How water works – Supplemental materials for LWV WCGA 4-19-21

This material is supplemental to the presentation. Please use it for background on the topics being discussed.

Hydrologic cycle

Video: Our groundwater connection
https://www.youtube.com/watch?v=gxENTkMmyEE

Video: How GW moves in karst – 2.55 min
https://www.youtube.com/watch?v=vAOcqHgwTfg&list=PL8pqzQfMH1BgX_AIw4TXhmF6Ogcl-8_Fm&index=4

Map and watershed info - https://www.pca.state.mn.us/metrowater -

Groundwater
Video – how pollutants move in SE MN
https://www.youtube.com/watch?v=YnGeE_gxM04&list=PL8pqzQfMH1BgX_AIw4TXhmF6Ogcl-8_Fm&index=3

Washington County Groundwater Atlas, 2019:
https://files.dnr.state.mn.us/waters/groundwater_section/mapping/cga/c39_washington/washington_report.pdf

Video – what age water are you drinking? 2 min.
https://www.youtube.com/watch?v=beUFrJu0Hjc&list=PL8pqzQfMH1BgX_AIw4TXhmF6Ogcl-8_Fm&index=3

Stormwater video from Australia: https://www.youtube.com/watch?v=BliZY3k_u1w

Metro wastewater plant: https://www.youtube.com/watch?v=b-EdqCvK6Z0 @ 3:34+

MPCA PFAS information: https://www.pca.state.mn.us/waste/pfas-pollution

Information about drinking water conservation in Woodbury and Cottage Grove

----- Forwarded Message -----
From: Nelson, Carmelita M (DNR) <carmelita.nelson@state.mn.us>
To: Gretchen Sabel
Sent: Wednesday, April 14, 2021, 09:49:40 AM CDT
Subject: Annual Water conservation in Woodbury and Cottage Grove

How water works – Supplemental materials for LWV WCGA 4-19-21

Hi Gretchen,

Attached are the past three years of conservation reports for Cottage Grove and Woodbury.

- The main three indicators that I focus on are water loss percentage, residential gallons per capita and peaking factor (summer water use).

- I don't worry too much about commercial water use because it can indicate good economic activity and businesses tend to be efficiency-minded for profitability (positive numbers indicate a reduction in nonresidential water use=good). Commercial also impacts the total water use.

- Both cities do some conservation efforts well, but there is always room for improvement. At the end of all reports are generic suggestions for improving water efficiency.

Here are a few ideas for homework. Maybe have different people do one of the items and then they can report their findings.

1. Focusing on Goals and Water Accounting, compare the trends over time for each city. What has improved in Cottage Grove? What has improved in Woodbury?

2. Focusing on the Water Conservation–Direct section, compare the trends over time for each city. What has improved in Cottage Grove? What has improved in Woodbury?

3. Pick one year, look at the Ordinances, Education and Collaboration sections and compare the strong points of one city to the strong points of the other city. What can the two cities learn for from each other?

4. Look at the generic recommendations at the end of the report. Would any of these suggestions help Cottage Grove or Woodbury to save water?

Carmelita Nelson

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Cottage Grove, City Of - Public Works Dept Summary of Water Conservation Report

