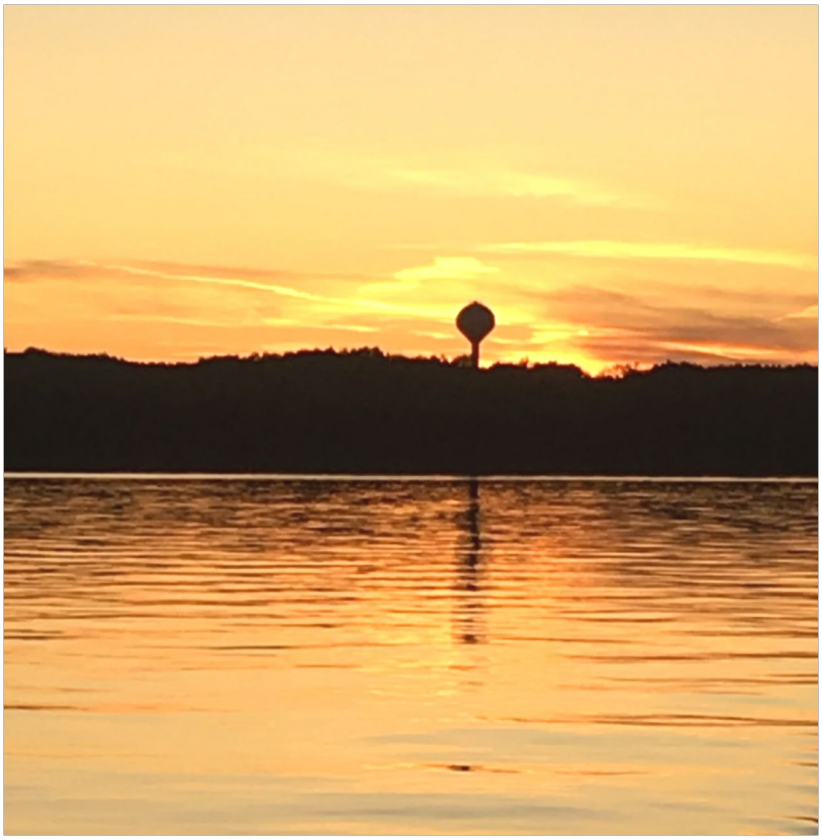
DEPARTMENT OF NATURAL RESOURCES

Minnesota Water Conservation Report

2020 Annual REPORT



Publication Information

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For current water conservation reporting information, a list of conservation best practices, and sector information, visit https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/conservation.html .

This report should be cited as: Minnesota Water Conservation Report for 2020, Minnesota Department of Natural Resources, St. Paul, MN. All images in this report copyright State of Minnesota, Department of Natural Resources unless otherwise credited. This report summarizes the water conservation efforts of the water appropriation permittees in the water supply sector, commercial, industrial, and institutional sector, and irrigators, livestock operators and other water appropriation permit holders.

Written By

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Minnesota Department of Natural Resources

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Energy Platforms LLC

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Figure 1. You can't manage what you don't measure.

Executive Summary

This report covers Minnesota water conservation efforts for water appropriation permit holders based on water use data in 2020. The year 2020 was a time of unprecedented change, including water use and water conservation trends. Early in the year we experienced a worldwide pandemic that caused a statewide lockdown and stay-at-home orders for everyone except essential services. Some Minnesota industries stepped up production of personal protective equipment, respirators, sanitizers, and other health care necessities. Other facilities were shuttered. These events shifted the usual pattern of water use in Minnesota.

We now have 4 years of large utility data and are adding trend analysis.

- This analysis reflects the impact of COVID, especially for municipalities.
- 2020 was the first year of irrigation and livestock operator sector reporting.

All water use also has an energy footprint; conserving water also conserves energy. Minnesotans helped save the energy used to heat, treat, pump, and deliver water to homes and businesses. These energy savings help combat climate change, prevent millions of metric tons of greenhouse gas emissions, and help consumers save on their energy bills. We would like to thank the cities, businesses, and agricultural water users who have worked to achieve water conservation goals.

Highlights for All Sectors

- Four consecutive years of large municipal water supply reporting (cities serving more than 1,000 people) gives us a solid picture of water supplier flow in the state.
- 184 of 342 utilities entered “reasonable” data four years in a row. Water flow measurement is often impacted by inaccuracy in water meters, and this high level of reasonable data indicates that many cities are doing a good job testing and maintaining their meters. Cities reporting “unreasonable” data should test their water meters and consider repair/replacement of those that are not performing properly.
- The second and third year of Commercial, Industrial, and Institutional (CII) reporting yielded more results.
- The first and second year of small municipal water supply reporting (cities serving under 1,000 people) response was good.
- 2020 was the first year of irrigation and the livestock operator sector reporting. While the voluntary reporting response was low, useful results can be gleaned. The irrigation and livestock operator group is the fourth and final addition to the Water Conservation Reporting System.

Program Overview

Minnesota is generally considered to have abundant water resources, sufficient to satisfy its domestic, industrial, agricultural, and environmental water supply needs. We use water from our lakes, rivers, and groundwater aquifers. However, water is not distributed evenly across the state and some areas are experiencing water shortages, increasing demand, or water use conflicts. As the state looks to the future, we are focusing on using water more efficiently to address our growing population and protect this precious natural resource.

The Water Conservation Reporting system is powered by ESPWater, built by ESPLabs, a Minnesota-based IT firm that is on contract with the Department of Natural Resources. The reporting system collects water conservation data on a voluntary basis from nearly 10,000 water appropriation permit holders. Reporting began in 2017 and was rolled out to various sectors over a four-year period. Through this reporting system the DNR encourages innovation in water savings, manufacturing, and irrigation.

The report helps water suppliers with their water accounting, finding system losses, and tracking water conservation progress. For industry and agriculture, the report offers a menu of innovative methods to conserve water and track annual implementation. Upon completing individual reports, each organization can download a summary of that year's accomplishments, as well as a certificate of completion. Municipalities are able to view each other's report to learn from each other and compare methods of conservation. To protect trade information, business reports are not shared with other businesses.

Guiding Mandates

A permit is required for all groundwater or surface water withdrawals that exceed in 10,000 gallons per day or one million gallons per year. Applicants for water appropriation permits must evaluate alternatives to the actions proposed in the permit application including conservation measures to improve water use efficiencies and reduce water demand.

To protect the Great Lakes' freshwater resources, in 2008, Minnesota joined with seven other states and two Canadian provinces to sign the Great Lakes Compact, agreeing to prohibit the removal of water from the Great Lakes or its tributaries for use outside the Great Lakes Basin. The compact also required that each state implement efficiency and conservation programs to reduce overall water use.

The Minnesota Department of Natural Resources is voluntary partner with U.S. Environmental Pollution Agency (EPA) WaterSense® program. Partners promote awareness of the WaterSense label and water conservation by distributing program materials at public outreach events and encouraging water suppliers and businesses to also become partners.

Multiple benefits of water efficiency/conservation

- Typically the fastest and least expensive way to save water
- Saves utilities and taxpayers money by minimizing the need for infrastructure expansion

- Reduces the amount of energy used to heat, pump, and treat water, which in turn reduces carbon dioxide emissions
- Increases resilience to weather extremes
- Protects our rivers, lakes, and aquifers by limiting withdrawals
- Saves consumers and businesses money: water efficient products typically have a very short return on investment
- Landscape/Ag water efficiency can limit chemical runoff
- Helps communities manage water supply disruptions

Overall Goals & Objectives of the Minnesota Water Conservation Reporting System

The Water Conservation Reporting System goals align with key Great Lakes Compact water conservation goals and objectives. Water conservation objectives in the Great Lakes Compact Section 4.2.1 have been adopted in Minnesota policy. These objectives include: 1. Guiding programs toward long-term sustainable water use; 2. Adopting and implementing supply and demand management to promote efficient use and conservation of water resources; 3. Improving monitoring and standardizing data reporting among state and provincial water conservation and efficiency programs; 4. Developing science, technology, and research; and 5. Developing educational programs and information sharing for all water users.

As part of our objective to improve monitoring and standardize data reporting, this Water Conservation Reporting system's goals are:

- Monitoring large water supplier's efforts toward reaching their water supply plan conservation goals/targets.
- Gathering data to guide water use policy decisions, especially for groundwater management areas, areas with water use conflicts or during droughts.
- Providing direct water conservation performance feedback to permit holders.
- Offering a statewide standardized data format for utility water usage analysis.
- Raising awareness of the importance of water conservation among Minnesota permittees and leading them to best conservation practices.
- Guiding sustainability of water resources and for community water supply planning.

Water Supplier Results

We gather water accounting data to see how cities are managing their water distribution with the goal of helping them improve. We have gathered four years of large water supplier information and patterns are emerging in the data. Smaller communities are summarized separately since they have not been reporting as long.

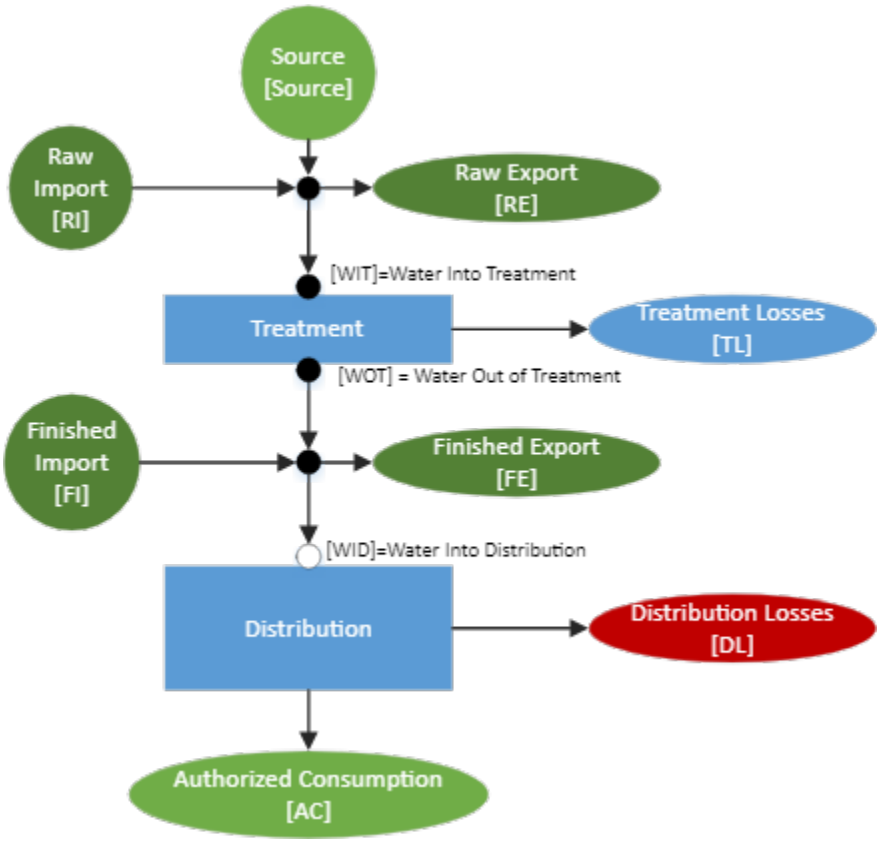
Local Water Supply Plan Goals (for cities serving over 1,000 people)

- Reduce distribution water loss to less than 10%

- Residential Gallons Per Capita per Day (GPCD) is less than 75
- Declining trend in non-residential water use
- Declining trend in total water use
- Daily peaking factor ratio of less than 2.5
- Implementation of demand reduction measures
- Reduce water use and support wellhead protection

Water Accounting Model

The following water flow schematic shows how water for municipal water supplies is distributed from the original source of water to the end user. The diagram also describes the relationships between the accounting fields that are collected.



Terms and Formulae:

The table below explains the abbreviations used in this report and in the online reporting system. The permit holder enters some of the online reporting data and other fields are derived automatically.

Term	Name	Entered or Derived	Formula / Description
Source	Own Sources	Entered	Total (Own Sources)

RI	Raw Imported Water	Entered	Total (Imported Raw Water)
RE	Raw Exported Water	Entered	Total (Exported Raw Water)
WIT	Water Into Treatment	Derived	WIT = Source + RI – RE
WOT	Water Out of Treatment	Derived	WOT = WID + FE – FI
FI	Finished Imported Water	Entered	Total (Imported Finished Water)
FE	Finished Exported Water	Entered	Total (Exported Finished Water)
WID	Water Into Distribution	Entered	"Billed Metered" + "Billed Unmetered" + "Unbilled Metered" + "Unbilled Unmetered"
AC	Authorized Consumption	Entered	Total (Residential Monthly) + Total (Non-Residential Monthly)
TL	Treatment Losses	Derived	TL = WIT – WOT
DL	Distribution Losses	Derived	DL = WID – AC
TotL	Total Losses	Derived	TotL = TL + DL
UWL	Unaccounted Water Loss	Derived	UWL = DL / WID

While it is important to implement water conservation practices "after" the customer meter, it is critical for a city to know its basic water accounting facts to successfully operate water treatment and distribution systems.

Valid Data

We have received a good response from the large water suppliers for the last four years.

Large Utilities	2017	2018	2019	2020	Totals
Utility Count	342	342	342	342	1,368
Reported	318	304	299	292	1,213
Valid Data	249	246	240	248	983

Of the 342 large municipal water suppliers (cities) in MN, 266 have reported data for four years in a row.

Using the water accounting data collected, we can see if a utility is reporting "valid" data. For analysis, we omit utilities that have reported invalid data.

The criteria for rejecting a utility's data are:

- Negative treatment loss
- Treatment loss > 50%
- Negative distribution loss
- Zero authorized consumption
- Zero gallons from sources
- Zero distribution loss ratio

Four Year Trends – Large Utilities

184 MN water utilities (54%) reported reasonable data four years in a row. These utilities are likely doing a good job with water accounting, monitoring, and maintaining their water meters. We call this list our "Gold" utilities and will use this group for four-year trend analysis.[1] An additional 44 of the large utilities (13%) reported valid data three years out of the four. We've dubbed this group our "Silver" utilities.[2]

There are inherent limitations to the accurate measurement of water flow. Even when meters are operating properly, they have tolerances on their accuracy. And meter accuracy decays over time; the wear in mechanical systems typically causes artificially low readings, while buildup occurring in modern electronic measurement systems typically causes high readings. It takes regular meter maintenance and calibration to produce accurate water flow measurements over time. It is likely that our Gold utilities, reporting valid data over a four-year period, are doing a good job maintaining their water meters.

The following observations of our Gold utilities are our best indications of statewide trends.

COVID Impact

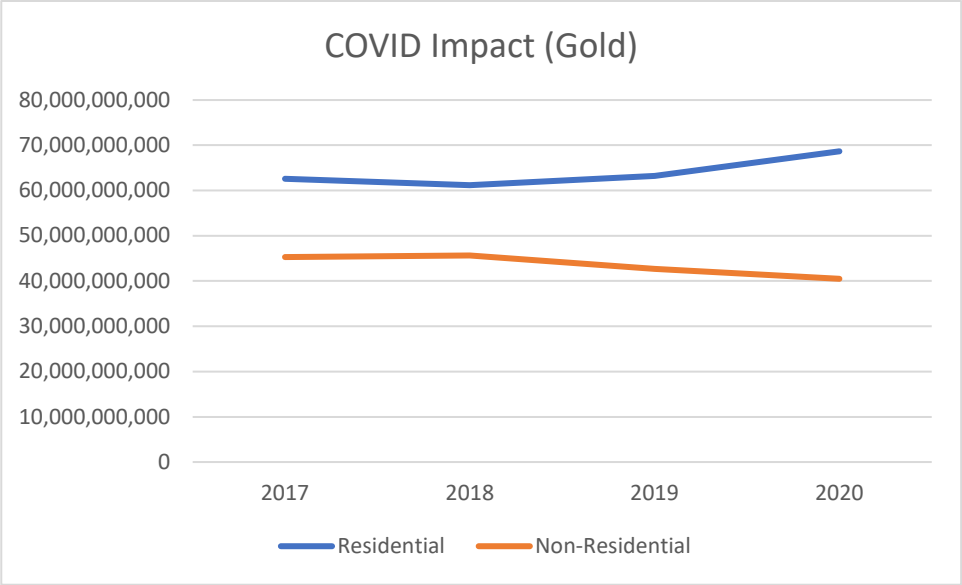


Figure 2: MN residential water consumption rose significantly in 2020. This is likely caused by increased time spent at home during lockdowns due to COVID-19. Simultaneously, water suppliers saw a decline in non-residential water use during the early period of the pandemic.

[1] "Gold Club" utilities are listed in Appendix A.

[2] "Silver Club" utilities are listed in Appendix B.

Average GPCPD Goal

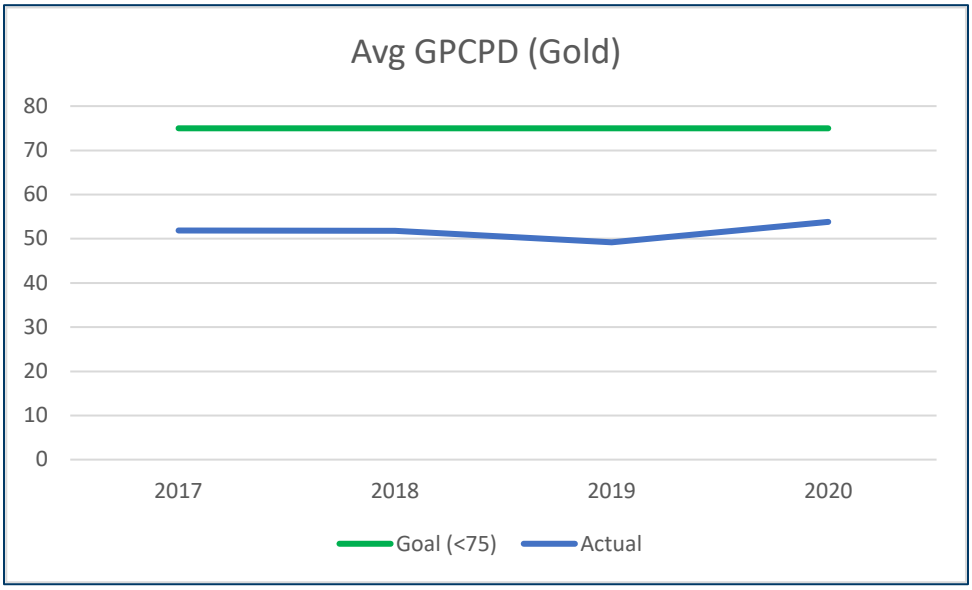


Figure 3: Gallons per capita per day rose in 2020, probably due to COVID-19. Still, MN utilities handily met the statewide goal of Residential Gallons Per Capita per Day (GPCD) is less than 75.

Average Total Peaking Factor Goal

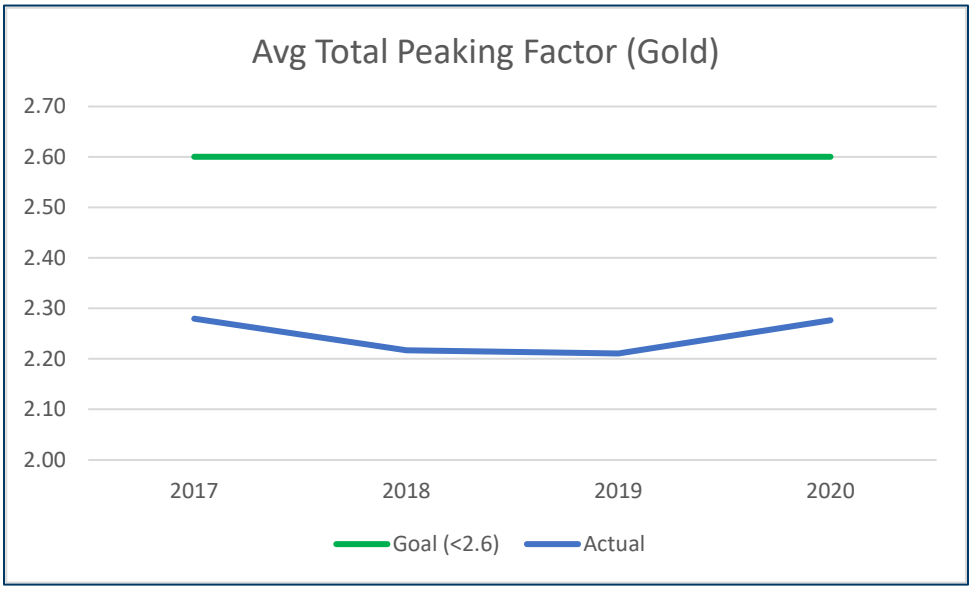


Figure 4: Gold MN utilities continue to meet the Average Total Peaking Factor goal

Percent Reduction in Non-Residential Water Use Goal

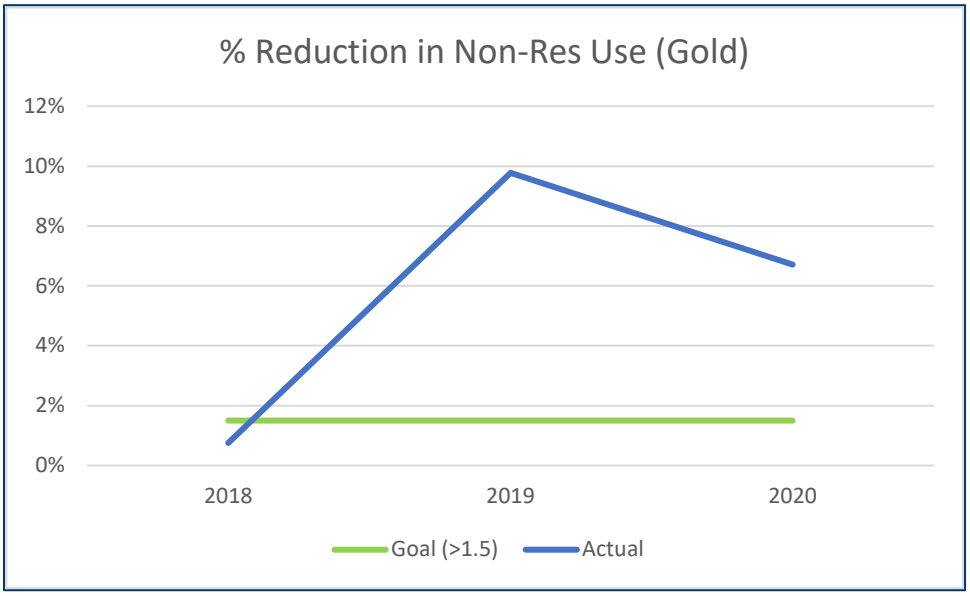


Figure 5: Gold MN utilities met the Non-Residential Water Use reduction goal in 2019 and 2020. The goal is a declining trend in non-residential water use.

Average Percentage of Distribution Water Loss Goal

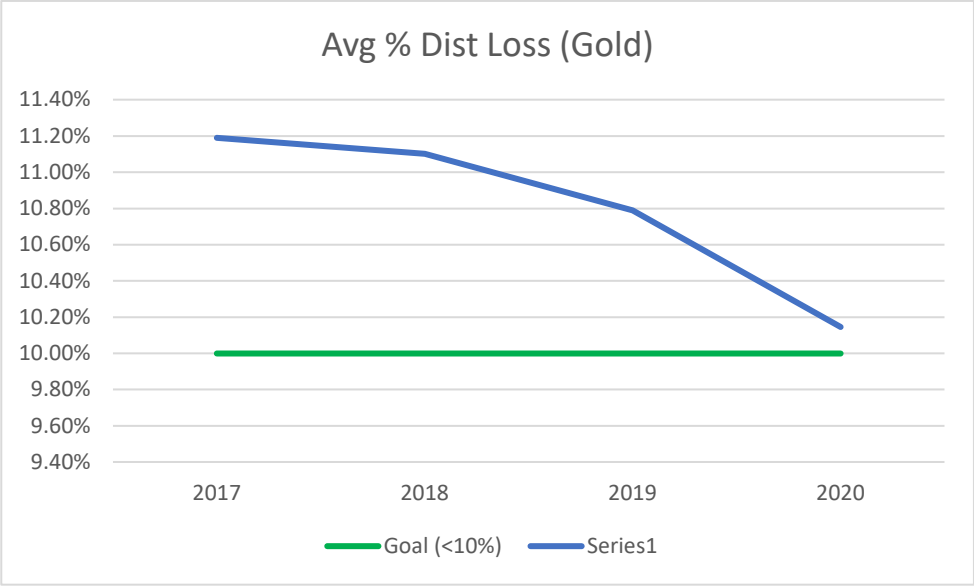


Figure 6: Each city has a goal to reduce distribution water loss to less than 10%. In aggregate, Gold MN utilities achieved the system loss goals in 2020 for the first time. This is good progress.

2020 Results - Large Utilities

The following large utility results only include the utilities that reported valid data in 2020 (this is not the Gold set of utilities used for 4 year trend analysis above).

In 2020, 236 of 342 large utilities (69%) reported valid “reasonable” data.

