

Water Efficiency

Conducting a Successful Water Efficiency Program



A successful water efficiency program should begin with a well-thought-out plan. Crucial to the development and use of this plan are management's commitment; sufficient technical staff and financial resources; employee awareness and participation; and well-publicized results. Water efficiency measures may very likely be just one part of an integrated energy management, pollution prevention or other cost-reduction program or environmental management system. Regardless the driving factors, a heightened awareness and road map to water efficiency opportunities and cost savings will help management make sound choices to optimize operational efficiency, improve economic competitiveness and conserve quality water resources for the future.

Steps for a successful water efficiency program

- Step 1** - Establish commitment and goals
- Step 2** - Line up support and resources
- Step 3** - Conduct a water audit
- Step 4** - Identify water management options
- Step 5** - Prepare a plan and implementation schedule
- Step 6** - Track results and publicize success

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Step 1

Establish Commitment and Goals

At first, water efficiency goals may be qualitative and included in statements of commitment, environmental policies, budgetary planning or other external awareness measures. Initial commitments should allocate staff and resources to assess the current water use baseline and explore water efficiency opportunities. With additional information, realistic goals of quantitative water efficiency can be established. For example, goals could include establishing a percent reduction goal in overall water consumption (such as a 10 percent overall reduction in water use next fiscal year) or establishing a gallon-per-year reduction goal in water consumption (such as reducing consumption by 20,000 gallons per year). Even better goal setting uses industry benchmarking information based on an operating index (such as gallons per pound of product manufactured or gallons consumed per client served). Remember, goal setting is an ongoing process requiring periodic review and revisions for continual improvement.



2. Establish a budget and funding.
3. Evaluate regulatory constraints and local water supply issues.
4. Seek outside funding, grants and available technical assistance.
5. Coordinate a water efficiency audit.
6. Establish implementation criteria for designing water efficiency measures.
7. Develop a plan.
8. Encourage employee participation and create awareness.
9. Oversee implementation of efficiency measures and activities.
10. Periodically review program progress and make modifications for continuous improvement.

Achieve Employee Participation

The importance of employee awareness and cooperation in the water conservation program cannot be overemphasized.

- Establish and promote the water efficiency/conservation program for employees. Provide background information about the water conservation policy and its implications for company operations.
- Initiate the employee awareness program with a letter directed to each employee from the head of the organization, such as the CEO, president, owner, mayor, city manager, governor or chief administrator. The letter should describe the established conservation policy, identify the water efficiency coordinator, express full support for the plan and invite feedback.
- Emphasize the need for individual responsibility as part of a team effort to achieve efficiency and environmental goals.
- Establish a “water-saving idea box” and encourage employees at all levels to sub

Step 2

Line Up Support and Resources

Designate a Conservation Manager

A conservation manager, coordinator or team leader also may have responsibilities for energy management and/or environmental management. The conservation manager should:

1. Review effectiveness of present water efficiency measures for further improvements.

mit water-saving ideas. Respond to each suggestion offered.

Communicate Water Conservation Awareness

- Incorporate water conservation policies and procedures into employee training programs.
- Use bulletins, e-mail, newsletters, paycheck stuffers or other appropriate methods to transmit policies, programs, ideas, announcements, progress reports and news of special achievements.
- Schedule staff meetings to communicate the organization's water-conservation plan and progress in water savings.
- Establish charts that graphically show the financial savings.
- Use audiovisual programs, outside speakers and other means for employee meetings.
- Post water-conservation stickers, signs and posters in bathrooms, kitchens, cafeterias, conference rooms and other places where employees congregate.

Check out these water efficiency Web sites

SaveWaterNC.org

www.savewaternc.org

N.C. Division of Pollution Prevention and Environmental Assistance

www.p2pays.org

N.C. Division of Water Resources

www.ncwater.org

N.C. Division of Water Quality

<http://h2o.enr.state.nc.us>

N.C. Drought Management Council

www.ncdroughtcouncil.org

EPA Office of Water

www.epa.gov/ow

Water Librarian's Home Page

www.interleaves.org/~rteeter/waterlib.html

EPA WaterSense

www.epa.gov/watersense

Establish Employee Incentives

- Recognize and reward those employees who submit water-saving ideas.
- Include water consumption measures in employees' job performance reviews.
- Motivate employees by rewarding them with a percentage of the first year's direct savings.
- Allocate water and sewer costs to each individual department to create responsibility for water efficiency.
- Organize and promote competition between shifts.

