed that their budgets were sufficient for these requirements. 40% of the respondents somewhat agreed. Only 20% agreed that their budgets are sufficient. Overall, this category received the lowest scores compared to the other categories.

Future Needs

MDEQ conducted an SRF Loan Program Needs Survey in 2008 which identified immediate wastewater infrastructure needs due to aging and failing systems of $587M.
This survey is based on identified problems with infrastructure that require attention in the short run and is not a

measure of long term needs related to aging, increased demand and regulatory changes, etc. This survey represents known problems, some of which are associated with enforcement actions or serious failures that require immediate action.

Based on an evaluation of Preliminary Engineering Reports and Master Plans for communities of varying sizes, the total cost to completely replace Montana's entire water and wastewater infrastructure is estimated to range between $12 billion and $15 billion. This analysis also showed that with the current replacement rate of 1.1% and 1.4% of the system, it would take 70 to 90 years to replace Montana's water and wastewater infrastructure. While not all of it must be replaced at once, the service life of treatment and pumping infrastructure is approximately 25 years and 75 years for water and sewer pipe. Based on the assumption that treatment and pumping consist of 40% of the infrastructure value, with the remainder being pipelines and other long service life components, the composite service life of Montana's water infrastructure is approximately 55 years.

City of Great Falls Wastewater Treatment Plant. Final Clarifier Basin No. 2, emptied for maintenance and examined to design duplicate for new clarifer equipment.

Source: Morrison-Maierle, Inc.

In the last 10 years or so, much of the replacement funding has gone towards water and wastewater treatment to address regulatory compliance issues. This is evident by the community survey conducted as part of this study where many small communities reported little reinvestment in pipelines. The larger communities typically have much better developed water distribution and wastewater collection replacement programs. However, even some of the largest communities expressed concern in their capital improvement plans over whether the level of pipeline reinvestment is sufficient.

Operation & Maintenance (O&M)

Communities were asked if their O&M capabilities and resources allowed them to perform preventative maintenance, comply with regulations and maintain a high level of service. Most communities rated their O&M capabilities as good to excellent. Per the MDEQ operator certification program, the number of certified operators has not significantly changed recently, but there is concern of retaining interest in the profession and losing operators. MDEQ has made recommendations for recruiting new operators.

Public Safety

Of the approximately 180 community public wastewater systems discussed, 20% of the publically owned wastewater treatment facilities have significant effluent violations; effluent is the treated wastewater that is discharged to the environment. Another 20% are under formal enforcement actions to correct system deficiencies. Based on the available funding discussed earlier, Montana communities do not have sufficient funds to satisfy immediate wastewater infrastructure needs, nor the ability to meet long term replacement needs.

Many wastewater lagoon systems were installed in the 1950s and 1960s. The Water Pollution Control Act of 1972 also resulted in a wave of wastewater treatment plant upgrades in the 1970s and 1980s. Wastewater treatment plants become obsolete not only by age, but also through increasingly more stringent regulation. In the last 20 years and especially in the last five to ten years, State discharge permit limits have expanded the pollutants regulated and decreased the pollutant effluent limits. The result is a need to upgrade existing mechanical wastewater treatment plants and in some cases convert from lagoons to mechanical wastewater treatment plants or non-discharging lagoon systems. Most of the communities (all sizes) surveyed reported experiencing two to six sanitary sewer overflows (SSOs) and/or backups every year. SSOs are events in which the sewer main does not have the capacity to pass high flows, or a sewer main plugs and the manhole overflows and spills wastewater overland. A few communities reported experiencing up to 10 to 20 SSOs and backups a year. Sewer backups into homes are also a result of insufficient capacity or sewer main plugs. SSOs and sewer backups are a public health risk and need to be eliminated.

Westby, Montana Wastewater Lagoon

Source: Great West Engineering, Inc.

Many respondents have upgraded their wastewater treatment system in the last 20 years, largely due to the need to meet the previously discussed regulatory changes. In some cases, these regulations, such as total nitrogen and total phosphorous, may not be able to be met with current technology. As technology improves, further treatment plant upgrades are likely to be required by MDEQ and EPA. While several systems have upgraded, there is still a large number of communities yet to come into compliance with the more stringent regulations. Wastewater systems will continue to require a significant reinvestment in treatment processes. Some areas of the state are seeing rapid growth that will also require wastewater collection and treatment upgrades. In addition, pending nutrient limits, and timing thereof, will affect treatment requirements and associated investments.

WASTEWATER

Resilience

Resilience to outside factors such as natural disasters is of only minor concern, due mainly to the nature of a wastewater system. Because most of a wastewater collection system is buried (collection system), it is essentially not subject to damage due to above ground events. Although much of Montana is located in classified seismically active zones, this has historically not been of concern. Both summer storms and winter blizzards have interrupted electrical service for mechanical treatment plants and pumping systems, but these are typically short-term situations. Also, many systems have backup generators to maintain electrical service and new or updated facilities are required to include a backup generator or secondary electrical feed.

Innovation

Most Montana systems are keeping up-to-date with the latest technologies. Innovation applies more to mechanical treatment plants as opposed to lagoon systems. Advanced wastewater treatment processes are becoming more common with larger systems. Upgraded or new mechanical systems include current treatment processes, and in some cases they are more advanced. Examples, include membrane bioreactors and fixed film nitrification processes. With regard to the disinfection process, in both lagoons and mechanical treatment systems, ultraviolet (UV) light systems are becoming more common. UV systems are being including in new and upgraded systems as well as being added to treatment facilities not otherwise undergoing upgrades.

Sources

ASCE Water Infrastructure Community Survey; 209 surveys mailed to public water systems of various sizes, mostly with a service population greater than 200. There were a total of 44 responses, representing a survey response rate of twenty-one percent.

Recommendations

Montana's wastewater treatment and collection systems are in fair to slightly poor condition, have limited capacity, and do not have sufficient budgets. A higher level of reinvestment in wastewater infrastructure is necessary to sustain reliability and improve the level of service. Wastewater infrastructure can be improved by the communities and agencies that oversee and use it by creating and properly funding capital replacement plans.

DAMS C-

Summary

Montana's 3,316 dams hold approximately 34.5 million acre-feet of water – roughly the amount of water it would take to cover the states of Maine, New Hampshire, and Vermont in water one foot deep. Yet Montana averages only 35% of the average dam safety state budget per dam. The majority of Montana's dams were constructed between 1930 and 1970, and many have reached the end of their design life. The overall condition of Montana's dams is difficult to track because 75% do not have periodic engineering inspections and are not required to have operation permits. Overall, dams designated high hazard are in significantly better condition than dams designated low hazard, as they are inspected and routinely maintained. Montana's Dam Safety Program is allocating the limited resources available to the dams that would have the greatest impact on public safety, but as all dams continue to age, the unknown risk and need for maintenance and rehabilitation will continue to increase. Currently, the funding available for dam maintenance and rehabilitation is not adequate to continue to ensure dam safety.

About Montana's Dams

Water is and has always been the blood that feeds economic development in the state. Throughout history, people have realized the importance of this commodity and have devised many ways of extending this resource to its greatest possible benefit. To tame this unpredictable resource, Montanans undertook the monumental task of constructing the current system of over 3,000 dams. As Montana's economy has evolved and the population has increased, the role dams play in Montana's future has expanded and become more complex. Today, the people of Montana enjoy the many vital benefits attributed to dams including:

- agricultural irrigation
- industrial applications
- municipal water supplies
- power generation
- tourism
- commercial endeavors
- aquatic habitat enhancement
- recreation
- flood risk reduction

With all of the beneficial uses of the dams comes a significant risk to public safety related to lack of both regulation and operating permits. According to the National Inventory of Dams (NID), administered by the Army Corp of Engineers, there are 3,316 dams in the State of Montana. This number would be significantly higher if small dams

located on private lands were included. Dams in the State of Montana are owned and operated by entities including private owners, water user associations, state government, federal government, and various tribal governments. According to the NID, of the 3,316 dams listed:

- 2,489 are privately owned
- 576 are federally owned
- 154 are state owned
- 74 are owned by local governments
- 22 are owned by public utilities

Nevada Creek Reservoir Spillway, Blackfoot River Basin, near Lincoln, Montana
Source: Montana DNRC

The diversity of the ownership and operation of the dams makes regulation of these facilities, in the interest of public safety, a difficult task. As required for public safety, the Montana Department of Natural Resources and Conservation's (DNRC) Dam Safety Program regulates all dams within the State of Montana. Due to the diversity of the ownership, many different agencies require various types of operating permits for individual dams. Hydroelectric dams are permitted by the Federal Energy Regulatory Commission (FERC); dams located in national forests are permitted by the U.S. Forest Service (USFS); and dams classified as high hazard that are located on private land, or lands administered by the State of Montana, are permitted by the DNRC. The majority of small dams, holding less than 50 acre-feet of water, and those classified as low hazard, are not required to have an operating permit. Dams that are not required to have an operating permit are significantly less likely to have an engineering inspection performed and therefore are only reviewed by a regulatory agency if there is a dam safety complaint.

Capacity

Montana is a relatively dry state with highly variable climatic conditions. Hence, without the ability to store water for use throughout the year, many of Montana's most important industries could not function. According to the NID, Montana's 3,316 dams have the ability to hold 34.5 million acre-feet (11 trillion gallons) of water; roughly the amount 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 US Census Bureau, Montana's population increased from approximately 799,000 in 1990 to approximately 1,015,000 in 2013. During a similar time period, the USDA reported that the value of agricultural products produced went from approximately $1.5 billion in 1992 to $4.2 billion in 2012. In this same time span the overall number of acres irrigated in Montana remained approximately 2 million acres.

In addition to increased use, Montana's reservoirs are shrinking. Montana streams transport a tremendous

amount of sediment from the mountains to the plains. When dams impound water, they also retain some of the associated sediments. Over time, sediment build up significantly reduces the reservoir storage capacity. Ruby Reservoir in Madison County, Montana provides an example of a reservoir that has lost noticeable capacity due to sedmimentation during the last 70 years of dam operation. A subsequent spillway replacement design incorporated features that will accommodate a potential future dam raise to re-capture the lost depth. At present, there is insufficient funding for the raise.

There is presently very little construction of new impoundment facilities. Most construction associated with Montana dams is focused on the rehabilitation of existing structures. Montana has a significant amount of water stored in its reservoir system, but the storage capacity of the system is decreasing and the demand for the water will continue to increase. The people of Montana will have to find new and better ways to conserve and utilize water.

Condition

Diversity of ownership, permitting requirements, and lack of data for low and significant hazard dams make it difficult to determine the overall condition of Montana's dam system. Because many dams do not meet the size or hazard requirements that mandate operation permits be obtained from state or federal dam safety programs, there is very little information related to the majority of dams in Montana. Fortunately, the designation of low and significant hazard dams as such is partially due to the low or limited potential for loss or impacts to public safety. In Montana, a state with very low population density, the potential for downstream impacts in the case of failure is very low. Therefore, while there is a lack of data for the majority of Montana's dams, these dams do not pose a public safety risk in case of failure. It is best to divide Montana dams into two distinct groups: those that are required or chosen to have regular engineering inspections, and dams that are not inspected.