Additional Details at www.espwater.org

2019 Report based on 2018 Water Use

Water Conservation Goals	
Unaccounted Water Loss	8.2 %
Residential GPCD	65
Annual % Reduction-Nonresidential	-29.57
Trend in total per capita demand	-13.60001
Total Peaking Factor	2.5
Water Accounting	
Total water to Treatment	1,097,166,614 gallons
Total water to Distribution	1,097,166,614 gallons
# of Residential connections	10,975
# of Non-Res. connections	170
Residential vs. Non-Res. Use	878.9 million gal. vs. 128.3 million gal.
Date of Highest Use	8/15/2018
Water Conservation - Direct	
Water Supply System Infrastructure Efficiency (leaks, meters, etc.)	• Meter Repair/Replace: gal -- $326,000
Date of last Audit/Percent done	% audit
Direct Conservation Single Family (SF) and Multi-Family (MF) and Commercial, Industrial, Institutional (CII) Efforts	• SF ET Irrigation Controllers: Quantity: 200 Gallons saved: 1,800,000
Reuse or other Customer conservation projects	None listed
Water Conservation Indirect	
Ordinances	• Irrigation restrictions Regulations
Education and Outreach	• Billing inserts or tips printed on the actual bill -- 12 • Consumer Confidence Reports -- 1 • Social media distribution (e.g., emails, Facebook, Twitter) -- 1 • Displays and exhibits -- 1 • Website -- 1 • Targeted efforts (large volume users, users with large increases) -- 1
Collaboration	None listed
Rate structure	• Increasing Block

Cottage Grove, City Of - Public Works Dept Summary of Water Conservation Report

Additional Details at www.espwater.org

2020 Report based on 2019 Water Use

Water Conservation Goals	
Unaccounted Water Loss	7 %
Residential GPCD	60
Annual % Reduction-Nonresidential	-82.82
Trend in total per capita demand	7.53386
Total Peaking Factor	2.54
Water Accounting	
Total water to Treatment	1,155,929,474 gallons
Total water to Distribution	1,155,929,474 gallons
# of Residential connections	11,212
# of Non-Res. connections	178
Residential vs. Non-Res. Use	840.8 million gal. vs. 234.5 million gal.
Date of Highest Use	8/9/2019
Water Conservation - Direct	
Water Supply System Infrastructure Efficiency (leaks, meters, etc.)	• System leak fixing (before the meter): 2,592,000 gal -- $5,650
Date of last Audit/Percent done	% audit
Direct Conservation Single Family (SF) and Multi-Family (MF) and Commercial, Industrial, Institutional (CII) Efforts	• SF ET Irrigation Controllers: Quantity: 200 Gallons saved: 1,800,000
Reuse or other Customer conservation projects	None listed
Water Conservation Indirect	
Ordinances	• Irrigation restrictions Regulations
Education and Outreach	• Billing inserts or tips printed on the actual bill -- 12 • Consumer Confidence Reports -- 1 • Social media distribution (e.g., emails, Facebook, Twitter) -- 1 • Displays and exhibits -- 1 • Website -- 1
Collaboration	None listed
Rate structure	• Increasing Block

Cottage Grove, City Of - Public Works Dept Summary of Water Conservation Report

Additional Details at www.espwater.org

2021 Report based on 2020 Water Use

Water Conservation Goals	
Unaccounted Water Loss	6.2 %
Residential GPCD	79
Annual % Reduction-Nonresidential	39.43
Trend in total per capita demand	-31.37037
Total Peaking Factor	2.26
Water Accounting	
Total water to Treatment	1,339,972,289 gallons
Total water to Distribution	1,339,972,289 gallons
# of Residential connections	11,513
# of Non-Res. connections	183
Residential vs. Non-Res. Use	1,115.5 million gal. vs. 142.0 million gal.
Date of Highest Use	7/17/2020
Water Conservation - Direct	
Water Supply System Infrastructure Efficiency (leaks, meters, etc.)	• System leak fixing (before the meter): 216,000 gal -- $10,800
Date of last Audit/Percent done	% audit
Direct Conservation Single Family (SF) and Multi-Family (MF) and Commercial, Industrial, Institutional (CII) Efforts	• SF ET Irrigation Controllers: Quantity: 146 Gallons saved: 1,314,000
Reuse or other Customer conservation projects	None listed
Water Conservation Indirect	
Ordinances	• Irrigation restrictions Regulations
Education and Outreach	• Consumer Confidence Reports -- 1 • Social media distribution (e.g., emails, Facebook, Twitter) -- 1
Collaboration	None listed
Rate structure	• Increasing Block

