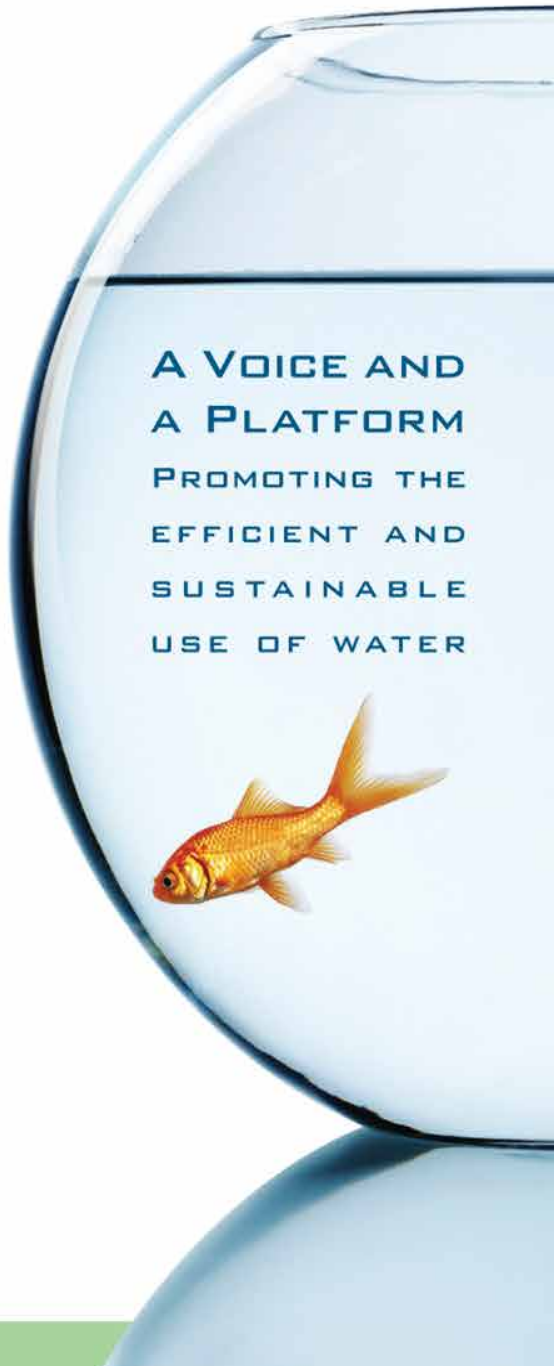
# The Benefits of Water Conservation in the World's Most Water Rich Region




Mary Ann Dickinson, Thomas Pape, William Christiansen

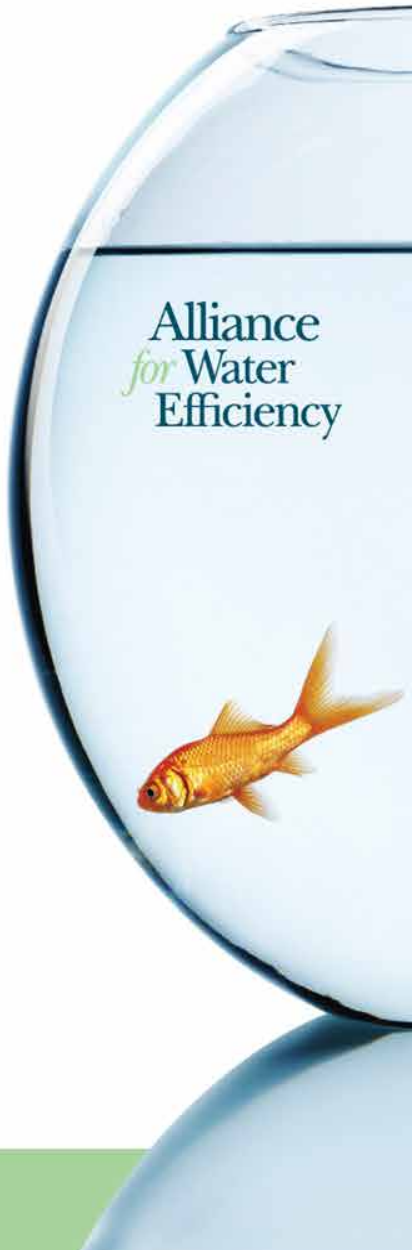
2014 Michigan Environmental Compliance Conference

Alliance *for* Water Efficiency

# Project Background

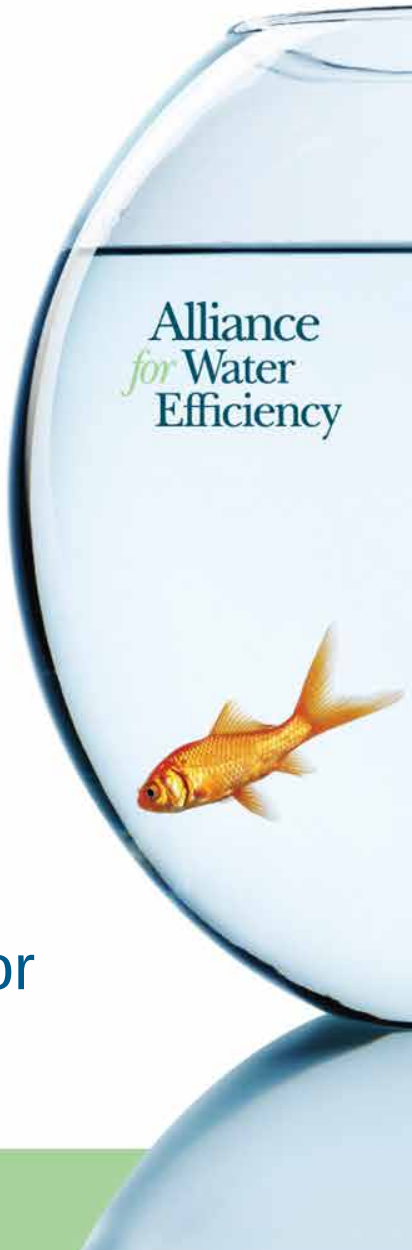
- 24 month project beginning in January 2011
- Funded by the Great Lakes Protection Fund
- Designed to evaluate industries served by public water supply systems
- Continued outreach work funded by the Alliance for Water Efficiency

Great Lakes Protection Fund



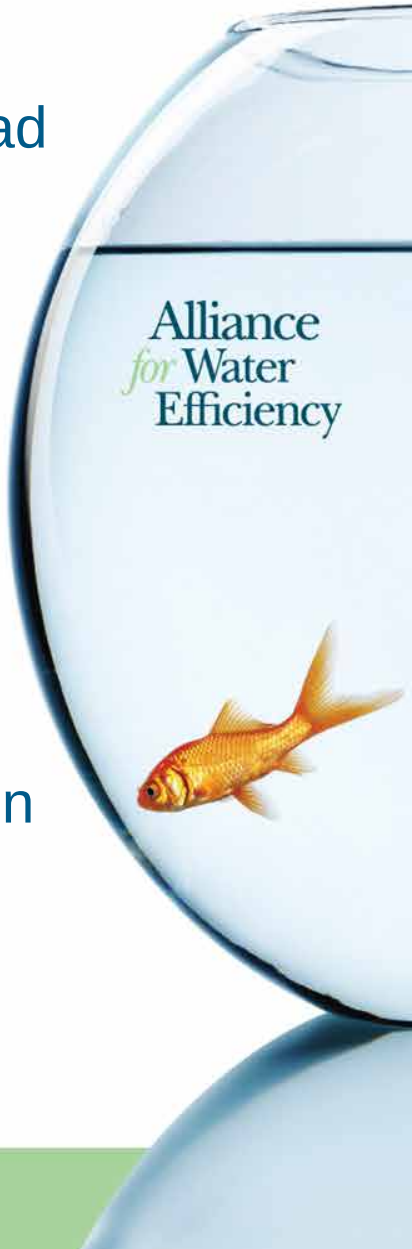
# Project Team

- Mary Ann Dickinson – Project Director
- Jeffrey Hughes – Administration
- Bill Christiansen – Research
- Molly Garcia – Finance Administration
- Thomas Pape – Project Manager
- Ken Mirvis – Communications
- William Hoffman – Project Engineer
- Jeff Edstrom – Environmental Assessment Advisor
- Townsend Albright – Loan Development Advisor



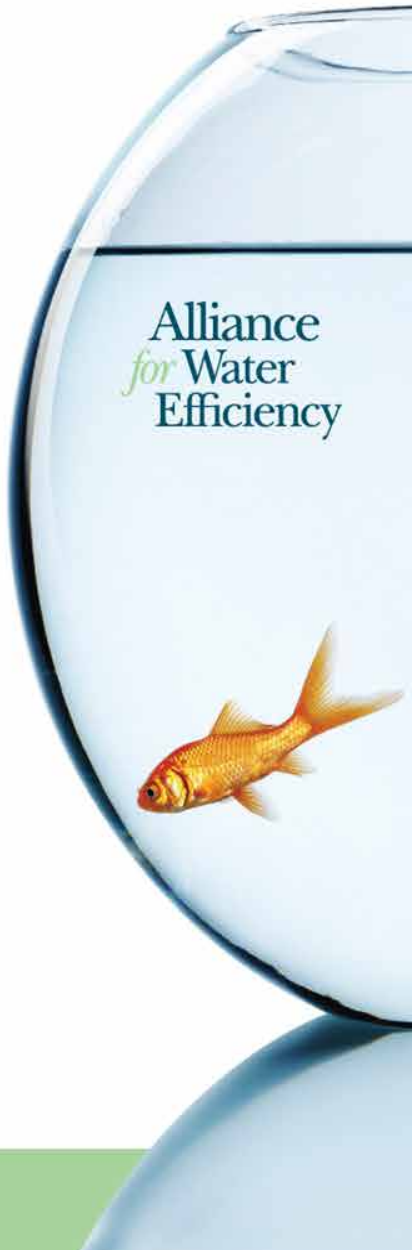
# Project Advisory Committee

- Lynn Broaddus, Johnson Foundation at Wingspread
- Shannon Donley, GLPF
- Claus Dunkelberg, Milwaukee Water Council
- Ed Glatfelter, Alliance for the Great Lakes
- J.B. Hoyt, Whirlpool Corporation
- Tim Loftus, Chicago Metropolitan Agency for Planning
- Dale Phenicie, Council of Great Lakes Industries
- Jeffrey Ripp, Wisconsin Public Service Commission
- Adam Rix, Watermark Initiative
- Karen Sands, Milwaukee Metropolitan Sewerage District