Flower Creek Dam, Originally Constructed in 1945, Libby, Montana
Source: Montana DNRC

Dams that have a regular engineering inspections include those classified as high hazard by the DNRC, classified as high or significant hazard by the USFS or Bureau of Land Management (BLM), regulated by FERC, operated by the Bureau of Reclamation or other federal agencies, and others that are required to have an engineering inspection performed as part of their operating permit. These dams account for approximately 10% of the total number of dams in the state and represent the majority of the moderate to large sized dams in Montana. According to the NID database, of the 215 dams designated high hazard, 83 have a condition assessment of satisfactory, 13 have a condition assessment of fair, 22 have a condition assessment of poor, 4 have a condition assessment of

unsatisfactory, and 93 do not have a condition assessment or are considered not rated. Engineering inspections and their associated analysis provide a vital role in not only determining if the dam can safely function, but also the potential risk to the public safety. These inspections evaluate the conditions of various portions of the dam to gather a significant amount of data with which overall condition assessments can be performed. As Montana's population increases and more areas are developed, the potential risk related to a dam may increase. This "hazard creep" can change dam classification from low hazard to high hazard and subsequently change the permitting and operation requirements. Engineering inspections are also used to determine and plan for future maintenance. When a dam owner can identify the need and scale of future maintenance they can begin economic and feasibility planning years in advance of repairs.

Recent failure of Choteau County, Montana dam due to deterioration of corrugated metal pipe. Inspections are not required for this low hazard dam.
Source: Montana DNRC

Dams that receive periodic engineering inspections are much more likely to have had some significant maintenance and rehabilitation performed during the life of the structure. In general, these dams are in significantly better condition because of periodic maintenance and rehabilitation than their unpermitted counterparts. For example, outlet conduits in dams built between 1930 and 1960 were commonly constructed out of corrugated metal pipe (CMP). Over time, CMP deteriorates and can cause dam failure. Owners of uninspected dams are often not aware of the serious nature of CMP deterioration until it is too late. During an inspection, the engineer will evaluate the condition of the CMP and make recommendations for relining or replacement if necessary. Few CMP outlets remain in inspected dams. For these dams, the condition of the outlet is being carefully monitored and plans for replacement are underway.

Newly constructed concrete outlet works for Teton County, Montana dam. The need for outlet replacement was identified during the engineer's inspection.
Source: Montana DNRC

The majority of dams that have engineering inspections performed also have Operation and Maintenance Manuals (O&M Manuals) and Emergency Action Plans (EAPs) in place.

- O&M Manuals outline monitoring and inspection requirements, how to safely operate the dam, and other pertinent operation information.
- The EAP outlines who to contact and the protocols to follow in the event of a dam emergency.

Both of these documents are invaluable for the safe operation of the dam during both normal and emergency operating conditions. The DNRC requires that the EAP be updated annually for each dam that receives an operation permit through the Dam Safety Program. According to the NID, all 88 of the high hazard dams permitted by the DNRC have an EAP. Overall, out of the 3,316 dams in the NID database, only 158 are listed as having an EAP.

Painted Rocks Dam, Bitterroot River Basin, near Darby, Montana
Source: Montana DNRC

Dams that have a periodic engineering inspection performed are typically in adequate condition with minimal maintenance needed. Contributing factors to this determination are the age of the majority of the dams, the need for future maintenance or rehabilitation, the amount of rehabilitation that has been completed, and the frequency with which engineering inspections are performed.

Dams that are not required or subject to regular engineering inspections are typically privately owned facilities that do not meet the high or significant hazard classification criteria as defined by the State of Montana or various regulatory federal agencies. This group of approximately 2,489 dams represents the largest subsect of dams in the state. Many of these structures have not seen significant improvement or rehabilitation since their initial construction. Also, many of these structures were constructed to lower standards than dams requiring engineering inspections because in most cases, they store a lesser volume of water. There is very limited data related to this group of dams. Without operation permit requirements, no data related to the condition of the dam is collected by regulatory agencies. In addition to the lack of data, most of these dams lack O&M Manuals and EAPs. Without the preparedness planning the EAP provides, the effectiveness of response to an emergency situation is greatly diminished.

Due to the lack of data, the condition assessment of this group of dams is based on the construction techniques and materials that were likely used during construction and the overall age of the dams. In general, these dams are constructed of compacted soil or rock with soil, with corrugated metal pipe (CMP) conduits. According to the NID information, the majority of the dams in the state were constructed between 1930 and 1970. This means many of the dams with CMP conduits are at or beyond their design life. Failure and subsequent piping issues associated with CMP conduits are one of the leading causes of dam failures nationwide.

DAMS

Dams that do not have a periodic engineering inspections performed are typically in need of repairs ranging from minor to serious. Contributing factors to this determination are the age of the majority of the dams, the need for future maintenance or rehabilitation, the number of dams that have CMP conduits, lack of engineering inspections, and lack of an O&M Manual and EAP.

Funding

The necessary funding for Montana dams has three parts. The first part is the quality of the dam. As the dams get older, the amount of repair and rehabilitation work that is required increases. In an ideal situation, there would be unlimited funding available to repair dams immediately and to upgrade them to the highest safety standards.

The second part is the funding available for the dam maintenance. If adequate funding is available for the dams, then repairs and/or upgrades to the facilities can be accomplished quickly and will be done to meet or exceed current dam safety and engineering standards. Dam safety is increased when the dams are repaired and/or reconstructed using the best available engineering standards.

The third portion is related to dam safety. The Montana Dam Safety Act states; "The legislature finds that dams provide a variety of benefits to the state of Montana." It also states; "The legislature understands the inherent risks to public safety associated with dam construction and operation but finds that compliance with the Montana Dam Safety Act reduces those risks to an acceptable level." As Montana's dam infrastructure ages, the importance of providing funding to rehabilitate structures so they are in compliance with the Montana Dam Safety Act becomes critically important.

Each of the three components that require funding to ensure the overall quality of dams is directly related to one another. If one of the components is declining, the other two will follow. Montana is currently faced with a decline in the quality of dam infrastructure. Many of the dams are at or beyond their original design life. As they continue to degrade, the safety of these dams begins to degrade and the funding needed to repair the dams increases.

The amount of funding available to dams is dependent on their ownership. Dams owned and operated by local, state and federal agencies have access to a variety of funding options including grant and loans, as well as budgetary or legislative funding from the State or Federal Government. The majority of dams in the state are privately owned and typically only have access to funding through various loan programs. In most cases, no single funding source can cover the overall cost of a dam rehabilitation project.

Rehabilitation of a dam so it meets current engineering and dam safety criteria can be very costly. The following examples are projects undertaken by the DNRC to rehabilitate three dams.

Project	Years	Project Included	Approx. Cost
Ackley Lake Dam	2007 to 2009	New Outlet and Slip Line Conduit	$1.61 Million
Nevada Creek	2000 to 2004	Toe Berm, Spillway, Outlet, Internal Drains	$2.86 Million
Ruby Dam	2005 to 2015	Spillway, Outlet, Tower	$17.1 Million

Source: Montana DNRC

In all three examples, no one funding source covered the complete cost of the project. In most cases funding was composed of grants, DNRC State Projects Hydropower funds, and loans taken out by the applicable Water Users Associations. Because of the rehabilitation efforts, the overall dam safety is increased and the amount of money needed for monitoring and maintenance is significantly decreased.

There are a significant number of dams in Montana that are in need of similar rehabilitation efforts. Because these dams do not have adequate funding to perform the necessary major repairs, more time and money is spent monitoring and performing minor repairs that do not adequately address the overall safety of the dam.

The State's financial contribution to Dam Safety regulation and inspection was estimated to be approximately $640,000 in fiscal year 2014. According to the ASDSO (Association of State Dam Safety Officials) Performance Report for the State of Montana, the Montana Dam Safety Program's budget per regulated dam is 35% of the national average. The report indicates the number of state regulated dams per FTE (full time employee) for Montana is approximately 400, which is well above the national average. The report also includes one very telling statistic—in Montana, the budget per regulated high hazard dam is 150% of the national average. This illustrates that Montana's Dam Safety Program is allocating the limited resources available to the dams that would have the greatest impact on public safety.

One of the primary ways the State Dam Safety Program gets dam owners to focus on proper dam maintenance and operation is through education and outreach. State funding provided to Montana under the National Dam Safety Act has been used to pay for this education and outreach. As such, programs sustained by this important source of aid have made significant improvements in the overall awareness of the dam owners and condition of dams in Montana.

Painted Rocks Dam, near Darby, Montana
Source: Montana DNRC

Operation and Maintenance

In most cases, Montana dams were designed and built to serve a primary purpose. Over time, many secondary uses of the dams and reservoirs have developed. As the number and importance of these secondary uses develop, balancing operation of dams for multiple uses becomes more difficult. For example, most of Montana's dams are used for irrigation. As the population increases, the reservoirs become increasingly important for recreation. Dam owners need to be cautious about drawing the reservoirs down too low in the fall to limit negative impacts on fishing, boating and other recreational uses.

Operation and maintenance of any dam is the responsibility of the owner. Like the condition, the operation and maintenance of Montana dams can be broken into two distinct categories: those that are required or choose to have an engineering inspection on a regular basis and those that do not. If a dam has a periodic engineering inspection, the likelihood that maintenance items are identified and repairs performed is significantly higher. In addition, these dams likely have O&M Manuals that identify guidelines for safe operation. Approximately 50% of the high hazard dams are owned and operated by local, state, and federal agencies. These dams have access to various grant and loan programs to help offset the cost of maintenance and rehabilitation projects.

Dams that do not have periodic engineering inspections are significantly less likely to have O&M Manuals in place. They are also less likely to identify maintenance issues before they become dam safety problems. Many of these dams are owned by a single individual, a ranch, or some other small cooperative. In most cases, these single owners or small groups of owners may not have sufficient funding to maintain or rehabilitate their dams. Without the necessary identification, planning, and funding, the condition of these dams will continue to deteriorate.

Future Needs

The majority of dams in Montana were constructed between 1930 and 1970. Many of these dams were designed, constructed, or funded by state or federal agencies with the understanding that the structure would be maintained and repaired by the owner. The future needs of Montana's dams can be broken into two critical areas: funding for rehabilitation of the structures, and dam owner education. Currently, there are a variety of funding mechanisms available to assist with the rehabilitation of dams, but most of these are only available to structures owned and operated by a governmental entity. Most of these funding alternatives do not cover the increasingly high costs of dam rehabilitation and owners are tasked with finding additional funding. There are various loan programs available to private dam owners, but as with any loan, the owner is tasked with paying back the loan for costly rehabilitation. There are often loans available to private dam owners for rehabilitation, which most owners do not realize exist. Awareness of this opportunity is spread through dam owner education.