Woodbury, City Of Summary of Water Conservation Report

Additional Details at www.espwater.org

2019 Report based on 2018 Water Use

Water Conservation Goals	
Unaccounted Water Loss	3.1 %
Residential GPCD	80
Annual % Reduction-Nonresidential	1.09
Trend in total per capita demand	-0.57395
Total Peaking Factor	2.4
Water Accounting	
Total water to Treatment	2,586,581,230 gallons
Total water to Distribution	2,586,581,230 gallons
# of Residential connections	22,595
# of Non-Res. connections	844
Residential vs. Non-Res. Use	2,078.5 million gal. vs. 427.8 million gal.
Date of Highest Use	8/14/2018
Water Conservation - Direct	
Water Supply System Infrastructure Efficiency (leaks, meters, etc.)	• System leak fixing (before the meter): gal -- $92,428 • Meter Repair/Replace: gal -- $383,185 • Hydrant repair: gal -- $13,365
Date of last Audit/Percent done	% audit
Direct Conservation Single Family (SF) and Multi-Family (MF) and Commercial, Industrial, Institutional (CII) Efforts	• SF ET Irrigation Controllers: Quantity: 1040 Gallons saved: 9,360,000 • MF/CII Large Landscape Projects: Quantity: 24 Gallons saved: 9,600,000
Reuse or other Customer conservation projects	None listed
Water Conservation Indirect	
	• Critical/Emergency Water Deficiency Ordinance • Irrigation restrictions Regulations • Water consumption regulation • Tree ratio requirement • Allow native plants and Low water use turf/plants • Mandatory “green” building or plumbing codes

	• Wellhead protection ordinance and zoning • Non-Zoning Wetlands Ordinance (beyond state/federal laws) • Track enforcement • Regulation for sensor and smart irrigation controllers (new instals)
Education and Outreach	• Consumer Confidence Reports -- 1 • Social media distribution (e.g., emails, Facebook, Twitter) -- 15 • Presentations to community groups -- 4 • Displays and exhibits -- 2 • Marketing rebate programs (e.g., indoor fixtures & appliances and outdoor practices) -- 15 • Community news letters -- 8 • Direct mailings (water audit/retrofit kits, showerheads, brochures) -- 1 • K-12 education programs (Project Wet, Drinking Water Institute, presentations) -- 1 • Community events (children's water festivals, environmental fairs) -- 1 • Water week promotions -- 1 • Website -- 4 • Targeted efforts (large volume users, users with large increases) -- 5 • Notices of ordinances -- 1
Collaboration	• Collaborated with watershed group(s) • Collaborated with other high volume water users (commercial, industrial, institutional or agricultural) • Collaborated with MDH on wellhead protection project
Rate structure	• Increasing Block

Woodbury, City Of Summary of Water Conservation Report

Additional Details at www.espwater.org

2020 Report based on 2019 Water Use

Water Conservation Goals	
Unaccounted Water Loss	4.4 %
Residential GPCD	71
Annual % Reduction-Nonresidential	3.93
Trend in total per capita demand	11.46187
Total Peaking Factor	2.48
Water Accounting	
Total water to Treatment	2,398,700,053 gallons
Total water to Distribution	2,398,700,053 gallons
# of Residential connections	23,055
# of Non-Res. connections	864
Residential vs. Non-Res. Use	1,882.0 million gal. vs. 411.0 million gal.
Date of Highest Use	8/8/2019
Water Conservation - Direct	
Water Supply System Infrastructure Efficiency (leaks, meters, etc.)	• System leak fixing (before the meter): gal -- $114,617 • Meter Repair/Replace: gal -- $336,645 • Hydrant repair: gal -- $26,695
Date of last Audit/Percent done	% audit
Direct Conservation Single Family (SF) and Multi-Family (MF) and Commercial, Industrial, Institutional (CII) Efforts	• SF ET Irrigation Controllers: Quantity: 660 Gallons saved: 5,940,000 • MF/CII Large Landscape Projects: Quantity: 13 Gallons saved: 5,850,000
Reuse or other Customer conservation projects	None listed
Water Conservation Indirect	
Ordinances	• Critical/Emergency Water Deficiency Ordinance • Private well ordinance (private wells in a city must comply with water restrictions)