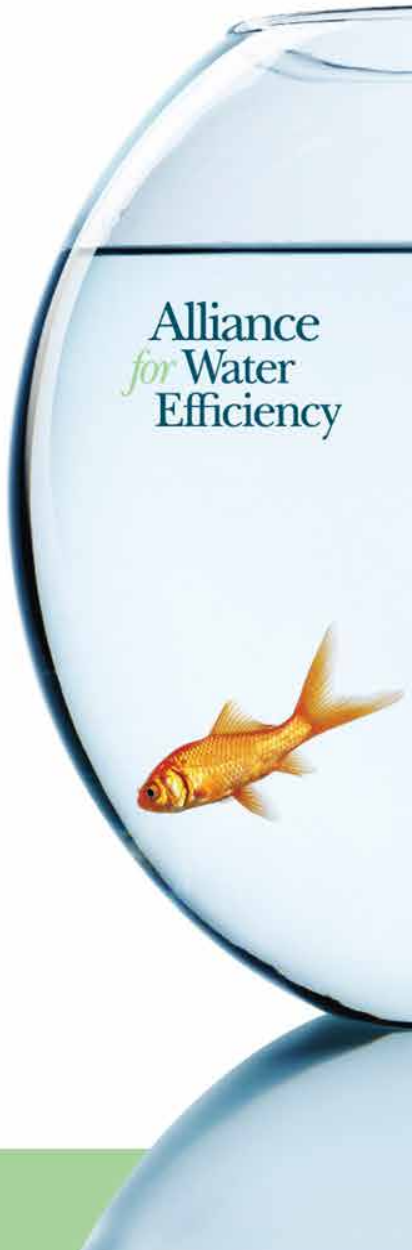
# Project Goal

Achieve environmental benefits in the Great Lakes ecosystem through demonstration of sustainable water use reduction in the industrial water use sector



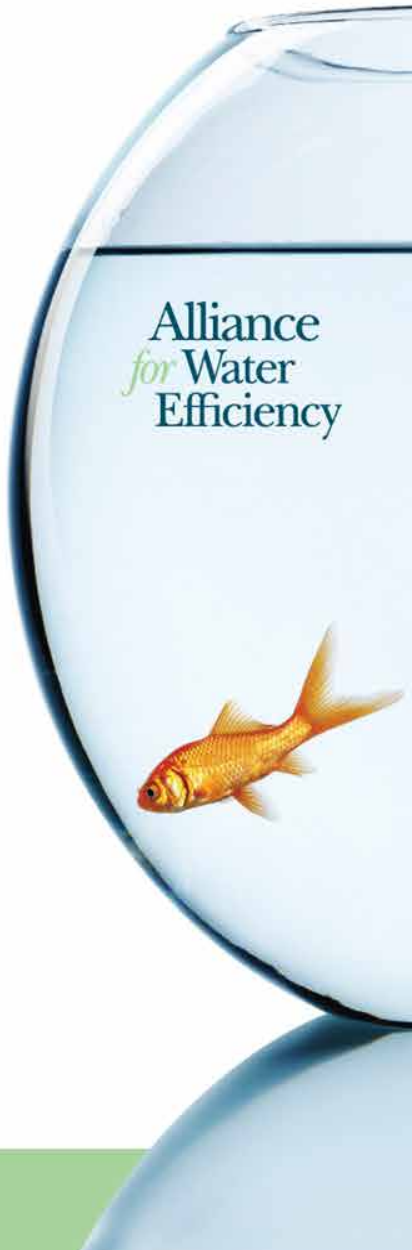
# Project Method

- Reach out to industries to create awareness of proven technologies and opportunities for efficiency
- Offer technical assistance to conduct or verify benefit/cost analyses
- Guarantee confidentiality
- Identify barriers to implementing recommended efficiency actions
- Create structure for low interest loans to offset implementation costs



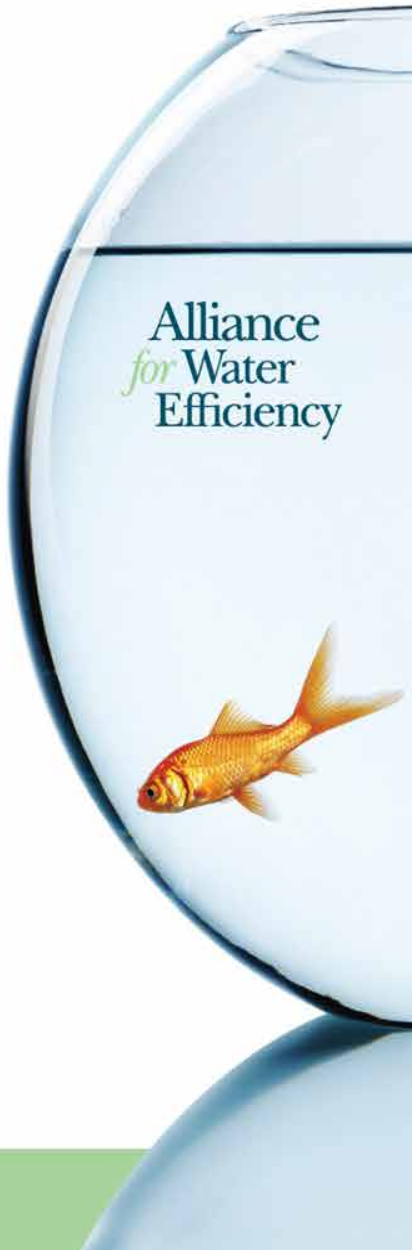
# The Target Market

- Industries common to Great Lakes area
- Industries receiving water from public utility sources in Great Lakes Basin
- Industries sustaining or growing in marketplace
- Industries or users that are high volume



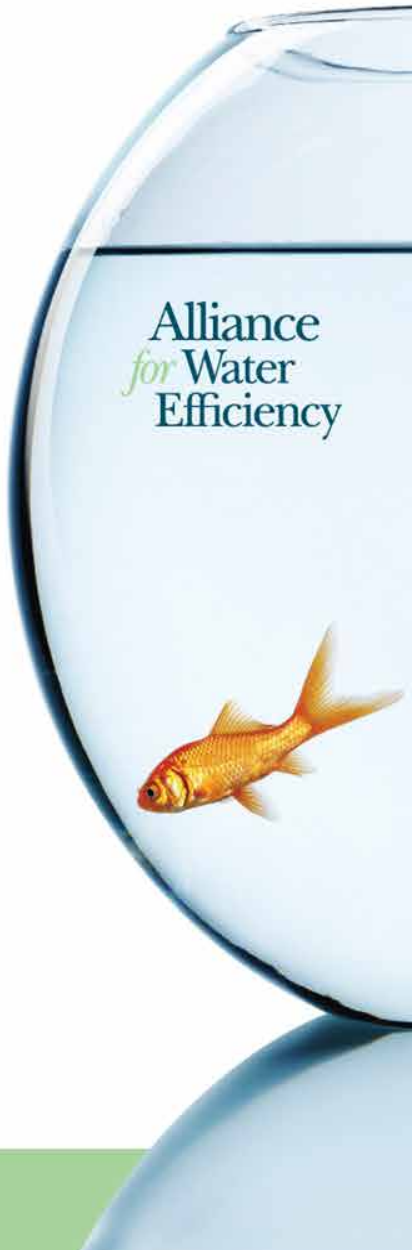
# Industries Marketed

- Pharmaceutical
- Agricultural products processing
- Beverage and food production
- Dairy products
- Appliance & electronics manufacturing
- Plastics molders
- Vehicle manufacturing
- Metal platers
- Commercial laundries



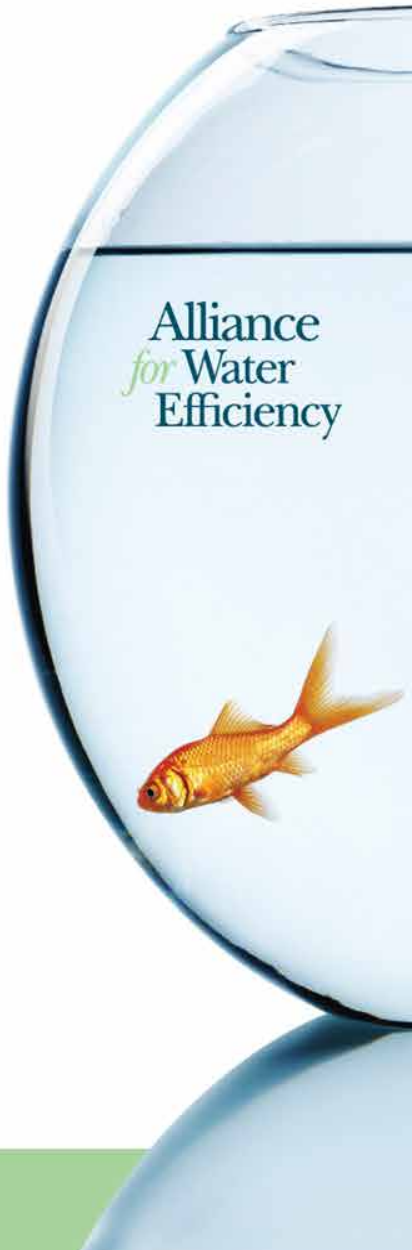
# Program Assessment Factors

- Participation by target industries
- Implementation of measures
- Water use reductions
- Financing feedback
- Implementation results
- Benefit-cost assessment
- Environmental assessment



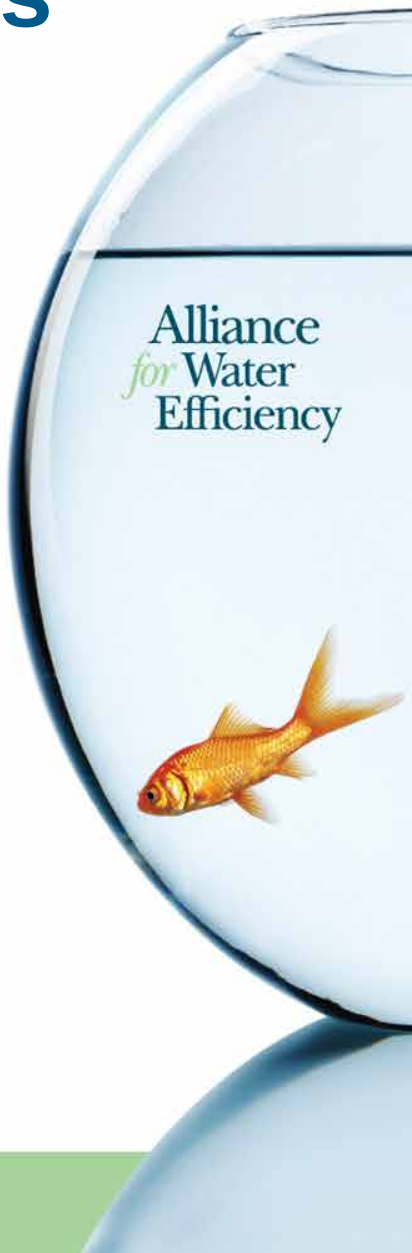
# Industries Selected

| Type of Industry | State | Source Water | Receiving Water |
|---|---|---|---|
| Beer Brewery | Michigan | Shallow Aquifer | Surface Stream |
| Leather Tannery | Wisconsin | Lake Michigan | Lake Michigan |
| Manufacturer | Ohio | Shallow Aquifer | Surface Stream |
| Metal Plater | Wisconsin | Lake Michigan | Lake Michigan |
| Plastics Compounder | Ohio | Lake Erie | Lake Erie |