Dam owner education is critical to the future of Montana dams. The DNRC has implemented outreach programs to try and educate both public and private dam owners on issues such as dam safety, downstream hazards, owner liability, and funding mechanisms. The more education that can be provided to dam owners, the higher the chances that dam safety issues will be identified before they become public safety problems. In addition, a well-educated dam owner can begin financial planning for dam rehabilitation work that may need to be performed in the future.

Public Safety

Dams represent a significant risk to the public and public safety is the primary concern for all of those involved in dam inspection. The impact a dam may have on public safety is recognized in various dam classification systems. Classification of high hazard, significant hazard, and low hazard potential are directly related to the potential impacts to life and property. Classifications are independent of the physical condition of the dam and depend only on the potential consequences of a sudden failure. High hazard dams have the potential for loss of life in the event of a sudden failure; in contrast, other dam types have little to no potential for loss of life downstream. High hazard designations drive the requirement for periodic engineering inspections, annual owner inspections, and the preparation of O&M and EAP documents. Because of these requirements, more maintenance and rehabilitation has been performed on dams designated as high hazard. Dam Safety Program efforts are concentrated on high

hazard dams because they represent the greatest risk to life and property. The DNRC Dam Safety Program also provides outreach to significant and low hazard dam owners. The outreach programs stress the significance of dam maintenance, knowing the downstream hazards, and the liability involved with being a dam owner.

As the population of Montana increases, the amount of development downstream of dams also increases. Dam classification should be reviewed periodically so potential hazards can be identified and the appropriate amount of consideration be given to public safety. Overall, experience with all dam types by DNRC Dam Safety Program staff shows that dams designated high hazard are in significantly better condition than dams designated low hazard because they have periodic engineering inspections. High hazard dams represent the majority of dam related risk to life and property throughout the state. As noted above, dams not required to get an inspection are more likely to fail. However, due to the lack of downstream development there is limited impact to public safety. For example, there were only minor impacts from the dam failure floodwave of the Choteau county dam discussed above because the only downstream hazard was a remote gravel road.

Resilience

The majority of dams were designed for a primary purpose and cannot be easily modified to serve a multitude of competing purposes. As Montana's economy and population grow, the number of demands on the current dam infrastructure grows.

Tongue River Reservoir, a Popular Recreation Area, Near Decker, Montana
Source: Montana DNRC

DAMS

If a natural disaster was to significantly damage or destroy a dam or series of dams, the cost and time required for the repair or reconstruction of a dam or dams would be significant. There is very little funding available for the repair or reconstruction of a damaged facility for the majority of dams in Montana. In the case of privately owned dams, the owner would have to decide whether it would be economically feasible to perform repairs or construction. If a high hazard dam were to fail and a loss of life occurred, it would likely be very difficult to obtain approval from various agencies to reconstruct the dam. If a dam were to fail it is unlikely the structure would be rebuilt. In addition, there are dams that are being removed because of lack of maintenance and related safety issues. Overall, the number of dams and the amount of water stored is decreasing as the demand for the water increases.

Innovation

As the gap between the cost of dam rehabilitation and the funding for dam rehabilitation continues to widen, the engineering community has implemented a variety of innovative dam rehabilitation solutions. When dams are reconstructed, they are designed and built using the newest design techniques, including graded internal drains, increased capacity spillways, and increasingly efficient gates. Many existing dams are rehabilitated using techniques such as slip lining of the outlet to extend the life of the existing structure, reconstructing spillways to increase capacity, and the addition of toe berms to increase internal drainage and dam stability. Innovation related to the way dams are constructed and rehabilitated increases the overall life spans of the structures, reduces risk to public safety, and increases the ways water can be used and controlled.

Innovative technologies are also being implemented in relation to how Montana dams are monitored and their records are kept. The DNRC Dam Safety Program is currently digitizing all dam safety files. All of these files are placed in file tracking data bases to ensure that information related to a dam can be found quickly and efficiently. In addition to digitizing this information, there is a program underway to perform an assessment on each of the DNRC-permitted dams in the state. The dam assessment will be used to identify and track potential problem areas with each of the dams, allowing limited dam safety resources to be targeted on areas where they can make the most difference.

State Authorities	State Compliance			2014 National Average
	1989	1998	2014	
Legislation (5)	95%	94%	94%	86%
Inspection (4)	54%	75%	90%	76%
Enforcement (4)	70%	89%	100%	92%
EAP & Response (4)	80%	92%	78%	74%
Permitting (3)	79%	98%	90%	75%
Education & Training (3)		43%	100%	74%
Public Relations (1)		67%	67%	30%
Weighted Percentage	76%	83%	91%	78%

Montana ranks above national average on important factors such as Emergency Action Planning and Education & Training.

Source: 2013 ASDSO Performance Report for the State of Montana

Recommendations

As Montana's dams continue to age, the need for maintenance and rehabilitation will continue to increase. There are several things Montana can do to plan for the future.

First, Montana can continue dam owner outreach programs. Knowledge is one of the most important assets the Dam Safety program can provide to dam owners and to the general public. In addition, Montana should continue to support the National Dam Safety Program, which provides financial assistance to the states for strengthening their dam safety programs (www.fema.gov/grant-assistance-states). Montana uses National Dam Safety Program funds for owner outreach and emergency action awareness.

Finally, Montana can create funding mechanisms for private dams that provide public benefits. Currently, there are very few programs to help private dam owners pay for engineering inspections, dam maintenance, or dam rehabilitations. Funding programs that bring public and private groups together to develop innovative ideas on how to maximize available resources benefit not only private dam owners, but the state of Montana as a whole.

Innovative ideas are necessary to finding effective means to educate dam owners. Innovative alternatives are needed to bridge the communication gap between private dam owners and the public. Our limited resources can have a greater impact on overall dam safety in the state if everyone is educated on the needs of our dams and working towards the common goal of dam safety.

This is why the Montana Dam Safety Program has placed a priority on educating dam owners. Over the past five years they have hosted numerous dam owner workshops around the state that focus on dam inspections, maintenance and responsible ownership. The Dam Safety Program has also assisted with the development of a statewide dam owners association (Montana Association of Dam and Canal Systems, www.madcs.org). A recent focus has been put on providing education and training to the state's practicing engineers through a series of technical newsletters, design aids, training workshops and engineering guidance documents.

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.

U.S. Federal Emergency Management Agency.

DRINKING WATER C-

Summary

Montana has over 5,300 miles of water distribution and transmission piping, a longer stretch than driving roundtrip from Billings to Miami. Montana has approximately 700 public water systems consisting of those in the seven largest cities, about 60 serving communities larger than 1500 people, and the remaining 630 being cities, towns, districts, associations, and private systems. Some systems have piping dating back to the late 1800s and early 1900s, with many systems including pipe that is 75 to 100 years old. Most systems, without regard for size, experience major leaks on an annual basis that waste valuable water. Over 50% reported that the capacity of their distribution system is five years or less. In 2011, the Montana Department of Environmental Quality identified an immediate water system financial need of $885 million. Of the 700 public water systems, more than 1 in 5 are currently not compliant with monitoring requirements and other regulatory requirements.

About Montana's Water

Montana has approximately 700 public water systems; approximately 600 are groundwater supplies that are found below the earth's surface, and 100 are surface water supplies like creeks, lakes and streams. These public systems provide and clean the State's water infrastructure and are owned by both public and private entities. Public water systems range in size — from those that supply as few as 50 people, to those that serve over 100,000 people. Public water systems may be:

- an incorporated community
- a water district (elected local board)
- a rural improvement district (political subdivision of a County)
- a water users association (non-profit corporation)
- privately owned

There are also a number of tribally owned systems within Montana. However, they do not fall under the jurisdiction of the Montana Department of Environmental Quality (MDEQ). These systems are recognized, but not considered, in the statistical review here. The size of MDEQ-regulated public water systems may be generally grouped into three categories:

1. Large community systems consisting of the seven largest cities in Montana—Billings, Missoula, Great Falls, Bozeman, Butte, Helena, and Kalispell
2. Medium-sized communities consisting of medium sized cities, towns, and water and sewer districts. This category includes approximately 60 communities with populations greater than 1,500 people

3. Smaller communities including towns, water and sewer districts, rural improvement districts, and water users associations. This group represents approximately 630 water systems including private systems

Water system infrastructure typically consists of:

- a source of water supply (groundwater or surface water)
- a treatment system
- a pipe transmission and distribution system
- transmission and distribution pump stations
- water storage tanks

Some of the larger systems may also have a large surface water reservoir with an earthen dam. Systems may also purchase water from federal or state owned reservoirs. Many groundwater systems do not provide treatment beyond that of disinfection, but some public systems may have to provide additional treatment for iron, manganese, and other dissolved solids in the water. Surface waters and groundwater systems determined to be under the influence of surface water (e.g. due to a history of certain contaminants, proximity to surface water, or shallow groundwater level) typically have to provide advanced water treatment using mechanical treatment plants.

Montana has approximately 5,300 miles of water distribution and transmission piping. Typically, the capital worth of the water distribution system is 60% to 75% of the total worth of the water system, with water supply and treatment making up the remainder. The supply and distribution of public drinking water is governed by the Montana Water Supply Act and the Federal Safe Drinking Water Act (SDWA). These laws are administered by MDEQ with oversight by the Environmental Protection Agency (EPA).

Capacity

Communities were surveyed about the capacity of their water treatment and distribution systems. They were asked to estimate if the capacity of their system could accommodate 20 years of growth, 5 years of growth, zero growth, or if it has insufficient capacity or is failing. The communities that responded reported that 35% of their water treatment systems had zero additional capacity or worse. Over 60% reported less than five years of remaining capacity. As might be expected, the more rapidly growing communities are experiencing more difficulty with capacity. The survey findings show that it's possible the majority of Montana's water treatment systems have limited capacity. For water distribution systems, it is estimated that approximately 30% of the systems report that the capacity of their distribution system is zero or less and over 50% is five years or less.

Condition

Some of the older and more established communities in Montana have water pipes that date back to the late 1800s. Many of the small to medium sized communities in Montana were platted in the early 1900s and much of this pipe has never been replaced, according to the owners and engineering records. Many communities saw additions built in the 1950s, 60s, and 70s, and again in the last 10 to 15 years. The larger communities have better annual replacement programs that budget for some pipeline replacement every year. However, even some of the largest cities have reported in their capital improvements plans that the level of reinvestment in pipelines may not be enough. In many communities, water pipes in the original town or city plat are 75 to 100 years old. Much of the pipe in the outer edges of the city or town limits range from 30 to 60 years old.

