

Industrial Water Conservation

TURA Resource Conservation Training/Workshop

March 31, 2022

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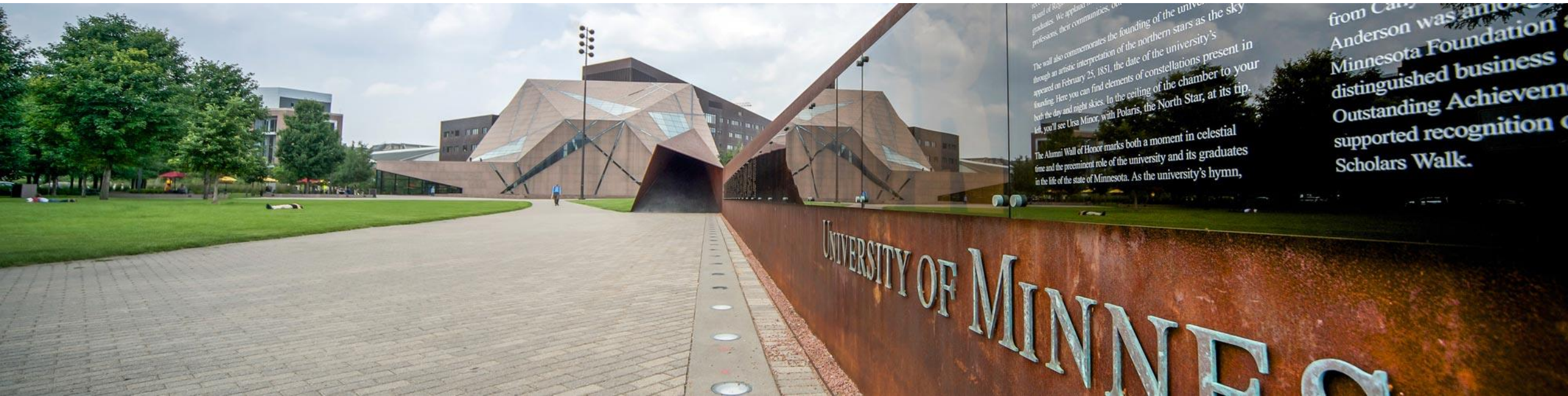
Overview

- **Introduction – MnTAP, Why water?**
- **Review strategies for water efficiency**
 - Find water efficiency opportunities
 - Define water efficiency opportunities
 - Identify co-benefits
 - Develop the business case
 - Resources
- **Conduct a water efficiency assessment**
 - Practice, practice
 - Discuss opportunities and challenges



Minnesota Technical Assistance Program

Strengthening Minnesota businesses by improving efficiency while saving money through energy, water, and waste prevention.



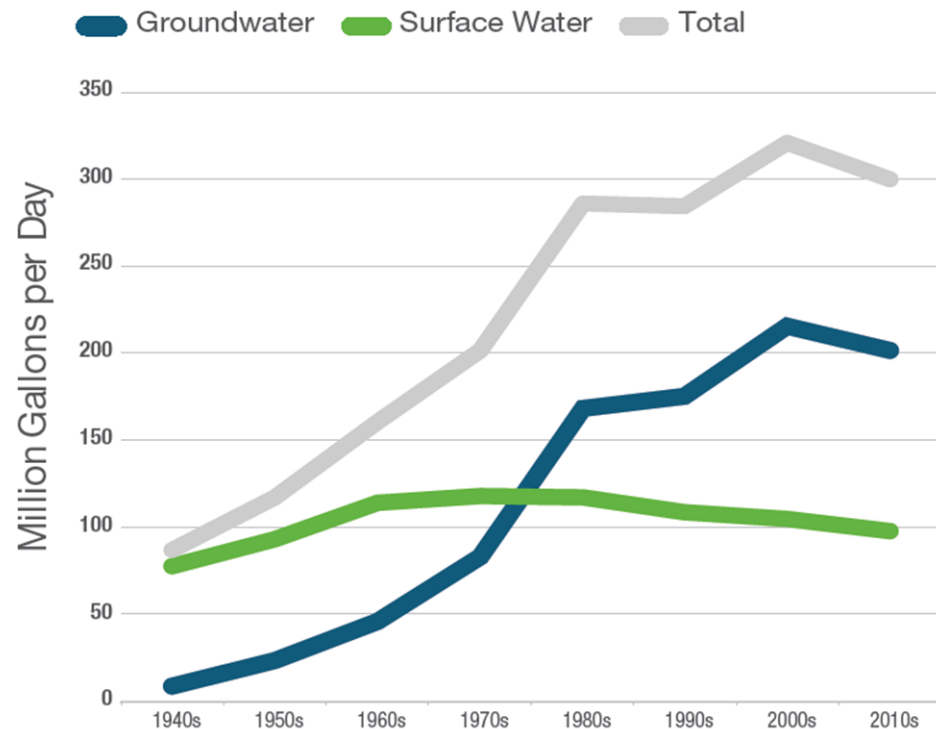
MnTAP

- Established in 1984
- University of Minnesota, SPH
 - Outreach and assistance unit
 - Grant and partner funded
- Confidential, No Cost Engineering Assistance for Minnesota Businesses
- Site Assessments, Interns, Teams
- <http://www.mntap.umn.edu>