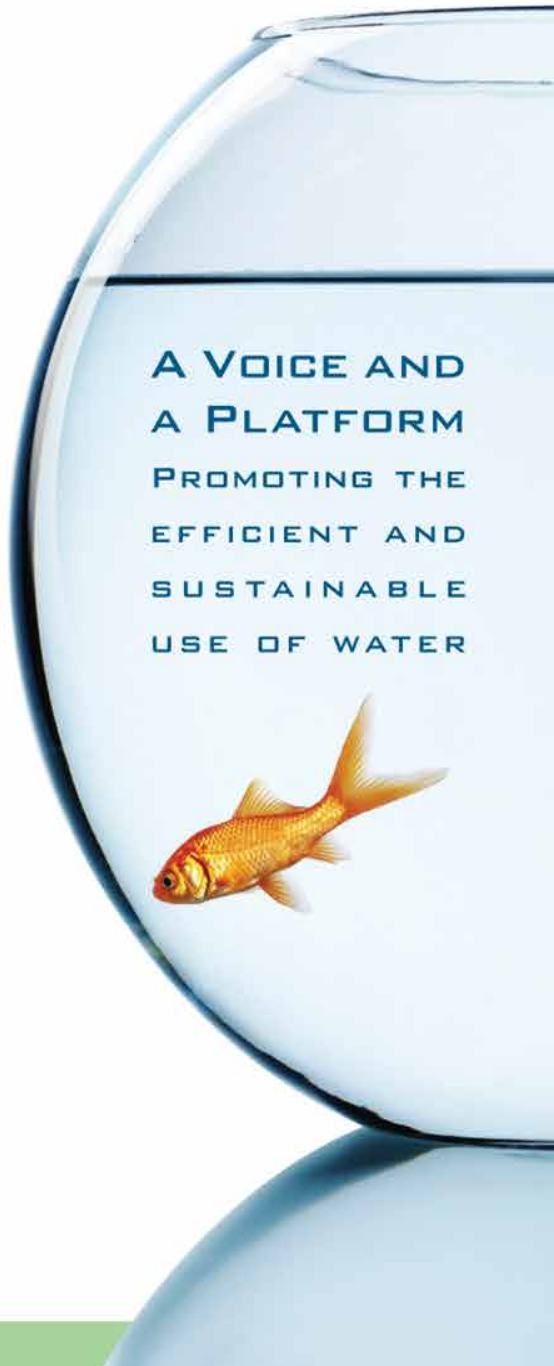


# Summary Findings for Five Sites

1. Potential water savings: **66 million gallons per year**
2. Reduced wastewater flows: Roughly 66 million gallons per year
3. Payback time: 0.2 years to 5.8 years (Average: 1.2 years)
4. Average annual return on investment: 84%



# Samples of Individual Site Recommendations



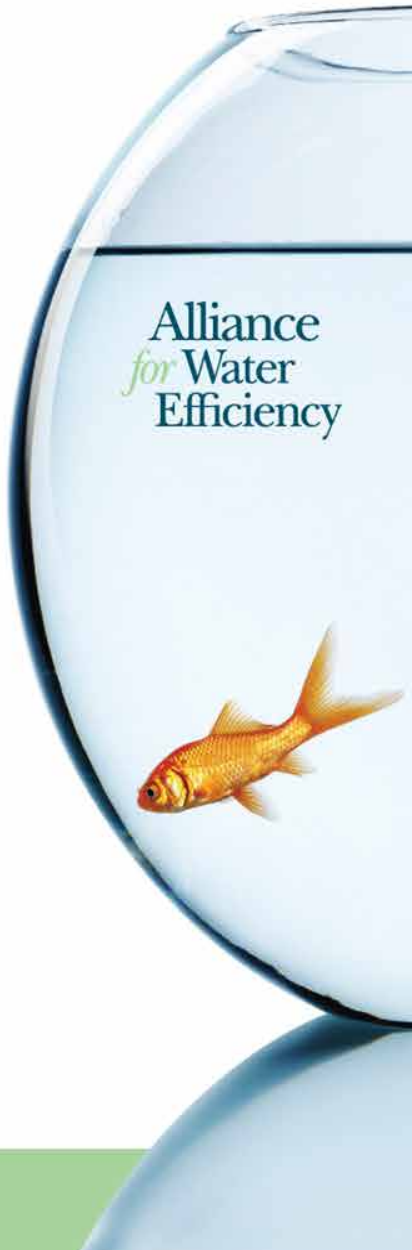

Alliance *for* Water Efficiency

# Plastics Compounder

**Recommendation:**

Change Cycles of Concentration from 2.5-3.0 to 3.5-4.0

| | |
|---|---|
| Water use reduction | 11% |
| Annual water savings | 87,166 gallons |
| Annual savings | $732 |
| Cost of measure | $500 |
| Payback | 0.7 years |
| ROI | 153.8% |

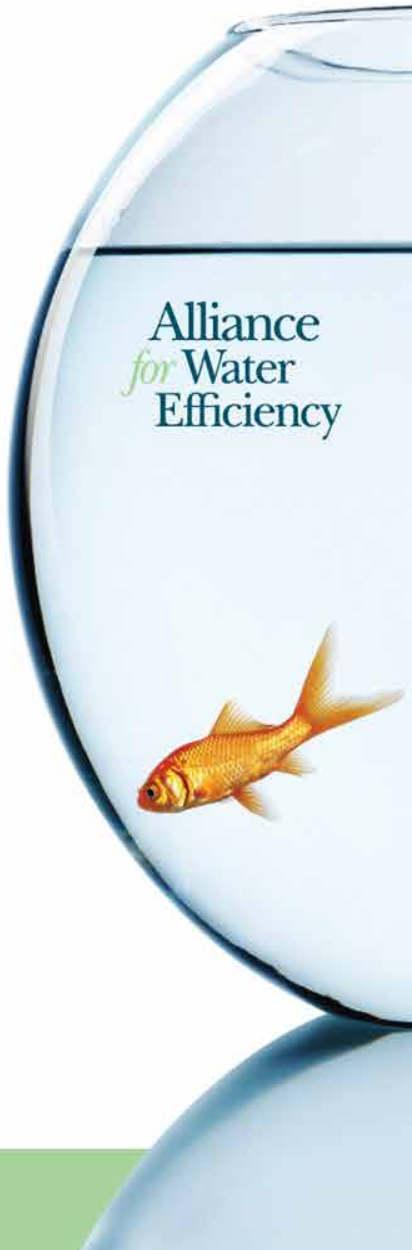


# Manufacturer

**Recommendation:**

Reuse testing water and RO discharge water

| | |
|---|---|
| Annual water savings | 43,800,000 gallons |
| Annual savings | $110,000 |
| Cost of measure | $60,000 |
| Payback | 0.55 years |
| ROI | 181.8% |

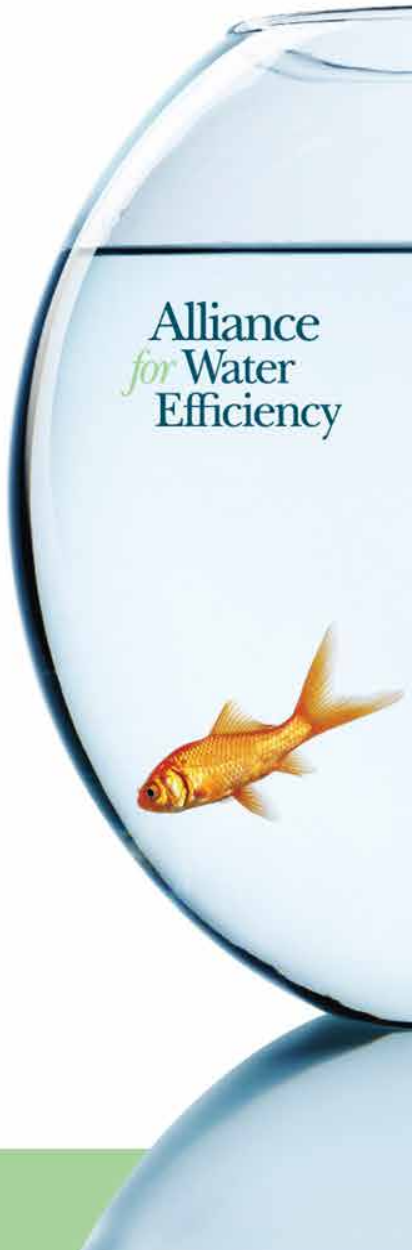


# Metal Plater

**Recommendation:**

Reuse rectifier cooling water in plating process

| | |
|---|---|
| Annual water savings | 3,000,000 gallons |
| Annual savings | $12,500 |
| Cost of measure | $31,000 |
| Payback | 2.5 – 3.5 years |
| ROI | 33.3% |

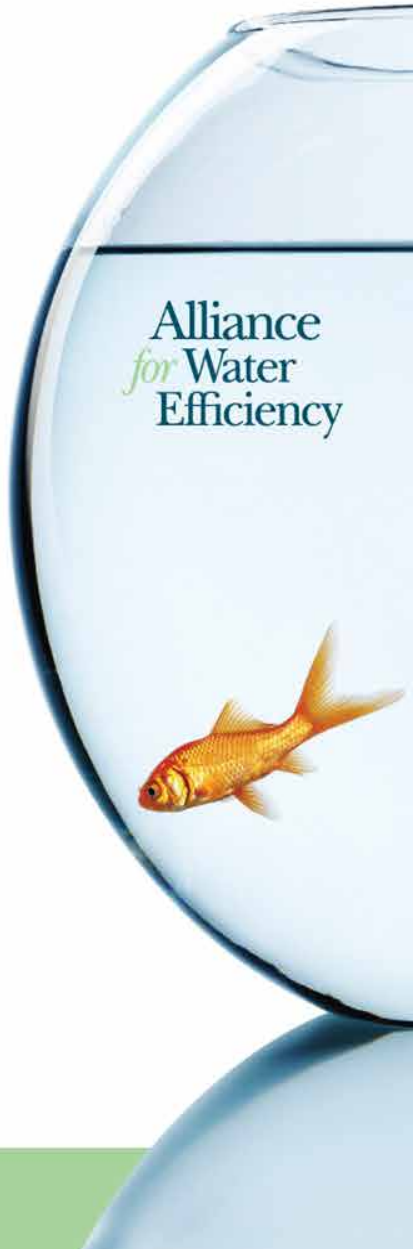


# Leather Tannery

**Recommendation:**

Reuse the water used in hydraulic cooling

| | |
|---|---|
| Annual water savings | 11,000,000 gallons |
| Annual savings | $21,800 |
| Cost of measure | $50,000 |
| Payback | 2.3 years |
| ROI | 43.4% |