DRINKING WATER

The structural service life of most pipes is approximately 75 years, but this does not consider the need to upgrade capacity due to growth. It is not uncommon for the pipelines in the originally platted area of a particular community to be undersized or corroded since smaller steel and cast iron pipe was often used and was not able to provide adequate fire flow. Because of poor flushing capability, corrosion, and low pressures, these pipes are also more susceptible to bacteriologic contamination and less able to maintain a chlorine residual. The older water mains in the original platted areas are reaching the end of their useful service life and are beginning to provide a lower level of service (lower pressures, reduced fire protection, poorer quality water).

The survey reported that most systems, without regard for size, experience major leaks on an annual basis. Some small communities experience extensive leak repairs, in excess of 10 leaks per year. One larger community experienced 15 major and 40 minor leaks in 2013.

Corroded Cast Iron Water Pipe, 75-100 Years Old, Cascade, Montana

Source: Great West Engineering, Inc.

Additionally, communities were asked to rate the condition of their water treatment and distributions systems relative to their current ability to protect public health and safety, comply with MDEQ requirements, and minimize service disruptions. The condition of the water treatment facilities ranges between poor to excellent. 9% of respondents to the survey rated the condition of their treatment system as fair to poor, with the remainder reporting the system condition as good or better. Many of the treatment systems have been upgraded in recent years to address changes to the SDWA, which accounts for the improved condition of water treatment works.

Over 90% of the communities that responded to the survey report that they are replacing none, or very little, of their water distribution system on an annual basis. As noted previously, the age of Montana's water distribution systems in the older parts of communities may be 75 to 100 years old or older. The age of pipe in later additions may range from 30 to 60 years old. While this pipe may be performing adequately now, it is aging and has been neglected in recent years in favor of addressing public health and regulatory issues for treatment facilities. Approximately 25% of the surveyed communities report their distribution system to be in fair or poor conditions. While many distributions systems are in acceptable condition now, a large percentage, estimated at 25%, still need to be upgraded. To sustain the condition of water treatment and distribution systems to at least a fair to good level of performance, as well as accommodate future growth and regulatory pressure, the level of investment in pipeline infrastructure should be increased. The low level of pipe replacement being reported by communities, the need to sustain the condition of pipelines, and the age of pipelines in the core areas of many communities are all reasons for concern.

Funding

Water infrastructure is financed 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 and Special Appropriations
- User and Service Charges
- Reserve Funds
- Special Assessments (Special Improvement Districts, Tax Increment Financing Districts, etc.)

Corroded Cast Iron Water Pipe, 75-100 Years Old, Cascade, Montana
Source: Great West Engineering, Inc.

Montana's seven largest cities typically use revenue bonds, the SRF Loan program, impact fees, reserves, grants and user rates to finance infrastructure improvements. The level of infrastructure investment is best measured by a review of the Capital Improvement Plans (CIPs) for each community.

Based on a review of the CIPs for the largest seven cities over a five year period, it is estimated that an average annual budget for water and wastewater infrastructure investment ranges between $65 million and $120 million for these seven cities, with an average annual budget of $80 million dollars. The smaller and medium sized communities rely more heavily on state and federal grants and loans. Many of the medium sized communities have also developed reserve funds to help fund projects. The total capital improvements budget for small to medium communities is well represented by a review of the Treasure State Endowment Program (TSEP), Renewable Resource Grant and Loan (RRGL), Community Development Block Grant (CDBG), Water Resources Development Act (WRDA), State and Tribal Assistance Grant (STAG), USDA Rural Development (RD) and State Revolving Fund (SRF) Programs. Often times, the grant and loan packages include the community share provided through reserves, special assessment and other sources of funding. The loans are typically either RD or SRF loans and paid back through user rates.

The total capital investment through various state and federal funding programs is $115 million dollars. This estimate is based on information provided by each of the funding agencies. The total SRF funding for large communities in 2014 was approximately $30 million. Subtracting this subtotal from the $115 million total presented previously, suggests that the total annual reinvestment for medium to small communities is approximately $85 million. Combining the large community subtotal ($80 million) to the small to medium sized community sub-total ($85 million), the total reinvestment in water and wastewater infrastructure by all communities in Montana is estimated to be $165 million.

Communities were asked if their budgets were sufficient for upgrades, maintenance, and regulatory requirements. Approximately 30% of the communities somewhat disagreed to strongly disagreed that their budgets were sufficient

for upgrades, maintenance and regulatory requirements. 35% of the respondents somewhat agreed. Only 35% agreed that their budgets are sufficient. This data suggests that there is great variability in the adequacy of budgets experienced for communities.

Future Needs

MDEQ conducted an SRF Loan Program Needs Survey in 2011 which identified an immediate water infrastructure need due to aging and failing systems of $885 million dollars. This survey is based on identified problems with infrastructure that require attention in the short run and is not a measure of long term needs related to aging, increased demand, and regulatory changes. This survey represents known problems, some of which are associated with enforcement actions or serious failures that require immediate action.

The total cost to completely replace Montana's entire water and wastewater infrastructure is estimated to range between $12 billion and $15 billion. This is based on an evaluation of dozens of Preliminary Engineering Reports and Master Plans for communities of all sizes, which was used to develop the replacement value for various categories (based on size) of public systems. These replacement values were then applied to all public water and wastewater systems identified by MDEQ to estimate total infrastructure replacement value. The service life of treatment and pumping infrastructure is approximately 25 years and 75 years for water and sewer pipe. Based on the assumption that treatment and pumping consist of 40% of the infrastructure value, with the remainder being pipelines and other long service life components, the composite service life of infrastructure is approximately 55 years.

In the last 10 years or so, much of the replacement funding has gone towards water and wastewater treatment to address regulatory compliance issues. This is evident by the community survey conducted as part of this study where many small communities reported little reinvestment in pipelines. The larger communities typically have much better developed water distribution and collection replacement programs. However, even some of the largest communities expressed concern in their capital improvement plans over whether the level of pipeline reinvestment is sufficient.

Operation & Maintenance (O&M)

Communities were asked if their O&M capabilities and resources allowed them to perform preventative maintenance, comply with regulations and maintain a high level of service. Approximately 50% of the systems reported that they somewhat agree that their operational resources are sufficient. Per the MDEQ operator certification program, the number of certified operators has not significantly changed recently, but there is concern of retaining interest in the profession and with losing operators. MDEQ has made recommendations for recruiting new operators. The American Water Works Association has also expressed a similar concern.

Public Safety

Of the approximately 700 community public water systems in Montana, 158 (23%) are currently not compliant with monitoring requirements and other regulatory issues. Based on the available funding discussed earlier, Montana communities do not have sufficient funds to satisfy immediate water infrastructure needs, let alone the ability to meet long term replacement needs.

The Federal SDWA is administered by the EPA. Starting with the 1986 Amendments to the SDWA, these regulations have increased the number of contaminants regulated for surface water, and decreased maximum contaminant limits for those contaminants regulated. Groundwater sources have increasingly seen more pressure to review surface water influence, provide disinfection, and monitor for more contaminants. As a result of these changes to the SDWA, most of which are supported by ASCE, many communities have upgraded their water treatment system in the last 20 years, sometimes at the price of needed upgrades to pipe distribution systems. Some areas of the state are seeing rapid growth that will also require water distribution, supply and treatment upgrades to accommodate this growth. Water supply is generally adequate in most cases.

Resilience

Resilience to outside factors such as natural disasters is of only minor concern, due mainly to the nature of a water system. Because most of a water system is buried (distribution system), it is generally not subject to damage due to above ground events. Much of Montana is located in classified seismically active zones, but damage due to earthquakes has been minimal at most. This is not to say that earthquake damage is out of the question. Rather, it has not been a concern to address because of the minimal damage caused in the past. Any new structures are designed in accordance with the latest edition of the International Building Code, therefore including provisions to withstand the expected seismic activity. Both summer storms and winter blizzards have interrupted electrical service for treatment plants and pumping systems. However, these are typically short-term outages. Also, many systems have backup generators to maintain electrical service; any new or updated facilities are required to include backup generators. Droughts can especially affect surface water supplies, with a delayed effect on groundwater supplies. Droughts have occurred in the recent past and are expected to occur again to varying degrees. In these cases, systems have imposed restrictions relative to lawn watering and other water uses. There have been sporadic cases where a water supply became limited. However, the system managers were able to implement means to meet basic water demand.

Innovation

Most Montana systems are keeping up-to-date with the latest technologies. Innovative treatment processes are utilized if the need arises and the utility owner elects to use them. Treatment systems which undergo upgrades/replacements utilize current treatment processes and conservatively apply new technologies. On the distribution side, many systems are already using or installing wireless meter reading systems, now a standard technology. Overall, systems are kept up to date, but aggressive innovation is not a trend.

DRINKING WATER

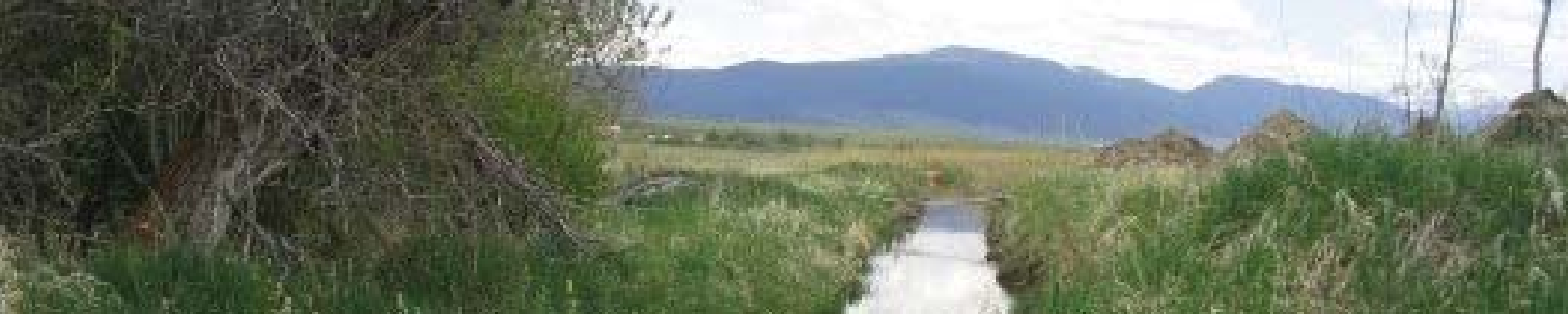
Recommendations

Montana's water treatment and distribution systems are aging but continue to serve their communities well. However, they have limited capacity and are supported by limited budgetary resources. These systems are beginning to show their age with reduced levels of service (fire flow, pressure, sanitary condition) and increased levels of failure. Water infrastructure can be improved by the communities and agencies that oversee and use it by creating and properly funding capital replacement plans. A higher level of reinvestment is necessary to sustain and improve water system reliability and level of service.

Sources

United States Environmental Protection Agency, "Drinking Water Infrastructure Needs Survey and Assessment, Fifth Report to Congress," April 2013.

ASCE Water Infrastructure Community Survey; 209 surveys mailed to public water systems of various sizes, mostly with a service population greater than 200. There were a total of 44 responses, representing a survey response rate of twenty-one percent.