Why Water Efficiency in the Land of 10,000 Lakes

Metro Area Water Use

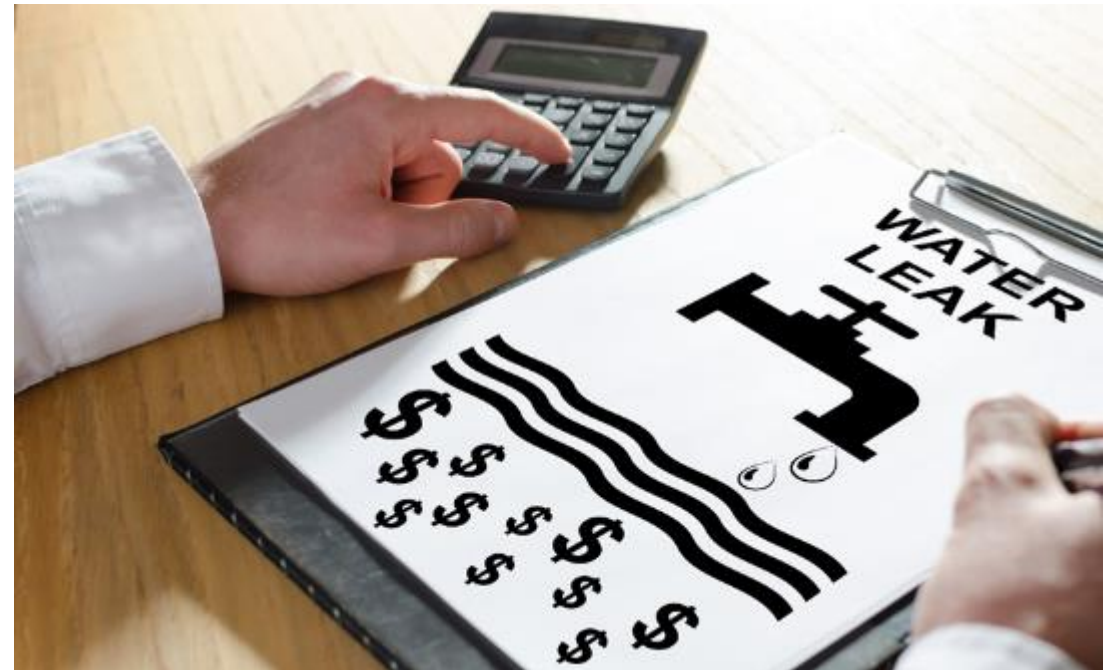


- Use increase with population
- Groundwater vs. Surface Water
- Unsustainable groundwater recharge
- Surface water impacts
- Contamination
- Hierarchy of use
- Cost avoidance
- Resource stewardship



Water: limited resource with real costs

- Water costs industry *THREE* times
- Incoming supply cost
- Processing cost
 - Purification
 - Heating/Cooling
 - Pumping
 - Treatment
- Discharge



Water use in the work place

Washing and rinsing



Water use in the work place



Product transport
Product processing
Product ingredient
Process sanitation



Water use in the work place



Evaporative cooling



Heating

Water use in the work place

Water treatment and purification

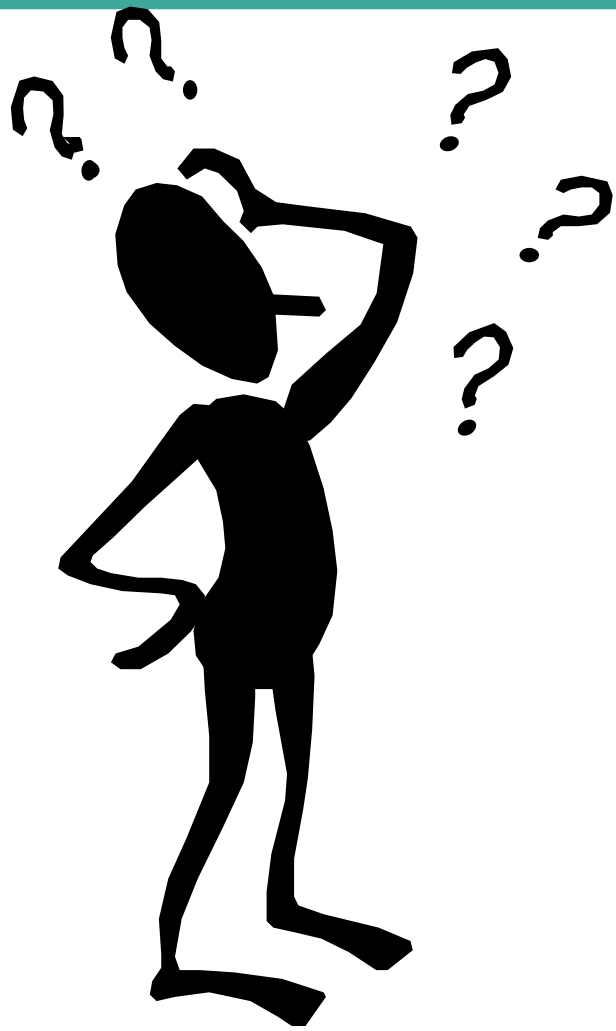


Water use in the work place

Domestic uses



Photo credit: Alliance for Water Efficiency www.allianceforwaterefficiency.org/



Strategies for Water Efficiency

Process for Technical Assistance

Map



- Measure
- Value
- Plan

Maintain



- Inspect
- Repair
- Prevent
- Repeat

Manage



- HP-LF
- High Eff.
- Automate

Modify



- Reduce
- Reuse
- Recycle

Strategies for Water Efficiency

Map – Get a picture of how water is actually used throughout the site

Map

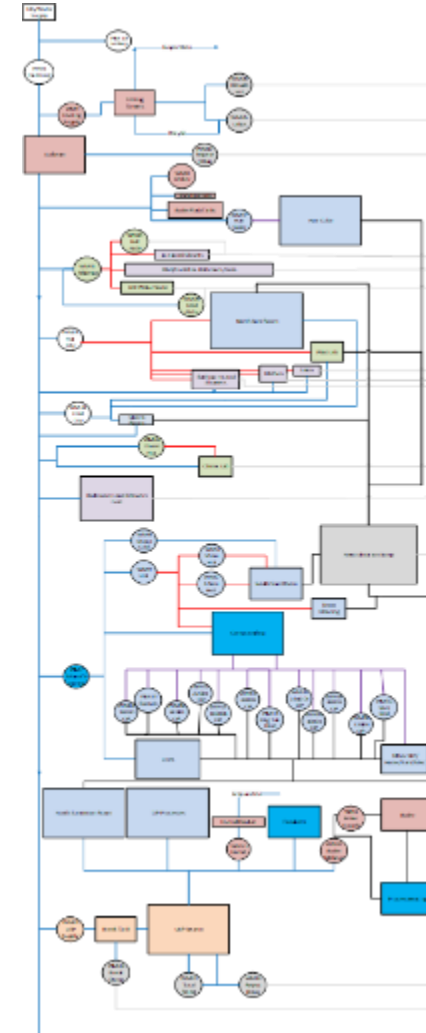


- Measure
- Value
- Plan

- First step in any water assessment
- Minimizes bias for/against operations
- May require multiple data sources, measurements and conversations
- Key to project selection
- Allows site to get best “return” on effort
- Facilitates site long term water efficiency strategy development - continuous improvement