Use Outside Assistance

Outside organizations are available to assist with water conservation activities. Assistance should be solicited wherever feasible as a resource for the promotion of water conservation. Some suggestions are listed below.

- Take advantage of free or low-cost technical assistance organizations such as EPA's WaterSense program, N.C. Division of Pollution Prevention and Environmental Assistance, N.C. State University's Industrial Extension Service, NCSU's Industrial Assessment Center, Waste Reduction Partners in western and central North Carolina, and energy utilities assistance programs (i.e., Progress Energy and Duke Energy).
- Water and wastewater utilities are vitally interested in assisting customers conserve water. They can provide information, contacts with other industries and advice. Water suppliers may even assist customers with leak-detection programs or water audits of facilities. Some utilities nationwide offer rate reductions and

financial incentives for water efficiency investments.

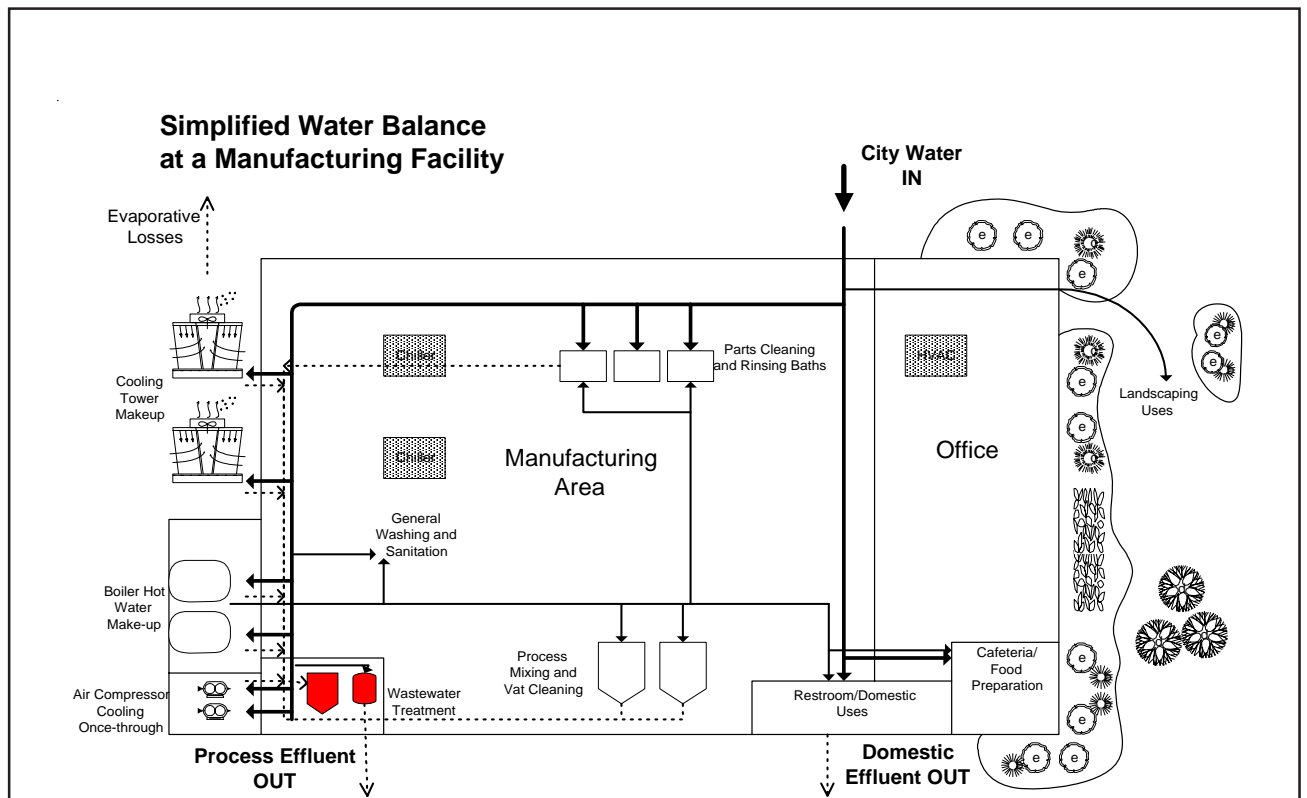
- Participate in any water conservation advisory group, or similar organization, generally sponsored by local water authorities. If such a group does not exist, help the utility establish one.
- Consider hiring private consultants to help develop water efficiency programs and conduct audits. Ensure professionals have adequate experience and proper certifications for their field (i.e., certifications for landscaping include certified landscaping irrigation auditors, certified irrigation designers and certified irrigation contractors.).
- Work with local wastewater utilities and wastewater discharge regulators. As conservation measures are put into effect in industrial processes, wastewater pollutant concentration may increase, although the same mass of these pollutants have stayed the same. These increased concentrations may alter a facility's ability to meet local, state or federal effluent discharge limits. Request wastewater regulators to recognize conservation efforts by amending the wastewater discharge permits to address total mass of pollutants instead of concentration levels.