Goals (for cities serving over 1,000 people)

- Reduce distribution water loss to less than 10%
- Residential Gallons Per Capita per Day (GPCD) is less than 75
- Declining trend in non-residential water use
- Declining trend in total water use
- Daily peaking factor ratio of less than 2.5
- Implementation of demand reduction measures
- Reduce water use and support wellhead protection

Highlights

- Reducing distribution water loss to less than 10% - 143 of 236 large utilities or 61% achieved
- Less than 75 GPCD residential water use - 207 of 236 utilities or 88% achieved
- Declining trend in non-residential water use – as seen in the Trends section above, this was met in 2020
- Daily peaking factor ratio of less than 2.5 was achieved by 172 of 236 utilities or 88%
- In 2020, utilities implemented 5,299 demand reduction measures for an estimated water savings of 37,595,431 gallons of water
- Leak detection and repair dominate the savings activities in the category of Reduce water use and support wellhead protection.

Large Utility Discussion and Recommendations

- Preparations are underway for the next round of Local Water Supply Plans. It is likely that communities that have adequately reported in the Water Conservation Report will be able to simply reference the report.
- Cities have been targeting and improving their water loss and leak management. Use the Water Conservation Report to prioritize other actions: commercial and industrial use, reducing irrigation, efficient appliances, process efficiency, advanced metering, customer outreach and education, policies and regulations, rates, partnerships, and water reuse.
- When you invest in conservation, you need to manage rates, but overall customers can save money too. Conservation can lead to avoided costs for utilities.

2020 Statewide Water Balance

Water Balance - Large Utilities
Millions of Gallons

Own Sources 181,079	Exported Raw 3,922	Treatment Loss 32,128 (22.6%)	Water Into Distribution 142,055 (100.0%)	Authorized Consumption 132,692 (93.4%)	Billed Metered 127,635 (89.8%)	Revenue Water 128,060 (90.1%)
		Exported Finished 7,920			Billed Unmetered 425 (0.3%)	
	Water Into Treatment 177,865	Water Out of Treatment 145,737			Unbilled Metered 1,883 (1.3%)	Non-Revenue Water 13,995 (9.9%)
Imported Raw 707					Unbilled Unmetered 2,749 (1.9%)	
				Distribution Loss 9,363(6.6%)	Unauthorized Consumption 104 (0.1%)	
					Meter Accuracy Loss 676 (0.5%)	
		Imported Finished 4,238			System Data Handling Discrepensy 47 (0.0%)	
					Reported Breaks and Leaks	
					Unreported Loss 8,536 (6.0%)	
181,787	181,787	193,944	142,055	142,055	142,055	142,055

Figure 7: This is the total water balance for the filtered set of utilities reporting valid 2020 data, shown in millions of gallons. AWWA water balance is shown in light green. In 2020 the filtered set of utilities reported a distribution water loss

North and East Metro Groundwater Management Area trends in water conservation:

- Per capita water use has been declining, in terms of residential use as well as total community use. However, total use is still above the 90 gpd goal. Residential use is below the 75 gpd goal.
- Results from several communities illustrate how leak detection can help communities conserve water and save money. St. Paul saved 166 million gallons of water and $1.7 million through leak detection efforts; Fridley saved 28 million gallons; White Bear Lake Twp. saved 21 million gallons.
- Cottage Grove saved 1.3 million gallons of water through installation of 146 "smart" lawn watering controllers. Hugo, Stillwater, and Oakdale also focused on "smart" lawn irrigation controllers to conserve water.
- Some communities are using ordinances and policies such as irrigation restrictions, and landscape, and vegetation requirements to advance conservation.
- Communities are also achieving water conservation by promoting efficient toilets and shower heads, as well as through the re-use of stormwater.

Distribution Losses

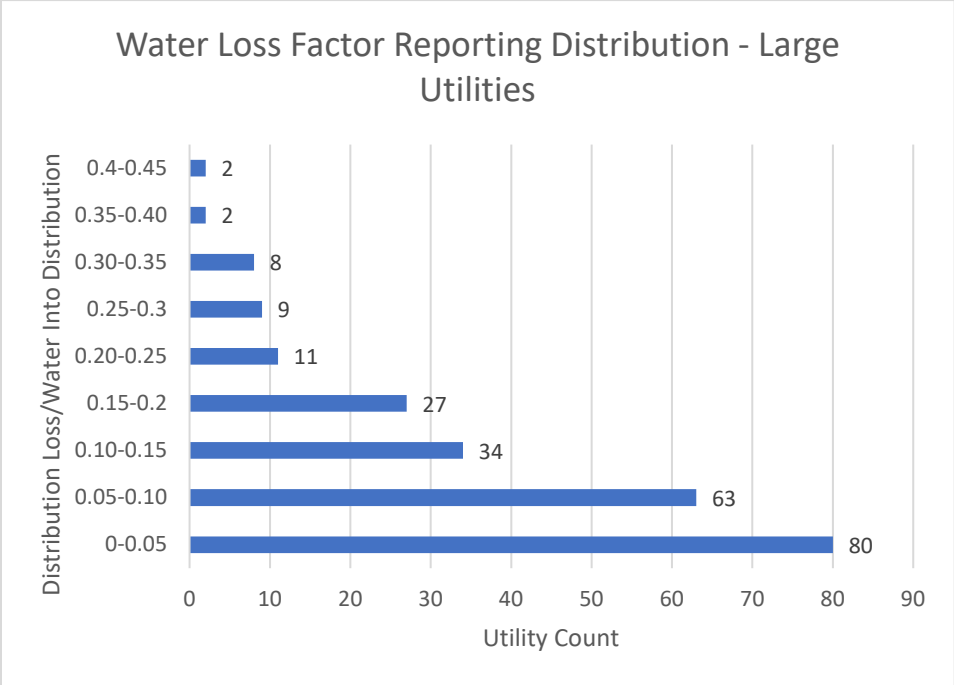


Figure 8: The statewide goal for distribution water loss ratio is 10%. 143 utilities (61% of those reporting valid data) achieved that goal in 2020.

Demographic Data

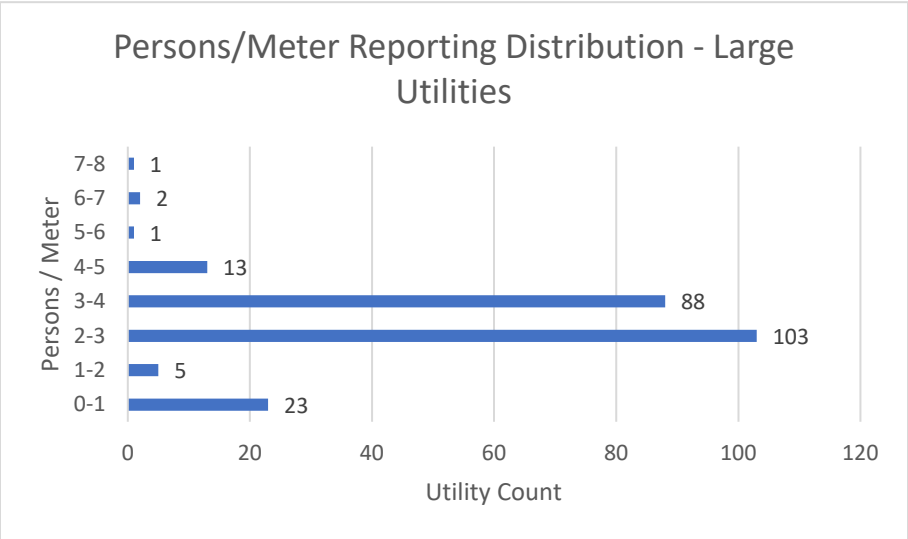


Figure 9: Persons/Meter values appear reasonable in 2020, considering an individual utility's mix of residential, multi-family buildings, and occupancy.

Residential Gallons Per Capita per Day (GPCD)

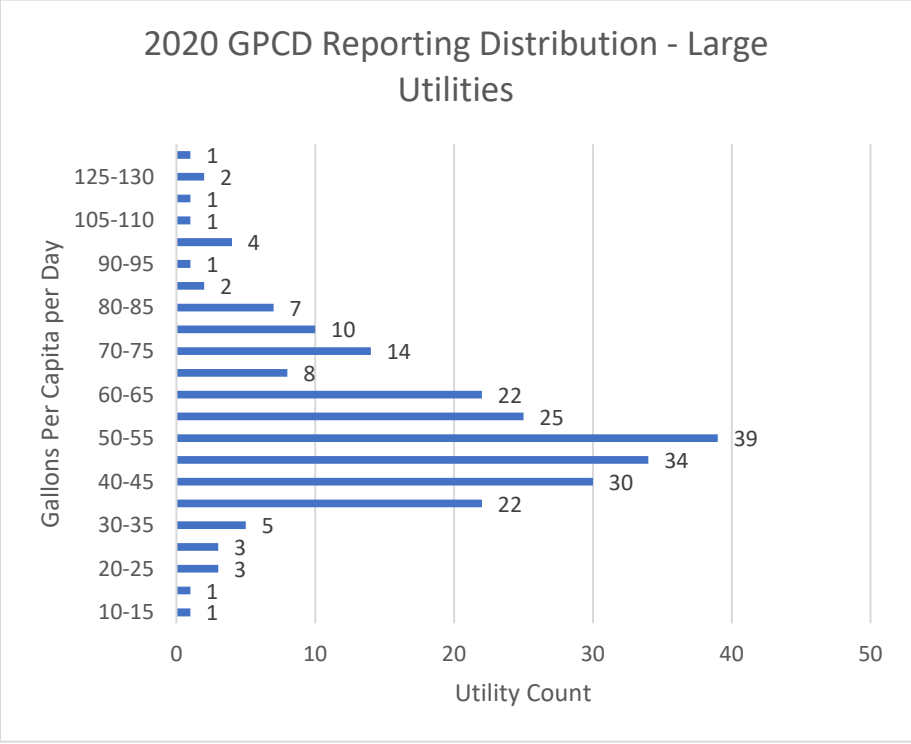


Figure 10: the statewide goal is 75 Residential GPCD. 207 of 236 large utilities (88%) met the goal in 2020.

Distributed Water

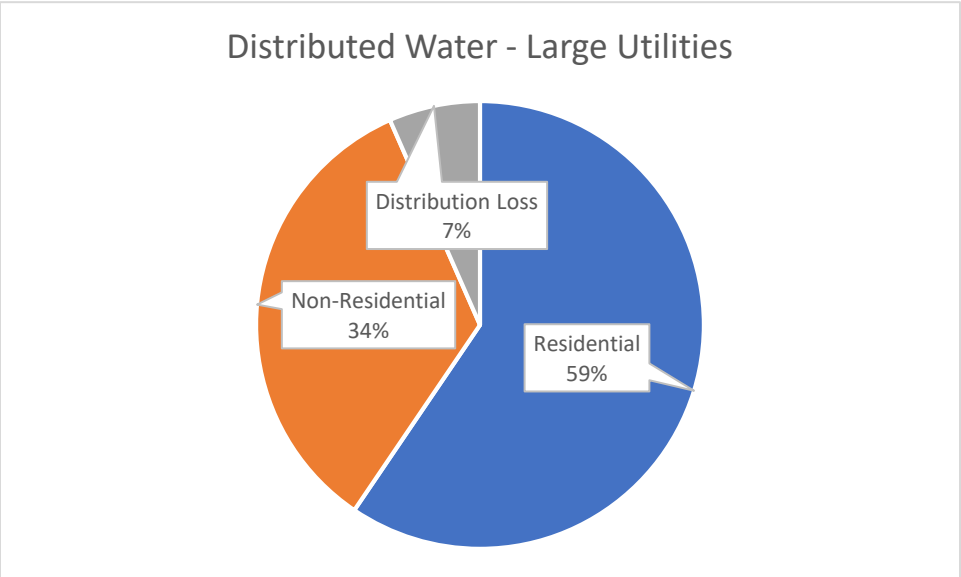


Figure 11: Aggregated distribution loss of 7% in 2020 meets the MN goal of 10% total loss.

Daily Peaking Factor

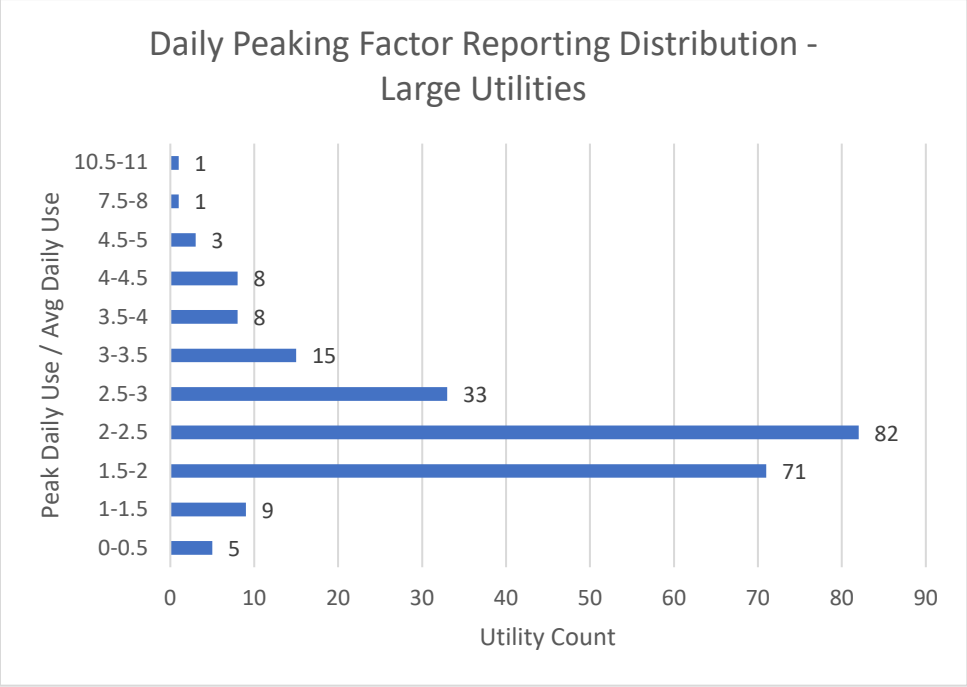


Figure 12: 172 of 236 large utilities (88%) met the MN goal of having a Daily Peaking Factor less than 2.6.

Water Infrastructure Conservation Efforts – Direct

System Project	Savings (Gallons	Cost	Cost/Gallon
System Leak Fixing Before The Mete	1,952,014,060	$ 126,557,081	0.065
Meter Repair/Replace	54,450,265	$ 10,296,988	0.189
Hydrant Repair	46,865,878	$ 4,117,296	0.088
Increase Treatment Efficiency	8,031,325	$ 140,789	0.018
Meter Testing	10,233,019	$ 164,595	0.016
Reduce Unauthorized Water Use	9,132,012	$ 34,277	0.004
Add NonIrrigation Meters	2,140,001	$ 12,038	0.006
Pressure Control	7,153,150	$ 124,300	0.017
Add Irrigation Meters	4,530,014	$ 53,486	0.012
Storage Mixing	4,750,000	$ 129,129	0.027
	2,099,299,724	$ 141,629,979	

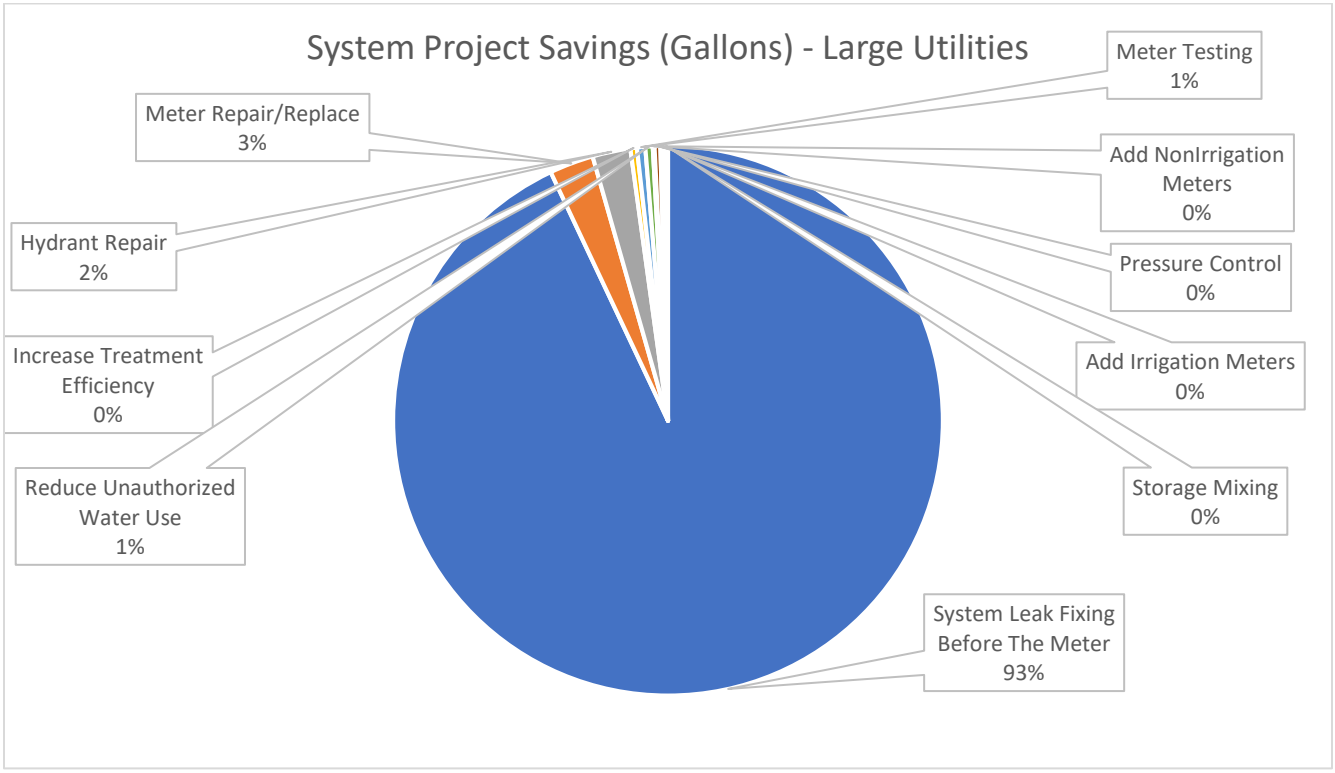


Figure 13: Leak detection and repair dominate the savings activities taking place “before the meter.” Utilities that are not reporting “reasonable” data should focus on meter maintenance, testing, and repair/replacement.

Customer Project	Qty	Savings (Galllons)
SF_Clothes Washer Rebates	1,569	7,845,000
SF_Toilet Retrofits	1,258	7,548,000
SF_ET_Irrigation Controllers	1,005	9,045,000
SF_Showerand Aerator Kits	650	3,261,700
SF_Rain Barrels	292	379,600
MF_Toilet Retrofits Unit	142	1,360,502
SF_LF Showerheads	98	202,076
MF_Showerhead and Aerator Kits	90	451,620
MF_LF Shower heads	50	94,900
MF_CII__ET_Irrigation Controllers	40	5,882,812
SF_HE_Water Softeners	28	0
CII_Automatic Faucets	24	36,000
CII_Dishwashers	19	1,097,383
MF_Clothes Washer Rebates	10	109,500
CII_Toilet Retrofits	9	85,410
MF_CII_LargeLandscapeProjects	5	0
SF_EfficientIrrigation Nozzles	4	0
SF_Rainwater Harvesting Rebates	2	15,768
MF_CII_Rainwater Harvesting	2	150,160
CII_Facility Audits	1	0
CII_Laundromats	1	30,000
CII_Spray Rinse Valves	0	0
CII_Food Steamers	0	0
MF_CII_Coin Operated Clothes Was	0	0
MF_Toilet Retrofits Common Area	0	0
CII_Waterless Urinals	0	0
	5,299	**37,595,431**

2020 Results - Small Utility Results

Small utilities (those serving under 1,000 people) represent a small percentage of the gallons used by all utilities in MN. Small utilities are not required to report into MN water conservation reporting system. We thank those that are reporting.

Statewide Water Balance (Small Utilities)

Water Balance - Small Utilities
Millions of Gallons

Own Sources 4,711	Exported Raw 1	Treatment Loss 105 (2.3%)				
		Exported Finished 0				
	Water Into Treatment 4,710	Water Out of Treatment 4,605	Water Into Distribution 4,606(100.0%)	Authorized Consumption 4,118(89.4%)	Billed Metered 3,883(84.3%)	Revenue Water 3,919(85.1%)
					Billed Unmetered 36(0.8%)	
					Unbilled Metered 63(1.4%)	Non-Revenue Water 687(14.9%)
Imported Raw 0					Unbilled Unmetered 136(3.0%)	
				Distribution Loss 489(10.6%)	Unauthorized Consumption 2(0.0%)	
					Meter Accuracy Loss 3(0.1%)	
					System Data Handling Discrepensy 0(0.0%)	
		Imported Finished 2			Reported Breaks and Leaks	
					Unreported Loss 484(10.5%)	
4,711	4,711	4,713	4,606	4,606	4,606	4,606

Distribution Losses

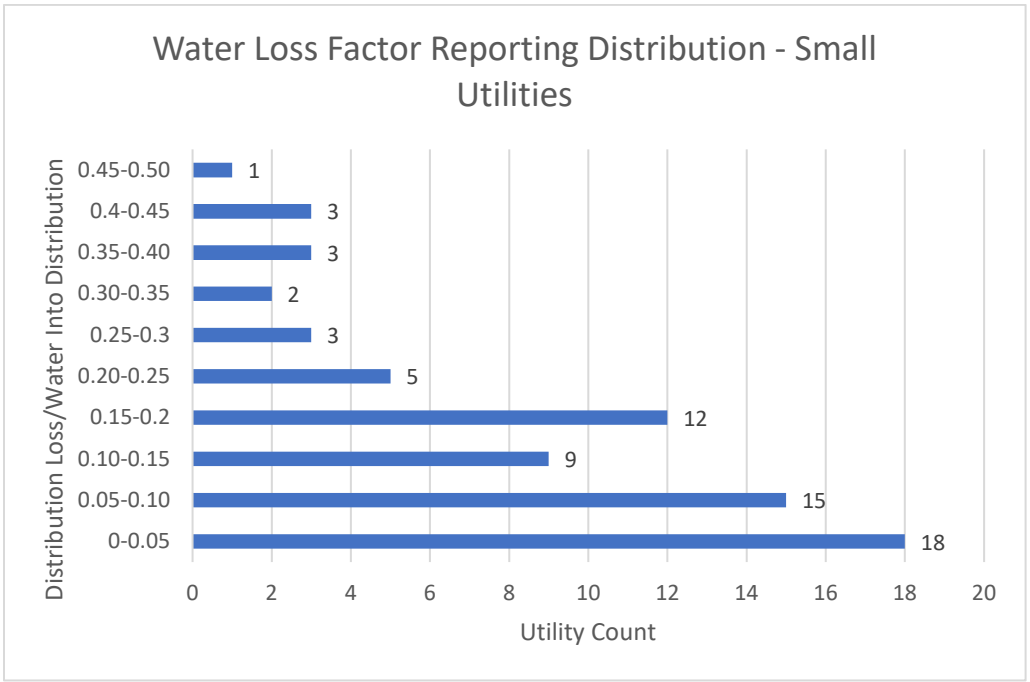


Figure 14. Many small utilities likely need better water accounting and additional meters for accurate water loss data.

Demographic Data

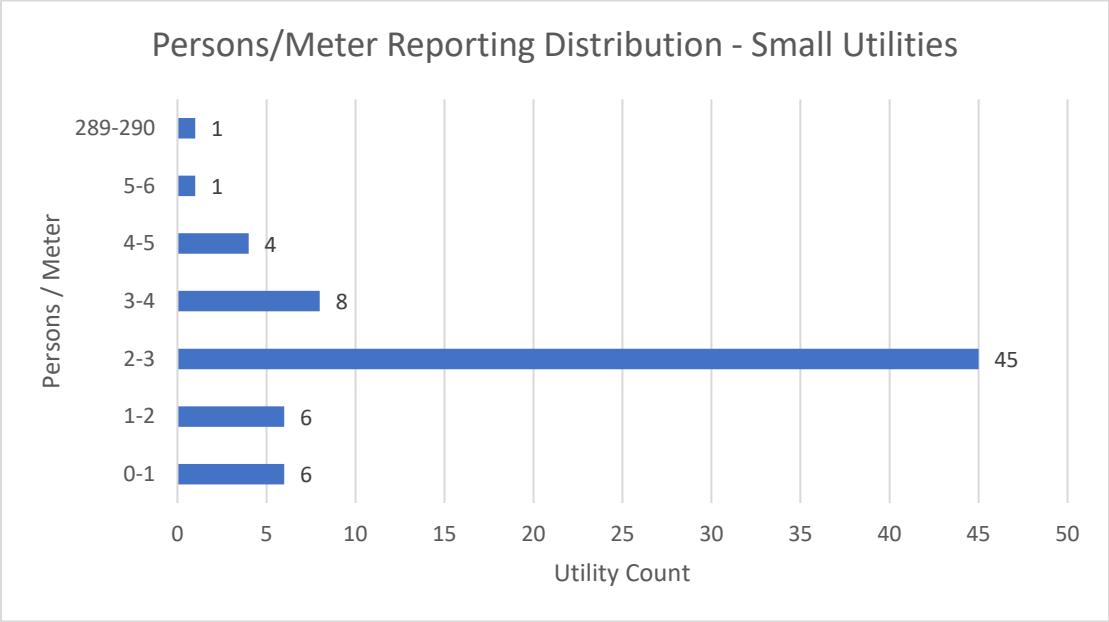


Figure 15. Most small communities serve households with 2-3 people.