Map Water Use – Aveda Blaine, MN

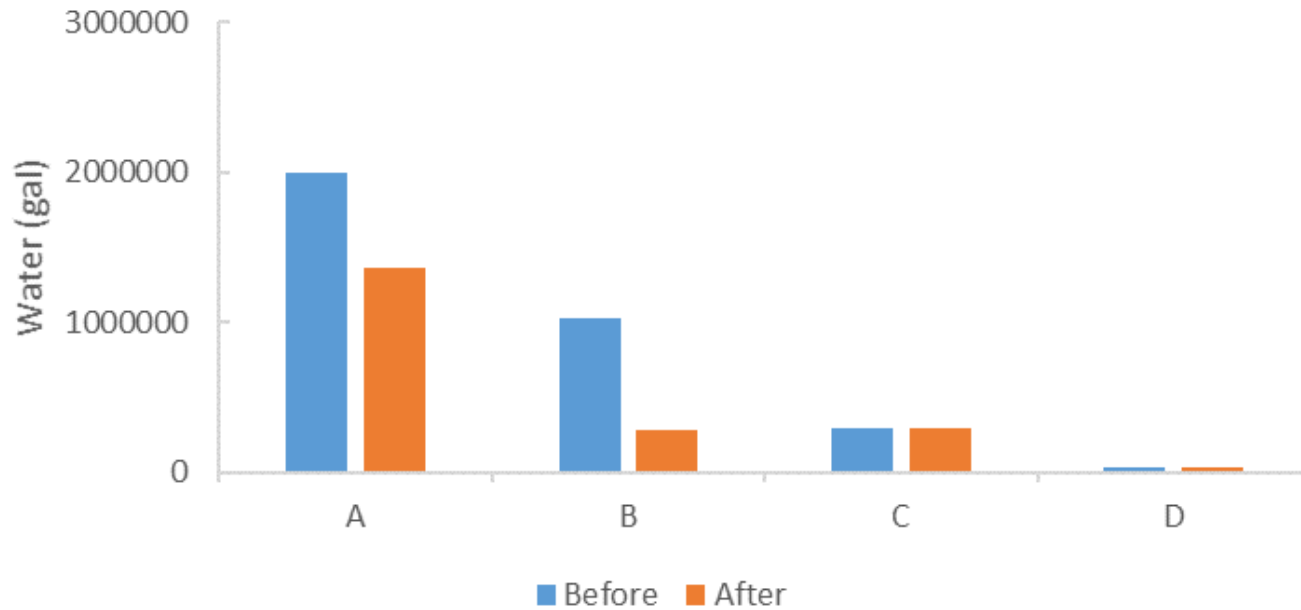
- **Motivation**
 - 22 million gpy water use
 - 25% used in cleaning
 - Reduce water use and costs
- **Approach**
 - Analyzing water meters
 - Observe CIPs and manual sanitization
 - Flow rate measurements
 - Talking with workers
 - SAP reports



<http://www.mntap.umn.edu/download/270/meghan-pieper/15179/meghan-pieper-aveda-corporation-summary-2018.pdf>

Water Efficiency Opportunity

Sanitation Room
Water Use Map



- **Facility water mapping**

- **15% - Sanitation room**

- 4 operations
 - Manual and automated

- **Changes in two operations**

- High efficiency spray nozzle
 - High efficiency spray ball

- **Savings**

- 1.4 million gpy (40% of area use)
 - 7,300 therms
 - 56,000 kWh
 - \$20,000/yr (<1yr ROI)

Water Map Data – Meter, Measure, Estimate

Determine major components of the water balance—
measure what's happening



Visual impact clues



1 GPM
500,000 gal/year



2 GPM
1,000,000 gal/year



6 GPM
3,000,000 gal/year

Strategies for Water Efficiency

Maintain - repairing existing process to operate as designed

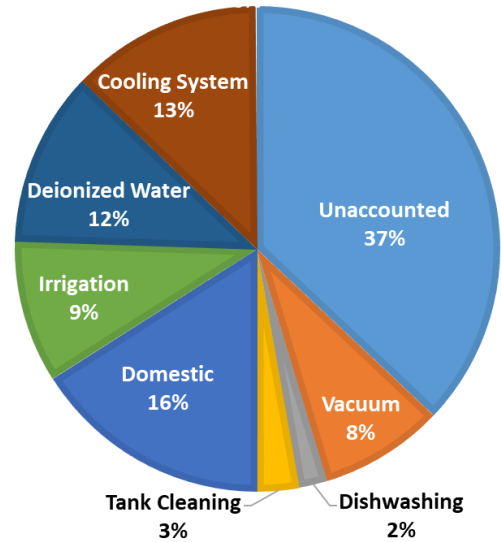
Maintain



- Inspect
- Repair
- Prevent
- Repeat

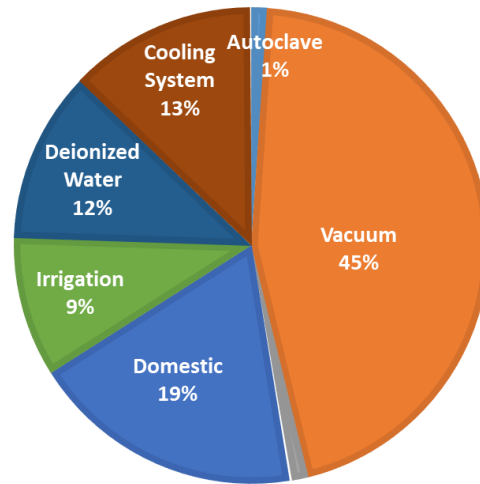
- Low hanging fruit, but can be significant
- Low cost within maintenance budget
- Requires staff time/attention
- Often postponed if not urgent
- Generally recurring
- Prevention is possible
 - Analyze leak incidents/recurrences
 - Add to PM schedule
 - Change materials or processes