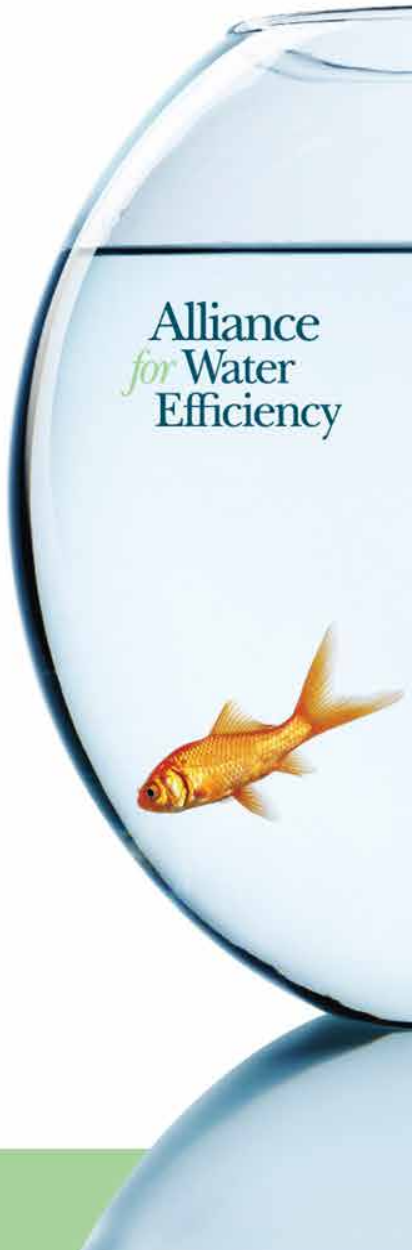


# Beer Brewery

**Recommendation:**

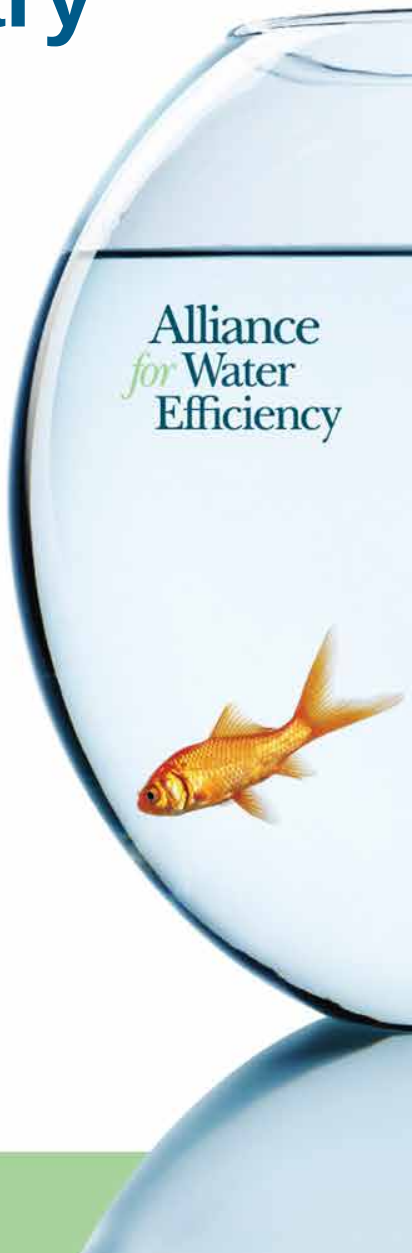
Redesign foam control measures

| | |
|---|---|
| Annual water savings | 1,800,000 gallons |
| Annual savings | $7,722 |
| Cost of measure | $500 |
| Payback | 0.1 years |
| ROI | 1,000% |



# Environmental Benefits Summary

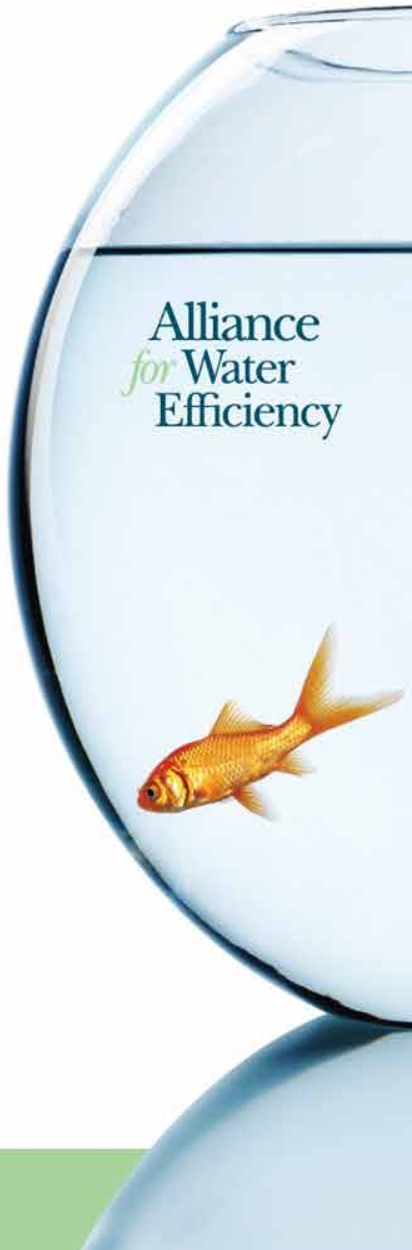
1. Improved stream flows and aquifer levels
2. Healthier aquatic ecosystems
3. Air quality improvements through reduced energy requirements for pumping



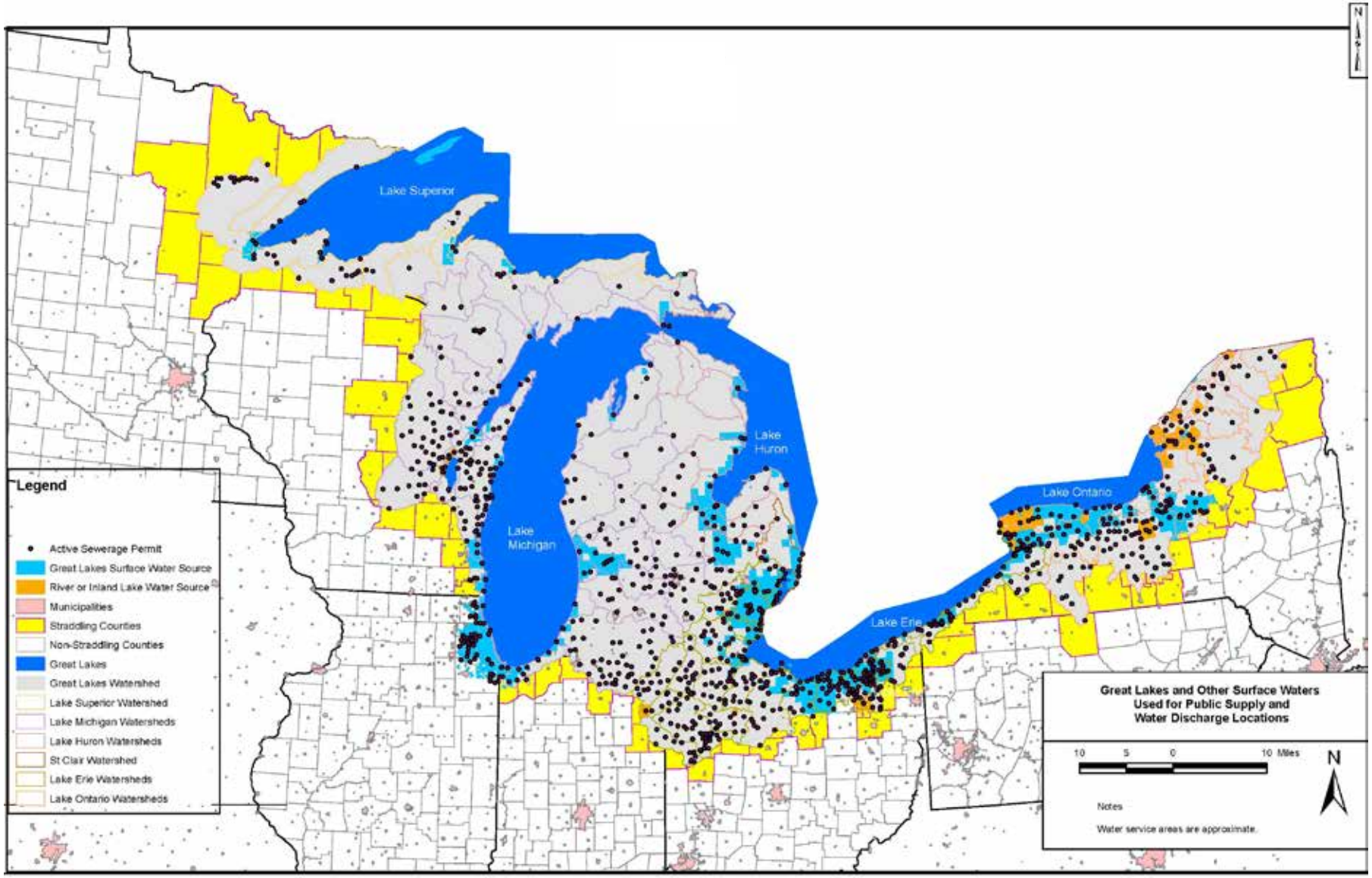
# Environmental Impacts

**Relevant Factors:**

- Origins of the water
- Type of sewer system receiving discharges
- Location of the wastewater system discharges
- Air quality impacts related to embedded energy



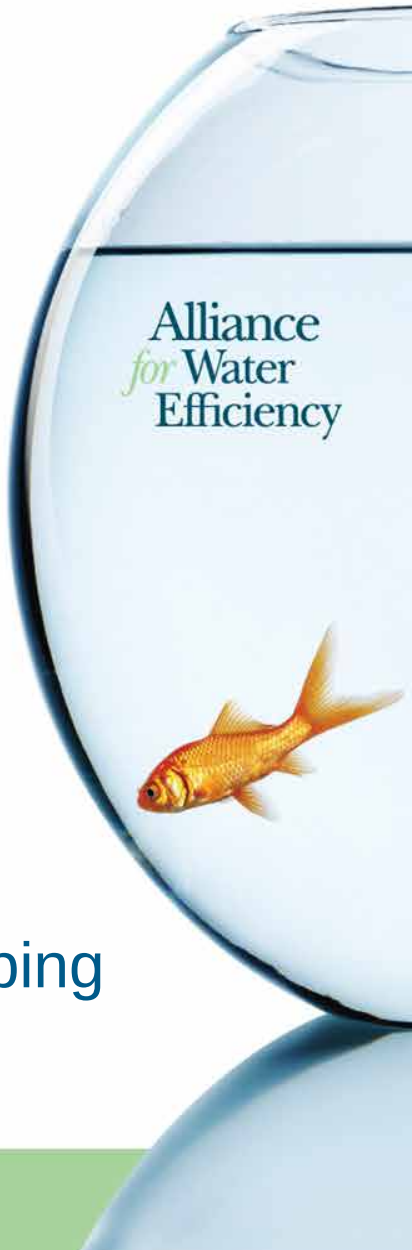
# Great Lakes Water and Wastewater



# Environmental Impacts

## Visible Effects

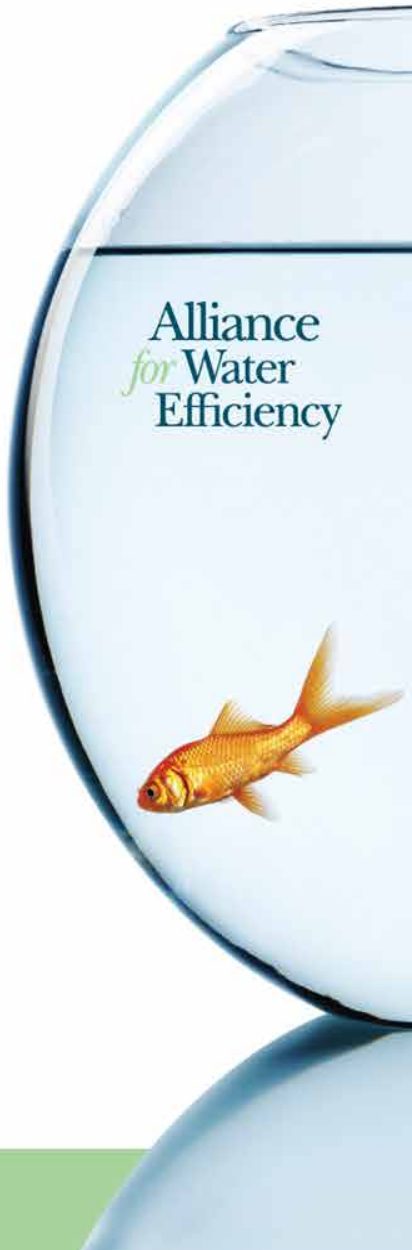
- Levels, flows, and quality of source water
- Health of water-dependent natural resources
- Groundwater and surface water levels & flows
- Quality of receiving waters
- Improved water supply reliability
- Ecosystem health
- Greater infrastructure capacity and reliability
- Protection of aquatic life from decreased pumping
- Improved air quality from reduced energy use