Residential Gallons Per Capita per Day (GPCD)

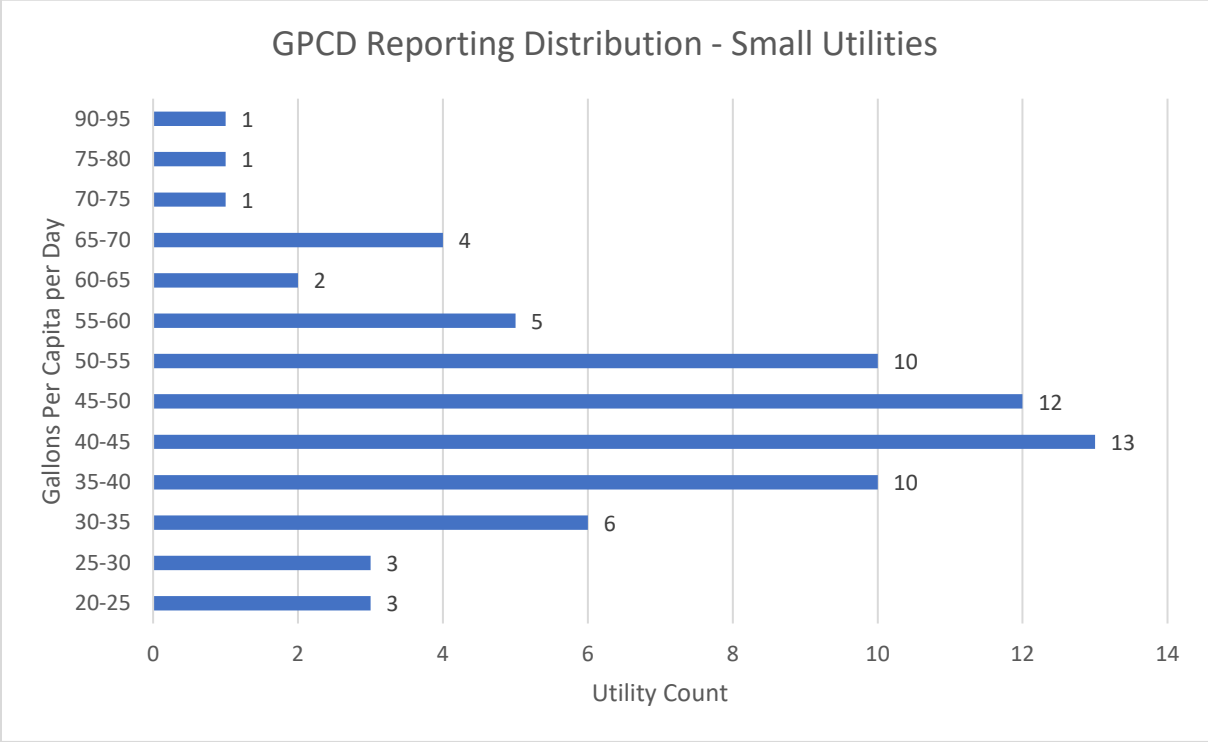


Figure 16. Residents in small communities tend to use less gallon/capita. Very few use over 75 gpcd.

Distributed Water

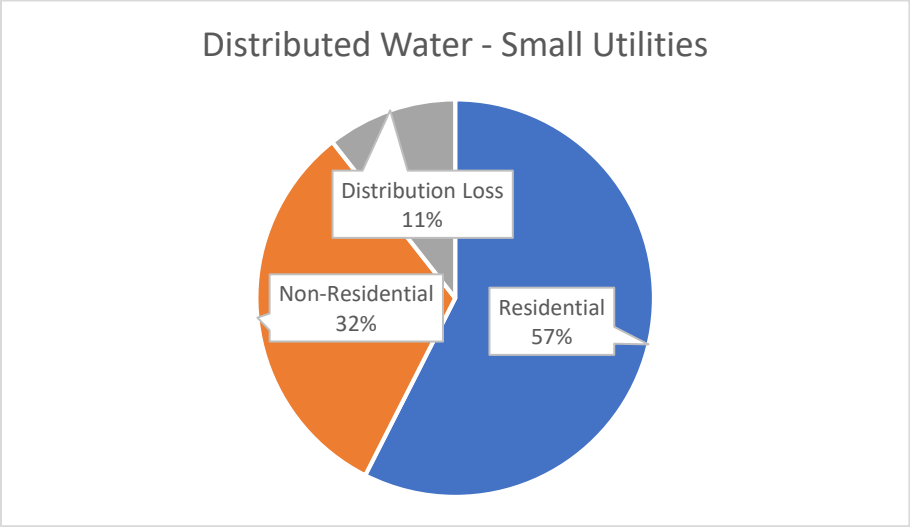


Figure 17. Small communities have a very similar ratio of residential to non-residential water use as large utilities. However, they have a slightly higher percentage of water loss.

Daily Peaking Factor

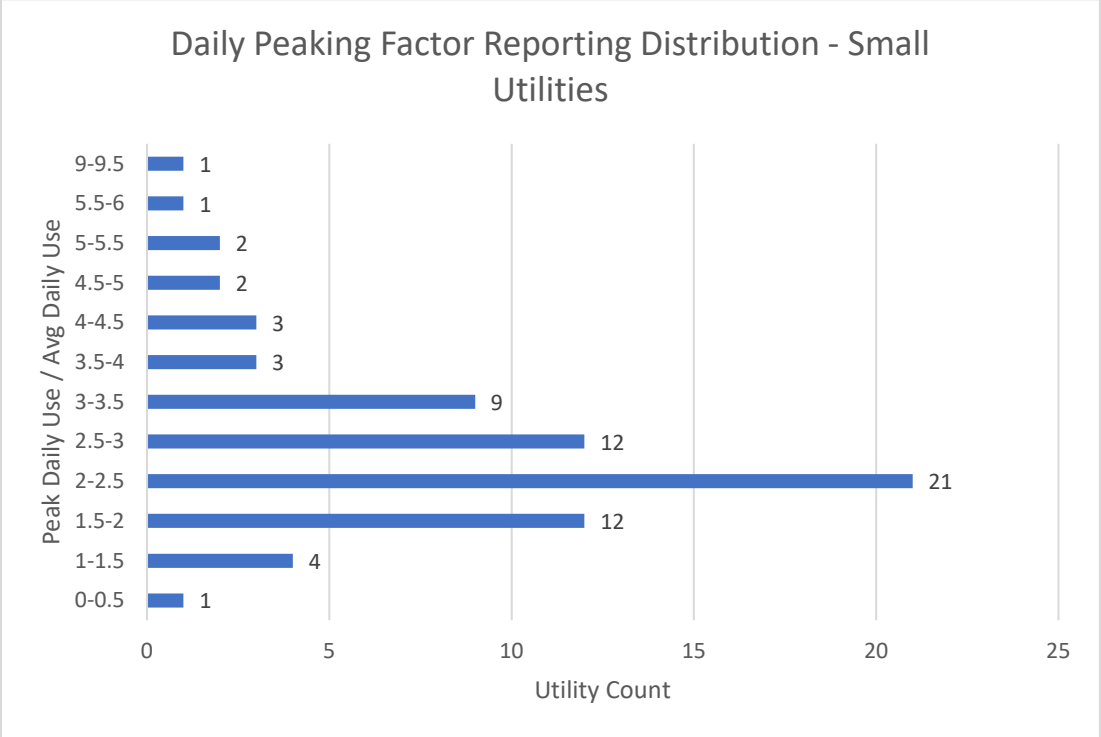


Figure 18. Peak water use is typically expressed as a ratio, dividing the peak water use by the average daily water use.

Water Infrastructure Conservation Efforts – Direct

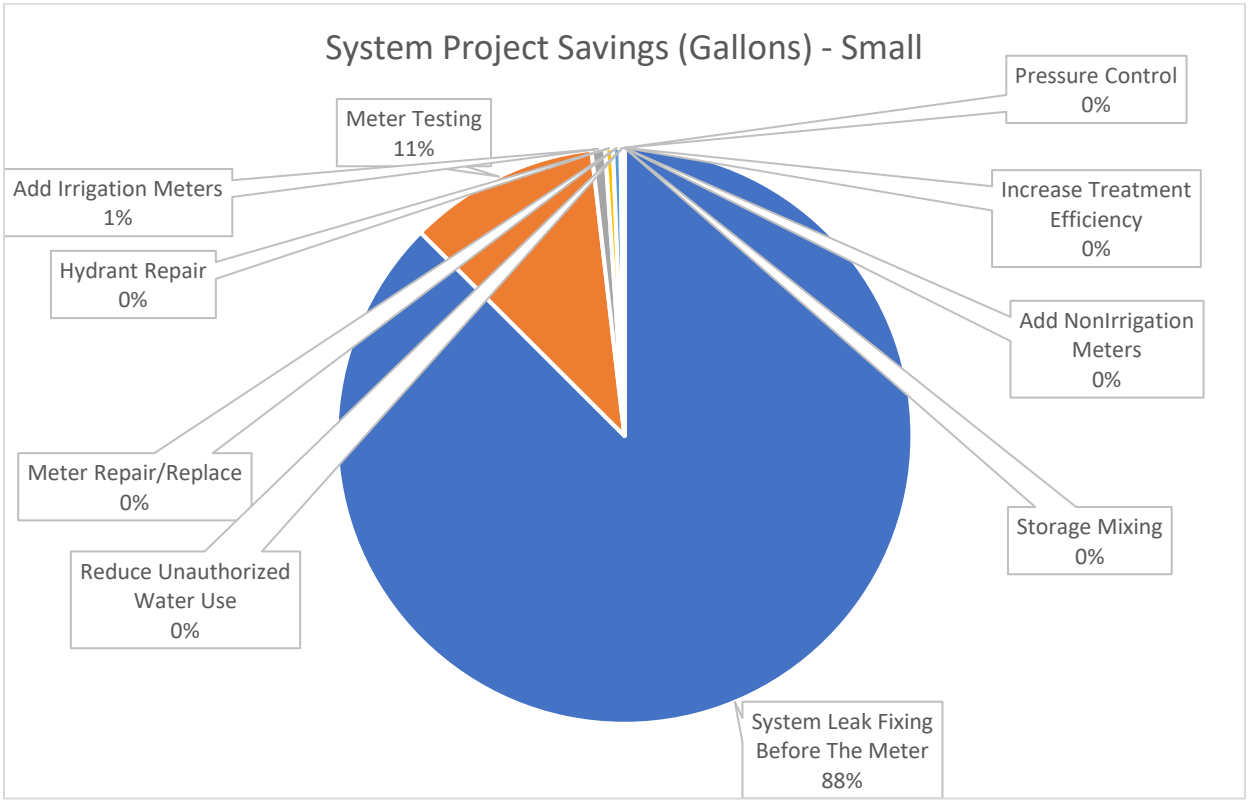


Figure 19. Like large utilities, small utilities focus their system conservation efforts on fixing leaks and meter testing. Going forward, small utilities may want to invest in hydrant testing and repair which are a common source of leaks.

Customer Project	Qty	Savings (Galllons)
MF_Showerhead and Aerator Kits	150	752,700
CII_Automatic Faucets	15	2,490
SF_Clothes Washer Rebates	11	55,000
SF_Toilet Retrofits	3	18,000
SF_Rain Barrels	2	2,600
CII_Toilet Retrofits	2	18,980
CII_Dishwashers	1	57,757
SF_ET_Irrigation Controllers	0	0
SF_Showerand Aerator Kits	0	0
MF_Toilet Retrofits Unit	0	0
SF_LF Showerheads	0	0
MF_LF Shower heads	0	0
MF_CII__ET_Irrigation Controllers	0	0
SF_HE_Water Softeners	0	0
MF_Clothes Washer Rebates	0	0
MF_CII_LargeLandscapeProjects	0	0
SF_EfficientIrrigation Nozzles	0	0
SF_Rainwater Harvesting Rebates	0	0
MF_CII_Rainwater Harvesting	0	0
CII_Facility Audits	0	0
CII_Laundromats	0	0
CII_Spray Rinse Valves	0	0
CII_Food Steamers	0	0
MF_CII_Coin Operated Clothes Washer Rebates	0	0
MF_Toilet Retrofits Common Area	0	0
CII_Waterless Urinals	0	0
	184	**907,527**

Figure 20. Very few small utilities can self-fund a water efficiency rebate program unless it is in cooperation with an energy utility. There are no water efficiency grants available for communities outside the Metro area.

2020 Results - Commercial, Industrial, and Institutional (CII)

The Commercial, Industrial, and Institutional (CII) sector water users have been voluntarily reporting their conservation efforts since 2019. Participation in reporting has been good.

Goals

- Help Minnesota commercial, industrial, and institutional water users understand their role in water conservation and using water efficiently.
- Provide clear actions to prevent the waste of water, improve efficiency, and while improving economics.
- Inform stakeholders, residents and other organizations of the sustainability and water conservation efforts of Minnesota's commercial, industrial, and institutional sector.

Highlights

- In the CII sector, the top motivation for water conservation has changed since the previous year. In 2019, more than 55% of CII users said they conserve water to reduce water and wastewater costs; in 2020, the top motivation for water conservation was stewardship, sustainability, and environmental responsibility.
- Barriers to water conservation continue to primarily be operational necessity; discharge water limits – which may be temperature requirements or stream flows to protect wildlife.
- Many CII users are already implementing strategies to conserve water. Water reuse and recycling was more prevalent than previously known.
- The type of water use across the CII operators varies widely and so do their water conservation efforts.
- Some water use permittees are proud of their efforts and appreciate the opportunity to share successes.

Commercial, Industrial, and Institutional Discussion and Recommendations

1. Conduct a water audit of where water is used, where it is lost, and how efficiency can be improved.
2. Install low-flow plumbing fixtures when feasible.
3. Regulate water pressure to optimize use.
4. Better manage outdoor landscape irrigation by routinely checking for leak, upgrade to Smart Meters and better soil moisture sensors, and reduce turf by converting unused areas to native species.
5. Separately meter and optimize cooling tower usage.

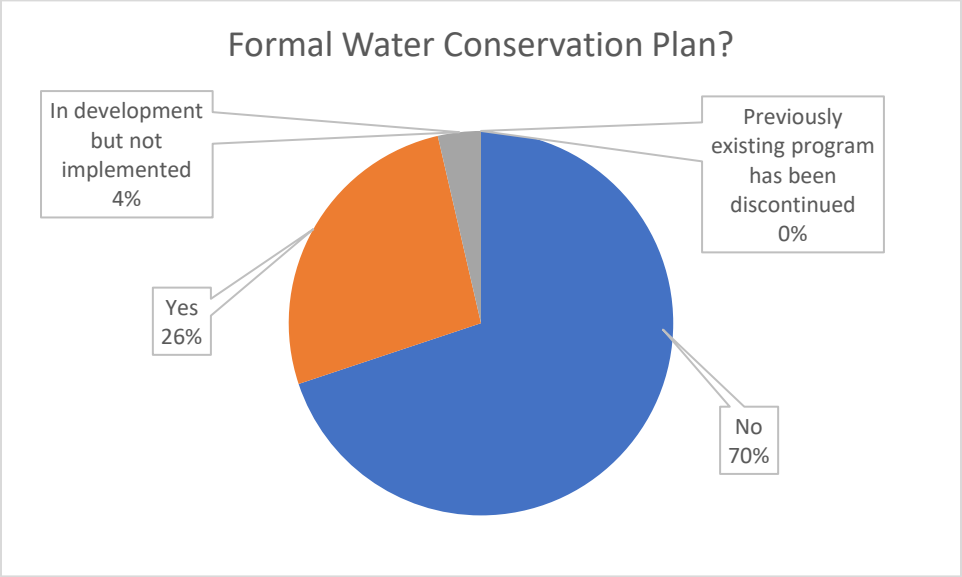


Figure 21. Of the reporting businesses, 26% have a formal water conservation program.

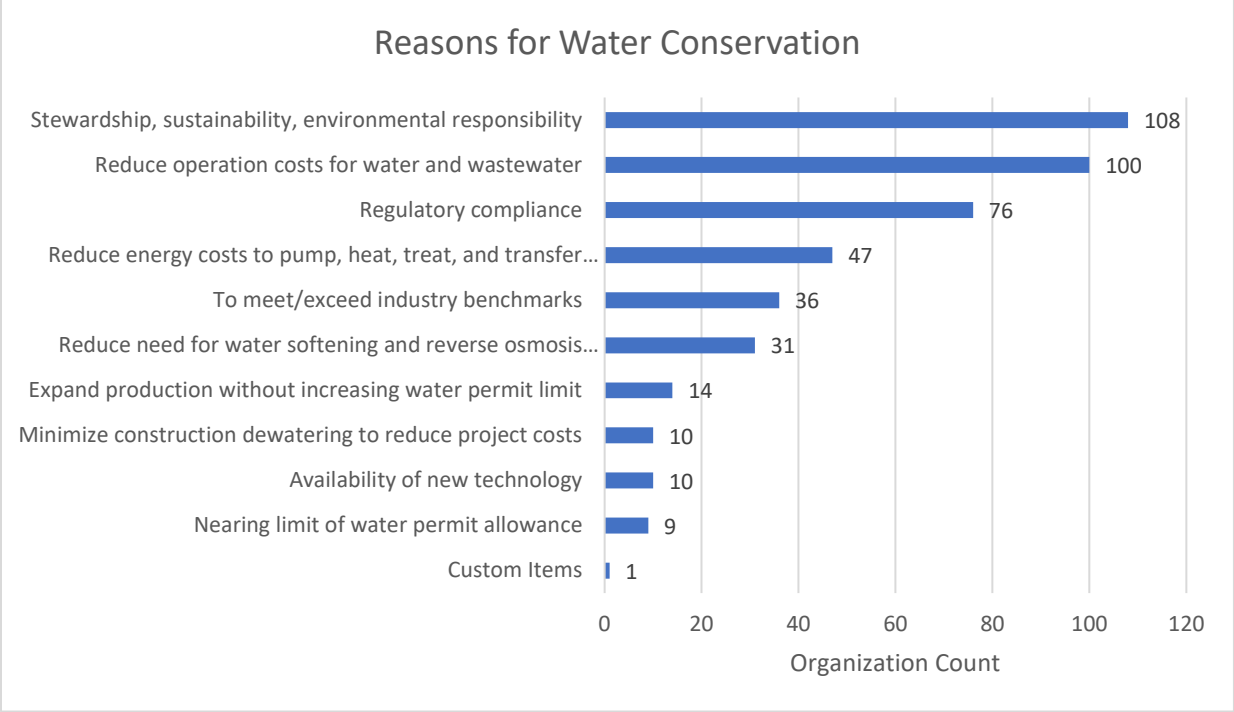


Figure 22. The top motivation for water conservation has changed since last year. In 2019, more than 55% of CII users said they conserve water to reduce water and wastewater costs; in 2020, the top motivation for water conservation was stewardship, sustainability, and environmental responsibility.

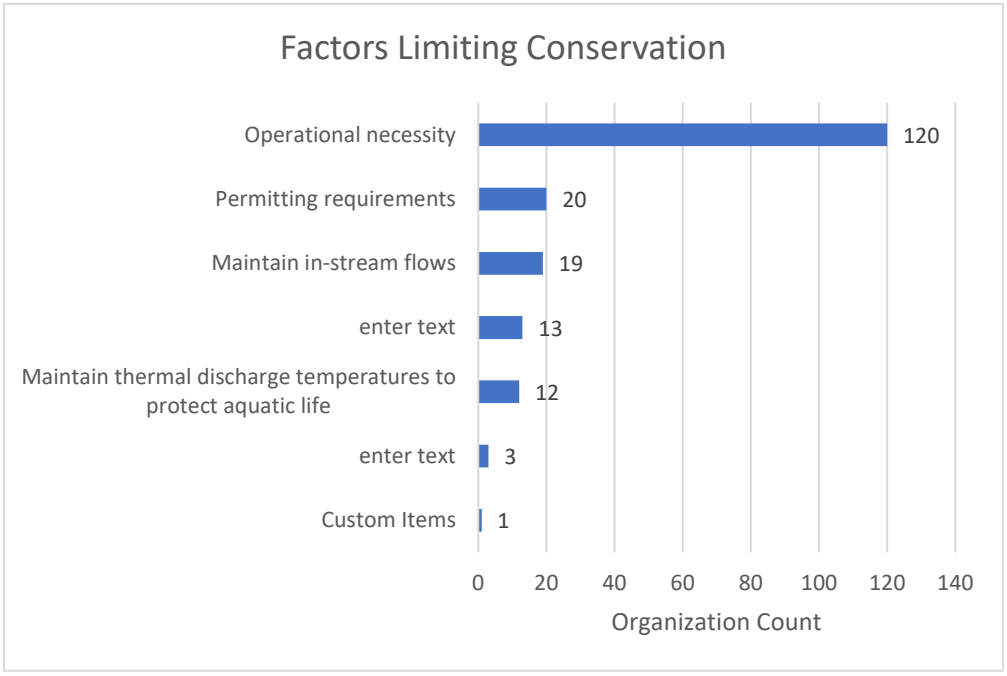


Figure 23. The primary factor limiting water conservation efforts is operational necessity. Multiple reasons could be selected.

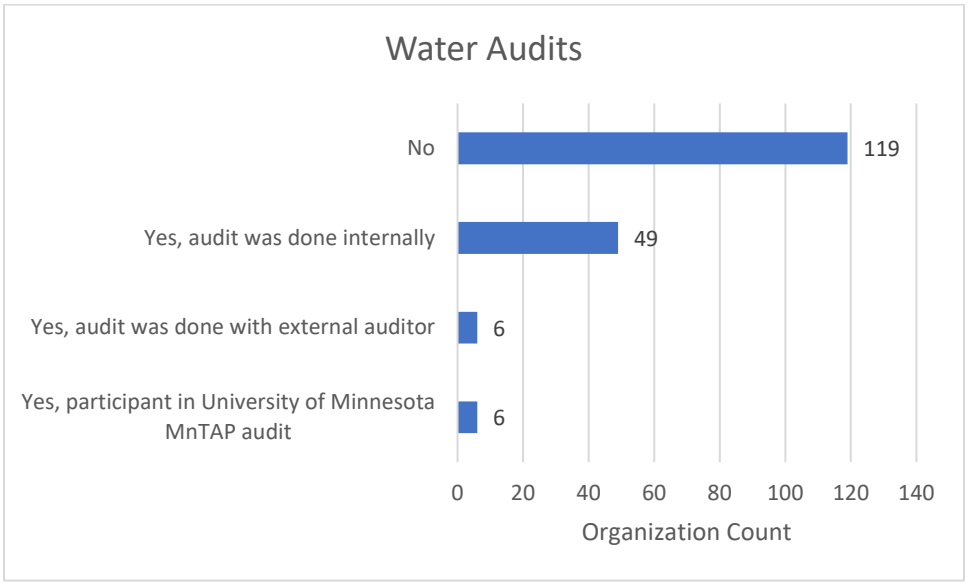


Figure 24. This chart lists the number of permit holders who performed a water audit in 2018, and the type of audit they performed. Businesses are encouraged to participate in the University of Minnesota MnTAP program.