Maintain Operations – Diasorin Inc., Stillwater, MN



Initial water map

Final water map
Full water accounting



• Motivation

- 8.5 million gpy water use
- 37% - 3.1 million gpy unaccounted
- Avoid SAC increase
 - up to 74 units at \$2,500/unit
- Reduce costs and water use

• Approach

- Create map of water use
- Close water balance
- Identify reduction strategies

Water Efficiency Opportunity

- **Facility water mapping**
 - Detailed inspection – no inconsistency
 - City meter identified leaks
- **Vacuum system optimization**
 - **Liquid ring seal corroded**
 - 3 gpm continuous leak
 - 1 million gpy direct to drain
 - **Replace broken flow meter**
 - 12.8 gpm actual flow vs 2.8 gpm target
 - 2.1 million gpy water savings
 - **Implement maintenance check**
- **Results**
 - 3.1 million gal water
 - \$23,000



Additional Efficiency Opportunities



- Domestic water use
- Hot water hardness
 - Hot water softened for quality
 - Unable to maintain low hardness
 - Required system purge, 15,600 gpy
 - Inspect water flow – hot/cold mix
 - Isolate under sink mixing valves
 - Replace check valve in safety shower
 - Implement hardness monitoring and maintenance action plan
- Other (Manage)
 - WaterSense toilets, 750,000 gpy
 - Irrigation – clock vs smart, 400,000 gpy

Easy conservation opportunities



Leak identification
and repair

Strategies for Water Efficiency

Manage – optimizing existing process and equipment operation

Manage



- HP-LF
- High Eff.
- Automate

- Second level of complexity
- Can be achieved with low or modest cost
- Reset operation within current system limits
- Retraining operations staff
- Changing SOPs or practices
- Add operating controls/automation
- Replacing like for more efficient like
- Ideal for Plan, Do, Check, Act approach

Manage Process, Commercial Kitchen

North Memorial Hospital, Golden Valley, MN



- Motivation
 - Soup kettle used 1.5 million gal 127°F water per year
 - Often left on when not needed
- Approach
 - Install solenoid and timer to replace hand valve - \$26
- Results
 - 1.3 million gal water/yr
 - 7000 therms/yr
 - \$13,000/yr

Manage Process, Federal Cartridge, Anoka, MN



- Motivation
 - Manage operating cost
 - Use on-site wastewater treatment
 - Avoid SAC increases
- Approach
 - Timed rinse cycle
 - High pressure low flow nozzles
 - Automatic shut off valves
 - Use recycled water (Modify)
- Results
 - 5.5 million gal water
 - \$83,000

Easy conservation opportunities

No water
cleanup



Easy conservation opportunities

Pressure (heat), not volume

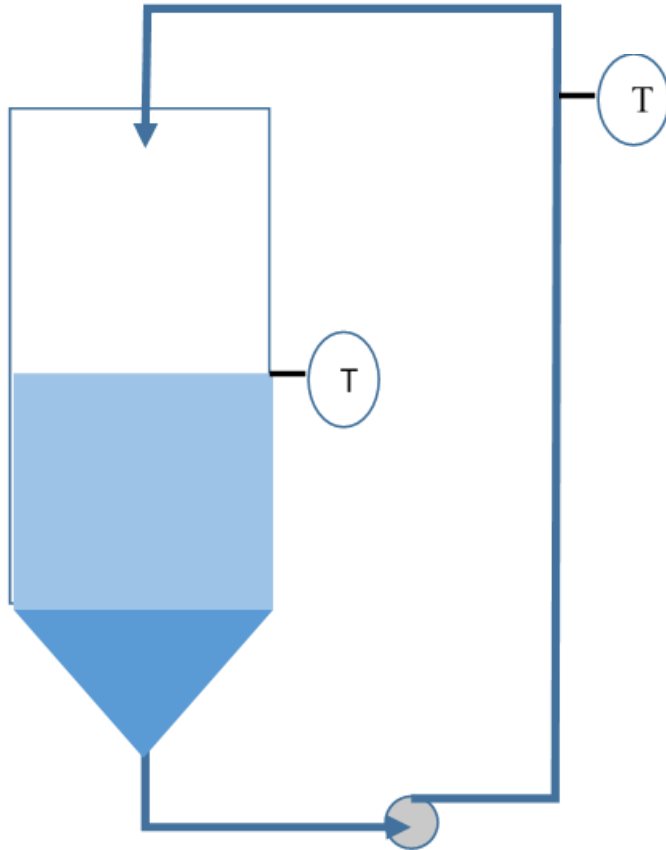


Conservation Opportunity - Hand Valves



- **Challenges**
 - Great for on/off
 - Difficult to manage flow
 - May be left on when not needed
- **Improvements**
 - Automatic shut off valves
 - Timers
 - Flow controllers
 - Increase automation

Conservation Opportunity - Measurement



• Challenges

- Hot water cleaning needed for sanitation
- Need to monitor T for compliance
- Need to fill tank to probe level

• Improvements

- Additional temperature probe
- Recirculation loop to see temperature
- Minimize fill volume needed
- Automate process to not overflow

Strategies for Water Efficiency

Modification – significant change to process or equipment

Modify



- Reduce
- Reuse
- Recycle

- High level of complexity
- Often presents some risk to the process
- Requires site champion to execute
- May require process redesign
- May require capital investment
- May require multiple levels of authorization
- Likely to require extended time to implement

