6.1 Industrial Landscape

Applicability

This BMP is intended for industrial water users that irrigate landscape areas or use a significant amount of water in outdoor irrigation. Water conservation in the landscape can reduce water demands overall, reduce peak stress on water delivery systems, save energy, and reduce fuel and water costs. Landscape irrigation also offers the opportunity for water reclamation and reuse or useful disposal of water sometimes considered waste, such as air conditioning condensate.

For industrial water users, reducing water used for irrigation as an efficiency measure has the benefits of reduced water bills and landscape maintenance costs. Studies have shown that many plants that have undergone the stress of water constraints become more drought resistant and require less irrigation. Once an industrial water user decides to adopt this BMP, the water user should follow the process closely to achieve maximum water efficiency and other benefits this BMP offers. This BMP is not intended for cases where irrigation water is applied to mining reclamation projects, landfill closeouts, or other similar revegetation projects, but those projects should be done in an efficient manner with attention to water conservation.

Description

Under this BMP, the industrial water user with an irrigated landscape area will conduct a landscape water-use survey of its site and facilities. The water-use survey should at a minimum include measurement of the landscape area; measurement of the total irrigable area; irrigation system checks and distribution uniformity analysis; and review or development of irrigation schedules. In addition, the survey should identify currently irrigated areas where irrigation could be discontinued because such areas are not highly visible or the plant materials in these areas do not need supplemental irrigation. The survey should also identify areas in which return flow reuse, stormwater reuse, and use of treated wastewater effluent for irrigation might be environmentally, legally, and agronomically feasible.

If the water user has an automated irrigation system to irrigate turf grass, it will develop reference evapotranspiration (ETo)-based water-use budgets equal to a maximum of no more than 80 percent of reference evapotranspiration per square foot of irrigated landscape area. The statewide Texas Evapotranspiration Network (http://texaset.tamu.edu/) should be consulted for historical evapotranspiration data and methodology for calculating reference evapotranspiration and allowable stress. As the website indicates, those desiring greater water savings can utilize stress coefficients lower than 80 percent. If irrigated landscape area exceeds one (1) acre, the water user should install a dedicated irrigation meter or submeter.

Some industrial users have found that ceasing all irrigation and allowing native groundcovers to grow amidst an existing turf grass landscape is an effective means of reducing water use. Others have used rainwater harvesting, condensate reuse, cooling tower blowdown, RO reject water or stormwater recovery to irrigate landscape areas. These approaches could be considered a substitute means to accomplish the water saving goals of this BMP.

At the start and end of the irrigation season, irrigation systems should be checked and repaired and adjustments made as necessary. For companies with landscape managers on staff, training in landscape maintenance and irrigation system design should be required. In accordance with Texas law, individuals responsible for installing irrigation systems must be licensed by the State of Texas.

Large managed landscapes and commercial operations should prepare a written irrigation management site plan that clearly identifies responses and priorities during water-limited situations such as various stages of drought. The plan should be part of a comprehensive landscape management plan that addresses other management practices such as mowing, fertilizing, etc. On large sites, written landscape plans that include specifications for soil preparation, plant materials, irrigation design, mulch, and maintenance instructions are particularly important.

A landscape conservation program might also incorporate systematic upgrades to reduce water use, including irrigation system components, design and maintenance programs, and landscape design. Rainwater sensors, irrigation controllers, pipe specifications, and hydrozone specifications are all potential elements of an irrigation systems upgrade.

Landscape design emphasizing low-water-use plants should also be considered. Plants appropriate to the region in which they are being planted and with documented low water requirements should be given priority in the landscape design. All designs should be based on the seven principles of WaterWise landscaping (also known as Xeriscape principles).[1] Careful follow-up is essential to ensure that water is not applied in excess of plant needs. In addition to the references noted below, many landscape management companies in Texas now offer water-efficient landscape design and maintenance services.

Landscape design for new construction should use low-water-use plants appropriate to the region of Texas. For large landscape areas, an evapotranspiration (ET) controller or soil moisture sensors should be installed in order to use real-time input to determine plant water stress and needs. A new irrigation system will include a rain sensor shutoff mechanism and use drip or low-pressure irrigation heads in hydrozones where appropriate in order to achieve maximum water efficiency.

Soil improvement is an effective method for reducing irrigation water usage while maintaining healthy soils. Soil improvement programs on high visibility areas can demonstrate

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[1] Water Wise Landscape programs follow the seven principles of Xeriscape™, from the Texas A&M Horticulture Website (2), listed below and explained in greater detail in resources listed in the reference section:

1. Planning and design; 2. Soil analysis and improvement; 3. Appropriate plant selection; 4. Practical turf areas; 5. Efficient irrigation; 6. Use of mulches; and 7. Appropriate maintenance.

to the public the effectiveness of this method. For most landscapes, compost applications of 1/4 to 1/2 inch annually on turf areas and one inch annually on flower beds are recommended. Compost is most beneficial when applied in the fall.

Implementation

The initial step is an efficiency evaluation of the existing landscape area and irrigation systems. Recommended changes to the irrigation system will come from the evaluation report.

The evaluation should include:

1) a list of landscape areas, measurements, plant types, irrigation system hydrozones, controller(s);
2) a list of existing irrigation policies including maintenance and irrigation schedules;
3) a distribution uniformity analysis on irrigated turf areas; and
4) an initial report summarizing the results of the evaluation.

Based on the results of the evaluation, the water user develops and implements a program to maintain and operate its irrigation systems in a water-efficient manner. Maintenance programs include seasonal system checks, adjustment of irrigation timers when necessary, installation of rain sensors, and regular review of irrigation schedules. Internal reporting should be done to confirm that regular seasonal maintenance of the irrigation systems is achieved. When landscape management companies are utilized, contracts should include a required report showing regularly scheduled maintenance and seasonal adjustments to irrigation systems controllers.