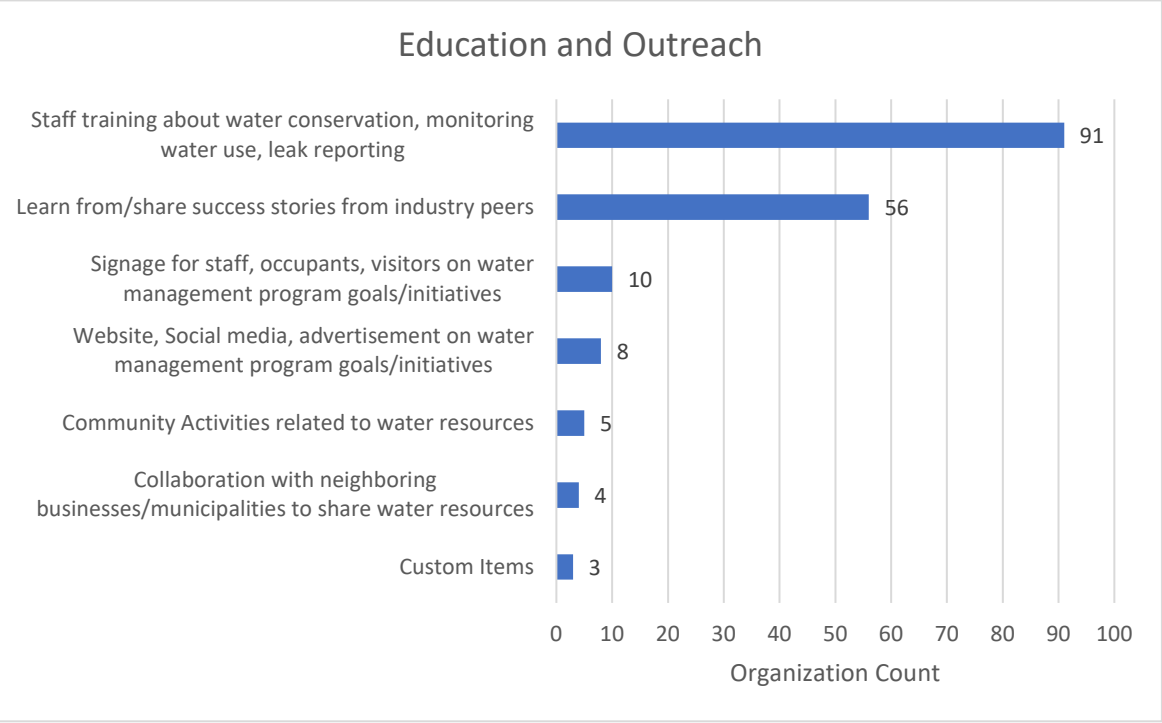


Figure 25. The top education and outreach efforts are the same as in 2019.

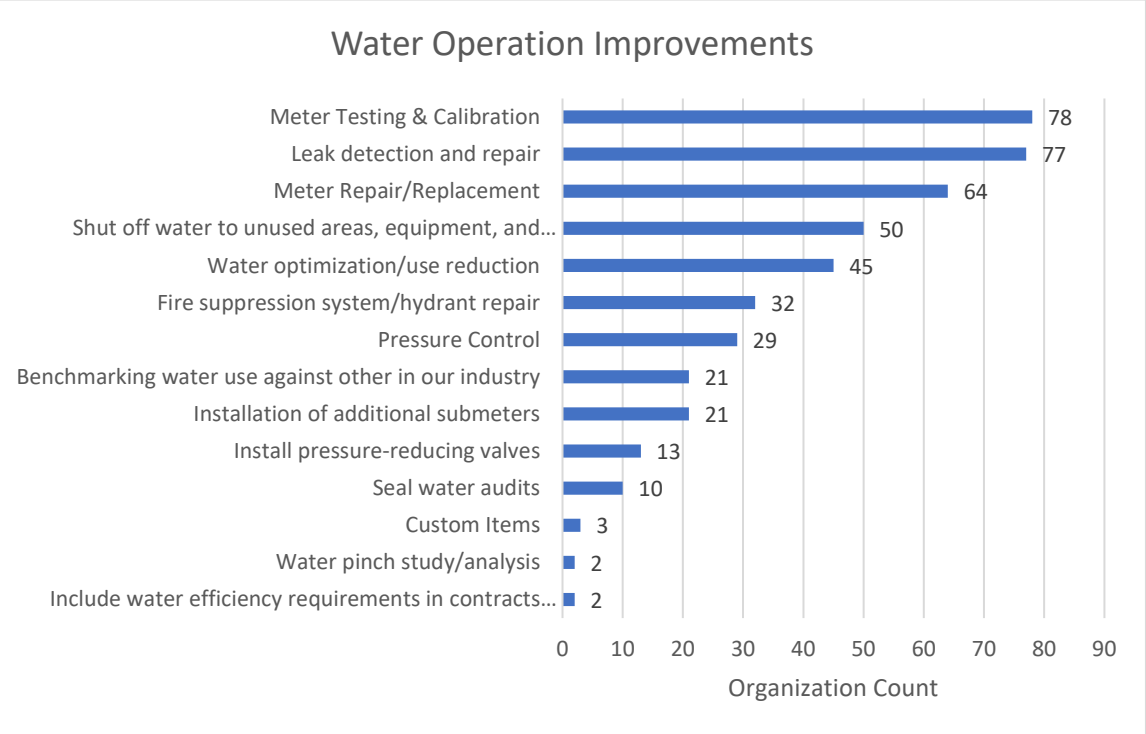


Figure 26. Meter testing and calibration and leak detection and repair are the top water operation improvements.

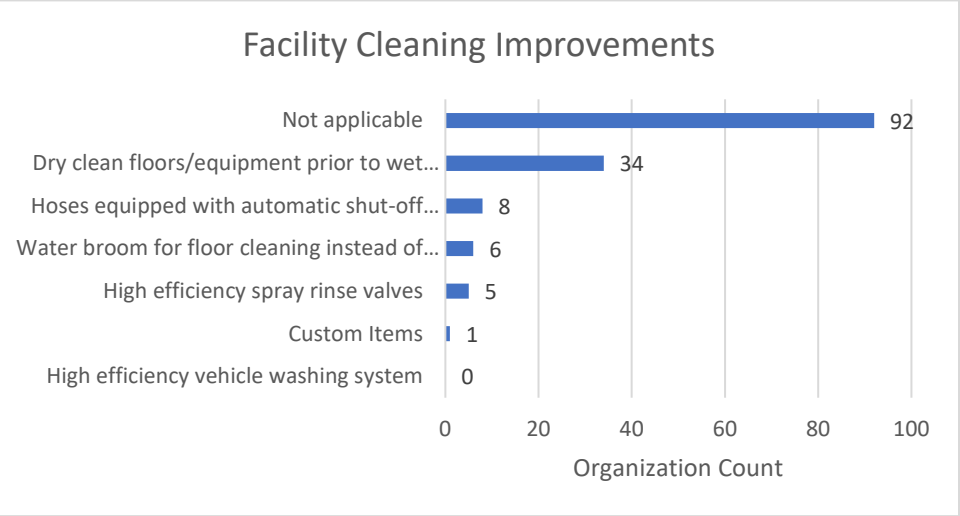


Figure 27. Although facility cleaning is not a major water use for most commercial, industrial, or institutional users, dry cleaning floors and equipment prior to wet cleaning is the most common practice.

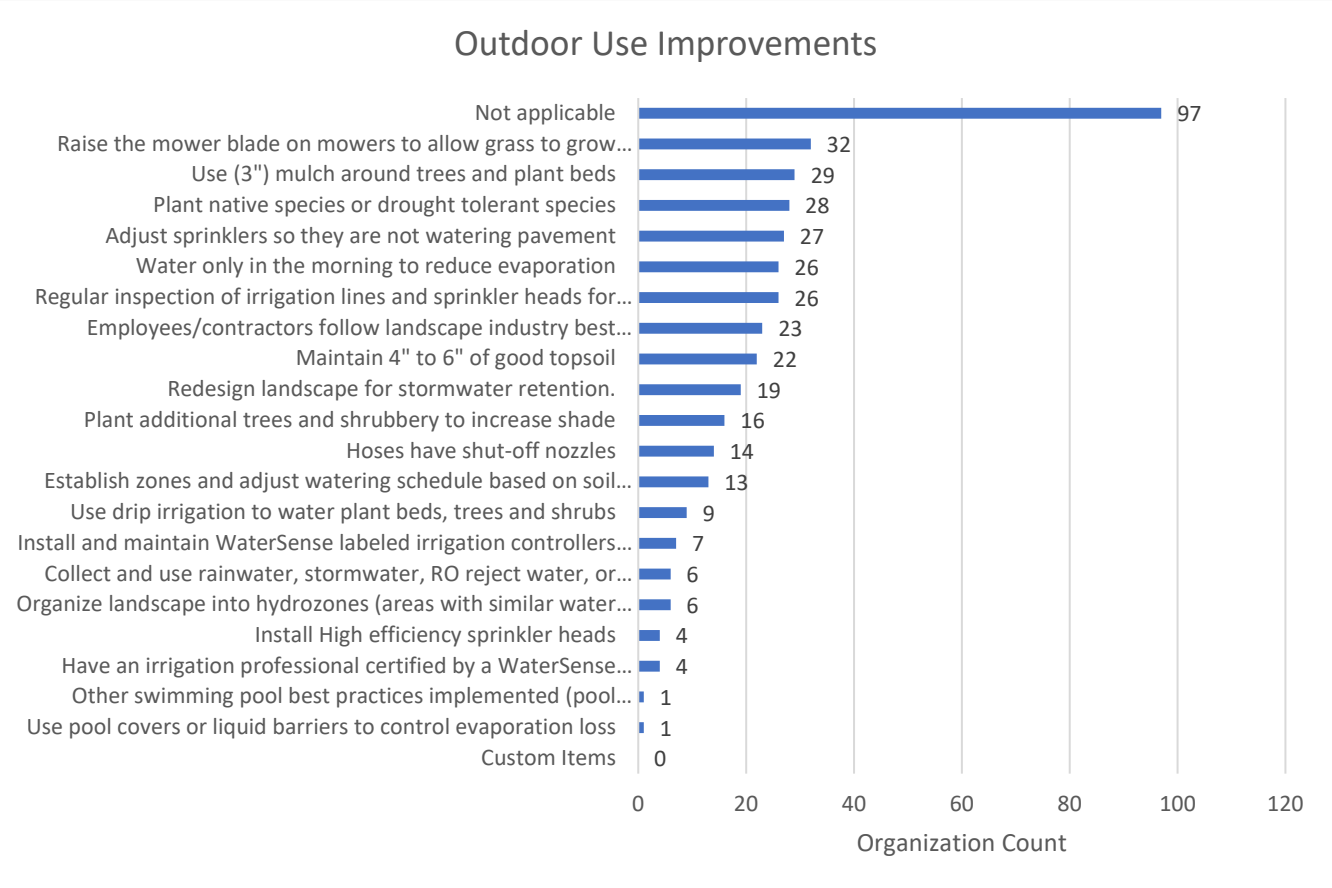


Figure 28. An increasing number of CII operations are planting native species or drought tolerant species as a method to reduce water use.

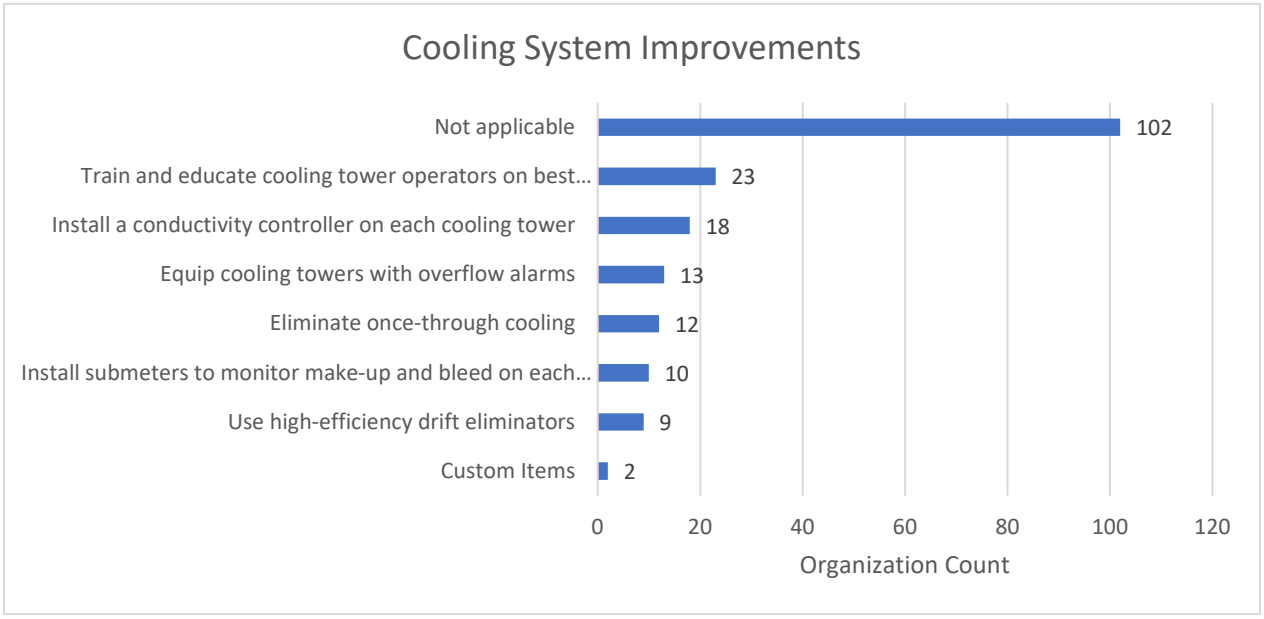


Figure 29. Building/Facility cooling system improvements included training cooling tower operators, installing conductivity controllers, equipping cooling towers with overflow alarms, eliminating once-through cooling, installing sub meters, and drift eliminators.

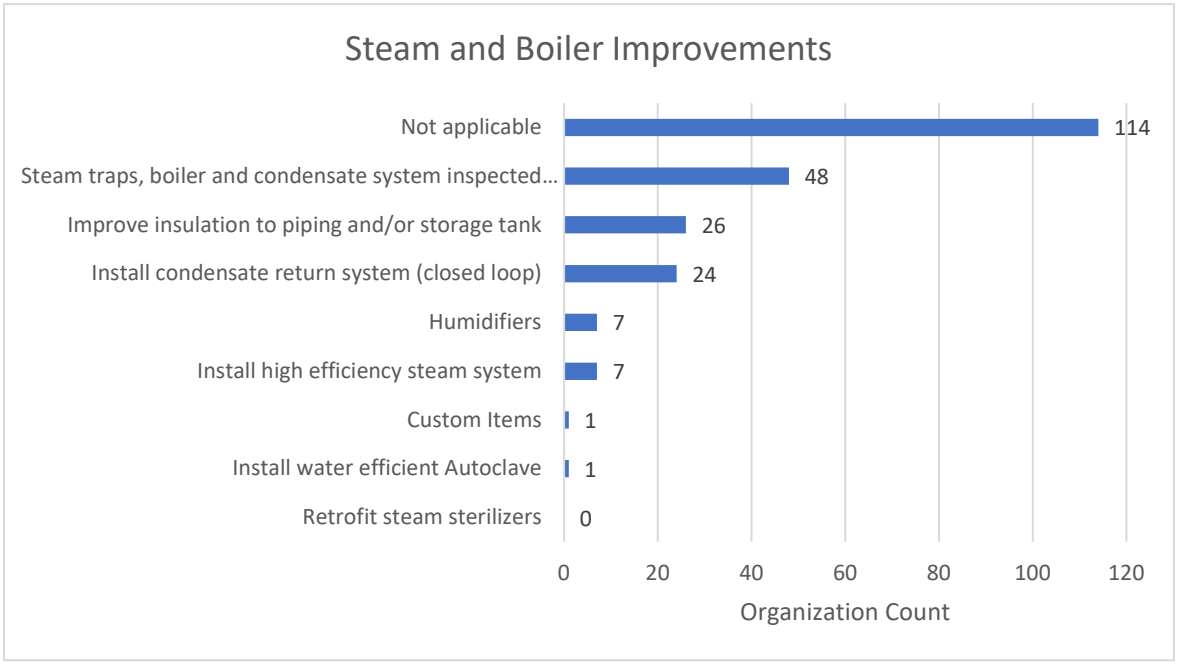


Figure 30. The most common method of improving steam and boiler system efficiency is carefully inspecting and maintaining traps, boilers, and condensate systems. The second most popular improvement is improving insulation.

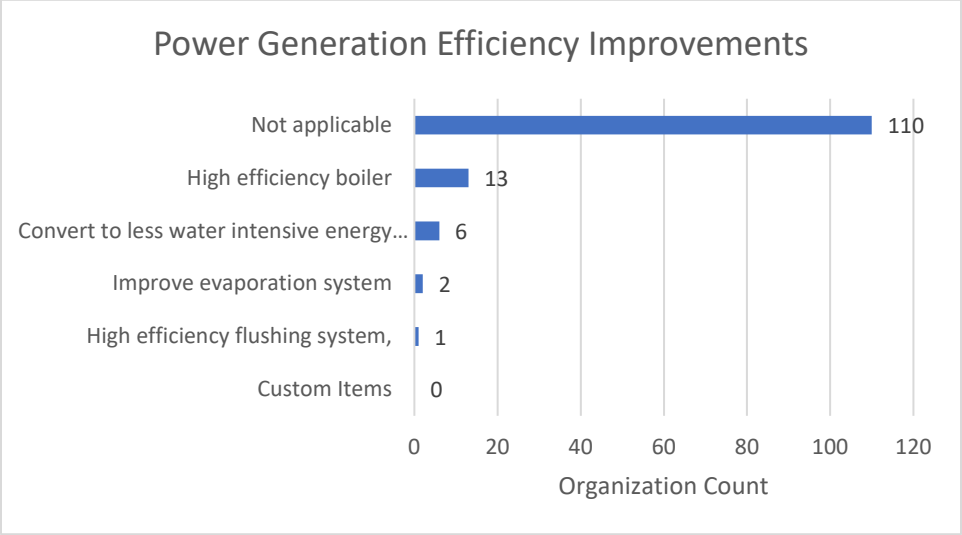


Figure 31. The most common way for Power Generators to improve efficiency of existing systems is to switch to high efficiency boilers. The second most popular improvement is converting to less water-intensive power sources such as solar and wind.

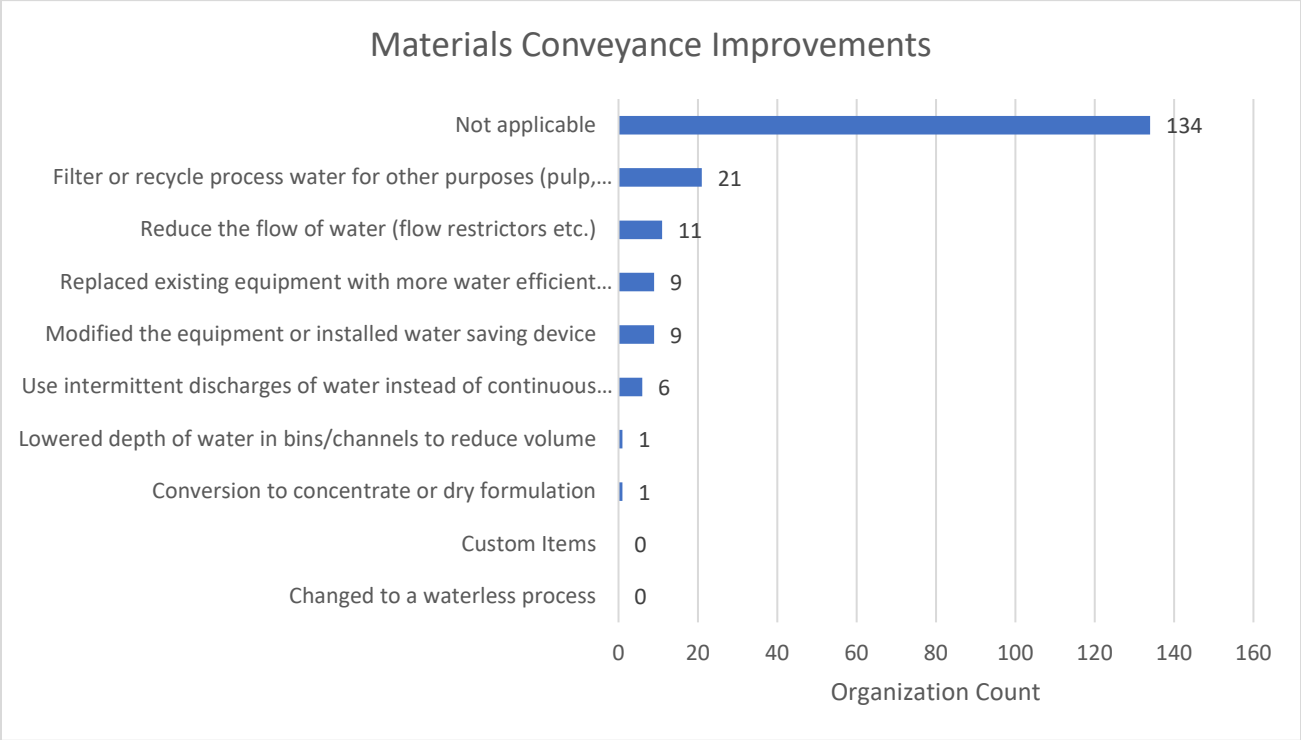


Figure 32. For industries that have materials conveyance equipment, the most common water efficiency improvement is to filter or recycle process water for other purposes. The next common best practices are reducing the flow of water and modifying the equipment.

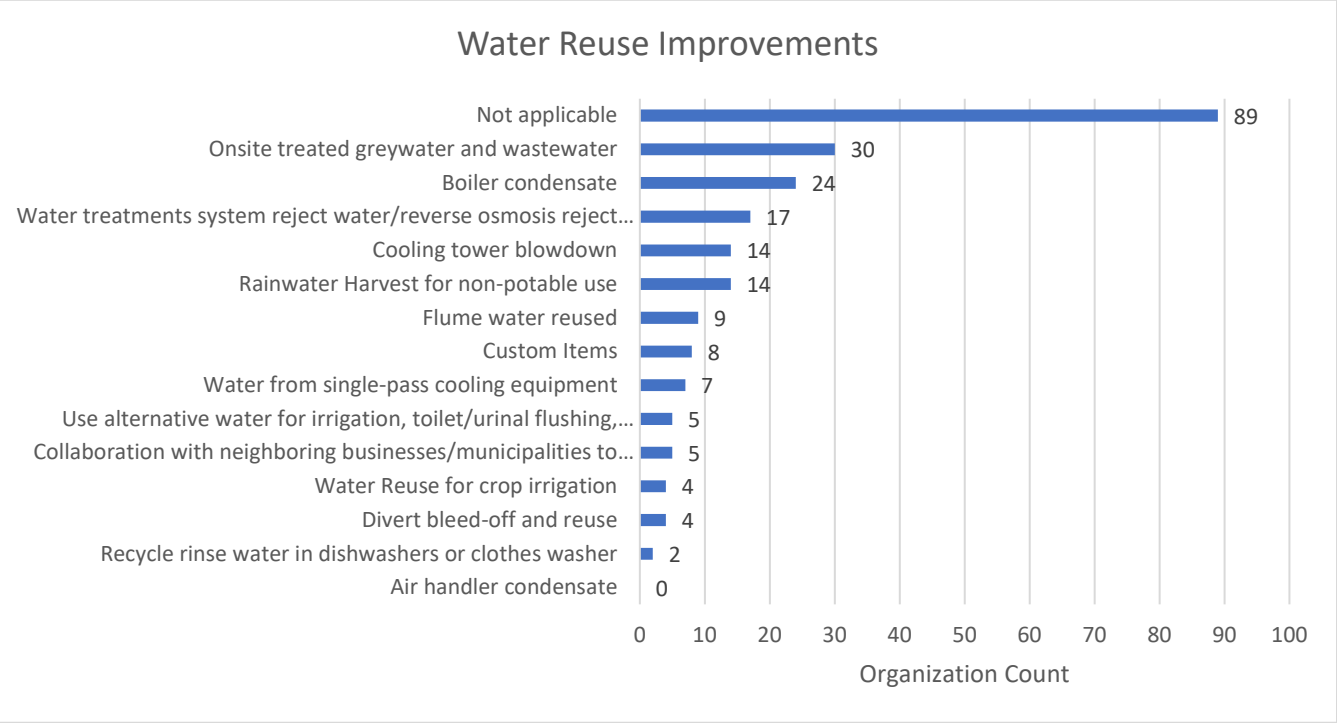


Figure 33. Onsite treatment of greywater and wastewater is becoming increasingly popular in Minnesota. Reusing boiler condensate and reject water are also methods to reuse water.

2020 Results - Irrigation

In Minnesota, the Department of Natural Resources (DNR) issues water appropriation permits to irrigation water users and livestock operators that use more than 10,000 gallons/day or one million gallons/year. In 2020, for the first time, we polled the irrigation and livestock operator permit holders to understand the extent of their water conservation efforts. We found that many Minnesota irrigators and livestock operators strive for environmental stewardship beyond what is required because saving water makes financial sense and is the socially and ecologically responsible choice.

The irrigation sector is a diverse set of users. The largest number of irrigators in the state are agricultural irrigators. Golf course irrigation is the second highest number of permit holders in this category, followed by non-crop, landscaping/athletic fields, and nurseries. The types of crops that are irrigated in Minnesota include: corn, soybeans, potatoes, alfalfa, canning vegetables, vineyards/orchards, and wild rice.

Because irrigators and livestock operators have very different reasons and methods of using water the two categories had a separate set of questions to answers. Irrigation will be shown first, and livestock responses follow.

Considering that we were in the midst of a pandemic, there was good participation for the first years of reporting by permitted irrigation and livestock operator water users. We heard from some facilities that they were grateful for an opportunity to highlight their water conservation and efficiency accomplishments.

Goals

- Help Minnesota irrigators water users understand their role in water conservation and using water efficiently.
- Provide clear actions to prevent the waste of water, improve efficiency while improving economics.
- Inform stakeholders, residents, and other organizations of the sustainability and water conservation efforts of the Minnesota water appropriators.