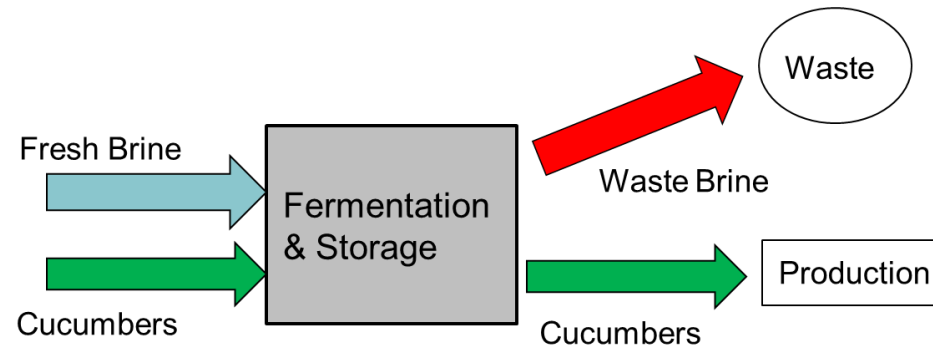
Modify Process Gedney Foods, Chaska, MN



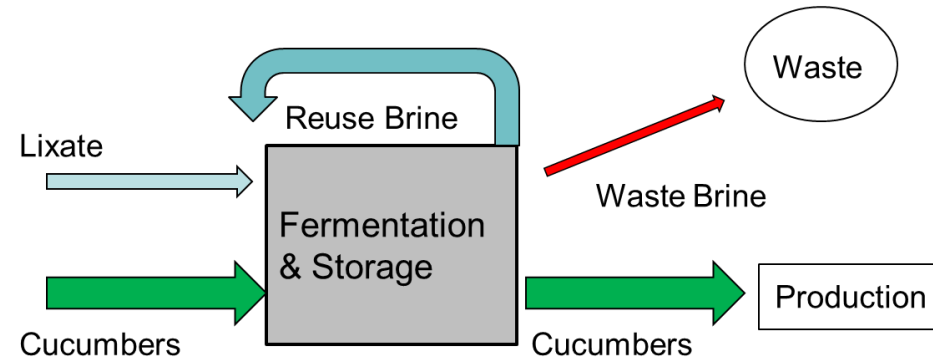
- Motivation
 - Reduce demand on well supply
 - Reduce wastewater discharge
 - Water not a production bottleneck
- Approach
 - Map water use
 - Identify water savings options
 - Reduce salt use

Water Efficiency Opportunity

Current



Reuse



- **Steam Pasteurizer Overflow**

- 2 systems – steam and hot water
- Reuse steam overflow as makeup water for hot water feed

- **Fermentation Brine**

- Current - fresh brine for each tank
- Proposed - reuse brine solutions

- **Results**

- 5 million gal water
- 213,000 lb salt
- 22,000 therms heat energy
- \$32,000

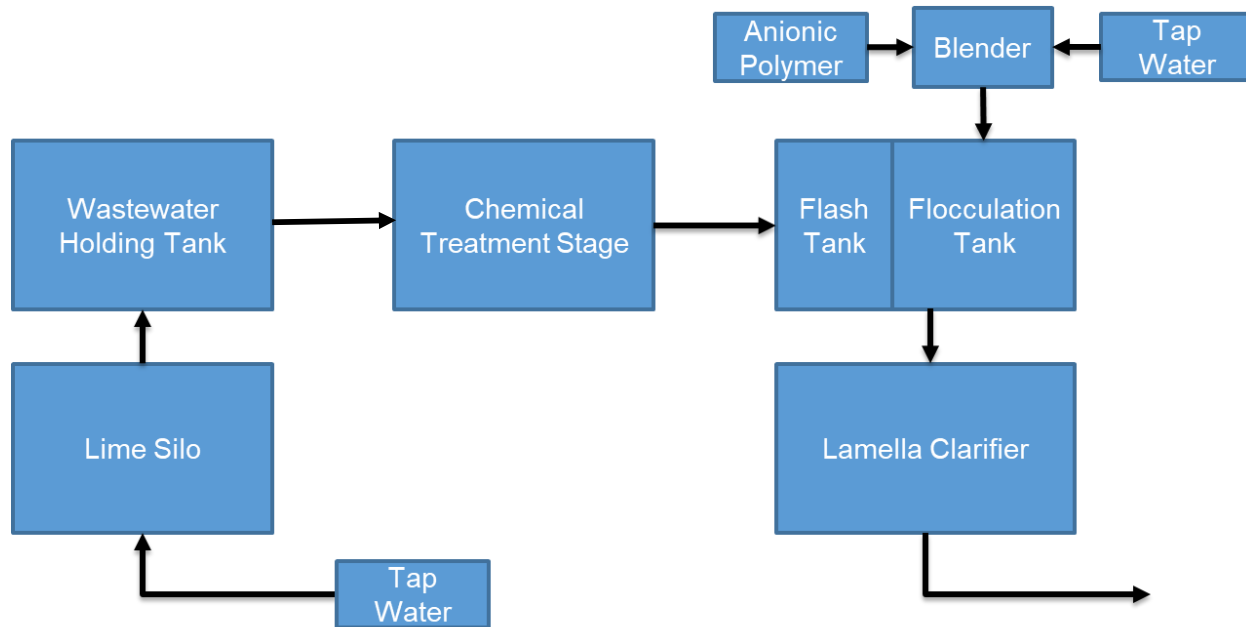
Modify Process Ball Corp., St. Paul, MN



- Motivation
 - 26 million gpy site water use
 - Water critical to supply chain partners
 - Water key corporate sustainability goal
- Approach
 - Assess water use in operations
 - Identify water reuse options