	• Irrigation restrictions Regulations • Water consumption regulation • Tree ratio requirement • Allow native plants and Low water use turf/plants • Mandatory "green" building or plumbing codes • Wellhead protection ordinance and zoning • Non-Zoning Wetlands Ordinance (beyond state/federal laws) • Track enforcement • Regulation for sensor and smart irrigation controllers (new instals)
Education and Outreach	• Billing inserts or tips printed on the actual bill -- 1 • Consumer Confidence Reports -- 1 • Social media distribution (e.g., emails, Facebook, Twitter) -- 20 • Displays and exhibits -- 2 • Marketing rebate programs (e.g., indoor fixtures & appliances and outdoor practices) -- 15 • Community news letters -- 8 • Direct mailings (water audit/retrofit kits, showerheads, brochures) -- 1 • Cable TV Programs -- 4 • K-12 education programs (Project Wet, Drinking Water Institute, presentations) -- 1 • Community education classes -- 1 • Water week promotions -- 1 • Website -- 4 • Notices of ordinances -- 1
Collaboration	• Collaborated with watershed group(s) • Collaborated with other high volume water users (commercial, industrial, institutional or agricultural) • Collaborated with MDH on wellhead protection project
Rate structure	• Increasing Block

Woodbury, City Of Summary of Water Conservation Report

Additional Details at www.espwater.org

2021 Report based on 2020 Water Use

Water Conservation Goals	
Unaccounted Water Loss	3.6 %
Residential GPCD	79
Annual % Reduction-Nonresidential	8.54
Trend in total per capita demand	-11.18293
Total Peaking Factor	2.07
Water Accounting	
Total water to Treatment	2,631,359,959 gallons
Total water to Distribution	2,631,359,959 gallons
# of Residential connections	23,457
# of Non-Res. connections	878
Residential vs. Non-Res. Use	2,161.6 million gal. vs. 375.9 million gal.
Date of Highest Use	8/21/2020
Water Conservation - Direct	
Water Supply System Infrastructure Efficiency (leaks, meters, etc.)	None listed
Date of last Audit/Percent done	% audit
Direct Conservation Single Family (SF) and Multi-Family (MF) and Commercial, Industrial, Institutional (CII) Efforts	None listed
Reuse or other Customer conservation projects	None listed
Water Conservation Indirect	
Ordinances	• Critical/Emergency Water Deficiency Ordinance • Private well ordinance (private wells in a city must comply with water restrictions) • Irrigation restrictions Regulations • Water consumption regulation • Tree ratio requirement • Allow native plants and Low water use turf/plants • Mandatory “green” building or plumbing codes • Wellhead protection ordinance and zoning

	• Non-Zoning Wetlands Ordinance (beyond state/federal laws) • Track enforcement • Regulation for sensor and smart irrigation controllers (new instals)
Education and Outreach	• Billing inserts or tips printed on the actual bill -- 1 • Consumer Confidence Reports -- 1 • Social media distribution (e.g., emails, Facebook, Twitter) -- 20 • Marketing rebate programs (e.g., indoor fixtures & appliances and outdoor practices) -- 15 • Community news letters -- 8 • Direct mailings (water audit/retrofit kits, showerheads, brochures) -- 1 • Water week promotions -- 1 • Website -- 4 • Notices of ordinances -- 2 • Emergency conservation notices -- 1
Collaboration	• Collaborated with watershed group(s) • Collaborated with other high volume water users (commercial, industrial, institutional or agricultural) • Collaborated with MDH on wellhead protection project
Rate structure	• Increasing Block

How water works – Supplemental materials for LWV WCGA 4-19-21

General Comments and Recommendations for additional conservation efforts:

1. **Water Conservation Goals:** Compare your water supply system results to the statewide water conservation goals that are set in the Water Supply Plans:
   a. Unaccounted for Water Loss <10%
   b. Residential Gallons per Capita Demand (GPCD) Daily <75
   c. Annual % Reduction in Nonresidential Use >1.5%
   d. Trend in Total per Capita Demand >=1.0
   e. Total Peaking Factor <2.6

   Each water supplier should try to achieve the statewide water conservation goals by the time their next Water Supply Plan is due (2026-2028).