IRRIGATION CANALS & WATERWAYS

C

Summary

Montana has over 2 million acres of irrigated land, an area almost double the size of Glacier National Park. 60% of this irrigated acreage receives some or all of its water needs from a canal supply. Suppliers include 20 State Water Projects, 17 U.S. Bureau of Reclamation facilities, and approximately 246 private irrigation organizations. 32% of owners identified their structures as notably impaired, with more than half reporting impairments due to infrastructure age of greater than 50 years. There is strong support for government facilities, but this is offset with the challenges of non-government facilities that have limited funding resources and a lack of assistance for facility operation. As Montana's irrigation systems continue to age and deteriorate, maintenance and repair demands increase, and operators should act now to better address these looming concerns.

About Montana's Irrigation Canals and Waterways

Agriculture makes up a significant portion of Montana's economy and Montana's man-made irrigation canals and waterways provide the necessary irrigation for this industry. The preparation of this Report Card relied on the findings of the latest inventory, "*Irrigation in Montana: A Preliminary Inventory of Infrastructure Condition.*" In 2006, the 60th Montana State Legislature authorized this statewide inventory for all irrigation infrastructure in Montana to assist the Montana Department of Natural Resources and Conservation (DNRC) in developing an understanding of the condition of existing irrigation systems and to determine an estimated cost to complete necessary improvements. The inventory was completed and published in 2009.

The inventory relied upon detailed information from United States Bureau of Reclamation (USBR) and DNRC files for canals owned and/or operated by these agencies. Further, a survey was sent to 229 irrigation water supply organizations and their 81 responses were used to supplement this information. Survey recipients included irrigation water supply organizations and some of the USBR irrigation districts. The remaining USBR irrigation districts and DNRC State Water Project-related users were excluded from the survey due to extensive information available in state and federal records. Further, there are also several Bureau of Indian Affairs (BIA) irrigation projects in need of improvements. However, that information was not available at the time of the report and is therefore not included.

Documented irrigation in Montana dates back to 1852, when the first irrigation water right was issued in Ravalli County for potato, wheat, and oat crops. Irrigated agriculture became more important in the middle to late 1800s

as settlers moved west and switched their interest to farming when mining claims could not be secured. The Desert Land Act (1877) in particular encouraged settlement on arid land by requiring prospective landowners to reclaim a portion of the land by irrigation. Irrigation companies began to form in the early 1900s, with many USBR projects completed by 1940. In the 1930s, federal water conservation funds became available to states, which facilitated the construction of 173 small irrigation projects by 1952. The DNRC still owns and operates a small handful of these facilities, but the vast majority has now been turned over to water user groups. As a result, the condition of irrigation canals and waterways infrastructure in Montana is notably aged and deteriorating. Current owners/operators vary greatly in their ability to afford required infrastructure improvements.

Capacity

The USDA Farm and Ranch Irrigation Survey of 2003 estimated that there were 2.1 million acres of irrigated land in Montana. It was estimated that 1.2 million of those acres were exclusively irrigated by water from a canal system, and an additional 100,000 acres were partially irrigated by canal system-based water. Hence, a total of 60% of the irrigated acreage in Montana receiving some or all of their water needs from a canal supply. Thirteen of the 17 USBR irrigation districts in Montana irrigate approximately 365,500 acres of this total. Twenty State Water Projects operated by DNRC include ten canal systems that comprise approximately 250 miles of ditches. The large area USBR and DNRC government systems irrigate accounts for a significant portion of acreage irrigated in Montana. In addition to government-related facilities, there are also approximately 246 private irrigation water supply organizations in Montana. It is recognized that the BIA has information on additional facilities that was not available for inclusion.

Irrigation Headgate, Near Choteau, Montana
Source:WGM Group, Inc.

Condition

The USBR conducts periodic reviews for each of their 13 Montana facilities, so they have a well-documented understanding of facility condition. The DNRC conducts annual inspections and coordinates design and construction of repair work for each of their 10 facilities, so these projects are also well-documented. According to the inventory, in general, the condition of the majority of these facilities is fair to good. In contrast, the survey results and onsite verification for the private irrigation systems show more significant challenges and deficiencies.

Facility age is an important factor for determining condition of irrigation facilities. For those facilities that were part of the survey, it was found that 11% of the initial diversion structures (i.e., those that allow water to enter the canal system from the initial source water) were less than 10 years old, while 53% were 10 to 50 years old, and the remaining 37% were more than 50 years old. Further, survey respondents were asked about the potential causes for impairment of their initial diversion structure. Possible impairments were classified as one or more of the following three types:

- worn out or damaged components,
- channel changes (e.g., channel migration, sediment accumulation),
- other

32% of the respondents characterized their initial diversion structures as notably impaired, with more than half of the respondents reporting impairments due to infrastructure age of greater than 50 years old. Also, approximately half of the facilities include a secondary diversion structure in addition to the initial source of water supply. Of these, 31% reported impairment, and 69% of those reporting impairment had a structure age of 10 to 50 years old. Between both initial and secondary diversion structures, it is estimated that there are 194 diversion structures statewide in need of repair.

To move the water through the system, several types of infrastructure are used:

- ditches,
- canal pipelines,
- siphons,
- culverts,
- flumes, and
- other related components.

An evaluation of the conveyance system showed that 40% of facilities had one or more of the parts of their conveyance system operating at less than full capacity due to notable impairments. These impairments included, in order of frequency identified:

- areas of porous subsoils (i.e., leakage),
- overgrown vegetation,
- sloughing of material into the ditch,
- leaks in pipeline/siphon/flume,
- damaged concrete,
- poor ditch grading,
- leaks in buried pipelines, and
- worn out or damaged lining.

Rural Irrigation Waterway near Lewistown, Montana

Source: WGM Group, Inc.

21% of the respondents reported conveyance components will need to be replaced in the coming five years, with siphons most commonly identified as needing work, followed by the ditches themselves. It is estimated that there are 152 impaired conveyance facilities in Montana. Note that even a small siphon or flume replacement can cost more than $150,000. If an average of $75,000 were needed to rehabilitate or replace each of these impaired facilities to good condition, this would result in a total cost of $11.4 million.

Funding

The USBR requires their facilities to maintain reasonable financial reserves. The DNRC has a water marketing contract with water users associations for each of their projects. This funding supports DNRC project operations

and maintenance (O&M), including the hiring of ditch riders, administrative costs, as well as O&M fees to support repairs and rehabilitation. Overall, funding opportunities fall into the categories of grants and loans from State and Federal government, technical assistance provided by the DNRC, and funds from water users associations.

Fourteen programs provide financial or technical assistance to irrigated agriculture in Montana. However, four of those provide direct assistance to farmers and ranchers, not to irrigators. The remaining ten funding sources include DNRC, Montana Department of Agriculture, and Montana Fish, Wildlife & Parks (with US Fish & Wildlife Service). Seven DNRC programs provide grants of hundreds of thousands of dollars per year and facilitate loans up to a maximum of approximately $35 million. The Montana Department of Agriculture's Growth through Agriculture Program provides grants and loans to strengthen Montana's agriculture industry, but irrigation projects are typically ineligible. Finally, Montana Fish, Wildlife & Parks administers the Fisheries Restoration and Irrigation Mitigation Program, which focuses on fish passage devices. These are not frequently applicable to irrigation projects, but can occasionally assist in diversion rehabilitations or replacement.

Non-government systems have a broader range of funding sources. To give a sense of this range, recently completed non-government projects showed the following funding breakdown on average, based on survey responses:

- 50% Private Funding (range from 43-71% depending on system component)
- 24% Federal Funding (range from 12-41% depending on system component)
- 18% State Funding (range from 9-35% depending on system component)
- 7% Local Funding (range from 6-8% depending on system component)

Funding becomes a challenge for non-government irrigation projects because the costs to make repairs frequently far exceed what water users can afford to pay, especially in rural systems with relatively few users.

Urban Irrigation Canal, Grate for Safety and Trash Rack

Source: WGM Group, Inc.

Future Needs

The DNRC estimated that $2.5 to $3 million must be spent in the next 5 to 10 years to maintain the current condition of their facilities, which includes both canals and dams. In contrast, they estimate a need of more than $50 million over the next 10 years to improve these facilities to good working order. USBR estimates that two of their irrigation systems require a $156 million investment for repair or replacement of major shortcomings. Survey evaluations estimated a $160 million need for non-governmental systems. In total, this is an estimated $343 million needed to improve all irrigation systems (private, irrigation water supply organizations, DNRC-owned projects, and USBR projects) to full operating condition.

Operation and Maintenance (O&M)

Regular O&M is needed to allow canal systems to operate at or near full capacity. However, it should be noted that there is no "typical" irrigation canal; each is subject to a variety of natural and man-made forces. At a minimum, clearing of vegetation along ditch banks and near structures is essential prior to seasonal use. Some systems make efforts to line portions of their ditch, as they can afford it, to minimize losses. Many systems need to address erosion damage as well as regular wear on mechanical parts. While system operators seek to make the most efficient use of their resources, they are often challenged by a limited number of work hours for miles of facilities.

Public Safety

As parts of Montana that used to be rural have seen residential growth over the last decade or so, canal systems that used to be far from the public eye now find themselves in people's literal backyards. While proximity to flowing water is an amenity, it also poses threats to public safety. The most frequently seen threats to public safety due to canal systems and growth are seasonal flooding and liability to the irrigation companies for personal harm. An example is when people get injured playing in or around irrigation facilities. In terms of personal safety, many irrigation system operators in more populated areas have included measures including fencing, piping, and grates to limit access to and injury from facilities.

Resilience

Both structural and policy measures are used to mitigate the risk to the public, especially in more urban and/or residential areas, due to flooding related to canal systems. Structural measures include headgates that can physically prevent flood waters from entering canals. In terms of policy, many of the county floodplain maps in the state have recently been updated, or are in the process of being updated, and better define flood risk. In Missoula County, a large area is currently proposed to be newly included in the floodplain due to backwater flooding from the Orchard Homes Irrigation Ditch. By better defining flood risk, mitigation measures can be more clearly defined.

Irrigated Agriculture near Big Sandy, Montana
Source: WGM Group, Inc.

Innovation

The most prevalent source of innovation related to Montana's irrigation canals and waterways is via the delivery systems by end users. Several types of irrigation distribution methods exist, including flood irrigation, sprinklers, drip irrigation and sub-irrigation. Historically, flood irrigation has dominated because it has the lowest capital cost, which was important to the end users growing and harvesting hay, a relatively low value, major irrigation crop. Hay crops, due to their low value, do not justify large capital irrigation investments because costs are not recovered quickly enough. At present, while flood irrigation still dominates, there has been a trend of growth in sprinkler irrigated acreage by both percent and number of acres. This trend may be attributed to water conservation concerns, which will only become more critical in the future if state water resources are stressed.

Recommendations

As Montana's irrigation systems continue to age and deteriorate, maintenance and repair demands will increase. Montana irrigation system operators should act now to better address these looming concerns.