Water Efficiency Opportunity

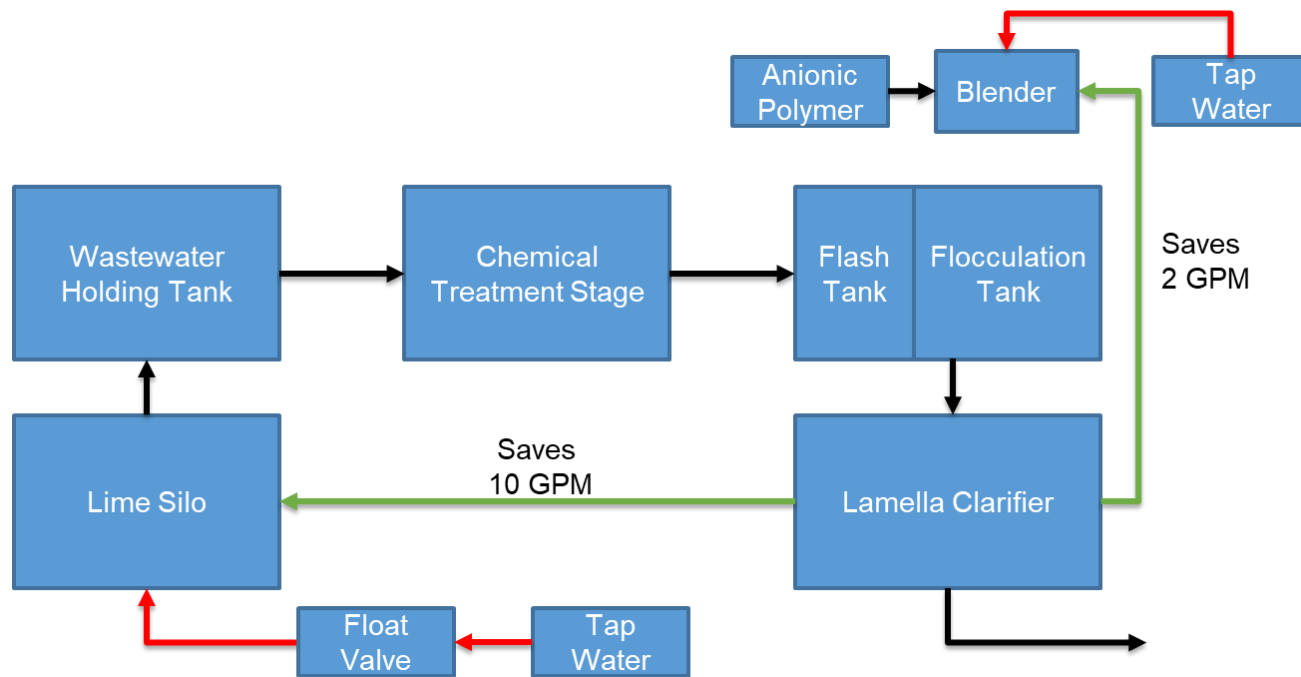
Original Process



- **Reuse Purified Water in Lime Silo**
 - Initial process – City water
 - Reuse WW for lime feed slurry
- **Reuse Water for Flocculant Delivery**
 - Initial process – City water
 - Reuse WW for polymer dispersion
- **Approach**
 - Recommission existing equipment
 - Modify process for reliability
 - Demonstrate impact on water

Water Efficiency Opportunity

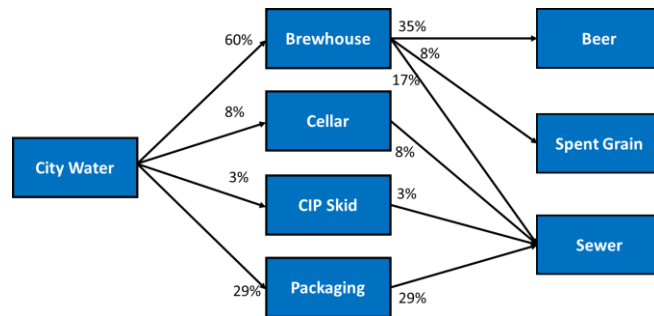
Final Process



- **Reuse Purified Water in Lime Silo**
 - Reuse WW for lime feed slurry
 - Reduced 10 gpm city water
- **Reuse Water for Flocculent Delivery**
 - Reuse WW for polymer dispersion
 - Reduced 2 gpm city water
- **Results**
 - 5.7 million gal water
 - \$55,000
 - <1 yr payback

Using All the Options at a Craft Brewery

Map



- Motivation
- Company commitment to minimize water use
- Prepare operations for growth

Maintain



- Repair broken valve
- 74,000 gpy water reduction
- 540 therm water heating
- \$1,100

Manage and Modify



- Install high efficiency rinse nozzle
- Reuse inside can rinse for outside rinse
- 150,000 gpy water reduction
- \$1,500

Strategies for Water Efficiency

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- Prevent
- Repeat

Manage



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Modify



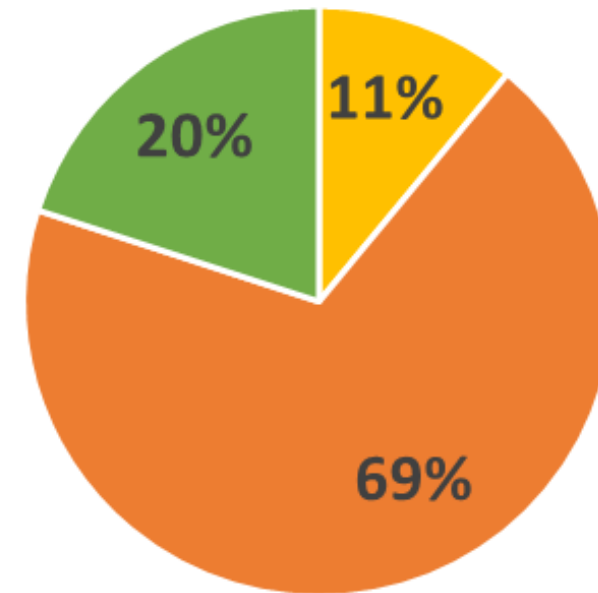
- Reduce
- Reuse
- Recycle

Water Treasure Hunt Site Assessment Simulation



Supporting Implementation

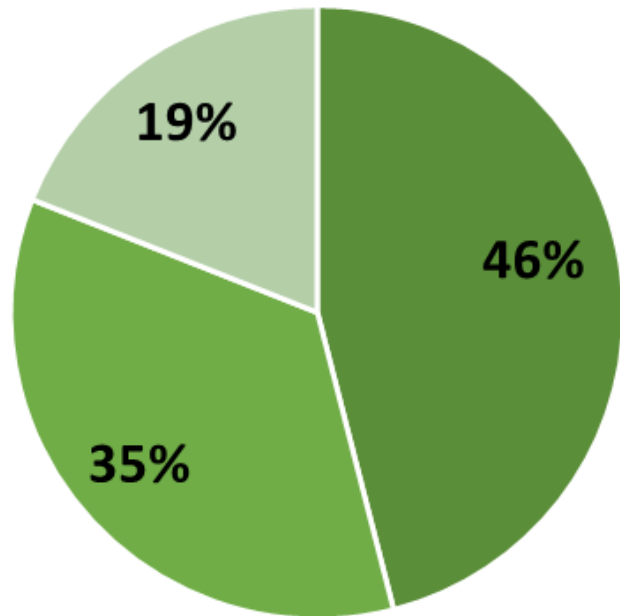
- **Industrial water efficiency focus since 2012**
- **Motivations study 2018**
 - Where is the motivation?
 - What are the barriers?
- **How do we act on this knowledge?**
 - Identify solutions for a business challenge
 - Build the business case for efficiency
 - Provide information for continuous improvement