2. **Water Loss**: For most water suppliers, working on reducing water loss should be your top conservation objective. Cities should first make their own water supply system as efficient as possible. In addition to leaks, water can be "lost" through unauthorized consumption (theft), administrative errors, data handling errors, and metering inaccuracies or failure.
3. **Leak Repair:** Budgeting for and keeping on top of aging pipes and infrastructure will be important in the coming years to reduce water loss. Also check fire hydrants frequently, many cities are finding these to be part of their water loss problem.
4. **Meters:** A water meter program should include selection, installation, testing and maintenance. Over time meters lose accuracy and inaccurate meters contribute to loss of revenue. Accurate meters are also key to getting a handle on water loss. Focus first on large meter installations.
5. **Audit:** Water audits are the first step for controlling water loss. AWWA offers free Water Audit Software. The second step is intervention and implementing solutions, and the third step is evaluation and further improvements if needed. Metering and better water accounting are key to improving the city's water loss percentage.
6. **Peak Water Day:** Generally this number indicates if the city has high summer water use. Conservation education should focus on improving landscape irrigation efficiency on public and private property. The UMN Turfgrass Science website has excellent irrigation resources. If your peak water day was for hydrant flushing, you might evaluate if this amount could be reduced without sacrificing best practices. Some cities are significantly cutting back with hydrant flushing and not impacting water quality.
7. **Residential & Non-Residential:** Compare the volume of Residential and non-residential water user. Is one significantly more than the other or are they quite close in water use? Focusing on your big water use accounts with education programs or conservation partnerships may make sense.
8. **Non-residential education and outreach ideas:**
   a. Non-residential use is always an opportunity for water conservation – economically Commercial, Industrial and Institutional users *want* to be as efficient as possible. The city should look at the 2-3 largest non-residential water users and meet with them to see if there are things they can do to conserve water.
   b. Cities often work with the CII categories that are easiest to implement: government/municipal buildings and facilities; large landscape areas; schools and/or colleges; office buildings; restaurants. Research shows that the degree of success for water conservation are: 1. Schools/colleges, 2. Commercial and apartments, 3. Large landscape areas, 4. Lodging, 5. Public pools/water parks. Target your efforts here for optimal success.

c. If any of the CII facilities have outdoor lawn irrigation this is an easy and quick way to reduce water use by installing smart meters, doing an irrigation audit to look for leaks and broken heads, or simply turning off the irrigation controllers and only turning them on when there has been a lack of rainfall.

9. **RESIDENTIAL EDUCATION AND OUTREACH IDEAS:**
   a. The city may want to offer free toilet leak detection tablets to customers since this is the most common leak and easy to fix. Contact the MN DNR Information Center for a free supply of toilet leak detection info cards and dye tablets.
   b. You may want to try promoting this home water conservation app that only takes a few minutes and is fun and informative http://nrwa.aqkwa.com (try it yourself!). In addition to adults, you can work with the schools, kids may influence their parents to conserve water.
   c. Other new water campaigns the city may want to participate in include: the US EPA WaterSense Program. Membership is free and allows you access to great resources. Also *Value of Water*- US Water Alliance has a Value of Water Campaign http://uswateralliance.org/initiatives/value-of-water with a toolkit that has PDFs of ads, billboards, bill stuffers, bus shelter ads, banners, and social media. The focus is positive, emphasizing that water is essential.
10. **ORDINANCES:** City Councils may want to strengthen their water conservation ordinances. League of MN Cities is a great source for sample ordinances.
11. **RATE STRUCTURE:** Cities should regularly evaluate the water rate structure. MN Rural Water Association provides this service (free for a quick review; small fee for a full bookkeeping audit).
12. **FUTURE WEATHER:** Northern cities are already experiencing changing seasons and weather patterns. Some of these will impact water supply and demand. Climate science tells us three key trends will likely continue through mid-century:
    1. Extreme rainfall is happening more often.
    2. Minnesota's climate is becoming warmer and wetter.
    3. Winter is warming 13 times faster than summer and there are fewer days of extreme cold.