Montana irrigation system operators should work to assess their current situation and make realistic plans for future operations. For example, the United States Bureau of Reclamation requires their facilities to maintain reasonable financial reserves; this would be a prudent step to sustain all systems.

Further, state and federal agencies should focus energy on educational efforts to inform operators of funding and technical assistance available. Innovation efforts should be emphasized to improve efficiency of existing systems at a likely lower cost than full reconstruction.

Finally, we need to document institutional knowledge about our systems before it is lost. Many non-government systems are run by long-time operators and ditch riders, people who have a wealth of knowledge about the history and operations of systems that is not recorded anywhere, valuable information that is needed to adequately care for our infrastructure.

Sources

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Montana Department of Natural Resources & Conservation, Irrigation Development Program Update, February 2012. http://dnrc.mt.gov/cardd/ResourceDevelopment/IrrigationDevelopment/docs/IrrigationDevProgramUpdate.pdf

PBS&J, Irrigation in Montana: A Preliminary Inventory of Infrastructure Condition, January 2009. http://dnrc.mt.gov/cardd/ResourceDevelopment/IrrigationDevelopment/docs/InventoryIrrigationInfrastructureMontana.pdf

TRANSPORTATION C

Summary

Montana has the third highest fatality rate in the nation, with a backlog of transportation projects waiting for available funding. 46% of major roads are in poor to mediocre condition and 40% of gravel roads are in poor or failed condition. These rough roads cost each Montanan approximately $292 to $484 per year in extra maintenance costs depending on their area's roads. 59% of the $60 billion in goods shipped within Montana travel by truck across the state's vast highway infrastructure, further emphasizing the vital role of the Montana transportation network. It is estimated that $14.8 billion is needed to take care of Montana's roadway system and bridges, but projected funding can only meet 25% of those needs. Despite being under funded, the state's highways are in fair to good condition and 92% of the state highway bridges are in good condition, efficiently moving citizens and goods from place to place. The overall lack of adequate funding cripples the effectiveness and lowers the overall rating to a C.

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 to Alzada (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.

Source: MDT Transportation Fact Book

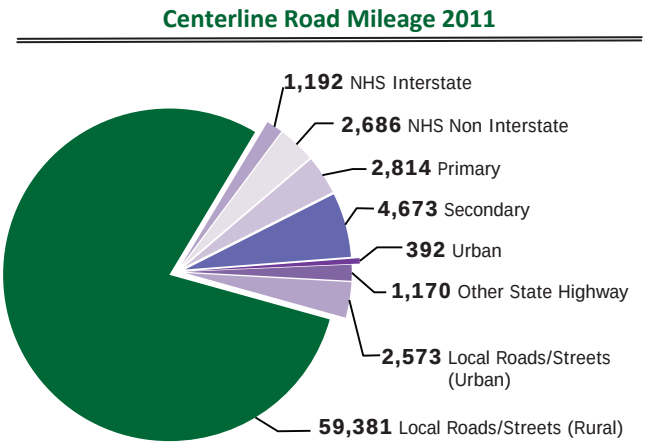
About Montana's Transportation System

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. Past investments in the transportation network

have increased opportunities for business and travel and as Montana continues to grow in population, vehicle miles traveled by visitors, and the related economic output. One of the burdens of growth is the requirement to adequately maintain and modernize the highway system.

Capacity



Source: MDT Road Inventory & Mapping Section

2010	Centerline Miles	AVMT
On-System	11,758	8.5 billion
Off-System	63,037	2.6 billion
2011	**Centerline Miles**	**AVMT**
On-System	11,758	8.6 billion
Off-System	63,123	3.1 billion

AVMT = Annual Vehicle Miles Traveled

Source: MDT Traffic Data Collection Section and MDT Road Inventory & Mapping Section

Montana enjoys some of the least crowded roadways in the world, with a very low ratio of population to number of lane miles in the state. There are few rural routes that are slowed by congestion such as 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.

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, $21.6 billion in goods are shipped from sites in Montana and another $37.9 billion in goods are shipped to sites in Montana, mostly by truck. 59% of the goods shipped annually from sites in Montana are carried by trucks.

Condition

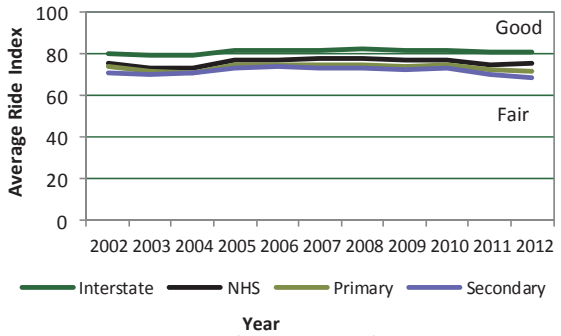
While the Montana Department of Transportation (MDT) uses asset management systems and the most cost-effective pavement preservation methods, a lack of adequate state and local funding has resulted in 46% of major urban roads and highways in Montana to have pavement surfaces in poor or mediocre condition. This includes both local- and state-maintained roads and highways; the rough conditions provide a rough ride.

At the local level, a 2008 comprehensive evaluation by 85% of the counties in Montana reported 40% of the

nearly 40,000 miles of gravel roads within their jurisdiction were in poor or failed condition. The roads were evaluated using the Pavement Surface Evaluation and Rating (PASER) system to ensure uniformity of evaluation techniques. It also found that 25% of the asphalt/chip sealed roads were reported to be in poor or failed condition. In 2013, after completing a review of 10% of the counties in Montana, evaluations indicated little change to these percentages.

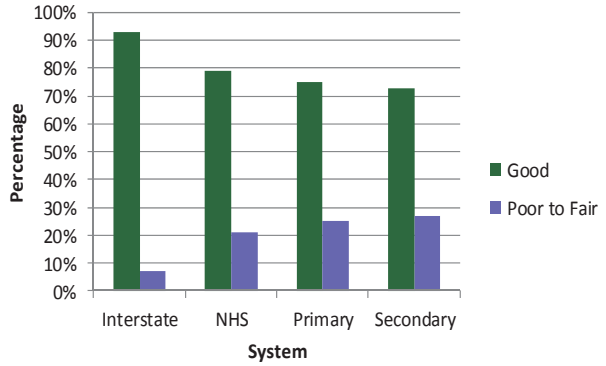
28% of Montana's major urban roads and highways have pavements in poor condition, while an additional 18% of the state's major urban roads are rated in mediocre condition. 22% are rated in fair condition and the remaining 32% are rated in good condition.

MDT Ride Condition Summary



Source: MDT Transportation Fact Book

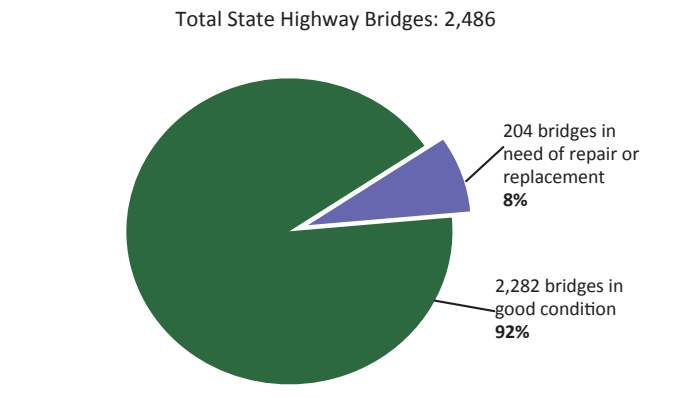
2012 State Highway Overall Pavement Condition Summary



Source: MDT Pavement Analysis Section

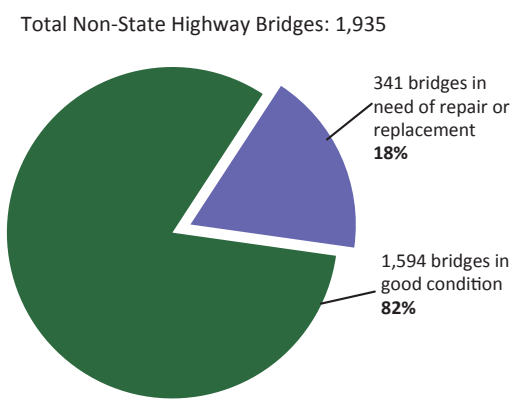
Driving on rough roads costs each urban Montana motorist $484 annually in extra vehicle operating costs. In addition, rough road conditions cost all Montana motorists a total of $170 million annually in extra vehicle operating costs. Costs include accelerated vehicle depreciation, additional repair costs, increased fuel consumption and tire wear.

2011 State Highway Bridges in Need of Repair or Replacement



Source: MDT Bridge Bureau

2011 Non-State Highway Bridges in Need of Repair or Replacement



Source: MDT Bridge Bureau

TRANSPORTATION

The dedicated staff and good management systems of state and local agencies have the bridges in Montana in good condition with 2,282 highway bridges or 92% rated in good condition and only 8% or 204 highway bridges in need of repair or replacement. Non-state highway bridges rate 82% (1,594) in good condition and 18% (341) in need of repairs or replacements.

Funding

Given the economic and safety impacts of Montana's road network, adequate funding for maintenance and expansion is of vital importance. 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. From 2008 to 2012, the federal government provided $3.07 for every $1 the state paid in federal motor fuel fees for road improvements in Montana. As the U.S. Congress debates the future of the almost insolvent Highway Trust Fund (HTF), the HTF balance declines, further delaying needed infrastructure replacements and improvements at the state and local levels. This delay stops progress on needed safety and infrastructure projects that only increases the deterioration of the transportation system.

US Highway 93 Hamilton to Victor, Ravalli County

Source: WGM Group, Inc.

The Fiscal Year 2014 estimate of the Federal Highway Administration (FHWA) spending in Montana is $396 million. That figure comprises the majority of MDT's transportation budget.

Future Needs and Operation & Maintenance

Montana has made significant investments in roadway infrastructure and must be cognizant of projecting that investment through ongoing maintenance of roads. In 2012, MDT conducted a Transportation Needs Study to determine the funding needed over the next decade to meet the construction, operation, and maintenance of the roadway network. The study revealed that $14.8 billion is needed to take care of Montana's roadway system and bridges, while projected funding can only meet 25% of those needs.

The study reveals that the life cycle of Montana's roads is greatly affected by the state and local government's ability to fund and perform timely maintenance and upgrades. Poor roads can be resurfaced, but waiting too long for available funding often means the road becomes too deteriorated and must be reconstructed at a greater cost.

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 clearly insufficient to improve current conditions over time. 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. Where appropriate, highway improvements can reduce traffic fatalities and crashes while improving traffic flow to help relieve congestion. Such improvements include removing or shielding obstacles, adding or improving medians, improving lighting, adding rumble strips, wider lanes, and wider and paved shoulders, upgrading roads from two lanes to four lanes, and employing better road markings and traffic signals. Investments in rural traffic safety have been found to result in significant reductions in serious traffic crashes.