Highlights

1. There are many reasons for irrigators to conserve water. The top reasons include stewardship, reduced operation costs for water, and to reduce energy costs. Increasing profitability, improving plant health, and being a good neighbor are other important reasons for conserving water.

2. The primary factors limiting water conservation are sandy soils and vegetation requirements.
3. Irrigation equipment efficiency includes widespread use of center pivot systems and low-pressure systems, new and better nozzles, and performance testing.
4. For agricultural irrigators, plant selection can help reduce watering needs. Crop rotation and selecting drought tolerant seed are top ways to conserve water.
5. Nearly all irrigators report leak detection and repair as part of their water management. Over half of those reporting also use off-peak irrigating.

Irrigation Discussion and Recommendations

1. Integrating water management with all other areas of operation is a key to success. Irrigators should plan to address both technical and human aspects of water conservation.
2. The first step for any facility should be a thorough water audit to determine where water is used or lost.
3. Owners and managers should plan to implement water conservation and efficiency measures in phases, starting with the most obvious and lowest-cost options. However, keep in mind the true cost of water is the amount of the water bill plus the expense to pump, treat, and distribute the water. The initial investment in technology or a retrofit may seem expensive but the return on investment may make it very cost-effective.
4. Consider additional sub-metering and advance metering technology.
5. Encourage technology upgrades to the most water efficient technology.
6. Improve building and water management operations to capture water efficient opportunities including leak repair, pressure reduction, irrigation zoning, etc.
7. Increase adoption of golf course watering BMPs and benchmarking.
8. Expand and improve water reuse options where feasible.

All Irrigation

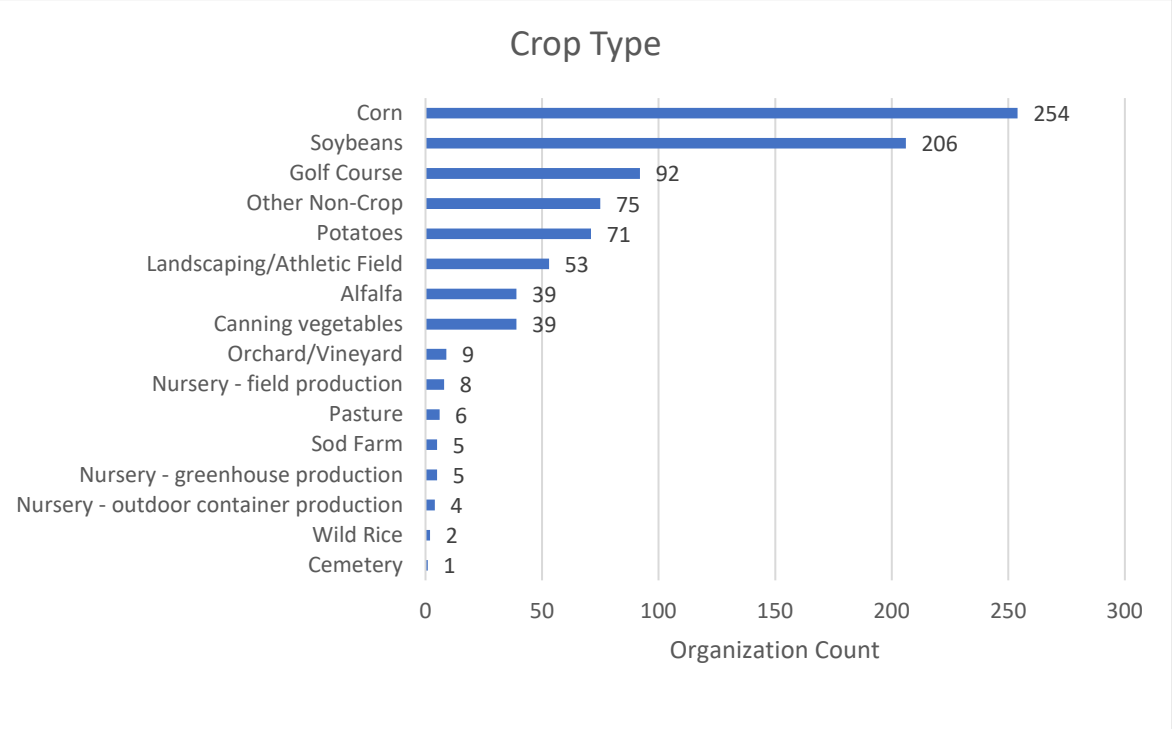


Figure 34. Of irrigators reporting conservation efforts, the top crops in Minnesota are corn and soybeans.

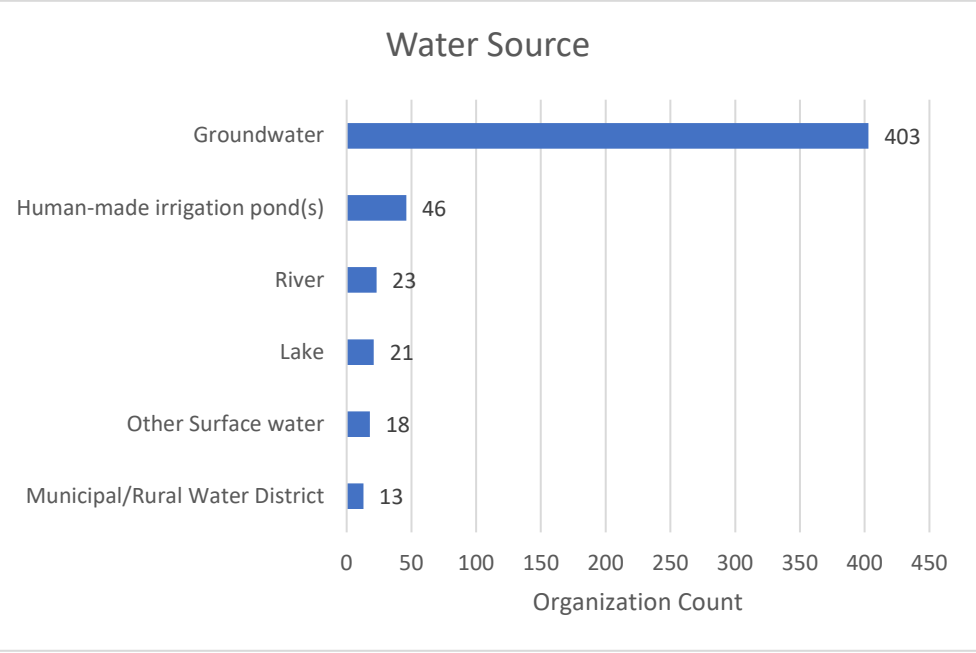


Figure 35. The vast majority of reporting irrigators use groundwater.

There were 92 golf course irrigation permittees who voluntarily responded and entered data into the DNR Water Conservation Reporting System. Of those reporting, 19 reported that they have a formal water conservation plan; 22 reported having a water conservation plan in development and 54 said they had no formal water conservation plan.

One area where golf courses differ somewhat from agricultural irrigators is in their water source. Although the primary source of water for golf courses is also groundwater, many golf courses also rely on a variety of surface water sources.

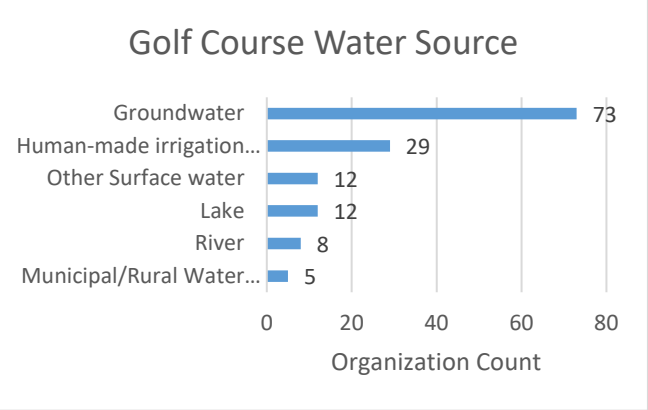


Figure 36. Groundwater is the most common water source for golf courses, followed by ponds.

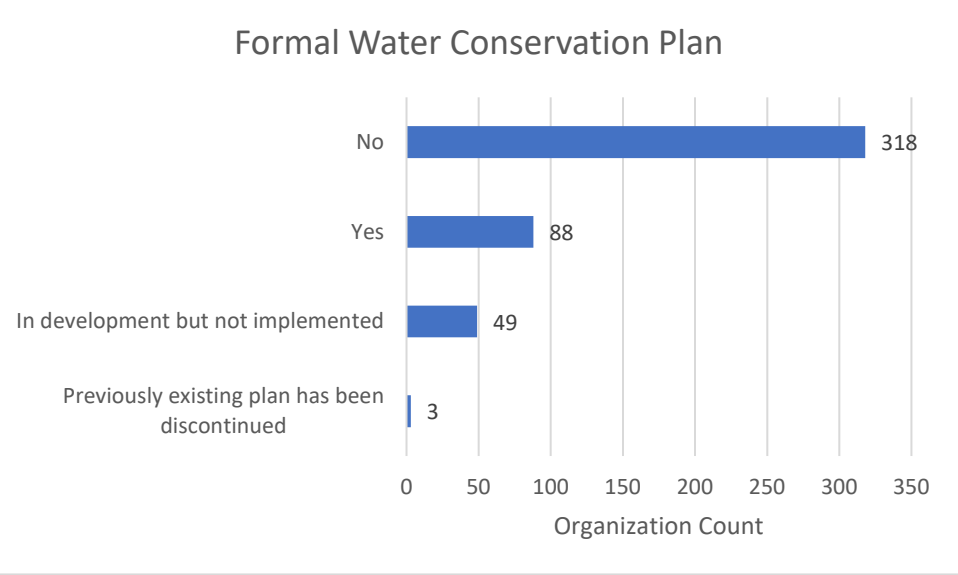


Figure 37. Most reporting irrigators do not have a formal water conservation plan or drought plan.

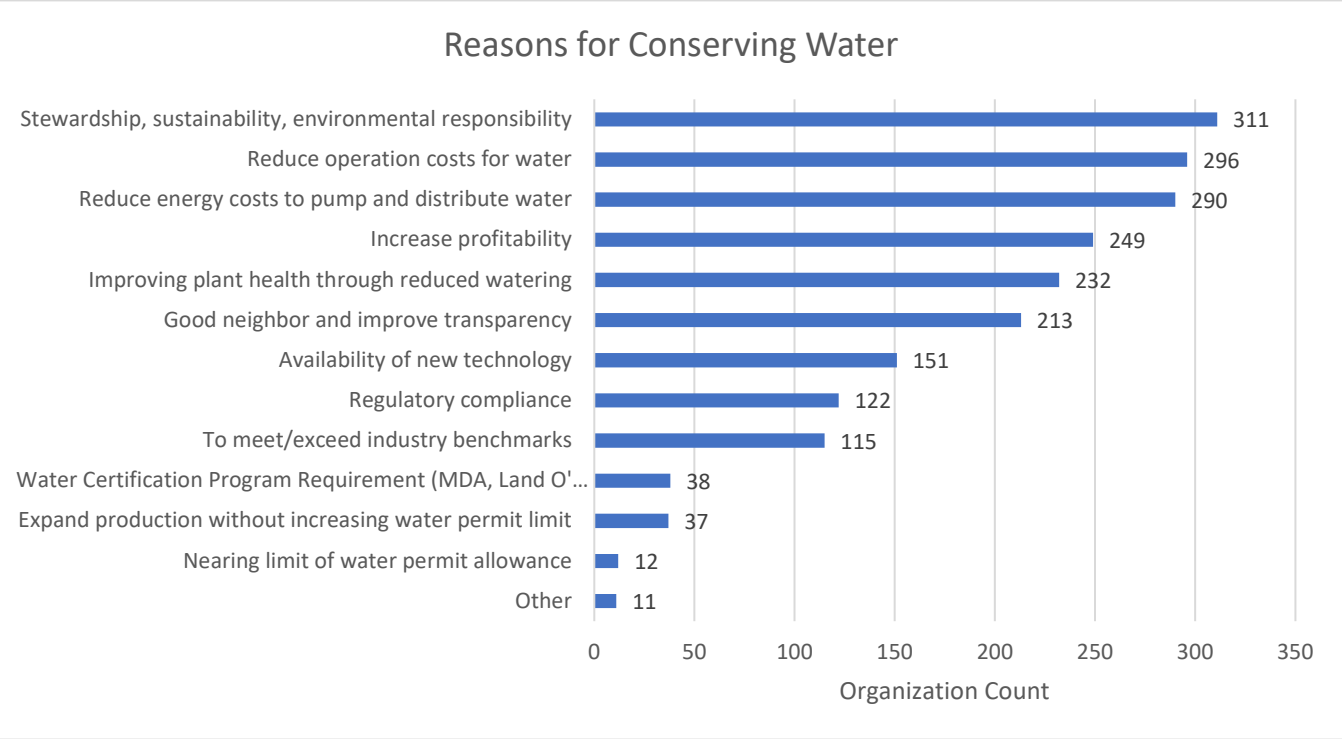


Figure 38. There are many reasons for irrigators to conserve water. The top reasons include: stewardship, reduce operation costs for water, and to reduce energy costs. Increasing profitability, improving plant health, and being a good neighbor are other important reasons for conserving water.

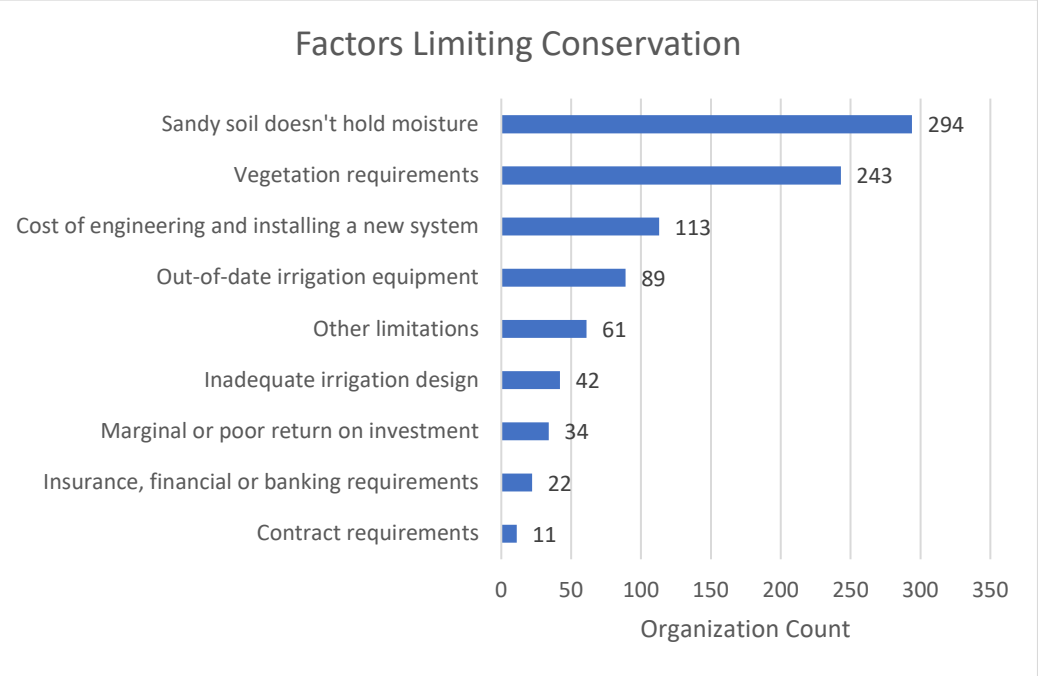


Figure 39. The primary factors limiting water conservation are sandy soils and vegetation requirements.

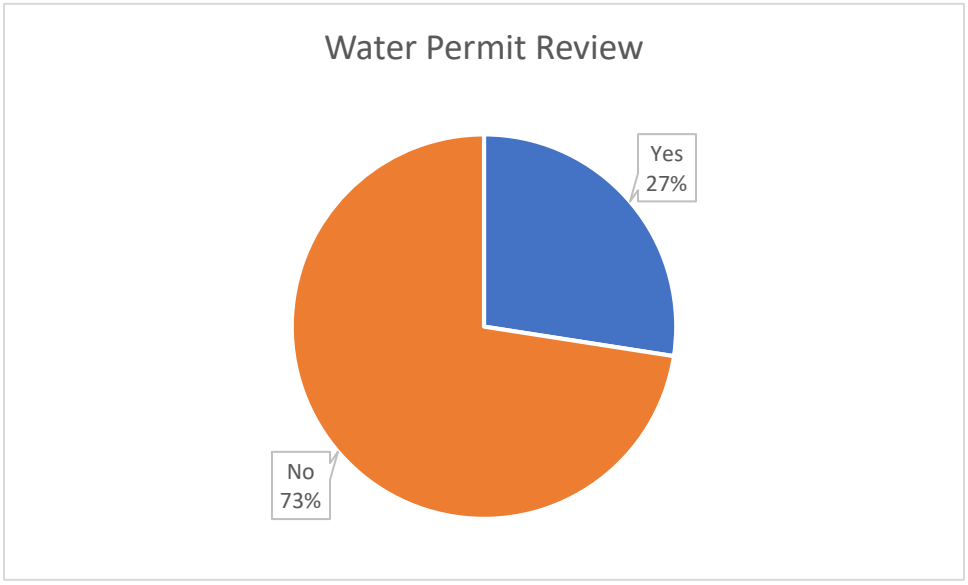


Figure 40. Only 27% of reporting irrigators have had their water permit reviewed by the DNR in the past 5 years.

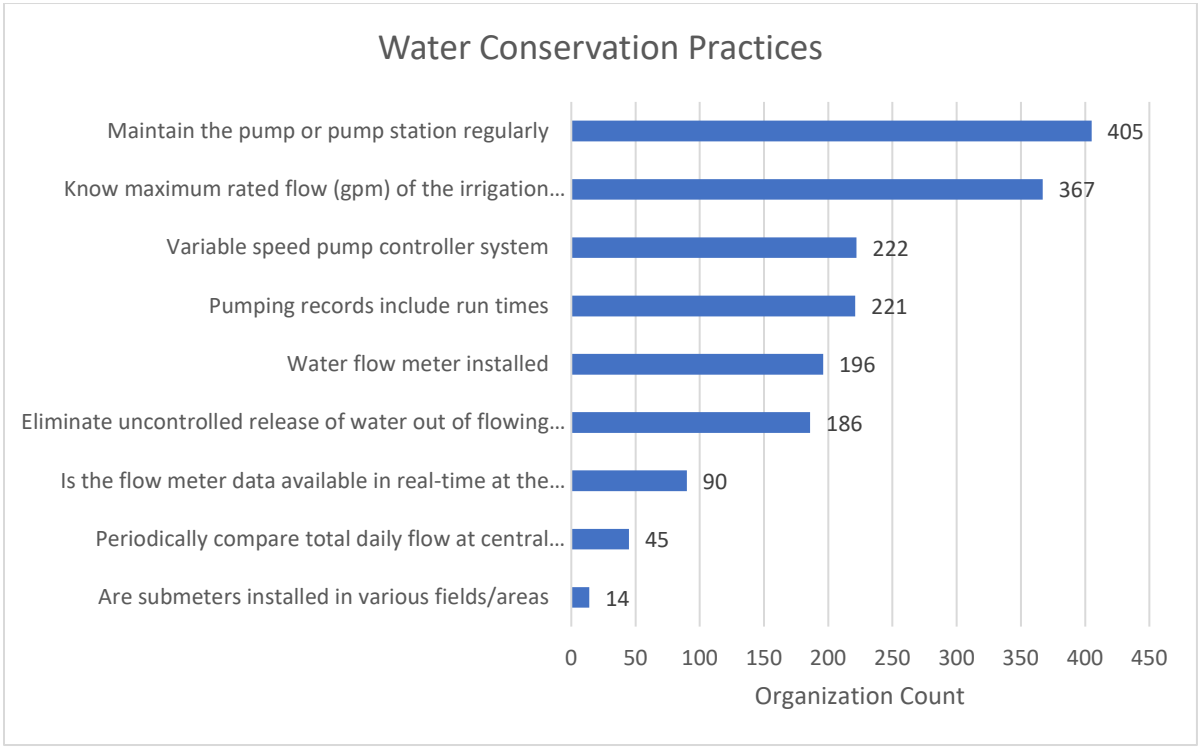


Figure 41. Common water conservation practices for irrigators include: pump and pump station maintenance, flow rating, variable speed pump controllers, pumping records, and flow meters.

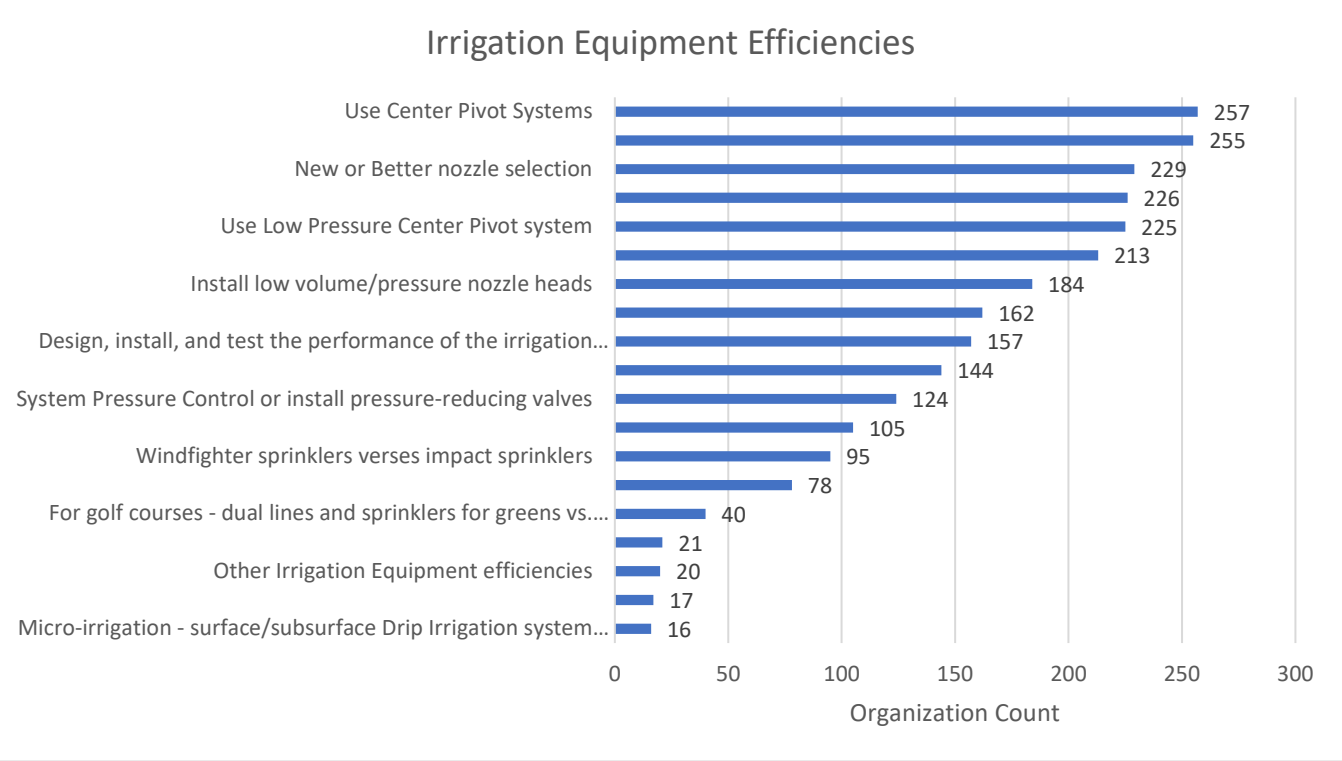


Figure 42. Irrigation equipment efficiency includes widespread use of center pivot systems and low pressure systems, new and better nozzles, and performance testing.

Figure 43. Golf course irrigation equipment has a very different design from agricultural irrigation equipment. Therefore, their water efficiency practices differed significantly. For example, Eagle Valley golf course uses 22 million gallons of Stormwater per year.