# Environmental Impacts

## Aquifers and Surface Water

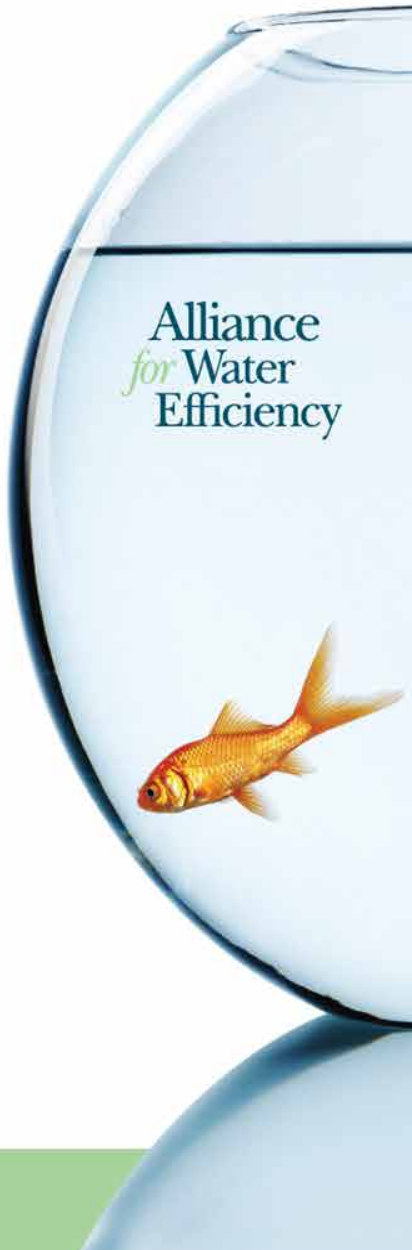
- Aquifer and surface water levels stay more reliable with concerted conservation efforts
- Surface receiving waters could experience decreased flow because of lower effluent flows
- In areas where water is drawn from one source and wastewater released to another, water flow could decrease in one watershed while increasing in another, thus changing the hydrology of both regions affecting plants, wetlands, and aquatic life



# Environmental Impacts

## Stormwater Management: Water Harvesting

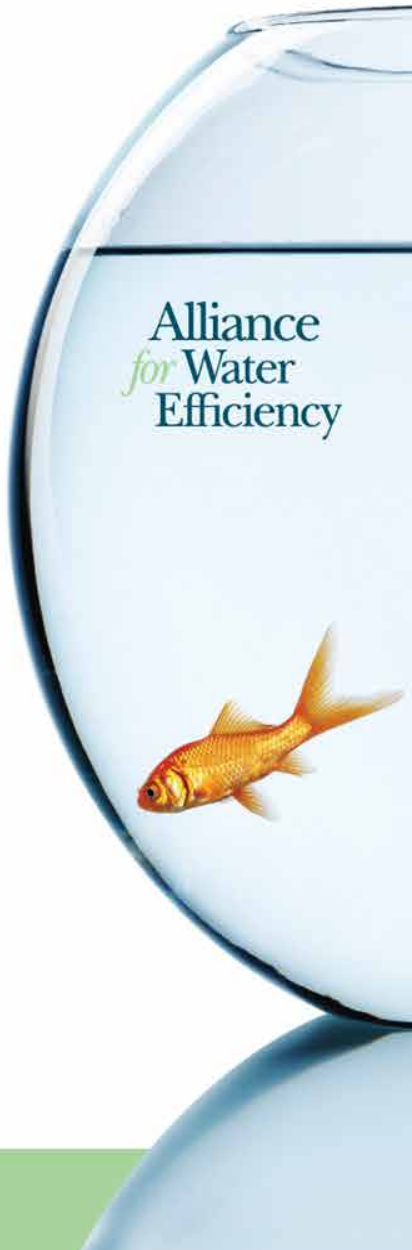
- Allows on-site retention of stormwater, reducing flows to storm sewers and treatment plants
- Improves the overall water quality of wastewater flows by capturing pollutants and debris carried by stormwater runoff
- Supplements an industrial facility's water supplies through appropriate use, reducing the need for treated municipal water



# Environmental Impacts

## Air Quality Impacts

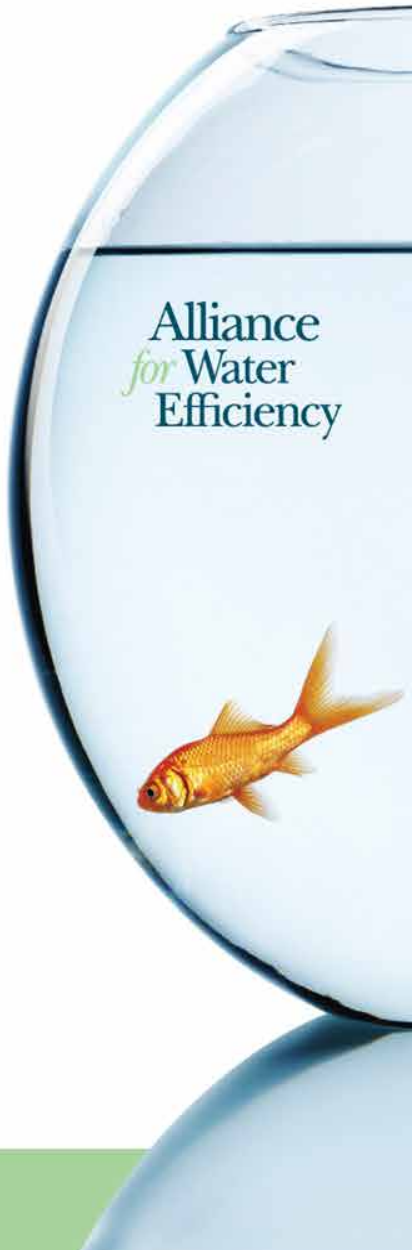
- Treatment processes and pumping are energy intensive
  - Lower water demand reduces this energy use
- Carbon dioxide emissions reductions in these industry sectors
  - Could eliminate release of 1 billion pounds of $CO_2$ over 20 years, which is the equivalent of 100,000 car-years



# Environmental Impacts

## Scaling the Results: Rough Approximations

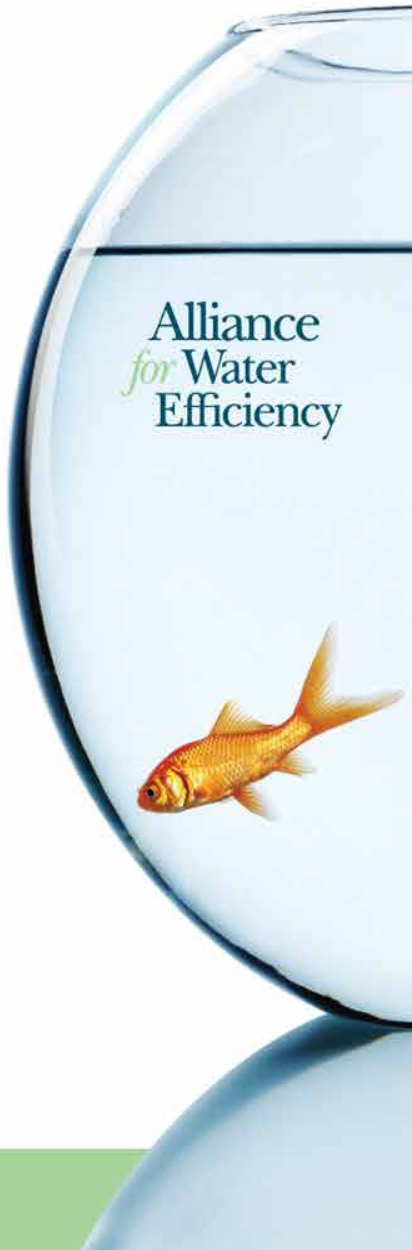
- The 5 examined industries revealed potential water savings of approximately 66.5 million gallons per year
- The Great Lakes region is home to approximately 1,000 comparable facilities in these five industry sectors
- What would the savings look like scaled up?



# Scaled Impacts: 20 Years

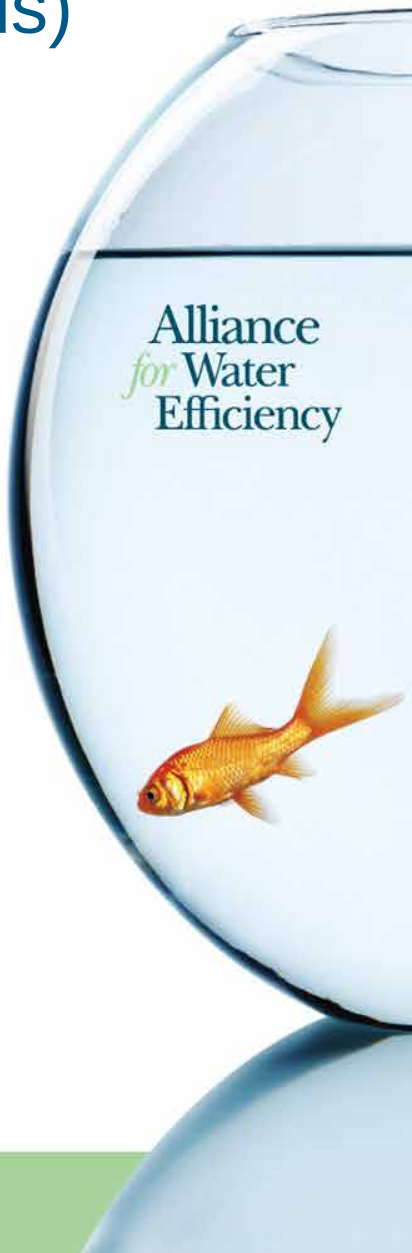
## Potential Savings:

| | |
|---|---|
| Surface Water and Wastewater: | 460 Billion Gallons |
| Ground Water and Wastewater: | 100 Billion Gallons |
| Surface Water, Wastewater Pumping and Treatment: | 500 Million kWh |
| Groundwater and Wastewater Pumping and Treatment: | 120 Million kWh |