Montana's traffic fatality rate of 1.72 fatalities per 100 million vehicle miles of travel is the third highest in the nation. On average, 211 people were killed annually in Montana traffic crashes from 2008 to 2012, a total of 1,053 fatalities over the five year period. The fatality rate on Montana's non-interstate rural roads is nearly double that on all other roads in the state (2.25 fatalities per 100 million vehicle miles of travel vs. 1.26). Major factors contributing to the high fatality rates are the distances to medical help and miles of highways that need upgrades to modern standards.

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 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. A couple of programs provide examples of good ideas being implemented on the road.

TRANSPORTATION

MDT utilizes an asset management strategy called the Performance Programming Process which links goals and expenditures for road and bridge conditions, safety, and traffic congestion, by prioritizing investment on the state's roads, highways, and bridges, that are cost-effective, safe, and environmentally efficient.

Traffic signal operations have been addressed within MDT over the past couple of years as well. In 2012, MDT had FHWA perform an in-depth "current practice report" to determine any deficiencies. MDT has incorporated the FHWA report on deficiencies in the traffic signal operations. Further, the Traffic Signal Management Plan has $2 million set aside per year from 2014-2018 (with 2016 getting $4 million) for controller and communication upgrades to address report findings.

North Higgins Avenue, Urban Complete Street, Missoula

Source: WGM Group, Inc.

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MONTANA TRANSPORTATION BY THE NUMBERS: Meeting the State's Need for Safe and Efficient Mobility, TRIP A National Transportation Research Group, February 2014.

Recommendations

Despite being under funded, the state's highways are in fair to good condition and 92% of bridges are in good condition, a system that efficiently moves its citizens and goods from place to place. This speaks well of MDT's and local counties' efforts in managing the project mix and innovations for maximizing the 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 inevitably will 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 O&M of its transportation network. This includes embracing the use of building information modeling (BIM)-inspired CAD 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.

As has been discussed on a national level, 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 interference.

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.

TRANSIT C+

Summary

In Montana, 65 different rail, bus, and van services provide rural and urban transit service; 36 of these are public transit systems. While Montanans who have access to transit have increased their ridership over the past decade, it is estimated that statewide, only 17% of transit needs are being met. Several agencies benefited from over $15 million in Federal recovery investments in 2009, which essentially doubled short-term transit funding in the state, although future maintenance efforts will fall to Montana. 31% of Montana transit agencies responded to a survey that funding levels are "Inadequate" or "Not at All Adequate" to meet future needs. When asked, "What should public transit/public transportation in Montana look like in 20 years?" the single word answer was "more."

About Montana's Transit

Providing transit service to a dispersed population over long distances is a significant challenge in Montana. A wide range of 65 different rail, bus, and van service providers deliver rural and urban transit service throughout the state. While Montanans who have access to transit have increased their ridership over the past decade, it is estimated that statewide, only 17% of transit needs are being met. This varies greatly by county. Many counties provide less than 10% of the trips needed by their residents. Conversely, other counties are meeting much of their residents' need, with over 70% of the need being met.

The State of Montana has a total of 36 public transit agencies. The majority of these agencies, 33 of them, are classified as rural agencies serving areas with a population of less than 50,000. In addition to public transit agencies, human service agencies, and intercity carriers provide transportation service in Montana. Transit plays a vital role in Montana, connecting people with jobs, medical facilities, schools, shopping, and recreation. Transit is particularly important to people who cannot or choose not to drive. Nationally, it is estimated that one-third of Americans do not drive cars. As Montana's population increases and becomes older, demand for transit services will continue to grow, forcing transit agencies to make tough choices about the services they can provide.

Capacity & Condition

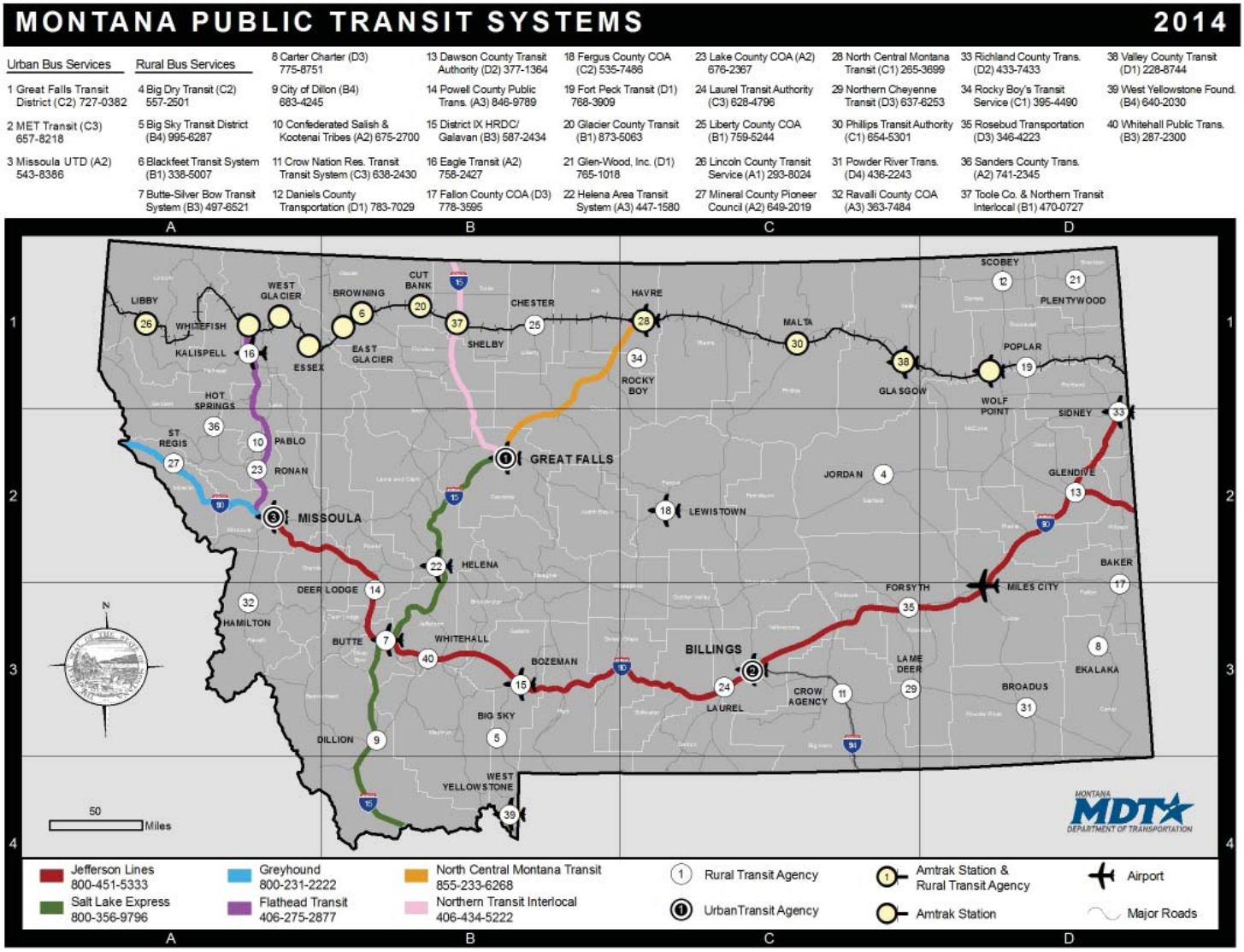
Transit providers in the state of Montana fall into three categories:

- Public Transit (Urban and Rural)
- Specialized Service Providers
- Intercity Services

The three urban public transit systems are the Great Falls Transit District, Missoula Urban Transportation District

(Mountain Line), and METTransit (Billings). These three agencies are responsible for providing approximately 38% of all transit trips within the State of Montana. This percentage equals 1.27 million of the 3.37 million total trips provided for the most recent fiscal year. The three large urban systems have a combined operating cost of $9.9 million, which is approximately half of the operating budget for all systems in the state for which data were available.

The 33 rural public transit systems in Montana are well-distributed throughout the rest of the state. The rural systems are a combination of tribal transit providers, county councils on aging, and municipal transit providers. Because of the relatively low population in these places, it is not surprising that these 33 rural agencies provide fewer trips than the three urban agencies. In total, the rural agencies provided approximately 1.17 million trips, representing 38% of total trips in the state. The operating costs of these agencies combined are slightly less than their urban counterparts, totaling $8.16 million, or 45%.



Source: MDT

Specialized service providers include agencies serving specific needs such as elderly individuals, people below a specific income level, or those with developmental and physical disabilities. Often, these providers serve a population that may not be able to use general public service safely and effectively or in areas where they would otherwise not have transportation at all. A total of 26 special service providers were identified in Montana, providing a total of approximately 978,000 trips in 2009 (29% of total trips in the state). The operating cost incurred by special service providers is relatively low when compared to general public providers. Total operating costs for the 26 human service providers is approximately $3.85 million.

Intercity services include:

- Major bus carriers like Greyhound, Rimrock Trailways, Black Hills State lines, and Salt Lake City Express
- Amtrak train service
- Minor intercity bus routes that provide service between communities on a regularly scheduled basis including Northern Transit Interlocal, North Central Montana Transit, and Skyline.

The 2012 Montana Statewide Transit Plan surveyed transit providers, users, and the general public. These surveys of Montana transit agencies, transit users, and the general public provide valuable insight into the condition of Montana transit infrastructure.

Gaps in service fall into three categories – geographic, temporal, and market. A geographic service gap refers to that a region that does not have any transit service. A temporal gap refers to times when service does not operate, thus creating a gap in service at specific times. Finally, a market gap is when service is available to individuals meeting a specific eligibility, but not others.

When examining a state as large as Montana, with a relatively dispersed population, there may be naturally occurring geographic gaps. However, many of the geographic areas that are not served may have a relatively low population or exist mainly as parkland or mountains. The majority of these locations within Montana are clustered in the south-central part of the state.

In addition to counties that lack transit service, there are also geographic gaps in the intercity services. These geographic gaps make it difficult for transit users to travel between these major destinations without having to take a longer alternate route.

Funding & Future Needs

Half of Montana transit agencies responded that current funding levels are "Somewhat Adequate," while another 25% said funding levels are "Somewhat Inadequate" to provide effective and efficient service. Responses declined when asked about the ability to meet future needs for upgrades and maintenance. 31% responded that funding levels are "Inadequate" or "Not at All Adequate" to meet future needs.

Several agencies commented that the majority of Montana's current fleet was purchased with American Recovery and Reinvestment Act (ARRA) funds in 2009 when transit funding in Montana essentially doubled with more than $15 million in investments. Future maintenance will be the responsibility of Montana's transit services, and many assets could need replacing starting in 2016, which will have a negative effect on transit services if funding for

replacement vehicles are not available.