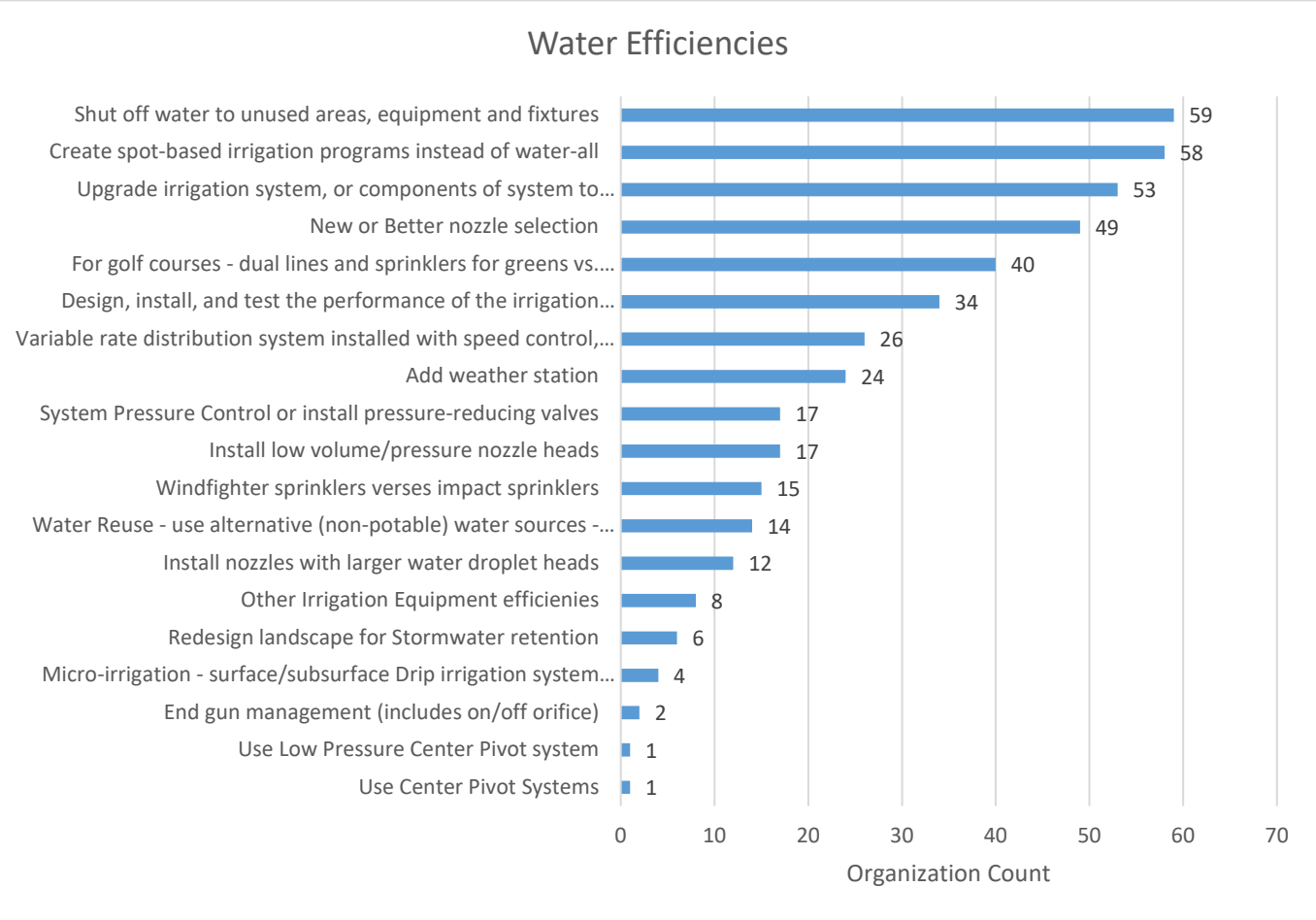


Figure 44. Some water efficiencies have little costs, others include upgrading equipment.

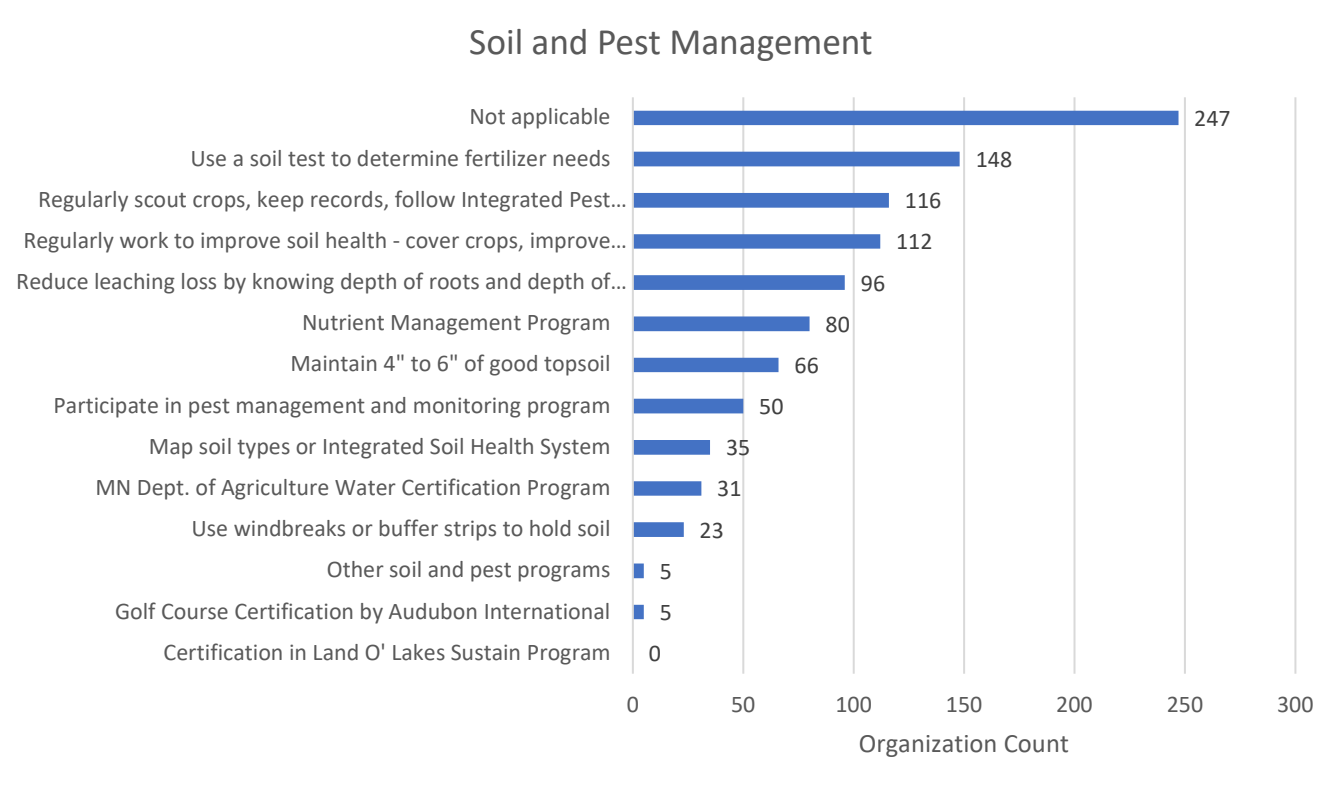


Figure 45. This question applies only to irrigation systems that use the equipment for fertigation or chemigation. Most irrigators do not use this practice. Those that do reported that they conduct soil tests to determine fertilizer needs, regularly scout crop, follow Integrated Pest Management best practices, and improve soil by planting cover crops.

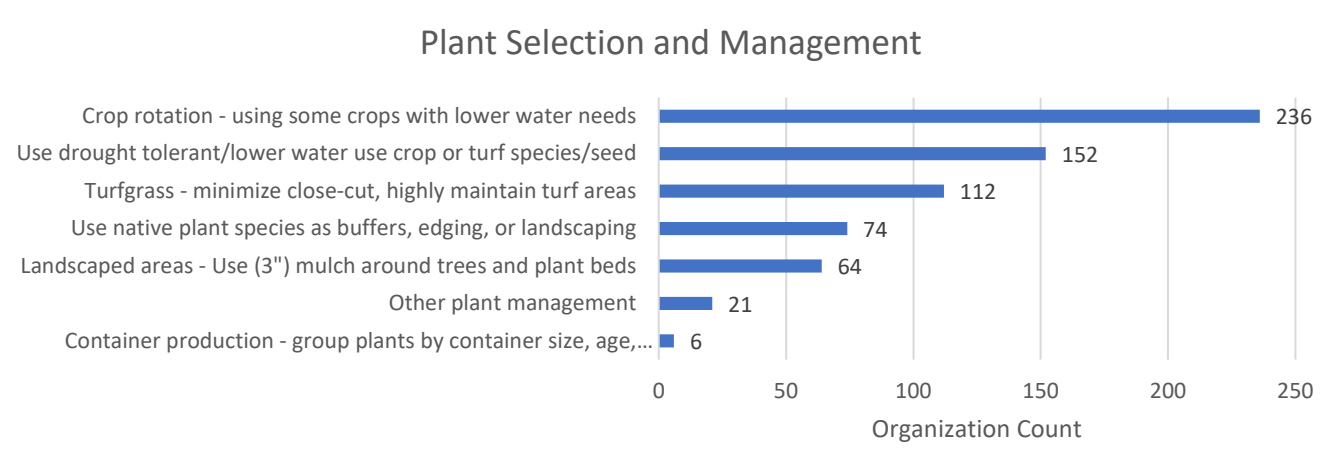


Figure 46. For agricultural irrigators, plant selection can help reduce watering needs. Crop rotation and selecting drought tolerant seed are top ways to conserve water.

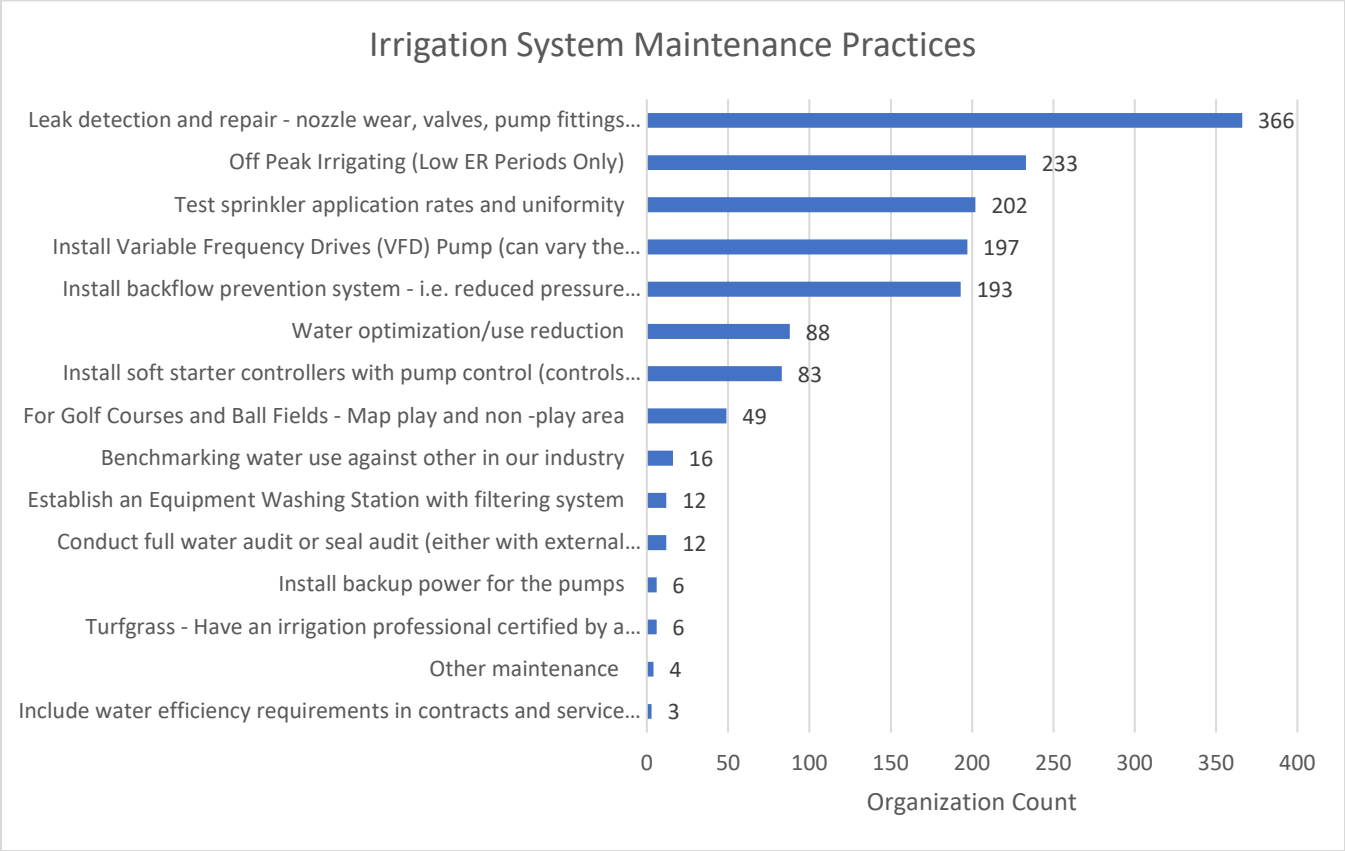


Figure 47. Nearly all irrigators report leak detection and repair as part of their water management. Over half of those reporting also use off-peak irrigating.

Figure 48. Some maintenance practices are the same for golf courses and agricultural irrigators, such as leak detection. But golf courses more broadly accept the technology of installing variable speed frequency drives (VFD) where the pumps can vary the speed of the motor.

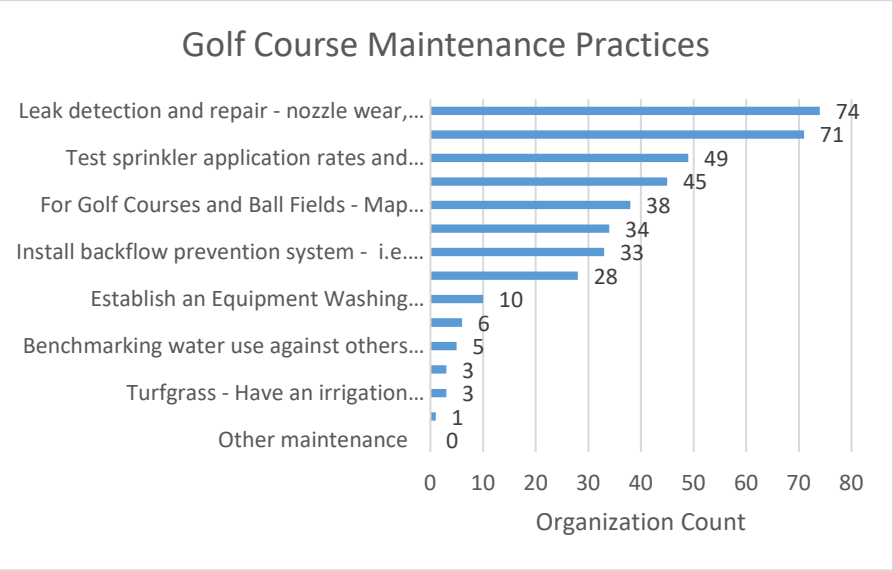


Figure 49. There is a wide variety of maintenance practices with the top two being leak repair and variable frequency drive pump installation.

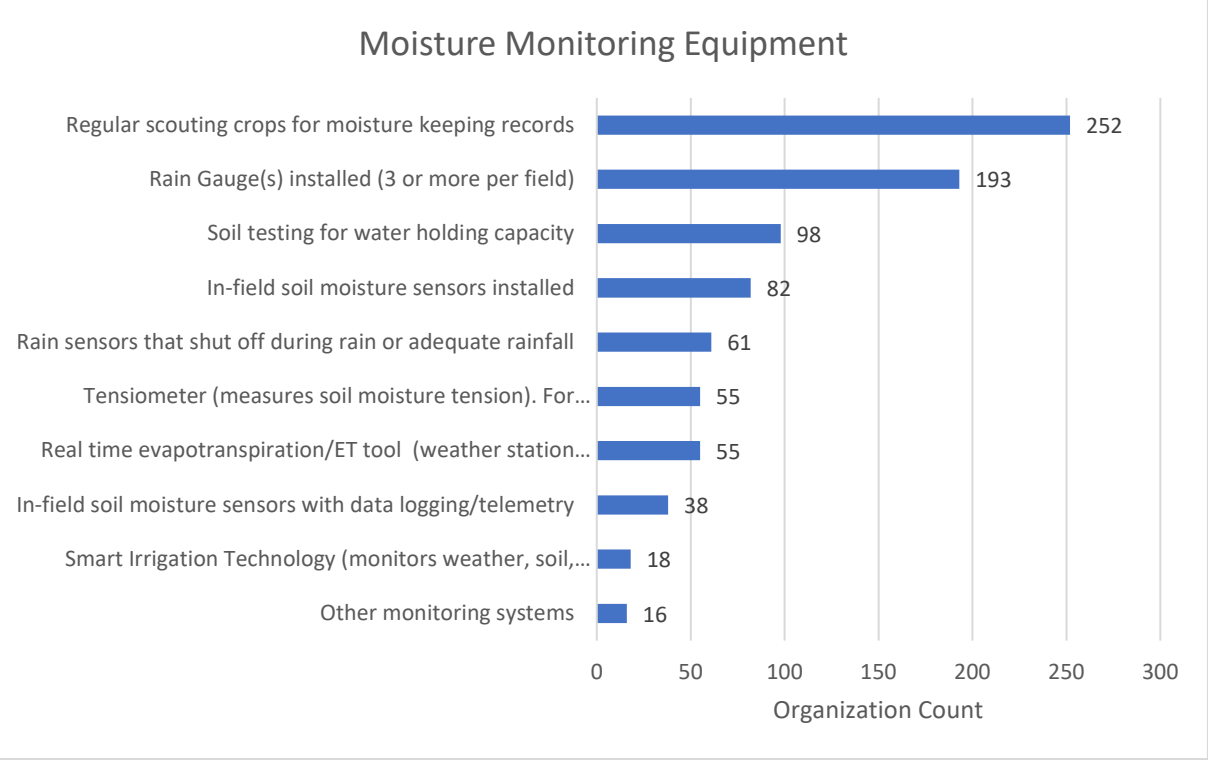


Figure 50. Regular scouting of crops for moisture needs, keeping records, and rain gauges are the most common methods of monitoring moisture.

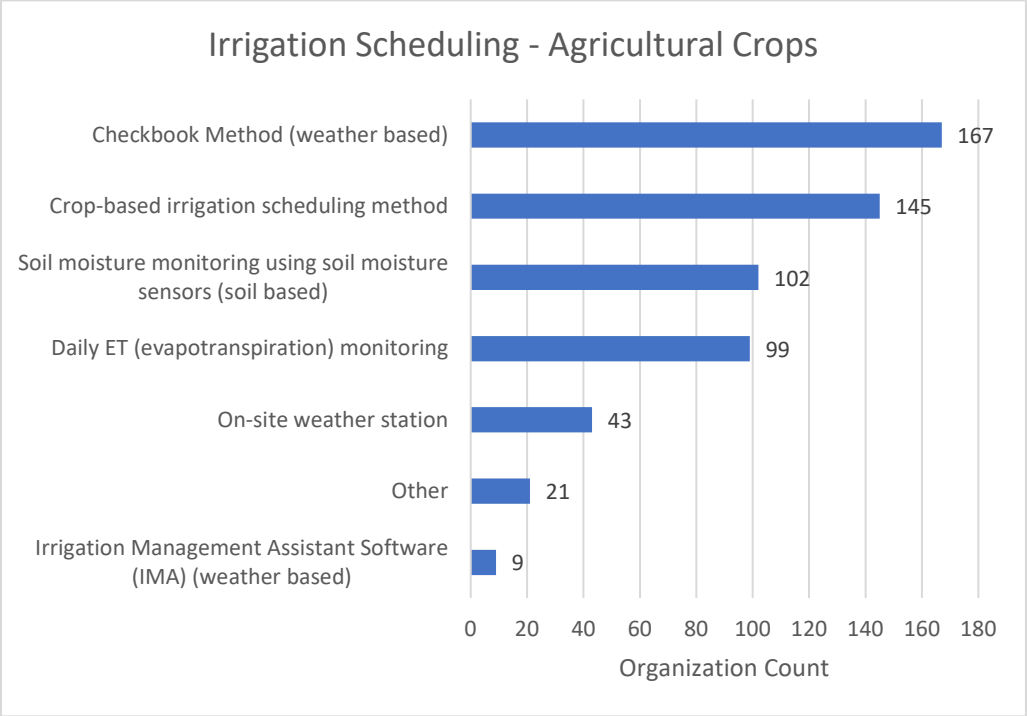


Figure 51. Use of an irrigation scheduling method is science-based way of knowing when to irrigate. The most common scheduling tool is the Checkbook Method, followed by crop-based method, and using soil moisture sensors.

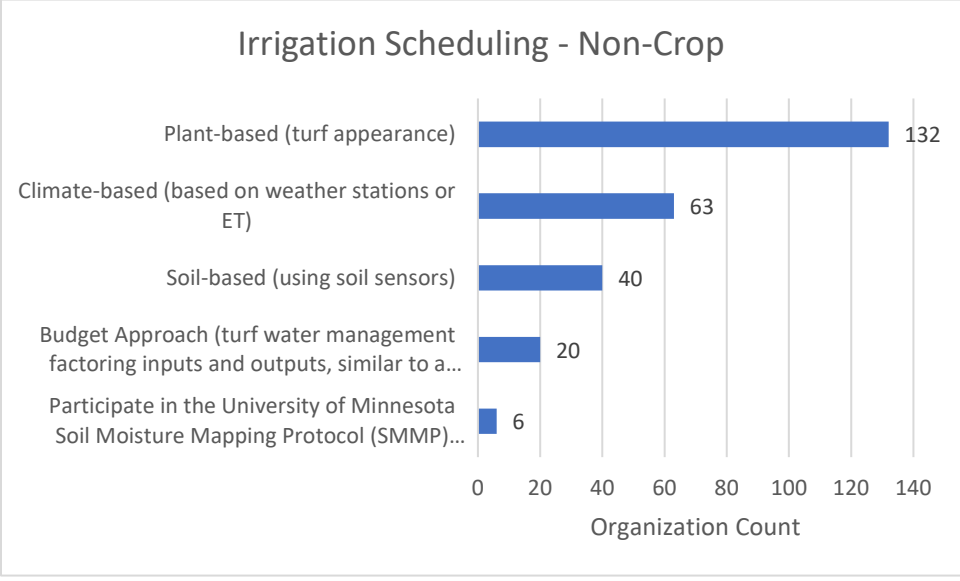


Figure 52. Irrigators who use water for turf management report minimal use of technology to know when to irrigate and rely more on turf appearance for watering needs.

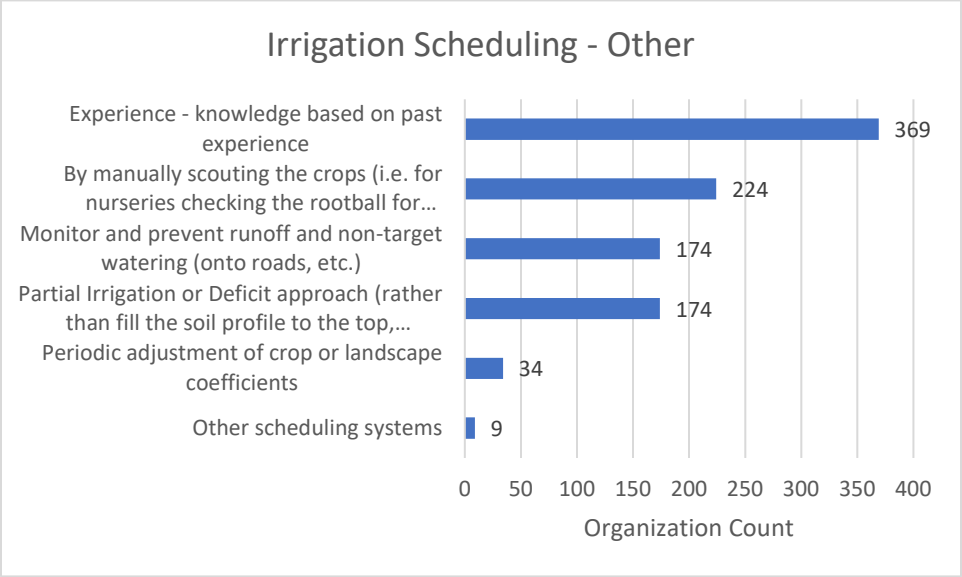


Figure 53. Experience and manually scouting crops remain important practices.

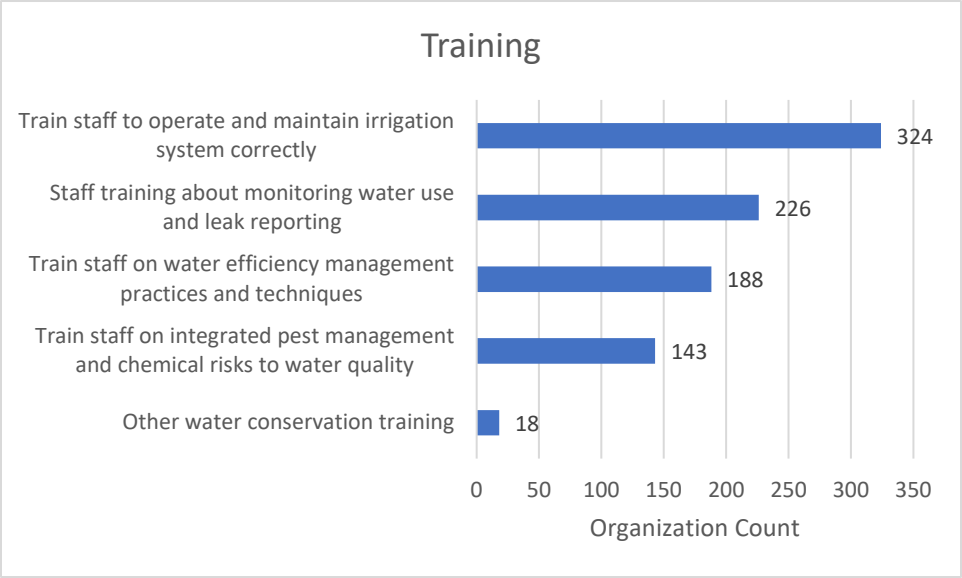


Figure 54. Training staff is important to irrigators. They train them how to operate and maintain irrigation systems correctly, monitor water use, and report leaks.