These changes will likely impact public water supplies in several ways:

   a. Rivers & Streams: Rivers will see altered high and low flows and an increase in contamination due to flooding. Whatever the historic flood level has been in the past, anticipate it to be higher. Are water treatment facilities, water towers, and pumps flood proof/resilient? Are there industries upstream that may contaminate drinking water supplies during a flood? Are communications in place to notify the city of possible contamination and emergency flood preparations in place? If the city is not a member of MnWARN they may want to consider this voluntary option. Warmer winters may mean more ice, which often requires more salt treatment. Chloride contamination is becoming a concern in many areas of the state and may require additional water treatment.
   b. Lakes: Longer thermal stratification on lakes means that seasonal mixing may be eliminated in shallow water, resulting in fish kills. This may not affect the city directly. Thin ice may pose safety hazards to citizens and staff.
   c. Possible City Infrastructure Impact: direct damage from heavy rain, increased mold/moisture damage, safety and accessibility on ice or trails, damage to culverts and bridges.
   d. Invasive species have new advantages. Are zebra mussels a threat at your water or wastewater treatment facilities? If not, they may be in the future. Forest insect pests may migrate further north killing vast forested areas and increasing fire hazards.
   e. Warmer winter temperatures: The good news is this may mean fewer frozen water lines.

f. Forests: Boreal species will face increasing hydrothermal stress. The heat stress is more than trees can tolerate and forest communities will change across the landscape and higher temperatures means more drying of vegetation. If geographically appropriate, is the water system prepared for a possible increase in forest fires?

2020 Woodbury Community Profile

CITY OF Woodbury MINNESOTA

Conservation Dashboard Metrics	Population & Water Resources
Unaccounted for Water Loss: 3.6%	19 wells = 2.6 billion gallons in 2020
Residential GPCD: 79 gpcd	23,457 residential connections + 878 CII
Total Peaking Factor: 2.07	Growing population = **74,542** people in 2020
Annual % reduction Nonresidential use: 8.5%	Did not report any leak or hydrant repairs
Reduction in Total GPCD: - 11%	*Very active* education, social media, collaboration
Most CII meters are mobile, but 56% of residential are touch read. Replacing meters	2012-2015: 5 major Reuse projects associated with stormwater that irrigates 227 acres.
2020 did not report irrigation controller or rebate programs. Previously very successful.	11 conservation ordinances including sensor and smart irrigation controllers (new installs)

2020 Cottage Grove Community Profile

Cottage Grove
Where Pride and Prosperity Meet

Conservation Dashboard Metrics	Population & Water Resources
Unaccounted for Water Loss: 6.2%	Cottage Grove has 12 wells = 1.3 Billion gallons of water 2020
Residential GPCD: 79 gpcd	Now selling water to a Woodbury development
Total Peaking Factor: 2.2	11,513 residential connections + 183 CII.
Annual % reduction Nonresidential use: 39%	Growing pop. of **38,555** people
Reduction in Total GPCD: -31%	
Residential use steady; Nonresidential use increasing; new development anticipated	Active SF Irrigation rebate program. Sold 146 Rachio smart irrigation controllers
Repaired 5 water main breaks that saved roughly 43,200 gallons/month	100% Mobile meters