Transit providers also commented that the rate of use by seniors is increasing due to medical treatments that emphasize physical therapy and outpatient services, as well as increases in job access requests for workers. These trends are prompting additional trips and longer operating hours. The medical treatment approaches, in particular, are requiring more trips because of the emphasis on frequent, short-duration office visits associated with preventive medicine.

The survey asked, "What should public transit/public transportation in Montana look like in 20 years?" the single word answer is "more." However, there is a diversity of opinion about what "more" means:

- More people riding transit and leaving their cars parked
- More interconnected
- More options for connections between rural towns and larger communities
- More public transportation available throughout Montana

Missoula Mountain Line Transfer Station

Source: http://commons.wikimedia.org/wiki/File:Buses_queue_in_Missoula,_Montana.jpg

In a public phone survey, two questions were asked to ascertain how current transit service could best be improved. Approximately 28% of respondents indicated that more information is needed about the transit service available. The next most common improvement requested was for more interconnections, indicated by 13% of respondents. Approximately 24% of respondents did not think any improvements were necessary, and 24% did not know what improvements are needed.

Operation & Maintenance

Most transit agencies responded that current fleets and facilities meet the needs, and that resources are available to perform preventative maintenance and maintain a high level of service. 75% rated their operations and maintenance "Good" or "Excellent."

Public Safety & Resilience

Most transit agencies responded that public safety at transit stops, park-and-rides, and other facilities is "Excellent" (38%) or "Good" (31%). 25% of respondents rated public safety "Fair". Continued investment in transit systems of all kinds is needed to support people's ability to access jobs and enjoy independent mobility as they age.

TRANSIT

Steps toward resilience vary widely among agencies. Typically, the urban public transit providers are more resilient than their rural counterparts. For example, Mountain Line in Missoula has a lot of redundancy in their routes and uses technology to monitor route service and delays with real-time bus tracking. In contrast, many rural agencies have much smaller fleets where the same level of redundancy is infeasible. Half of Montana transit agencies that responded rated their ability to maintain current level of service as "Good", while 38% rated "Fair".

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Recommendations

Montanans want "more" when it comes to public transit/public transportation. This can be achieved by increasing access to transit in urban, suburban, and rural communities. Transit should be included in state and local project development processes and metrics to track performance of transportation systems. This would support adequate funding of maintenance of transit vehicles and facilities to keep systems in state of good repair and reduce life-cycle costs. Further, federal investment in transit through a robust surface transportation program (authorization and appropriation) and a solvent Highway Trust Fund should continue. Local, regional, and state government entities – especially in smaller urban and rural areas – should prioritize transit investments that can enhance sustainable land-use decisions. Finally, transit systems should be required to adopt comprehensive asset management systems to maximize investments.

SOLID WASTE B-

Summary

Of the 1.6 million tons of solid waste generated annually in Montana, approximately 1.3 million tons are landfilled. Since municipal solid waste rules changed in 1993, significant improvements have occurred within Montana's solid waste infrastructure and operations, including a reduction from over 300 facilities statewide to just 31. The state has approximately 38 years of landfill capacity currently permitted. Most of the municipal landfills were either constructed or have received significant upgrades within the last 25 years, providing good to excellent environmental protection. In addition, the support infrastructure, including roads, stormwater controls, and equipment buildings are in relatively good condition. One exception is rural container sites and some transfer facilities, which are generally older and in fair to poor condition, posing significant public safety issues. Montana has improved the percentage of material diverted from its landfills, but needs to continue to make progress towards increasing waste diversion through reuse and recycling. Overall, Montana's solid waste infrastructure is in relatively good condition and solid waste rates are reasonably affordable.

About Montana's Solid Waste

The State of Montana generates approximately 1,600,000 tons of solid waste annually which, according to the Integrated Solid Waste Management Plan (ISWMP) by the Montana Department of Environmental Quality (MDEQ), must be handled by the solid waste infrastructure. MDEQ approximates that 1,300,000 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
- Other special wastes such as asbestos, agricultural, sludge, electronic waste (e-waste)

Montana currently has 31 licensed Class II landfills (municipal waste) spread across the State which accept between 1,500 and 250,000 tons of waste per 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. Landfarms
6. Recycling facilities

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

Helena Transfer Station

Source: Great West Engineering, Inc.

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 regulations were adopted in 1993, regulating the proper design, operation, and closure of MSWLFs in the US. Montana took over 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 1980s to the 31 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 and state requirements to 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 are required to remove and treat water that percolates through the waste to the top of liner system. This provides further protection of the groundwater
- Operations Requirements: Daily compaction and cover of waste, stormwater controls, and liquids restrictions provide environmental protection of surface water, reduce litter, and control vectors like flies, birds, and rodents
- 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. This requires that the landfill be properly closed and reclaimed to protect the environment long term. Landfill owners are required to maintain and monitor facilities for a minimum of 30 years after final closure

- Financial Assurance: Insures adequate funding is available to pay for closure and post closure care of the landfill.

Since the majority of wastes are ultimately placed in Class II Landfills and these facilities are primarily responsible for the protection of public health and the environment, the analysis and grading was heavily based on these facilities.

Capacity

The primary asset of MSWLFs is air space. Air space is the volume available for the disposal of solid waste. MSWLFs manage their air space by compacting waste within the landfill prior to covering it with soil. 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 5 to 10 years to license a new facility in the State depending on the public acceptance of the new facility. Montana has approximately 5,000,000 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

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 compliance 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 prior to Subtitle D, making them more susceptible to environmental pollution than new facilities that were sited, designed, and operated in accordance with Subtitle D. Most of the 31 existing MSWLFs were designed and constructed in compliance with Subtitle D or were significantly upgraded since the implementation of these federal rules.

Billings Reginonal Landfill Phase 5 Cell

Source: Great West Engineering, Inc.

The most common serious environmental issues with solid waste facilities are groundwater pollution and landfill gas migration off the facility. Existing facilities in Montana with environmental issues are taking corrective measures to remedy those issues. Corrective measure requirements are mandated in the federal and State legislation. As an example, one facility in Montana received solvents that were dumped in unlined areas prior to the implementation of federal rules restricting liquid wastes from landfill disposal. This resulted

in contamination of the groundwater at the facility. However, the facility has implemented corrective actions over the past twenty years that have reduced pollution levels below the Safe Drinking Water Act standards at the property line of the facility. The strict federal laws require the facility to continue to take measures to improve the groundwater quality, even though the water now meets the Safe Drinking Water Act standards for human consumption. As a result, the few facilities in Montana that have issues with groundwater or gas pollution are making significant efforts to reduce these impacts, and the scale of the actual environmental pollution due to solid waste facilities in Montana is very limited.

Another common, but less serious environmental issue at these facilities is windblown litter. Litter control is primarily an operational issue rather than infrastructure related. Facilities are continually improving their litter control infrastructure and operations, but litter control issues in the state of Montana will remain because the majority of the state is very windy. The large majority of solid waste facilities in Montana provides good to excellent environmental protection and is in compliance with State and federal requirements.

Operation & Maintenance

The federally mandated standard operating procedures followed by all landfills in Montana include screening of waste material types, proper compaction techniques, daily soil cover, stormwater controls, and liquid restrictions. These operational practices largely eliminated past poor practices including open burning and improperly covered wastes, which often resulted in the breeding of rodents, flies, and other undesirable species which negatively impacted human health. The Montana Department of Environmental Quality (MDEQ) attempts to inspect each facility 1-2 times per year. MDEQ issued many violations to facilities immediately after the implementation of Subtitle D because operators and facilities had to adjust to many new operating procedures and many did not have the resources available to meet the new standards. The number of violations issued by MDEQ has since dropped dramatically as operators and facilities have learned how to best comply with the rules.

Funding

Solid waste systems were questioned about their rates; however, this was not used in the scoring criteria. There are a wide range of methods used to charge customers including property taxes, monthly billing, and "pay as you throw". In addition, some entities do not provide curbside pickup and which is traditionally billed through another provider. This made a comparison of rates more difficult. However, data was obtained that was used to get an idea of the range of solid waste service costs.

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 grants for solid waste infrastructure. 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 $45,072 for 2012, as cited by the American Community Survey. Rates paid by users include disposal fees and curbside pick-up of waste. In some cases the landfill and

Scale – Philipsburg, Montana

Source: Great West Engineering, Inc.

pick-up service may be operated by different entities. In some jurisdictions, curbside pick up 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 $180-$350 per year. Therefore, the household cost for solid waste services in Montana varies from 0.4% to 0.8% of the statewide MHI.

The solid waste facilities in Montana are largely financed by the users and grant funding is rarely used for solid waste infrastructure projects. The facilities in Montana are doing a good job of planning their needed capital projects and developing reserve accounts for future capital projects. If needed, the Montana State Revolving Fund (SRF) will provide low interest loans for most solid waste infrastructure projects.

Public Safety

Solid waste infrastructure experiences heavy public and institutional use at landfills and other solid waste facilities such as transfer stations and container sites. This includes roads, buildings, stormwater controls, container sites, and fencing. This report card also evaluates the facility condition with regard to compliance with safety standards.

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. This includes on-site roads, stormwater controls, and equipment buildings. The one component of the solid waste infrastructure that 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.

Small transfer stations and container sites in Montana remain one of the public's biggest safety issues. These facilities are not regulated by the federal or State government. 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 over the last 20 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, resulting in death. Unfortunately, there is no regulatory authority to force existing facilities to make upgrades to these facilities. The Montana Association of County Officials (MACO), who insures most of the County facilities, has asked their members to make safety improvements at facilities that include installing 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 that is currently required under building codes for all new construction. Existing facilities are not regulated by these building code requirements.

Gallatin County Landfill – Logan: Leachate Collection Trench

Source: Great West Engineering, Inc.

MACO has also suggested that facilities be supervised and access 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. We recommend that access to these facilities be limited to certain hours, be staffed when open, and building-code compliant safety improvements be made. Safety improvements and upgrades are needed at over 100 container sites in the State.

Resilience and Innovation

The national trend is to increase the percentage of solid waste being diverted though recycling, composting, and other measures to divert wastes from the landfill. This increases the life of landfills and is an environmentally responsible approach. Recycling in Montana is 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 waste, and cardboard is common in Montana. Some facilities recycle paper, plastics, tin, e-waste, batteries, glass, and other materials. Some 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 ISWMP published by MDEQ in 2013, the State is currently diverting approximately 22% 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 solid waste operators in Montana. Examples include active gas collection and energy generation at the Flathead County Landfill and active gas collection and processing for supply at the City of Billings Regional Landfill. Waste Diversion was assessed by the facility diversion rate and the plans for the future. 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.

Recommendations

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 should 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 install safety measures at container sites, particularly those in rural areas. This should include limited, regular hours of operation with staffing for oversight of the public using these facilities. Montana should continue to encourage education of landfill operators and managers to improve operations practices. Finally, Montana 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 years in Montana.

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MDEQ Solid Waste Facility Database and Tonnage Summary for 2012.

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