■ Maintain ■ Manage ■ Modify

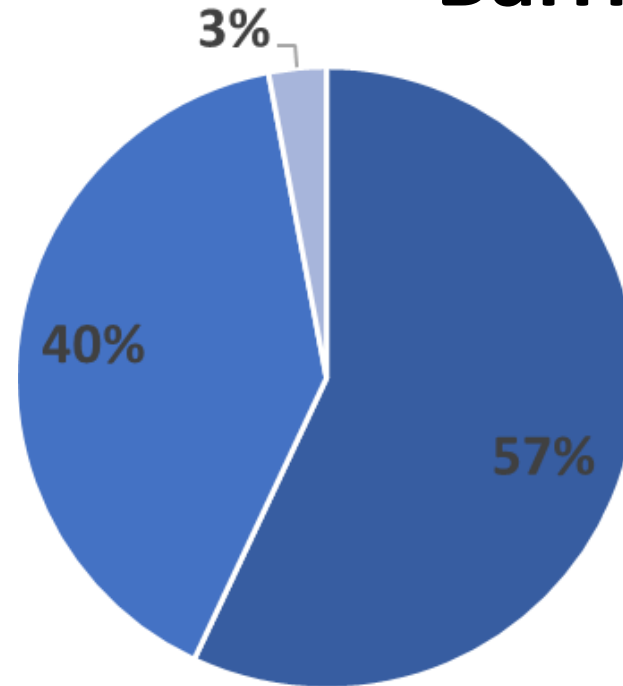
Supporting Implementation

Motivations



- Corporate Goals, Sustainability, Stewardship
- Process Improvement, Cost Savings, Efficiency
- Supply, Disposal, Regulation

Barriers



- Project Cost, Justify ROI
- Lack of Time, Labor, Resources
- Technical Hurdles

Summary

- **Billions of gallons of ground water used for industry**
 - Critical asset
 - Ample efficiency opportunity
 - Continue attention needed
- **Company benefits from industrial water efficiency**
 - Reduce costs
 - Support expansion
 - Meet corporate sustainability goals
- **Other benefits from industrial water efficiency**
 - Avoid more well pumping and water treatment
 - Decrease volume to wastewater treatment facilities
 - Decrease energy and chemical use
 - Increase action to protect and preserve water sources

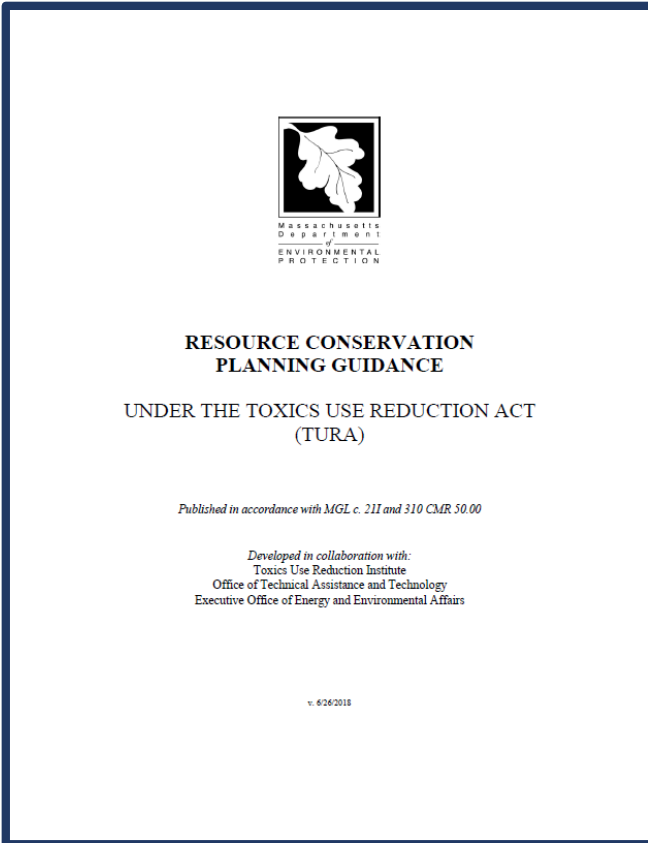


Summary – Assessor’s Role

- **Show where water is used**
 - Create the site map
 - Identify site opportunities
- **Develop actionable recommendations**
 - Maintenance – short term and ongoing
 - Manage – Do what you do - better
 - Modify – Rethink the process to minimize inputs
- **Build the business case for implementation**
 - Reduce costs
 - Support expansion
 - Meet corporate sustainability goals