# Scaled Impacts: 20 Years (in pounds)

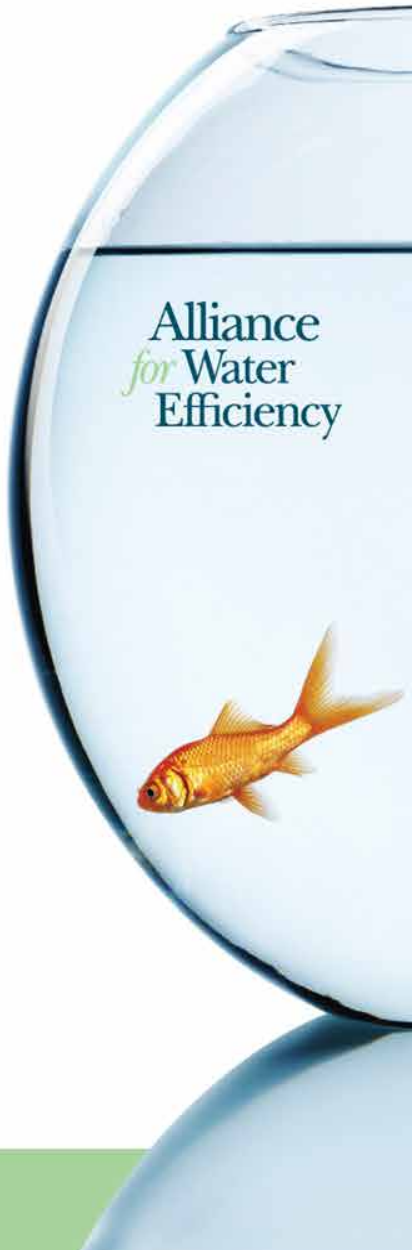
| | |
|---|---|
| $CO_2$ | 1.02 Billion |
| $SO_2$ | 4.36 Million |
| $NO_X$ | 1.4 Million |
| Ozone season $NO_X$ | 1.02 Million |
| Annual HG | 19 |
| Annual $CH_4$ | 18,000 |
| Annual $N_2O$ | 15,600 |



# Utility Revenue Loss

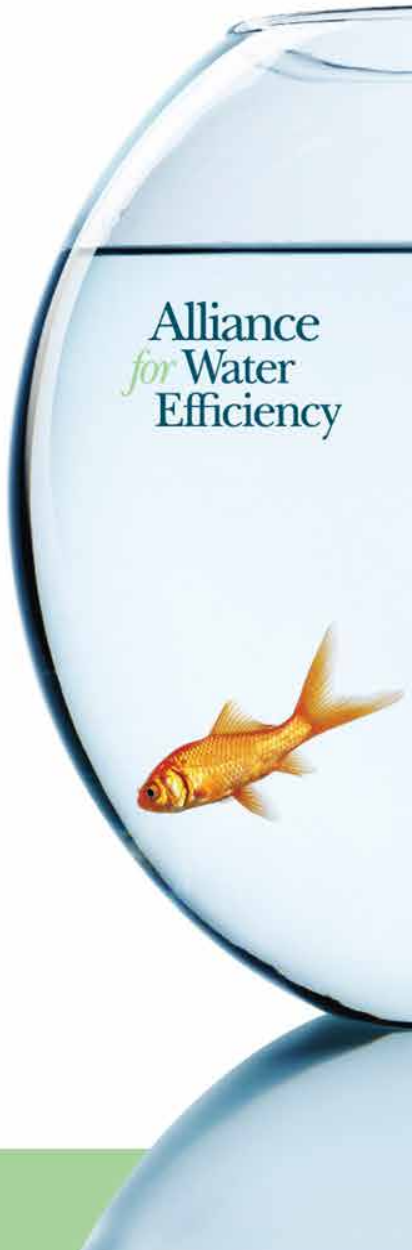
***Lost revenue from decreased water sales is of significant concern to some utilities … and less concern to others.***

- Surveyed 100 water utilities, 87% of which were in the Great Lakes Basin
- Efficiency improvements present a significant challenge for utilities with a shrinking customer base or large debt service on an infrastructure system with unused capacity
- Yet efficiency improvements reduce variable costs for energy and treatment chemicals, and defers the high costs of developing new supplies or infrastructure



# Funding: Survey Results

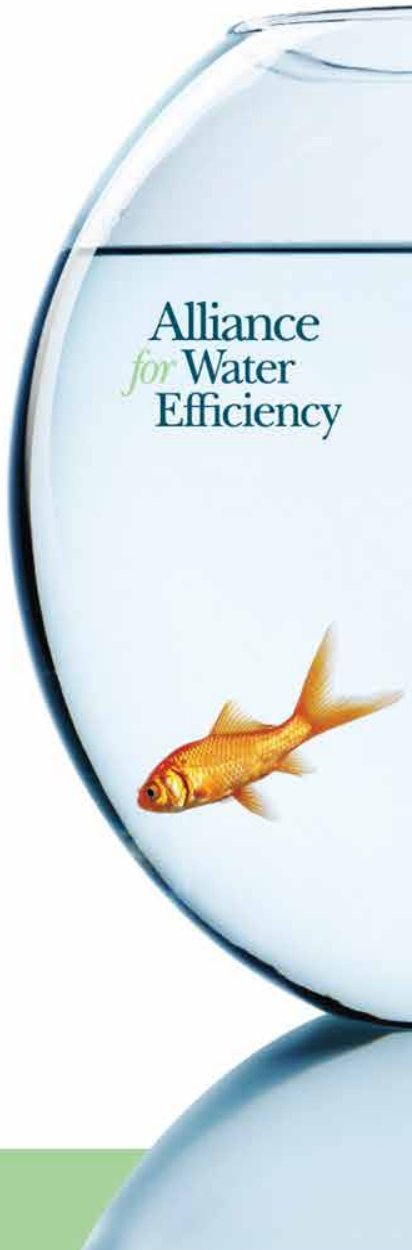
- Survey conducted of **37** companies to determine the importance of funding on a decision to implement measures
- Available funding would “likely” or “very likely” affect a company’s decision to implement water efficiency measures: **66%**
- Water efficiency improvements are planned but not implemented because of a lack of available funding: **36%** (25% unsure)



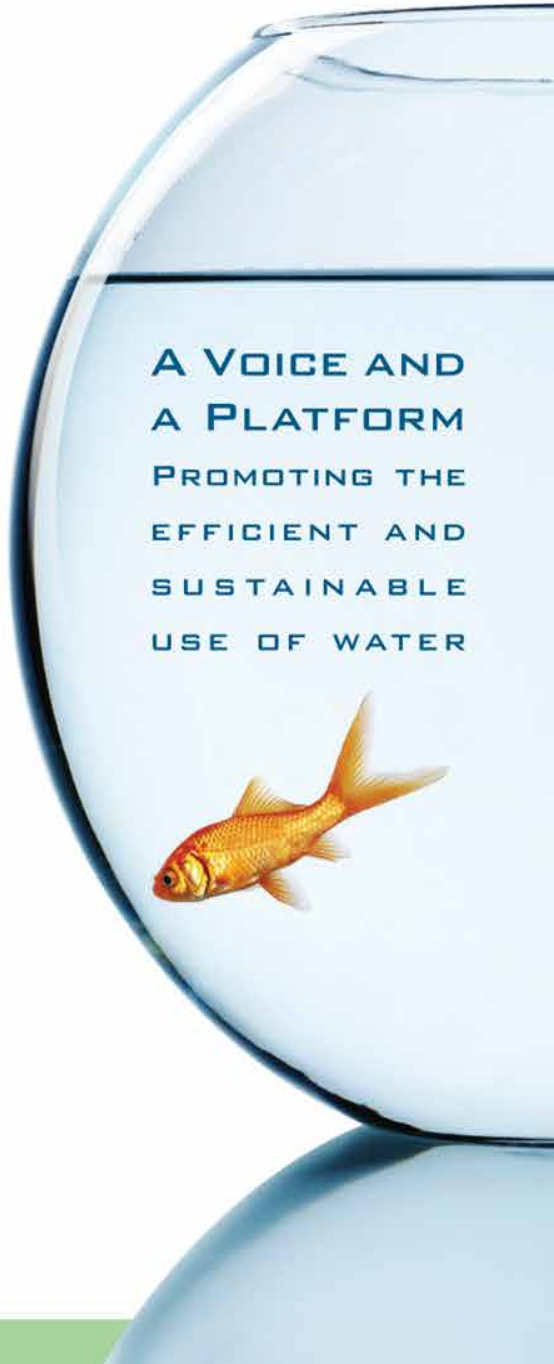
# Funding: Survey Results

- Interest rates of 5% or lower would encourage decisions on facility improvements: **60%** YES
- Need to be able to document payback times of two years or less: **45%**
- Would undertake projects with payback times of five years or more: **26%**

  - **A structure for a revolving loan fund was developed in this project to help incentivize more industrial water efficiency retrofits**



# Conclusions and Recommendations



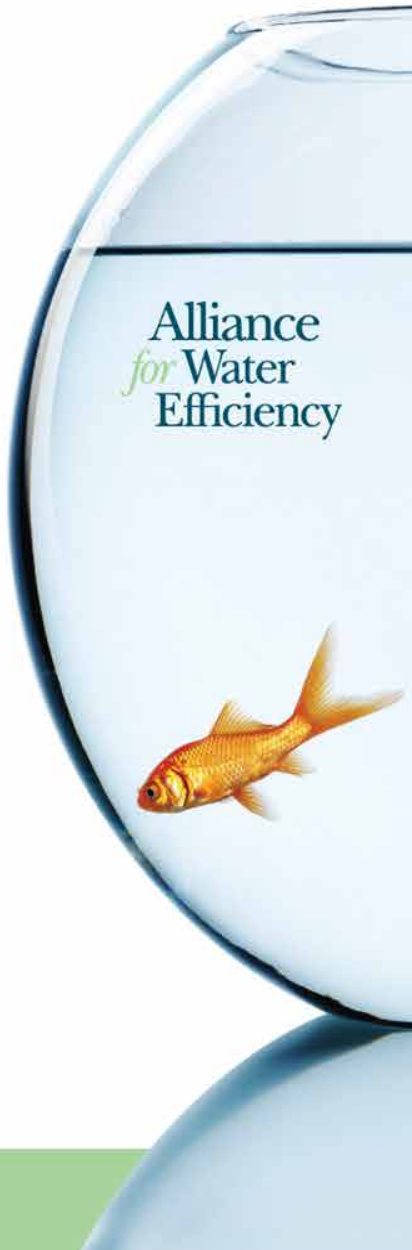

Alliance *for* Water Efficiency

# Conclusion #1

## Significance of Benefits

Even in a region as water rich as the Great Lakes basin, the benefits of water conservation are meaningful across a range of areas. These include:

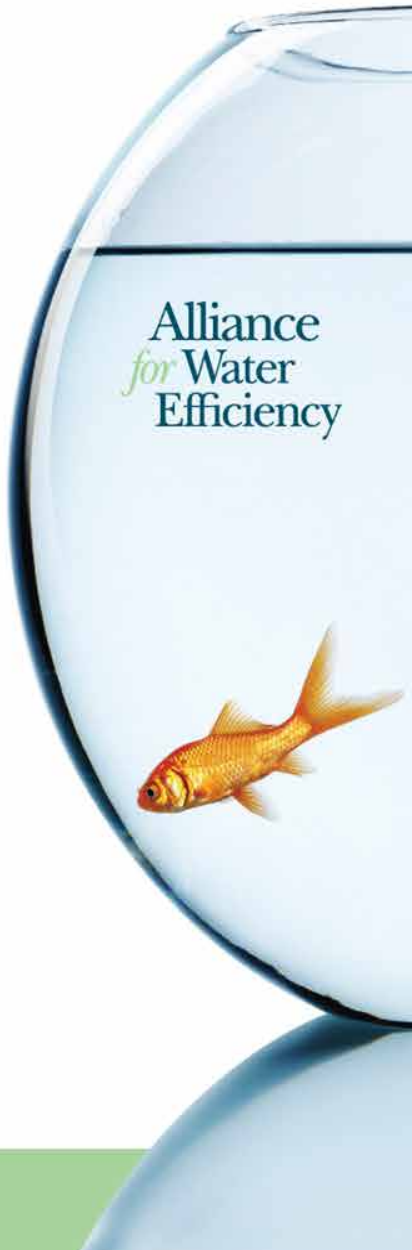
- supply reliability
- reduced pumping
- reduced treatment



# Conclusion #2

## Protected Wastewater Stream

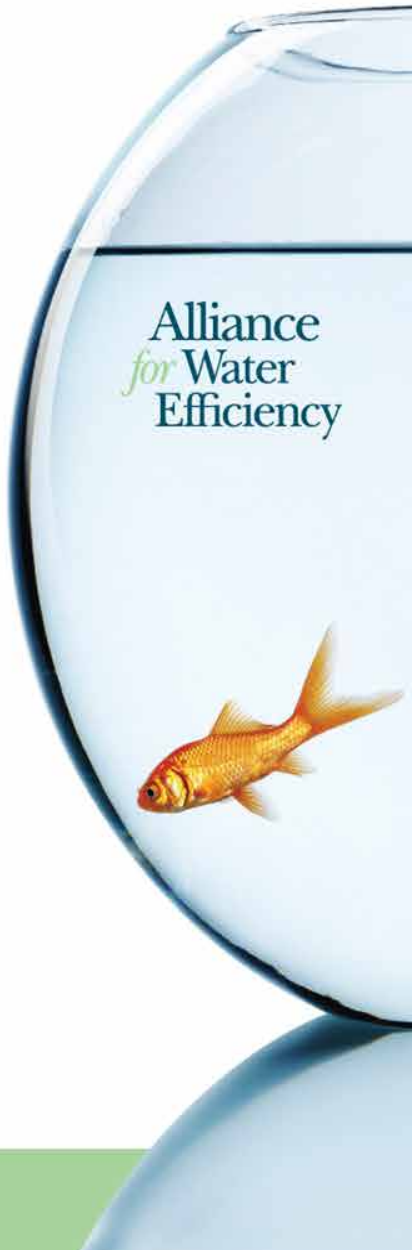
Filtering, treating, and re-using water on site not only reduces water consumption, it can also remove dissolved and suspended solids and BOD from the wastewater stream.



# Recommendations

## 1. Explore Untapped Opportunities

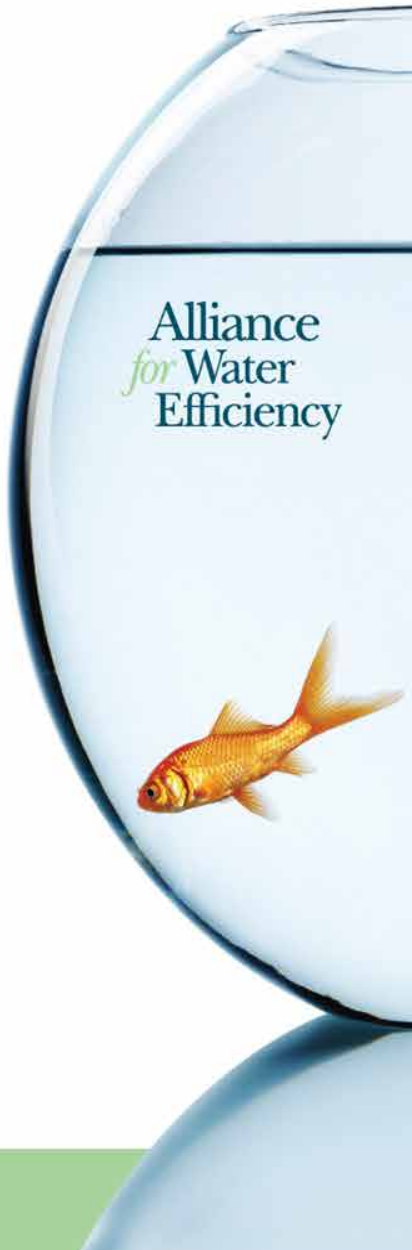
Other high-water-use industry sectors, such as food processing, dairies, cheese making, meatpacking, concrete batching, and pharmaceuticals, should be explored and assessed.



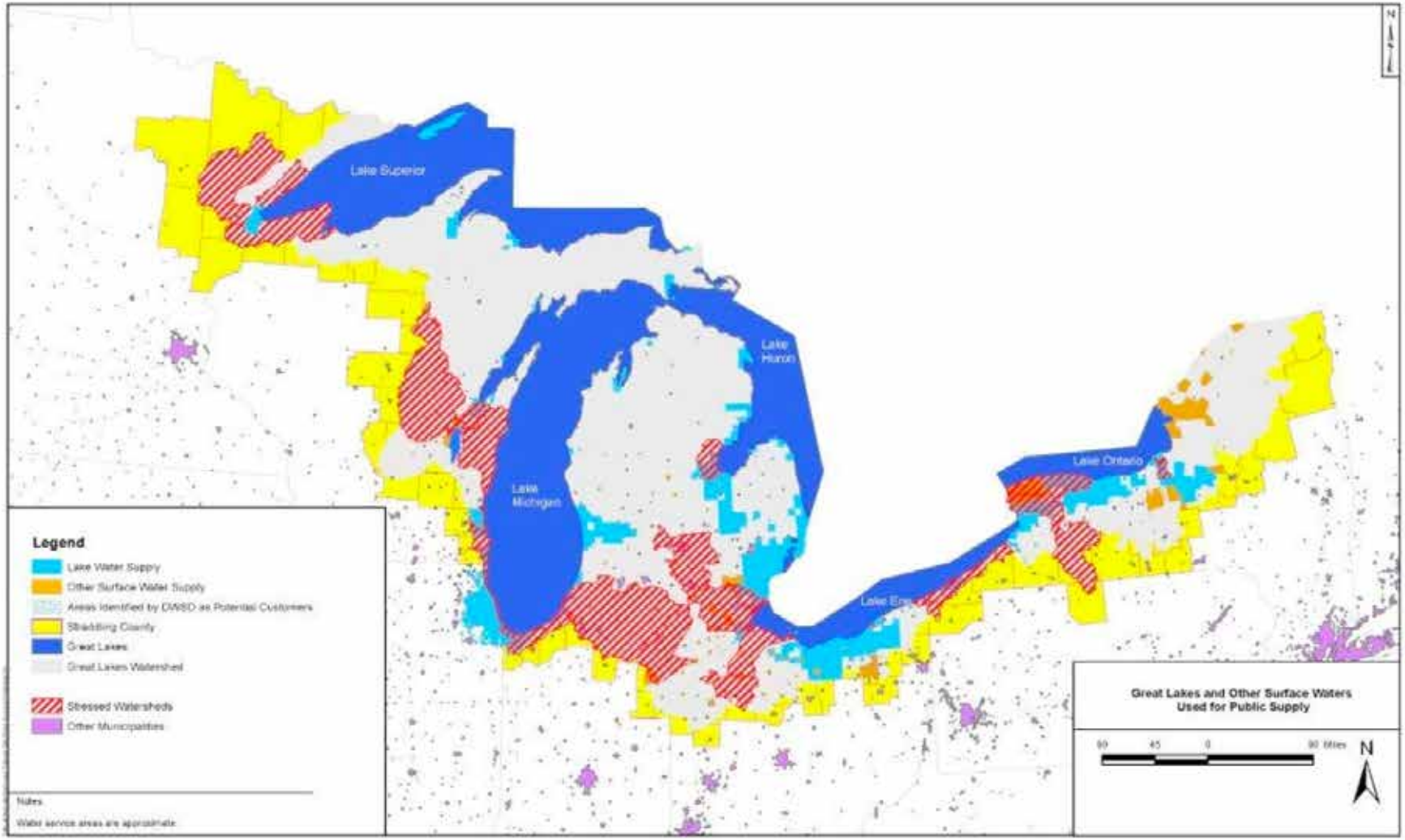
# Recommendations

## 2. Explore Regions with the Potential to Have the Greatest Impact

While the benefits of conservation are apparent everywhere, they are most profound in areas with stressed supplies, especially where utilities draw water from and release water to streams or aquifers.



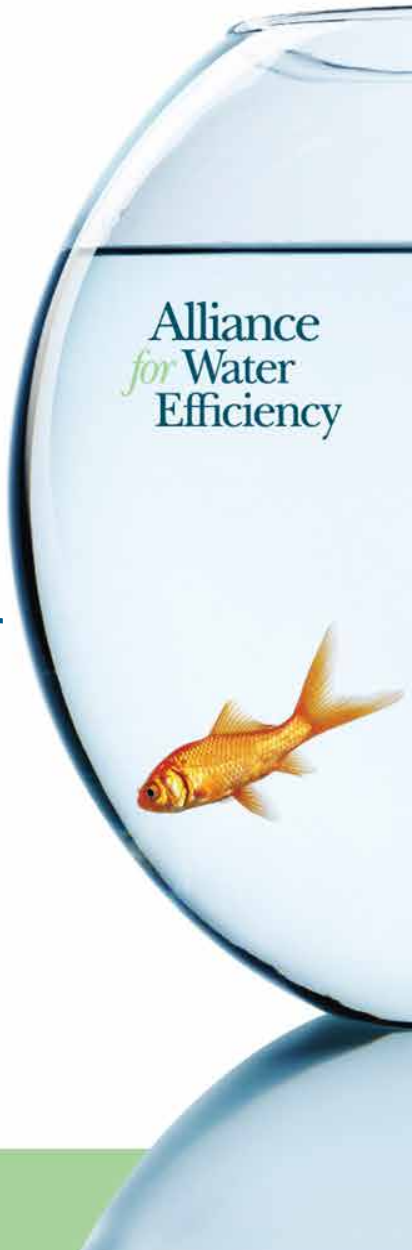
*The red hash marks on this map show the three most-stressed watersheds in each of the Great Lakes States.*



# Recommendations

## 3. Explore Utility Service Areas with the Greatest Potential Benefit from Conservation

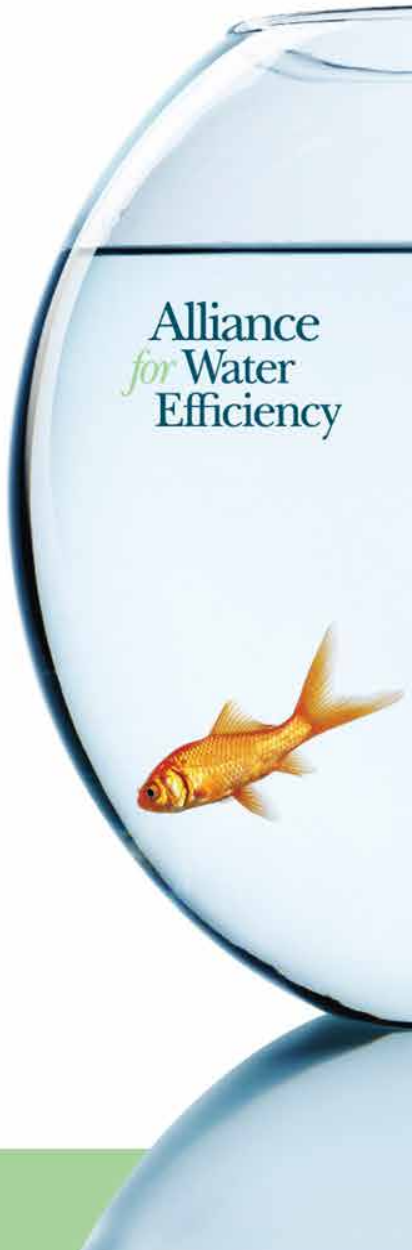
Targeted utilities should realize the greatest benefits from large-scale industrial water conservation efforts. These are utilities in either water-stressed areas or those experiencing rapid growth. Environmental benefits will have value to all regions, but not equally.