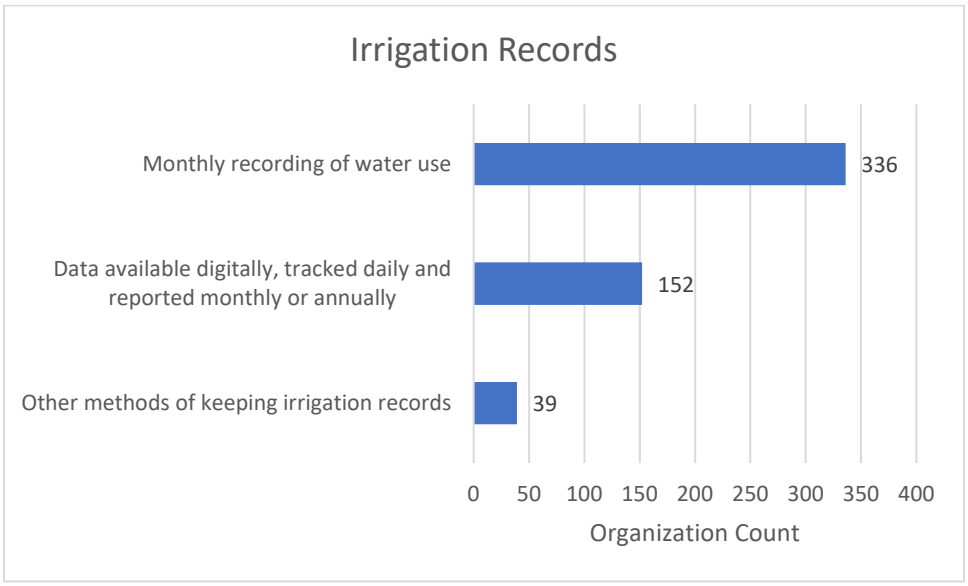


Figure 55. All permitted irrigators are required to report their monthly water use annually. Some irrigators have the data tracked digitally on a daily basis.

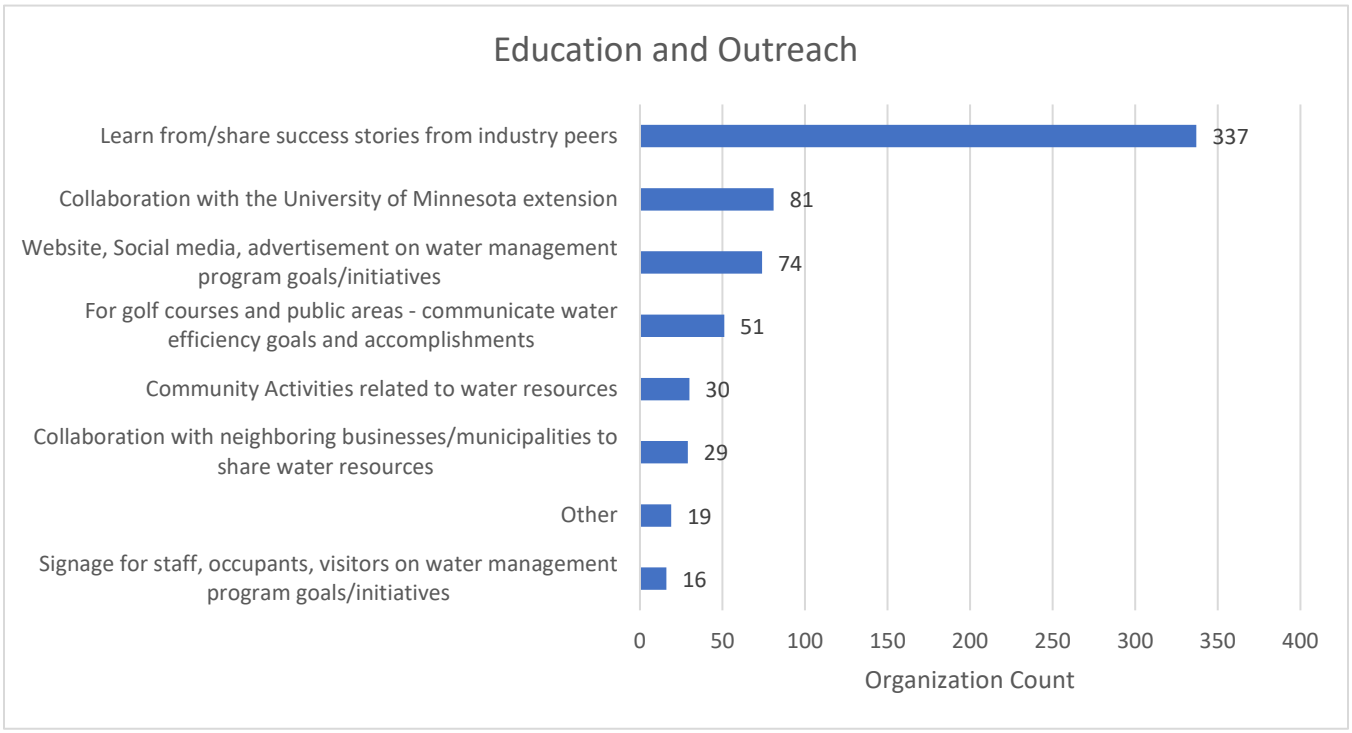


Figure 56. By far, most irrigators learn from industry peers. U of M Extension is also a source of educational materials.

2020 Results - Livestock Operations

Livestock Operation is a separate reporting section in the Water Conservation Report, with questions specific to their facilities. Their first year for reporting water conservation efforts began in 2020. Because it was a new, voluntary reporting system and opened during the peak of the pandemic, reporting has been lower than other sectors.

To manage water for everyone in the state, a permit is required when water use is more than 1 million gallons of water per year or 10,000 gallons of water on any given day. Most livestock operations do not use more than 1 million gallons per year, but those that do need a DNR permit. Water use between 1 and 5 million gallons per year are eligible for a General Permit for Animal Feedlots and Livestock Operation. For livestock water use greater than 5 million gallons per year, operators usually need an individual permit. There are 634 active General Permit authorizations for Livestock Watering and 284 active individual permits for livestock watering.

Water is needed for various types of livestock including: beef cattle, dairy cows, pigs, turkeys, and chickens. Water is also used for cleaning and cooling the animals and cleaning the buildings and equipment. Minnesota also has a few shrimp, fish, and other aquaculture facilities that are grouped under livestock operations.

Water conservation and efficiency are the simplest and most economical ways to preserve our water supplies, especially in areas where there may be limited water supplies. Using water efficiently will help ensure reliable water supplies today and for future generations. Saving water also saves energy and reduces the cost of pumping water.

Livestock Highlights

1. Over 20% of the reporting livestock operators have conducted a water use assessment on their facility.
2. The primary reason that livestock operators conserve water is for stewardship, sustainability, and environmental responsibility.
3. The primary water-efficient drinking devices that were reported are: maintenance and repair of water troughs to eliminate leaks at regular intervals and insulated water troughs, followed by water bowls and installing more efficient water troughs.
4. Livestock operators recycle/reuse water in a number of ways, including reusing process water, harvesting and reusing rainwater, and recycling the (cooling) water back into the drinking water system.
5. In their housing, yard, and machinery areas of operation, livestock producers save water by using high pressure washers to increase efficiency and reduce water use for

cleaning, leak detection, have shut-off valves on hoses, pre-soaking parlors, yards and housing to loosen dirt before washing, and use appropriate nozzles and valves among other practices.

Livestock Operation Discussion and Recommendations

1. Integrating water management with all other areas of operation is a key to success. Livestock operators should plan to address both technical and human aspects of water conservation.
2. The first step for any facility should be a thorough water audit to determine where water is used or lost.
3. Owners and managers should plan to implement water conservation and efficiency measures in phases, starting with the most obvious and lowest-cost options. However, keep in mind the true cost of water is the amount of the water bill plus the expense to pump, treat, and distribute the water. The initial investment in technology or a retrofit may seem expensive but the return on investment may make it very cost-effective.
4. Consider additional sub-metering and advanced metering technology.
5. Encourage technology upgrades to the most water efficient technology.
6. Improve building and water management operations to capture water efficient opportunities including leak repair, pressure reduction, irrigation zoning, etc.
7. Expand and improve water reuse options where feasible.

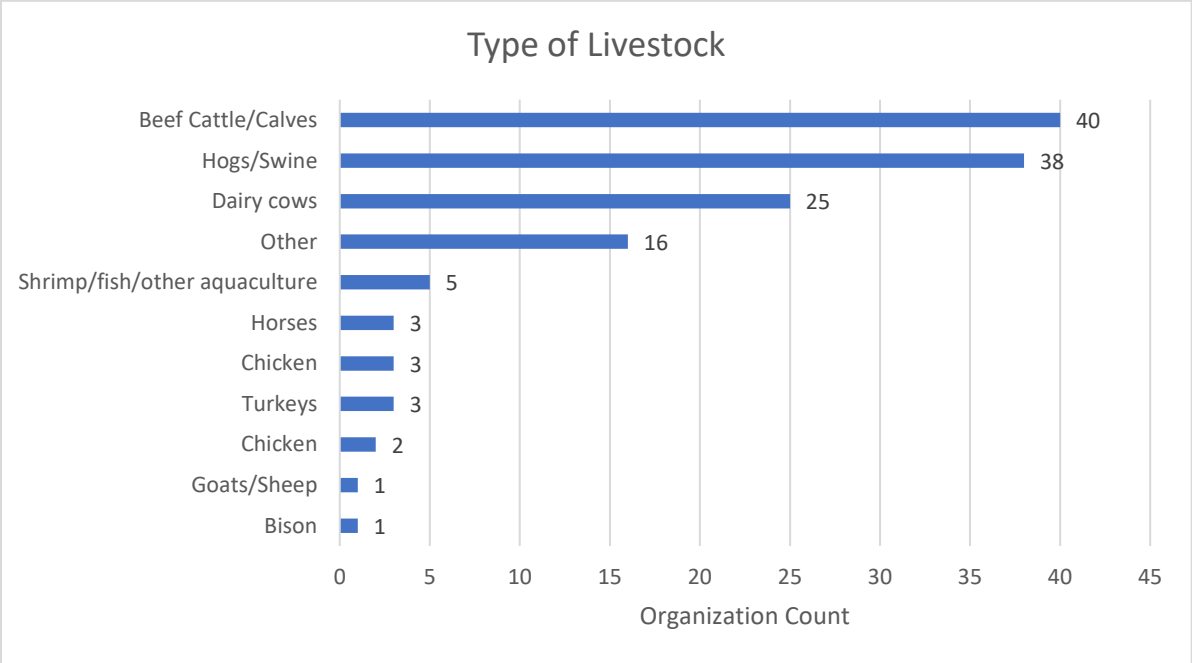


Figure 57. Of the various types of livestock and feedlot operations, the highest number reporting are beef cattle/calves, followed by hogs/swine and dairy cows. Minnesota also has shrimp/fish and aquaculture operations.

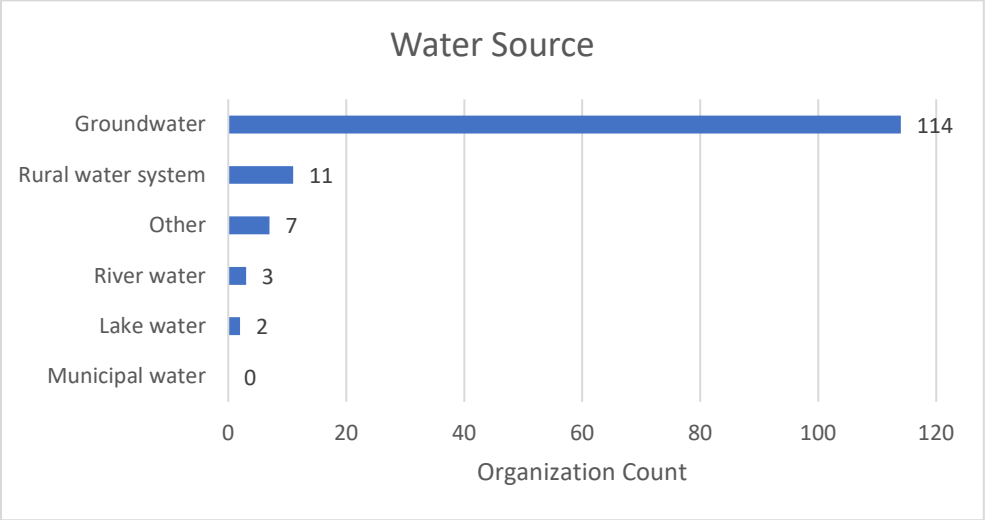


Figure 58. The majority of livestock operators use groundwater. There are a number who use rural water systems. This is potential issue in times of extreme drought when human drinking water is a higher priority water use than livestock watering.

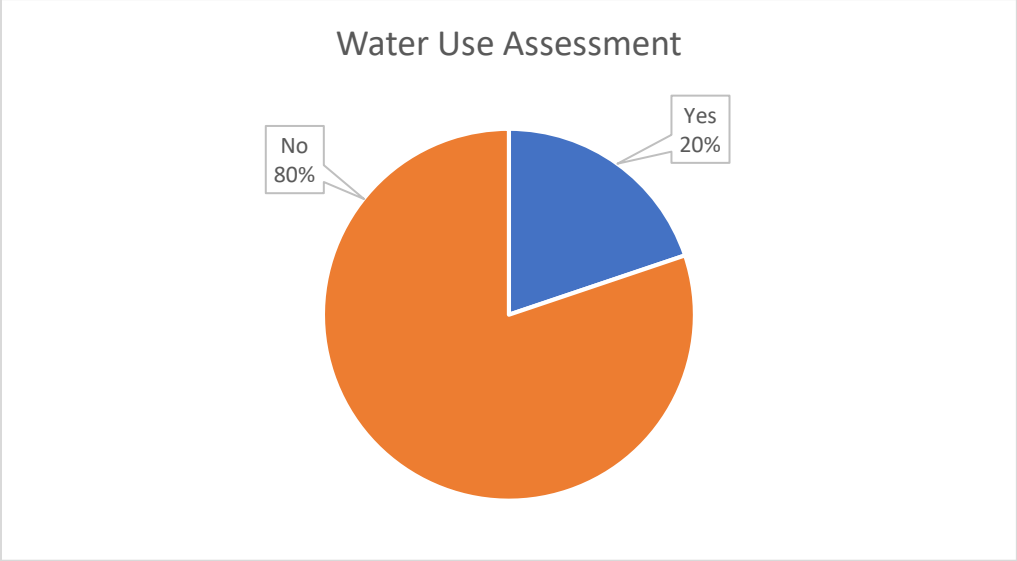


Figure 59. Over 20% of the reporting livestock operators have conducted a water use assessment on their facility. A water use assessment can help identify and prioritize actions businesses can take to save water and money. During the assessment, all water use is evaluated, along with pressure, flow, and water loss. Ideally this is followed up with a report on where improvements can be made

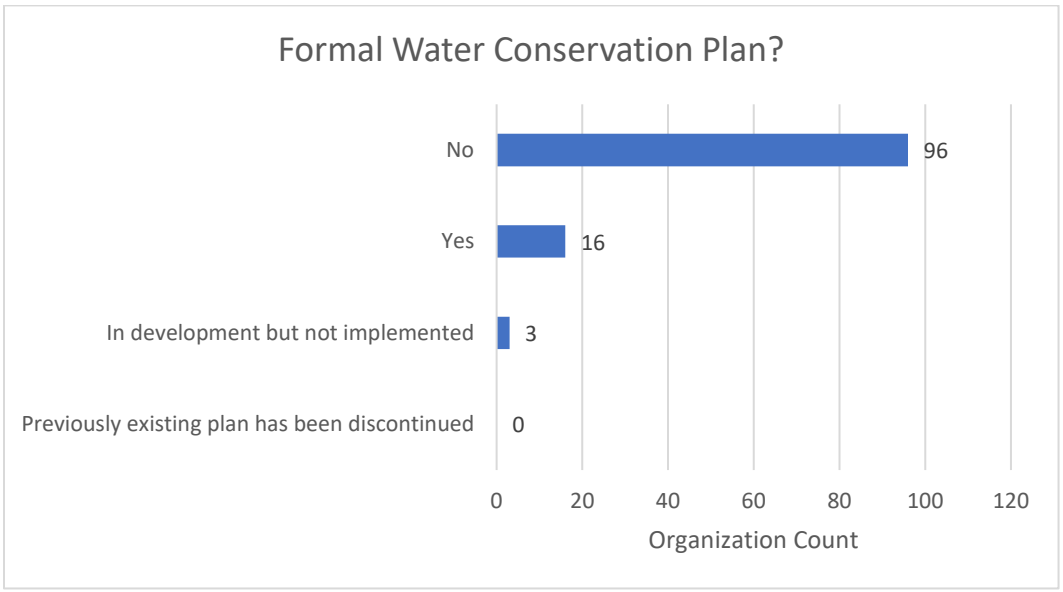


Figure 60. 19 operations have or are developing a water conservation plan for their facility.

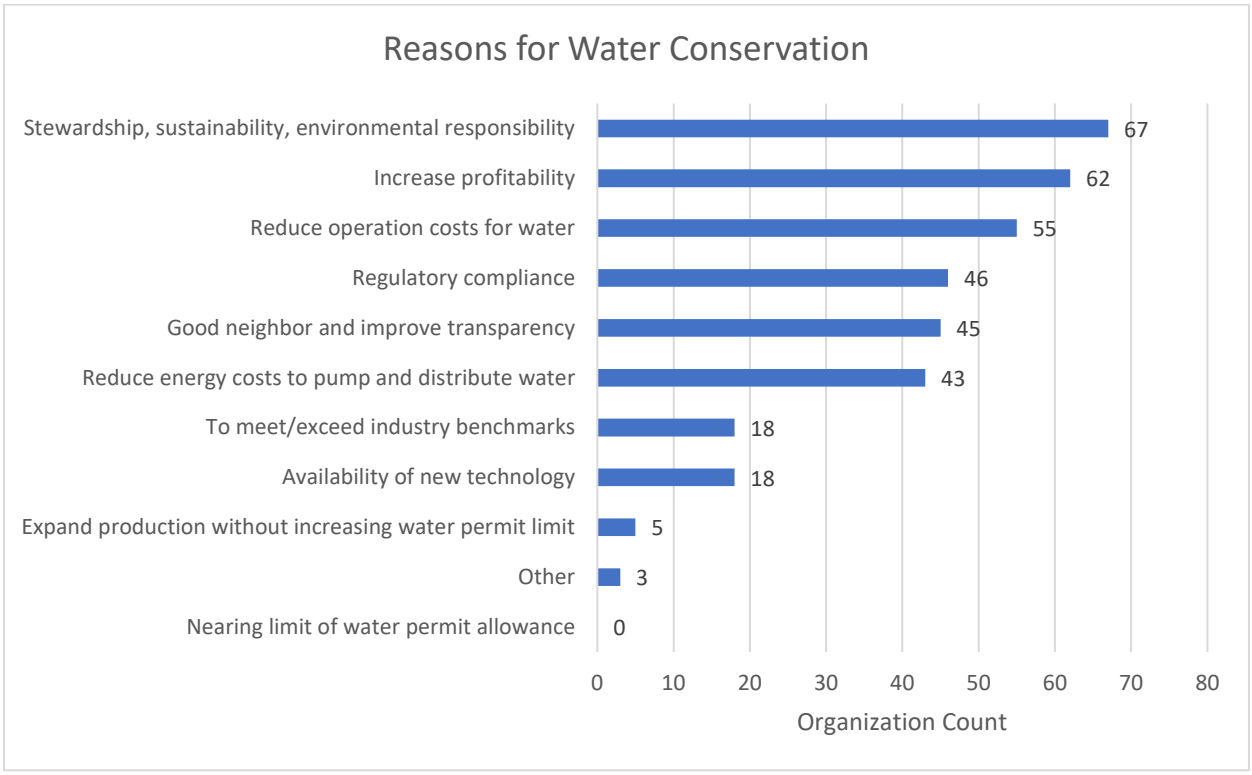


Figure 61. The primary reason that livestock operators conserve water is for stewardship, sustainability, and environmental responsibility. Increasing profits is a close second priority.

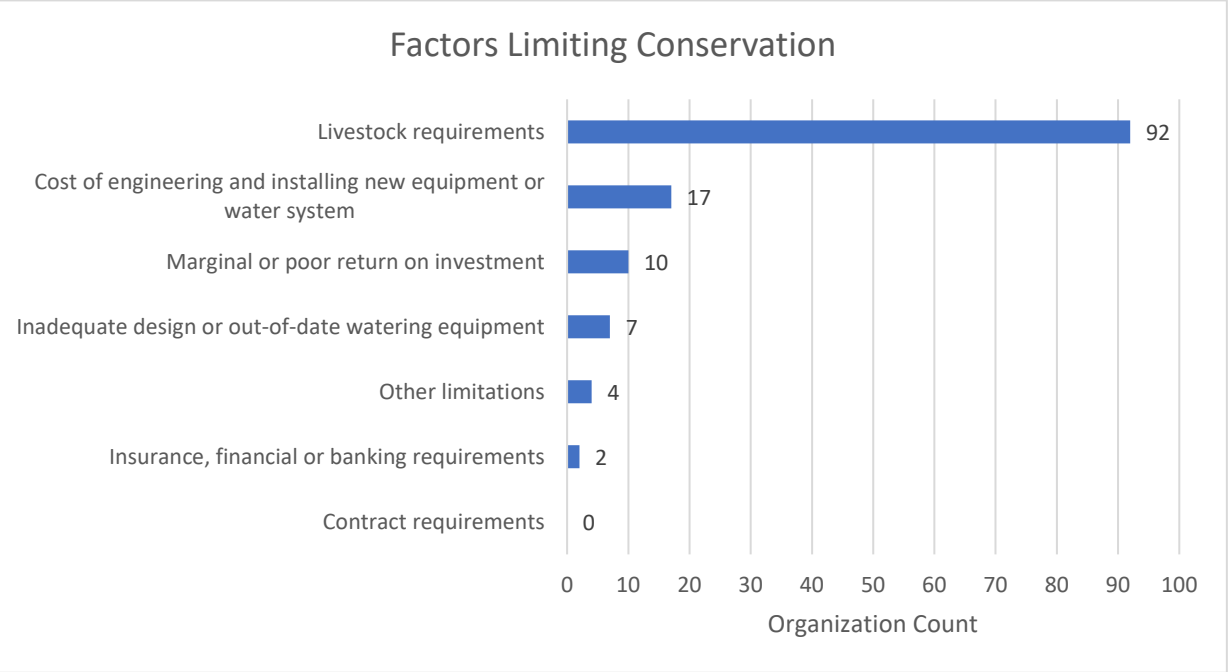


Figure 62. Logically, the primary factor limiting water conservation is livestock watering requirements. During hot summers, more clean water is needed to avoid heat stress.