Help Take the Message Home

Develop an employee education program that will encourage employees to save water at home, as well as in the workplace. Some suggestions are:

- Offer home water-saving devices to employees free or at cost.
- Sponsor demonstrations that will educate employees how to water landscapes

FIGURE 3-1



Water Balance Summary

Sources of water use	Gallons per year	Percent of total
Cooling: tower make-up and boiler make-up	7,966,000	38.3
Process use: parts and mixing vat cleaning	3,848,000	18.5
Domestic: faucets, toilets and showers	3,536,000	17
Once-through cooling: air compressors and pumps	2,388,000	11
Landscaping	832,000	4
General washing, sanitation and maintenance	561,600	2.7
Leaks (detected)	416,000	2
Food preparation: dishwasher	312,000	1.5
SUBTOTAL	19,859,000	95.5
TOTAL WATER PURCHASED	20,800,000	100.0
UNACCOUNTED FOR	941,000	4.5

efficiently, plant seeds for water-thrifty plants, install low-flow plumbing fixtures and improve water-use habits. Device manufacturers, local hardware stores or your water utility may be happy to assist with such a program.

- Distribute home water conservation booklets.

Step 3

Conduct Water Audit to Assess Current Water Uses and Costs

To identify potential water efficiency opportunities, it is first necessary to gain a thorough understanding of the site's water uses through a water audit. A water audit is defined as the process by which all uses of water on a site are characterized as to flow rate, flow direction, temperature and quality requirements (see *Chapter 6*).

Water Balance

An important task is to construct a water balance diagram or summary chart, which identifies all water use from its source through the on-site processes, machines, buildings and landscape irrigation to evaporation and wastewater discharge. To account for all uses in the water balance, the total inflow should equal the total outflow plus irrigation, evaporation and other water losses (see *Figure 3-1*).

Select a Water Audit Team

Include the following representatives:

- Water efficiency coordinator
- Personnel familiar with the operations
- Facility management/plant manager
- Maintenance
- Possible outside auditors

Collect Background Site Information and Records

- ▶ Water bills (previous full year to three years) – note rate structures
- ▶ Water meter sizes and locations

- ▶ All sources of potable and non-potable water
- ▶ Process sub-metering data
- ▶ Wastewater treatment
- ▶ Sewer bill
- ▶ Production process sheet
- ▶ Plumbing diagram
- ▶ Irrigation drawing/plan and existing irrigation control program
- ▶ Number of employees
- ▶ Number of shifts, work and clean-up schedules
- ▶ Facility description – square footage, functions
- ▶ Products and services performed at the site
- ▶ Production rates or client service rates
- ▶ List of known water-consuming processes and uses
- ▶ Prior water use or energy survey
- ▶ (Preventive) maintenance schedules

Walk-Through Survey

The next step is to conduct a walk-through survey with the audit team. Use direct observation and measurements, and ask questions. Talk with equipment operators who may have important first-hand information. Use the following procedure to conduct the survey.