# Recommendations

## 4. Include Stormwater Capture

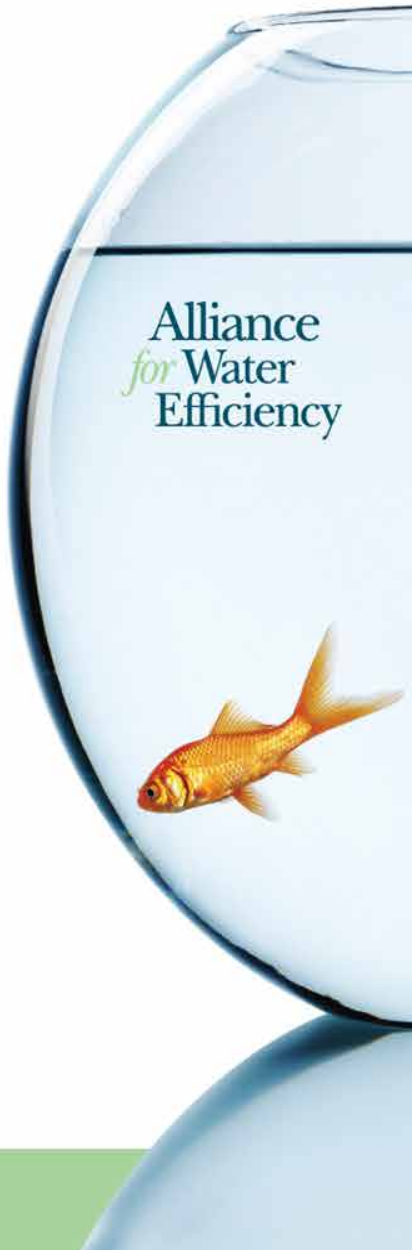
Capturing and using rainwater on site requires minimal treatment and may be used for cooling towers, irrigation, or floor washing. It reduces the need for treated water and provides additional protection from storm surges and combined sewer overflow events.



# Recommendations

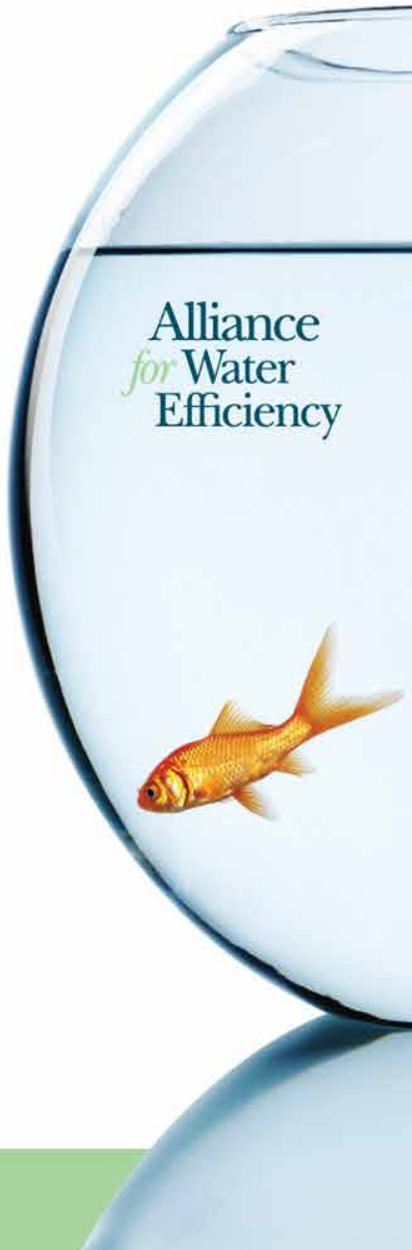
## 5. Develop Funding Options

In addition to securing a source of dollars for the revolving fund, work must be done to determine how to assess and fund those measures that balance financial return with benefits to the environment.



# Takeaway Lesson

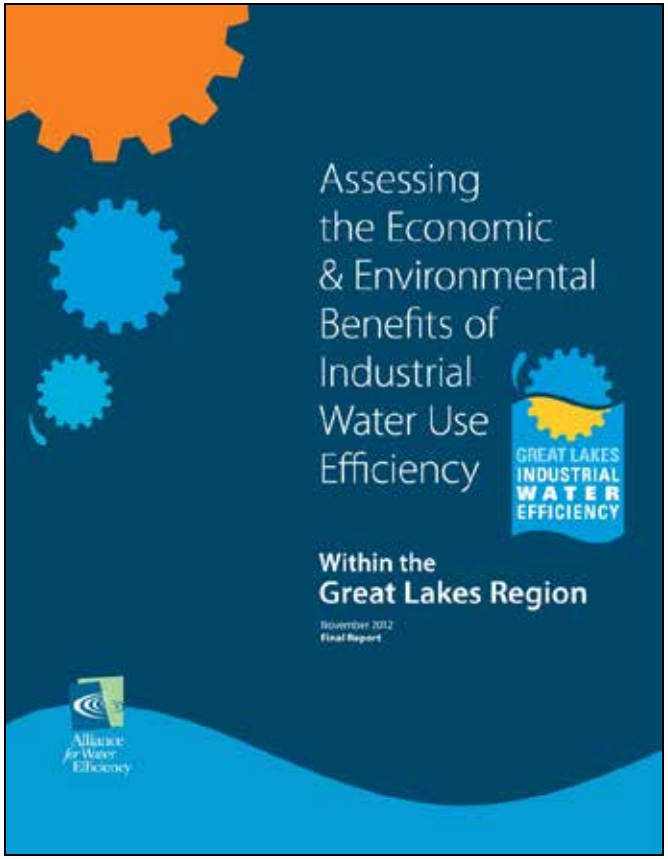
Even in the most freshwater-rich area on earth, industrial scale water conservation provides meaningful benefits and should be pursued.



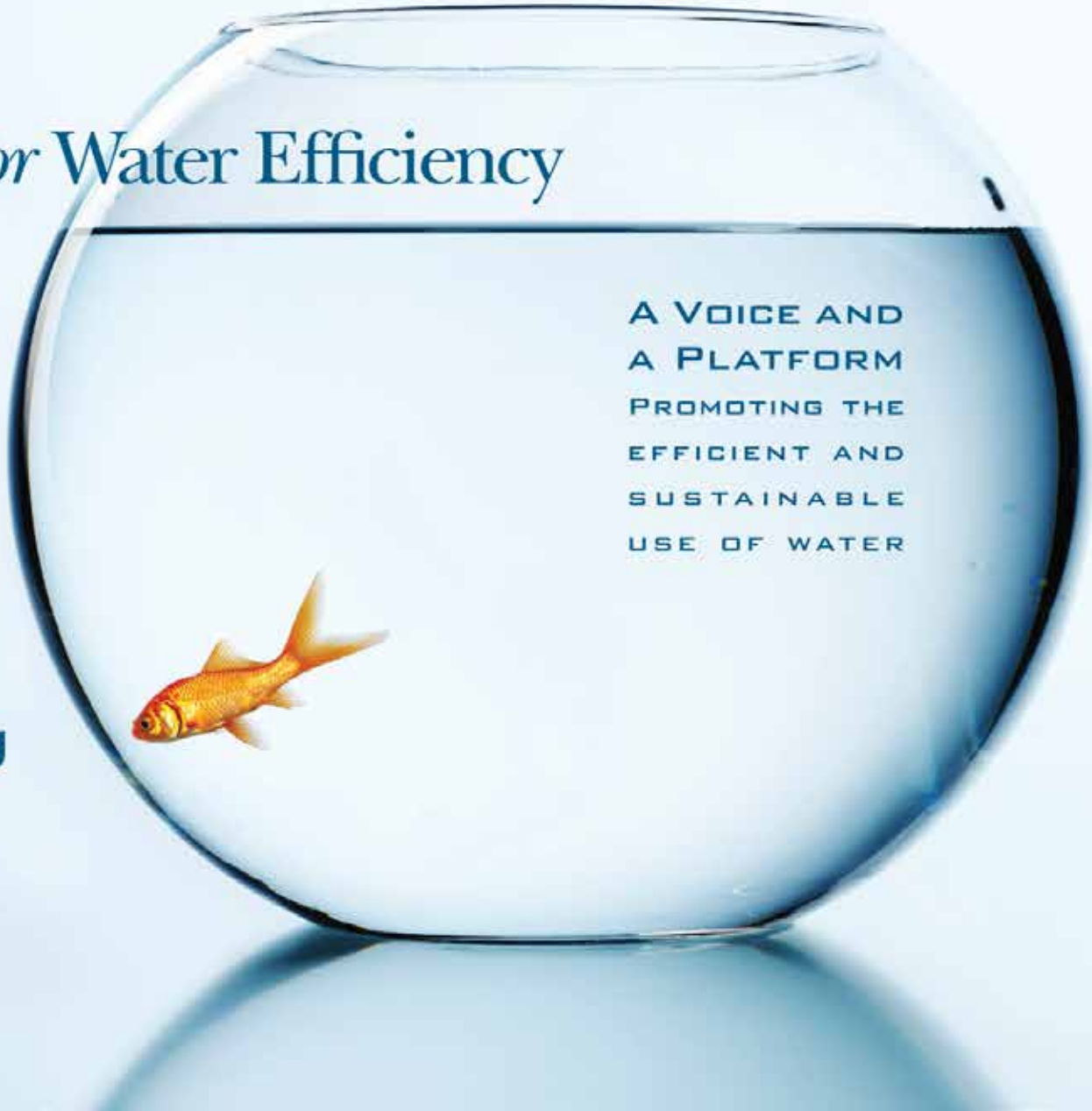

GREAT LAKES INDUSTRIAL WATER EFFICIENCY

# Industrial Water Use

- Results of 5 sector audits of industrial water use
- Water efficiency improvements identified and ROI calculated
- Environmental benefits calculated and scaled up for the region
- Detailed Report
- Posted at **a4we.org**



# Alliance *for* Water Efficiency



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