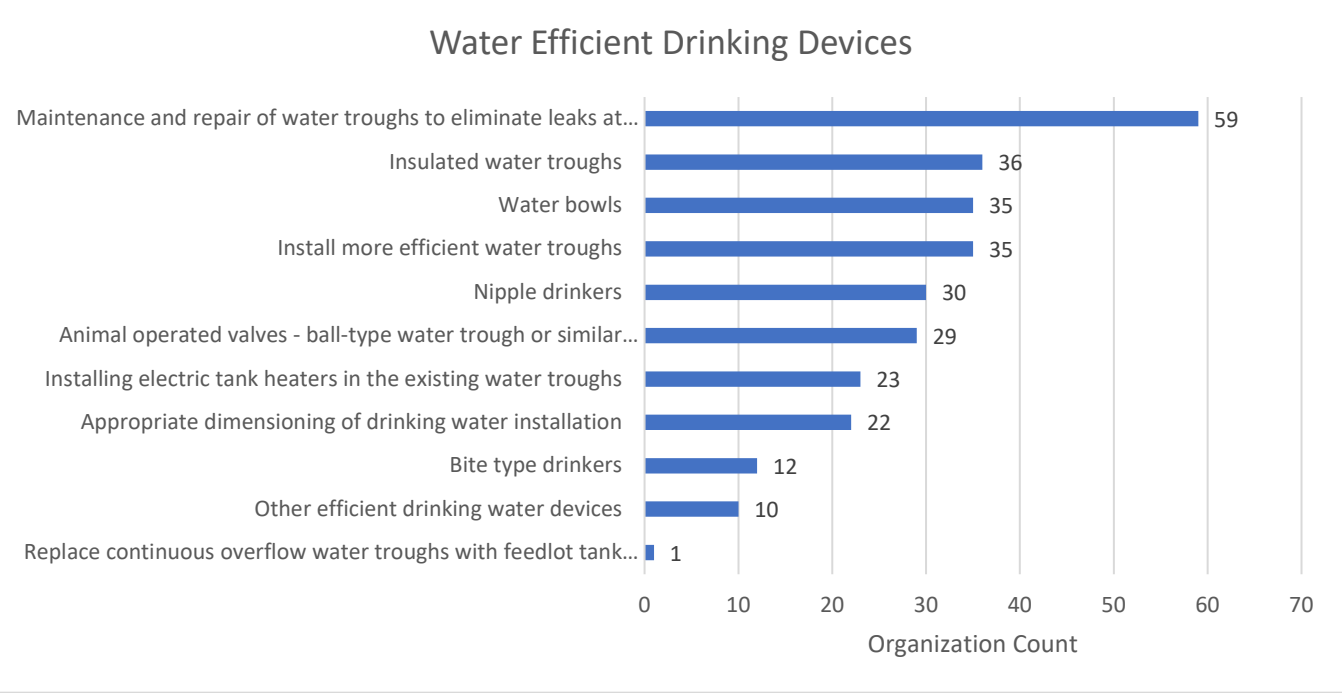


Figure 63. The primary water-efficient drinking devices that were reported are: maintenance and repair of water troughs to eliminate leaks at regular intervals and insulated water troughs, followed by water bowls and installing more efficient water troughs.

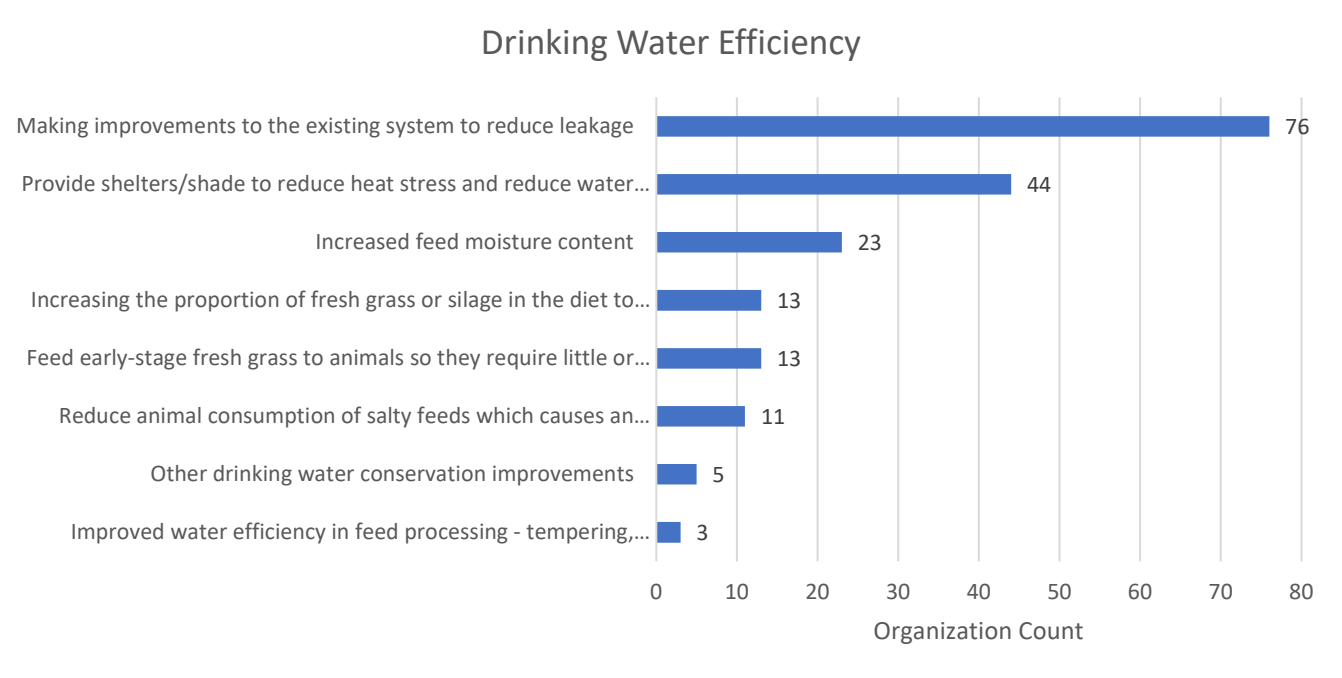


Figure 64. Other drinking water efficiencies include reducing leakage to the existing system, providing shade to reduce heat stress and reduce water intakes and increasing the feed moisture content.

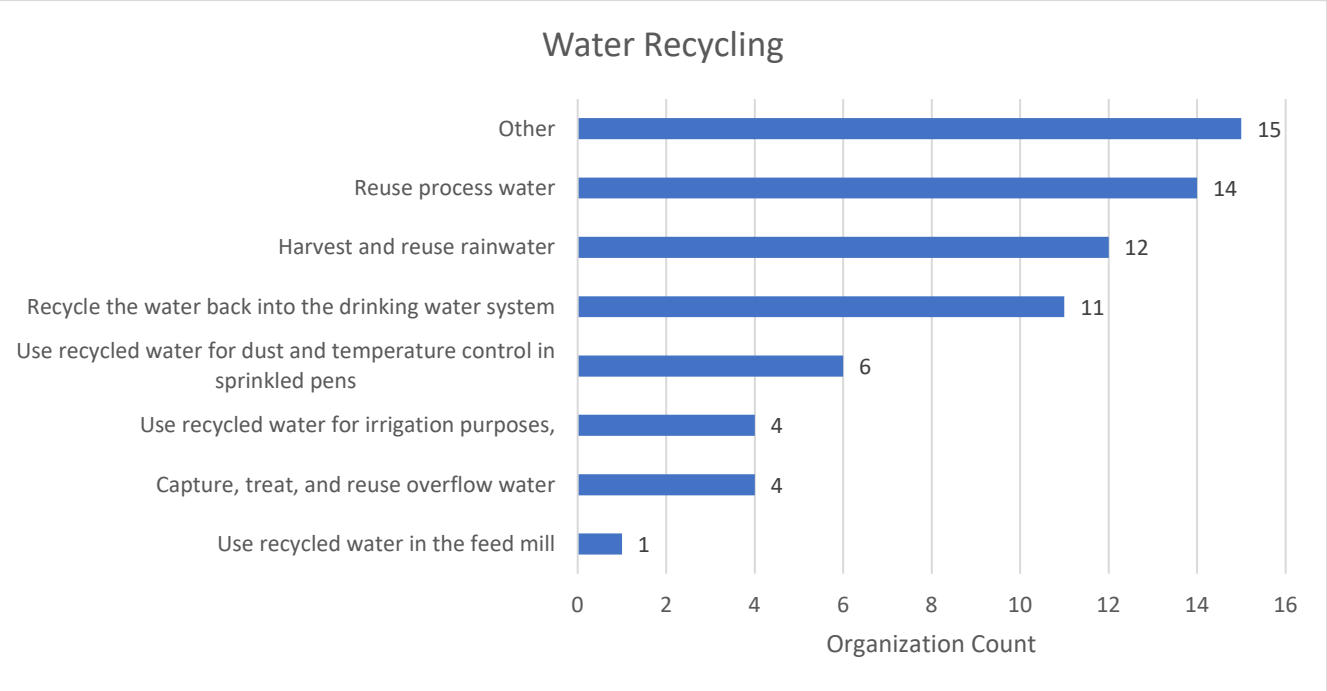


Figure 65. Livestock operators recycle/reuse water in a number of ways, including reusing process water, harvesting and reusing rainwater and recycling the (cooling) water back into the drinking water system.

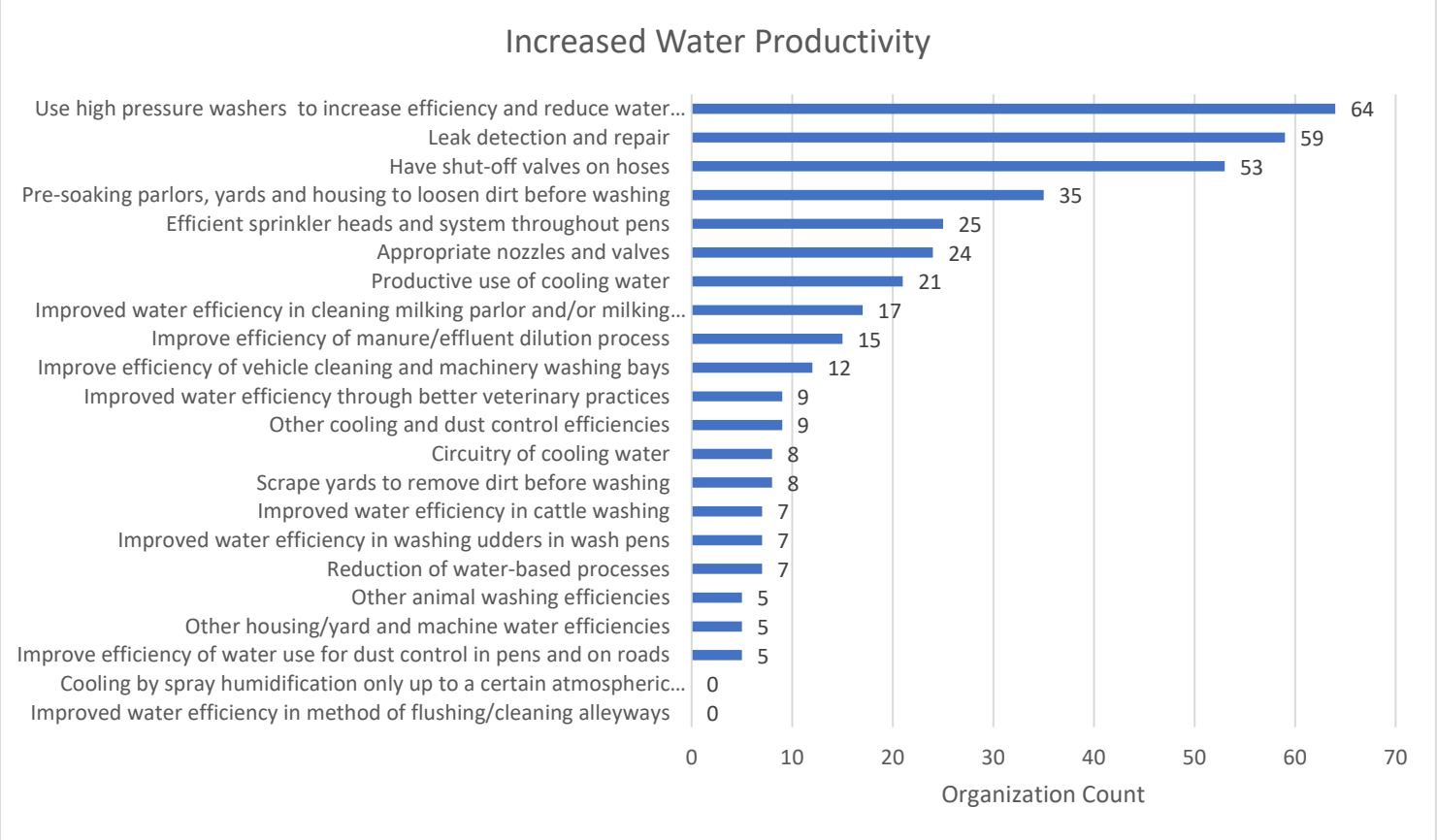


Figure 66. In their housing, yard, and machinery areas of operation, livestock producers save water by using high pressure washers to increase efficiency and reduce water use for cleaning, leak detection, have shut-off valves on hoses, pre-soaking parlors, yards and housing to loosen dirt before washing, and use appropriate nozzles and valves among other practices.

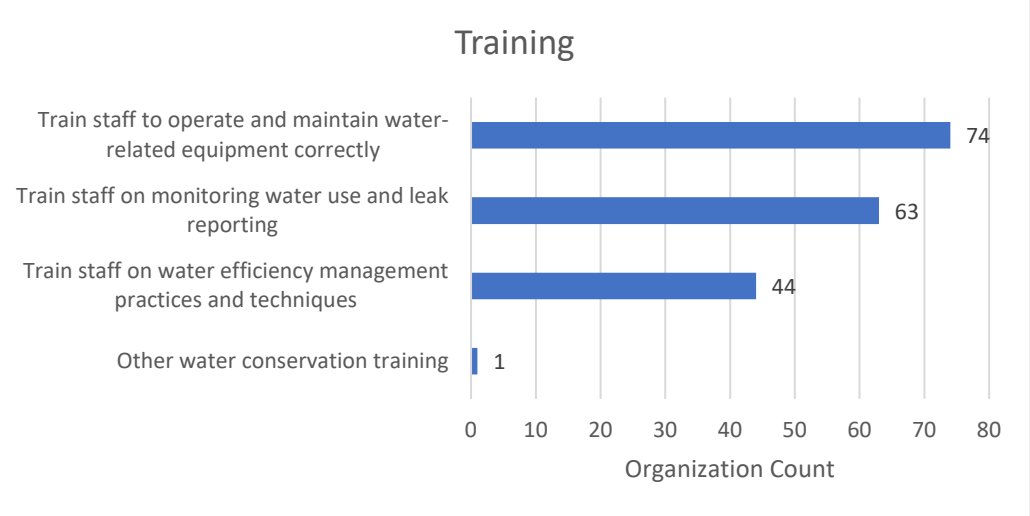


Figure 67. Training is an important part of water conservation. Feedlot operators report training staff to operate and maintain equipment properly and to monitor water use and report leaks.

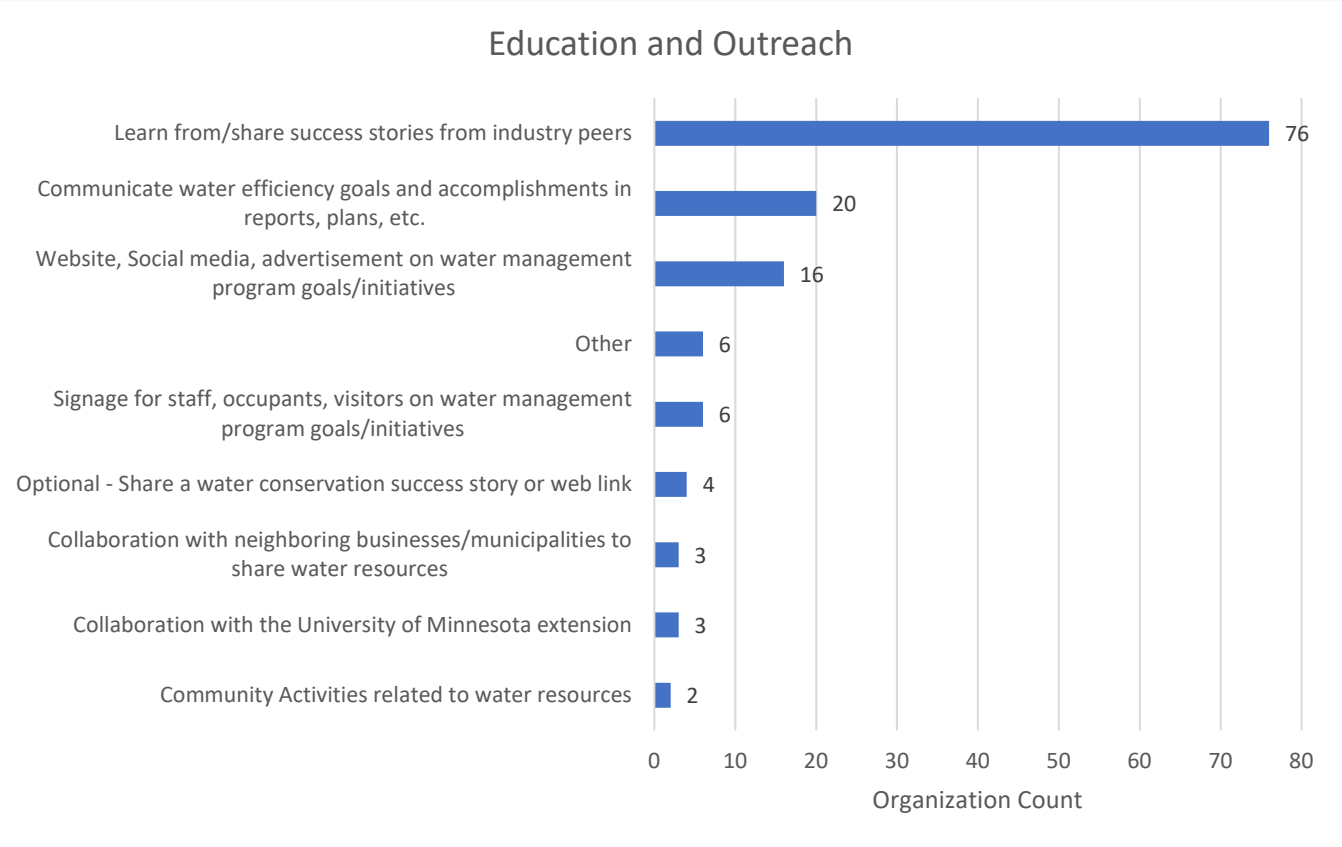


Figure 68. Livestock operators' primary education is through sharing success stories and learning from industry peers.

Figure 69. Minnesota has consistently ranked #1 in U.S. turkey production.
Every year Minnesota turkey farmers raise 40-42 million birds. Photo by MPCA

Appendix A

Gold Club Utilities – large utilities reporting reasonable data four years in a row

Adrian, City of	Aitkin, City Of - Public Utilities
Albany, City Of	Alexandria, City of
Arlington, City Of	Atwater, City Of
Avon, City Of	Bagley, City of
Baudette, City of	Baxter, City Of
Becker, City Of	Belle Plaine, City Of
Bemidji, City of - Public Works	Blooming Prairie, City Of
Braham, City of	Brainerd, City of
Brooklyn Center, City of	Brooklyn Park, City of - Public Works Dept
Buffalo, City Of	Buhl, City of
Burnsville, City Of	Byron, City of
Caledonia, City of	Cambridge, City of
Canby, City Of	Cannon Falls, City of
Carlton, City Of	Chanhassen, City Of
Circle Pines, City of	City of Albert Lea
City of Anoka	City Of Big Lake
City of Bloomington-Public Works	City of Dassel
City of Duluth; Duluth, City Of - Public Works Dept	City of Eden Prairie
City of Edina - Public Works	City of Howard Lake
City of Lakeville	City of Maple Grove
City of Maple Lake	City of Minneapolis
City of Perham	City of Plymouth
City of Robbinsdale	City of Starbuck
City of Tonka Bay	City of Waterville
City of White Bear Lake	Cloquet, City Of
Cokato, City Of	Cold Spring, City Of
Cologne, City Of	Columbus, City Of
Cottage Grove, City Of - Public Works Dept	Cottonwood, City of
Crosby, City of	Detroit Lakes, City of
Dodge Center, City Of	East Bethel, City Of
East Grand Forks, City Of	Eden Valley, City Of
Elbow Lake, City Of	Elk River Municipal Utilities
Empire Township	Excelsior, City Of
Foley, City Of	Frazee, City Of
Fridley, City Of	Gaylord, City Of
Glacial Lakes Sanitary Sewer & Water District	Glencoe City of
Glenwood, City Of	Goodhue, City of
Goodview, City of	Grand Forks, City of

Grand Meadow, City Of	Grand Rapids, City Of
Granite Falls, City Of	Greenfield, City Of
Hastings, City Of	Hayfield, City Of
Hinckley, City Of	Hugo, City Of
Hutchinson, City Of	Inver Grove Heights, City of
Isanti, City of	Jackson, City Of
Joint Powers Water Board	Kasson, City of
La Crescent, City of	Le Center, City Of
Litchfield, City of	Little Falls, City Of
Long Lake, City of	Lonsdale, City of
Loretto, City of	Madelia, City Of
Madison, City of	Mahnomen, City of
Mahtomedi, City of	Mankato, City Of
Mapleton, City Of	Mayer, City Of
Medford, City Of	Milaca City Of
Minnetonka, City Of	Minnetrista, City of
Montgomery, City Of	Monticello, City Of
Montrose, City Of	Moorhead Public Service
Moose Lake, City Of	Mora, City Of
Morris, City Of	Mounds View, City Of
New Prague, City Of	New York Mills, City Of
Newport, City of	North Branch, City Of
North Mankato, City Of	Norwood Young America, City Of
Oak Grove, City Of	Oak Park Heights, City Of
Oakdale, City of - Public Works Dept	Olivia, City Of
Orono, City of	Oronoco, City of
Otsego, City of	Owatonna Public Utilities
Parkers Prairie, City Of	Paynesville, City Of
Pelican Rapids, City Of	Pine River Area Sanitary District - Pequot Lakes; Pine River Area Sanitary District - Pine River
Ramsey, City Of	Red Lake Falls, City Of
Redwood Falls, City Of	Renville, City Of
Rich Prairie Sewer & Water District	Richfield, City Of
Richmond, City of	Rochester Public Utilities
Rockford, City Of	Rosemount, City of
Rushford, City of	Saint Peter, City Of
Sandstone, City of	Sauk Centre, City Of
Sauk Rapids, City Of	Schaefer, Monty; Wanamingo, City of
Shafer, City Of	Shakopee Public Utilities Commission
Sherburn, City Of	Shoreview, City Of
Silver Bay, City Of	Slayton, City Of
Spring Lake Park, City Of	Spring Valley, City of

St Anthony, City Of	St Francis, City Of
St James, City Of	St Joseph, City Of
St Louis Park, City Of	St Paul Park, City Of
St Paul Regional Water Services	Stacy, City Of
Staples, City Of	Stillwater, City of-Board of Water Commissioners
Superior Water Light & Power Co.	Tracy, City Of
Truman, City of	Two Harbors, City Of
Virginia Public Utilities	Watertown, City Of
Wheaton, City of	Willmar, City of
Windom, City Of	Winnebago, City Of
Winona, City of	Winsted, City Of
Winthrop, City Of	Woodbury, City Of
Worthington, City Of - Engineering	Wyoming, City Of

Appendix B

Silver Club Utilities – large utilities reporting valid data three years out of the four

Andover, City of	Appleton, City Of
Austin Utilities	Carver, City of
Chaska, City of	Chatfield, City of
Chisago City, City of	Clara City, City Of
Cohasset, City Of	Crookston, City Of
Edgerton, City Of	Elgin, City of
Eveleth, City of	Eyota, City of
Fairfax, City Of	Forest Lake, City Of
Glyndon, City Of	Hamburg, City Of
Hampton, City Of	International Falls, City Of
Lake City, City of	Lake Crystal, City Of
Lakefield, City of	Le Sueur, City Of
Lester Prairie, City of	Lewiston, City of
Lexington, City Of	Lindstrom, City Of
Lino Lakes, City Of	Mantorville, City Of
Medina, City Of	Minnetonka Beach, City Of
Mountain Iron, City Of	New Brighton, City Of
New Ulm, City Of	Ortonville, City Of
Park Rapids, City of	Prior Lake, City Of
Red Wing, City of; Red Wing, City of - Public Works	Rice, City Of
Rock County Rural Water	Shorewood, City of
Wabasha, City of	Warren, City Of

Appendix C

Small Utilities Reporting Reasonable Data

Adams, City Of	Alden, City of
Amboy, City Of	Argyle, City of
Audubon, City Of	Backus, City Of
Battle Lake, City Of	Beaver Bay, City of
Bovey, City of	Brandon, City of
Brooten, City of	Browerville, City Of
Brownton, City Of	Buffalo Lake, City Of
Cass Lake, City of	City of Kimball
Claremont, City of	Donnelly, City Of
Ellendale, City of	Elmore, City Of
Farwell Kensington Sanitary District	Garfield, City of
Gibbon, City Of	Graceville, City Of
Green Isle, City Of	Grove City, City Of
Hackensack, City Of	Hammond, City of
Hancock, City Of	Herman, City Of
Hokah, City of	Houston, City of
Karlstad, City Of	Lafayette, City Of
Lamberton, City Of	Lanesboro, City of
Linwood Terrace Company	Lowry, City of
Mabel, City Of	Motley, City Of
Nerstrand, City Of	New Auburn, City Of
New Germany, City of	New Richland, City of
Newfolden, City of	Onamia, City of
Orr, City Of	Remer, City Of
Revere, City Of	Rollingstone, City of
Rushford Village, City of	Sacred Heart, City of
Sebeka, City of	Silver Lake, City Of
South Haven, City of	St Cloud, City Of
Stockton, City of	Trimont, City Of
Twin Valley, City Of	Ulen, City of
Upsala, City Of	Verndale, City Of
Vernon Center, City Of	Waite Park, City Of
Walnut Grove, City Of	Waseca, City of
Watson City of	Waubun, City Of
Welcome, City of	Wells, City of
Wrenshall, City Of	