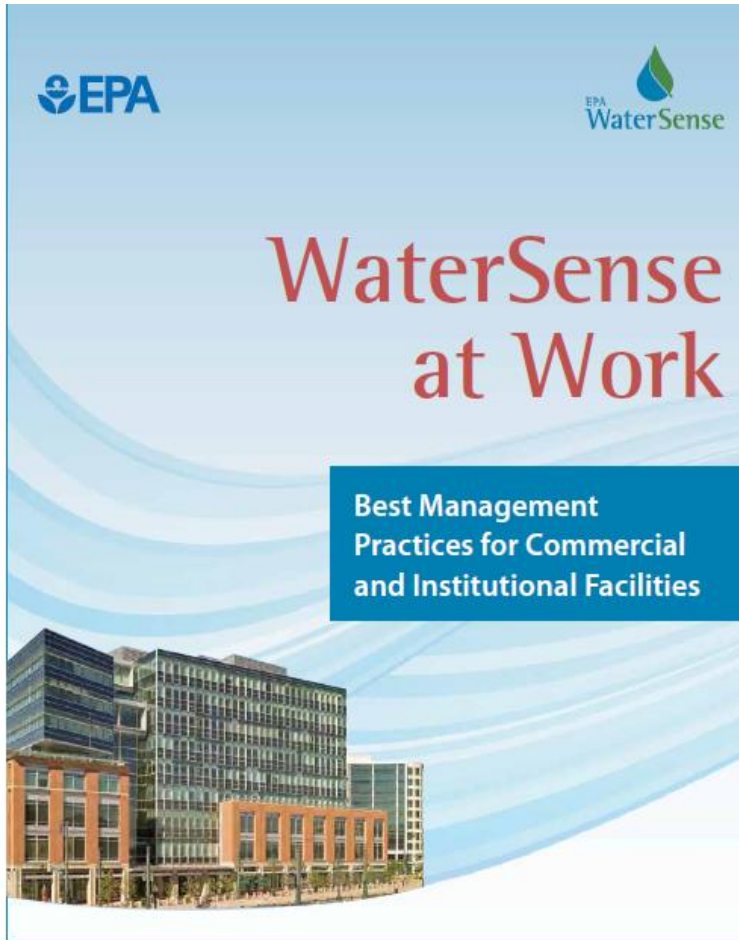
Resources for your project



<https://www.mass.gov/files/documents/2016/08/rq/rcplguid.pdf>

<https://www.mass.gov/service-details/water-conservation-techniques-and-resources-for-massachusetts-industries>

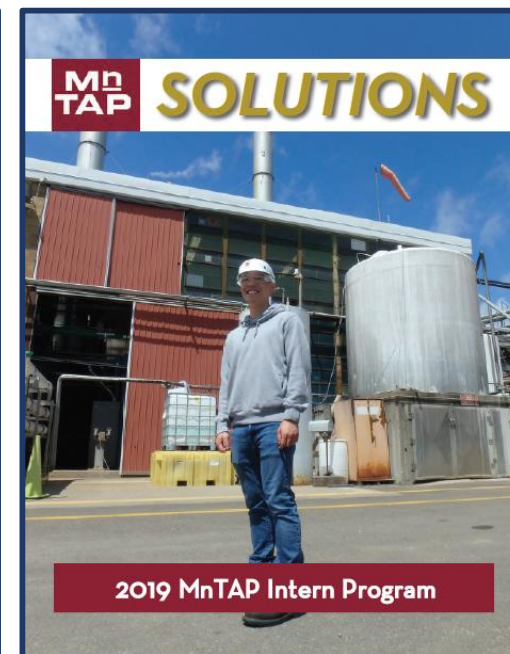
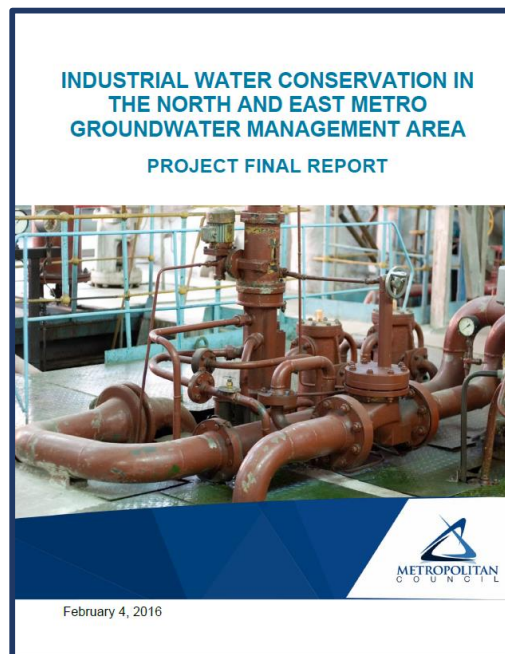
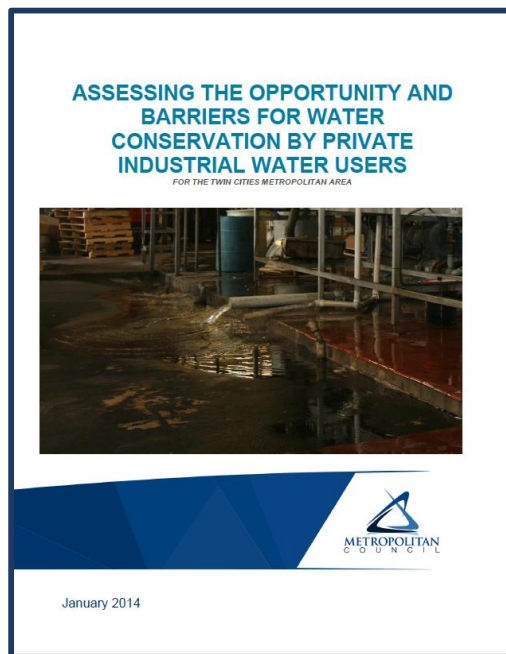
References for your project



https://www.epa.gov/sites/production/files/2017-02/documents/watersense-at-work_final_508c3.pdf

<http://www.allianceforwaterefficiency.org/resource-library/default.aspx>

MnTAP Water Efficiency Studies/Publications



<https://metro council.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Water-Conservation-by-Private-Well-Industries.aspx>
<https://metro council.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Industrial-Water-Conservation-North-East-Metro-G.aspx>
<https://metro council.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Industrial-Water-Conservation-Motivations-Report.aspx>
<http://www.mntap.umn.edu/resources/publications/solutions/> - 2013 - present

MnTAP Water Efficiency Tools

- **MnTAP developed 2 new tools related to water efficiency in 2021**
- **Industrial Water Efficiency Optimization Search Tool**
 - Search MnTAP Intern summaries
 - Recommendations by industry and operation
 - Identify related recommendations and case studies
 - <http://www.mntap.umn.edu/resources/tools-calculators/water-tool/>
- **Industrial Water Softening Chloride Reduction Tool**
 - BMPs to reduce chloride discharge to WWTPs from industrial water softening
 - Softener assessment strategies
 - Efficient softening systems conserve water
 - <http://www.mntap.umn.edu/resources/tools-calculators/chloride-reduction-tool/>

Thank You!

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