- Identify all water-consuming equipment
- Confirm plumbing diagrams
- Quantify water flow rates and usage
- Determine water quality needs for each process
- Review current water-saving measures
- Observe shift clean-ups (third shift), and process change-overs
- Also note all water losses, evaporative losses and water incorporated in product; excessive water pressure; and leaks
- Judge current water use efficiency and potential for each operation

Determine the True Cost of Water Use

The true cost of using water may include several factors other than the actual water util

ity fees. Examples of costs include water heating, chemical agents, electrical pumping, on-site pretreatment and related labor (see Figure 3-2).

To calculate the dollar savings resulting from reduced water use, a value for each unit of water used must be derived. One approach is to divide the total costs of water used per year by the total amount of water used. For facilities engaged in production of “widgets,” the

total cost of water used for a production run should be divided by the total number of widgets produced to get a “cost per widget” of water use.



In calculating the total cost of water use and the many components that go into the total cost, current prices of all these elements is a good starting point. However, a more mean

Key areas to check during a walk-through survey

Process and Equipment Use

- Cleaning, washing, rinsing
- Metal finishing
- Painting
- Dyeing and finishing
- Photo processing
- Reuses
- Product fluming (water transport)
- Water use in products

Cooling and Heating

- Single-pass cooling
- Cooling tower/chillers
- Boiler, hot water, steam systems
- Air washers
- Boiler scrubber

Sanitary and Domestic

- Toilets
- Urinals
- Faucets
- Showers
- Wash-up basins



Kitchen Food

- Cafeteria uses
- Dishwashers
- Ice machines
- Faucets



Other Facility Support

- Floor washing
- Air emission wet scrubbers
- Building washing
- QA/QC testing
- Laboratories
- Wastewater treatment

Outdoor Uses

- Landscaping
- Irrigation
- Particulate emission control

Decorative fountains/ponds

Vehicle washing

Personnel

Medical



ingful comparison can be made using future rates and prices for these elements after the efficiency measures are put into effect. These major cost elements include:

1. Water purchased from utilities. Billing normally consists of a fixed service cost and water rate cost. The fixed charge should be excluded from the analysis.
2. Wastewater sewer rate and surcharges.
3. Total cost of on-site water softening or treatment before use.
4. Cost of energy for heating water.
5. Total cost of pretreating wastewater effluent, including labor, chemical, energy

and residual disposal.

6. Cost of maintenance personnel performing preventive or reactive maintenance on water-using components.
7. If water demand is increasing, determine the marginal costs of increasing effluent treatment capacity.
8. Energy costs for pumping water from wells or pumping water within the facility itself.

When comparing efficiency options, first consider reducing consumption of the most expensive components of water use.

FIGURE 3-2

True Cost of Water		
Example: Metal Finishing Operation (not heated)		
Activity	Unit Cost (\$/CCF)	Total Unit Cost (\$/CCF) 1 CCF = 748 gallons
City water purchase		\$2.11
Sewer rate		\$2.43
Deionized using reverse osmosis		
Equipment	\$0.41	
Energy	\$1.07	
Labor	\$1.23	
Total deionized water (flexible cost)*	\$2.71 x 40%	
Deionized water (flexible cost)*	40% x \$2.71	\$1.08
Wastewater treatment		
Sludge disposal	\$3.78	
Treatment chemicals	\$2.64	
Energy	\$0.25	
Labor	\$6.01	
TOTAL wastewater treatment	\$12.69	
Wastewater treatment (flexible cost)*	40% x \$12.69/CCF	\$5.07
TOTAL cost of water		\$10.69/CCF
		(\$14.29/1,000 gallons)

If a metal finisher consuming 35,000 gallons per day reduces use by 10 percent, estimated savings using water and sewer cost only = $250 \text{ days/yr} \times 0.1 \times 35,000 \text{ gpd} \times (2.11/784 + 2.43/784) = \$5,310/\text{year}$

Estimated savings using total cost of water = $250 \text{ days/yr} \times 0.1 \times 35,000 \text{ gpd} \times \$14.29/1,000 \text{ gallons} = \$12,503/\text{year}$

*Flexible cost savings of conserved water estimated to be 40 percent of total treatment cost.

Step 4

Identify Water Management Opportunities in Plant and Equipment

Many general approaches exist for identifying water-saving opportunities. The approaches listed below can be applied to water uses at any site.

General Approaches for Water-Saving Opportunities

- Identify unnecessary uses and fix leaks.
- Use minimum amounts of water to accomplish the task.
- Recirculate water within a process or group of processes.
- Reuse water sequentially.
- Treat and reclaim used water.
- Displace potable water supplies with water from non-potable sources where appropriate.
- Install meters at high-flow processes and equipment.
- Pressure-reducing valves.

This manual provides a detailed discussion about water reduction options in Chapters 4 and 5.

Step 5

Prepare a Plan and Implementation Schedule

Develop an action plan that outlines and lists all proposed water efficiency measures resulting from the facility audit. Include the following items in the plan:

State the company policy regarding conservation and water efficiency, reflecting the commitment of company management.

Quantify your goals. Establish the amount of water to be saved through-

out the entire facility, as well as by each organizational unit. Also, set deadlines by which these savings are to be achieved.

3. Summarize all efficiency measures identified during the water audit and by employee suggestions.
4. Evaluate each of these measures. Be sure to include all costs and benefits including capital costs, operating costs, projected savings and payback periods. Do not forget to include cost of energy consumption, treatment of water, chemical costs, creation of solid and toxic wastes and wastewater discharge.
5. Prioritize the measures in the following order:
 - ▶ Those that are most cost-effective and should be put into practice as soon as possible.
 - ▶ Those measures that should be evaluated through a trial period to collect meaningful data.
 - ▶ Those measures that are not cost-effective, but could be implemented in times of drought or emergency situations.
6. Identify need for any engineering design changes.
7. Establish the schedule for implementing each specific measure.
8. Identify the employee responsible for implementing each measure; continuously monitor the effectiveness and performance of each measure.
9. Identify funding sources for specific measures that will require capital expenditure. Consider loans and rebates that may be available from energy and water utilities.
10. Review periodically, and revise plan appropriately.

Step 6

Track Results and Publicize Success

Publicize the success of your program. Positive publicity promotes good relations with employees, the community, other businesses and organizations that support economic development. It also helps to stimulate similar water management efforts. Some publicity options include internal memos, company newsletters, brochures, trade publications, news releases to local media, letters to public officials, talk radio and interviews with the media. Many water utilities will help publicize good results to encourage others to develop similar plans. A good water efficiency program is news because it means more water will be available to the community.

Businesses with successful water management programs deserve recognition by the public. Likewise, the public should be informed that businesses are socially and environmentally responsible partners in the community. These steps can help businesses make their publicity efforts more visible and successful:

1. Encourage company conservation team members to participate in:
 - ▶ Community conservation seminars to share program results, as well as obtaining useful information from other companies' efforts.
 - ▶ Water conservation committees sponsored by local water utilities.
2. Present savings in relevant terms such as dollars, water savings per unit of product, earnings per share or annual consumption per household.
3. Prepare, display and promote the company's water conservation successes by means such as:
 - ▶ Display the company's water conservation results in public reception areas.
 - ▶ Place posters and other exhibits in public buildings and art fairs.
 - ▶ Post signs on water-thrifty landscapes to identify types of plants that require little water.
 - ▶ Once the plan has shown significant savings, develop a public relations program, including interviews with local radio and TV stations and newspapers, about the company's successes.
4. Sponsor water conservation projects such as a public xeriscape demonstration garden.
5. Sponsor water conservation contests in schools. For example, encourage students to create posters to be displayed in the community and at company work sites.



The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory technical assistance and education on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. Telephone DPPEA at (919) 715-6500 or (800) 763-0136 for assistance with issues in this fact sheet or any of your waste reduction concerns.