In its landscape management programs, the water user should consider installation of climate-appropriate water-efficient landscaping; installation of an ET-based irrigation controller; and dual metering. Another measure to consider is the training of personnel in landscape maintenance, irrigation system maintenance, and irrigation system design. Implementation of Integrated Pest Management strategies can also result in reduced use of pesticides and fertilizers, thereby reducing the amount of water required.

For users that do not have an ET-based controller collecting real-time data, evapotranspiration data is available for numerous parts of the state from the Texas Evapotranspiration Network (Network). This Network will expand over time, as more weather stations are added. If the water user is located in a part of the state not covered by the Network, then it can use the methodology on the Network Website (http://texaset.tamu.edu/) and weather data available from federal agencies such as the National Oceanic and Atmospheric Administration (“NOAA”) or the United States Geological Survey (“USGS”). While this BMP sets 80 percent ETo as the minimal allowable stress (“AS”) to achieve water conservation, lower irrigation amounts are achievable by reducing the AS coefficient further. A preferred alternative approach is to utilize the methods for reducing irrigation quantities as outlined in this BMP and on the Network, but collect evapotranspiration data on site by purchasing a weather station.

If significant changes to irrigation systems or landscape design are implemented, these should be planned with a licensed irrigation professional or a professional landscape designer for optimal water savings. Ceasing irrigation of the landscape and allowing native groundcovers to flourish or converting to an alternative water source are also acceptable means of implementing this BMP.

Schedule

If the water user chooses this BMP, the following is a recommended schedule:

1) The irrigation systems evaluation should be completed in a timely manner. Efficiency evaluations of very large or complex systems should be completed within the first twelve (12) months of implementing this BMP. This is a reasonable time period to complete a thorough evaluation.
2) Develop ETo-based water-use budgets for all landscape zones no more than two years after the implementation start date.
3) Within two years of the implementation start date, install a dedicated landscape meter if landscape use is determined to exceed one (1) acre.
4) If irrigation systems upgrades are indicated or new landscape designs are planned, the changes should be initiated immediately after the landscape report is concluded and be completed within twelve (12) months.
5) The Landscape BMP shall be fully implemented within two years of the start date. If determined to be necessary for very large or complex facilities, the schedule can be extended. BMPs should be initiated in the second year and continued until the targeted efficiency is reached.

Scope

To accomplish this BMP:

1) Industrial water users with several facilities with the same or very similar landscape irrigation systems should conduct a landscape evaluation following the schedule outlined in Section D.
2) Industrial water users with several facility sites with very different landscape irrigation systems at the various sites should follow a progressive implementation schedule, implementing the BMP successively until all facilities have been audited and conservation measures implemented.
3) Cost-effectiveness considerations may result in partial implementation of this BMP at one or several of a large number of facilities.

Documentation

To track the progress of this BMP, the industrial water user gathers and maintains the following documentation and can utilize industry accepted practices:

1) Summary report of the initial landscape survey;
2) Estimated ETo-based budget and annual water savings using the method described in Section G below;
3) Records of monthly landscape water use, personnel training, and changes to equipment and performance specifications;
4) Demonstrated water use reduction in targeted landscapes; and
5) Data on program progress, water savings, and expenditures.

Determination of Water Savings

Estimated water savings should be based on the assumption that a landscape survey and resulting programs will result in a 15 percent reduction in the amount of water used for landscape purposes. Calculating savings can be more accurately achieved after implementing the BMP.

Water savings calculation: $S = I_{(h)} - I_{(BMP)}$

Where S is savings in acre-feet/year
$I_{(h)}$ is annual irrigation average prior to implementing BMP
$I_{(BMP)}$ is annual irrigation after implementing BMP

80 percent ETo calculation: $I = ETo \times Kc \times AS$

Where I is the irrigation amount to be applied for a given period (daily, twice weekly, weekly, etc.) in inches or centimeters
ETo is the measured reference evapotranspiration over the irrigation period
Kc is a turf coefficient for turf grasses, and can be found at http://texaset.tamu.edu/
AS is allowable stress of 0.8 (or less if the landscape manager wishes)

When applying irrigation, the equation should be modified to gain greater water savings, by accounting for precipitation: $I = (ETo \times Kc \times AS) - P$
Where P is precipitation in inches or cm.

Cost-Effectiveness Considerations

The industrial water user should determine the cost effectiveness to implement each identified replacement or upgrade to its landscape irrigation equipment and procedures, utilizing its own criteria for making capital improvement decisions. Many operating procedures and controls that improve the water use efficiency should be implemented simply as a matter of good practice. A cost effectiveness analysis under this BMP should consider capital equipment costs and changes in staff and labor costs.

References for Additional Information

1) *A Water Conservation Guide for Commercial, Institutional and Industrial Water Users*. New Mexico Office of the State Engineer, July 1999. http://www.seo.state.nm.us/water-info/conservation/pdf-manuals/cii-users-guide.pdf

2) *EARTHKIND™ Environmental Landscape Management* http://aggie-horticulture.tamu.edu/earthknd/earthknd.html 2004.

3) *Landscape Irrigation Scheduling and Water Management,* Water Management Committee of the Irrigation Association, September 2003. http://www.irrigation.org/PDF/IA_LIS_AND_WM_SEPT_2003_DRAFT.pdf

4) *Turf and Landscape Irrigation Best Management Practices*, Water Management Committee of the Irrigation Association, September 2003. http://www.irrigation.org/PDF/IA_LIS_AND_WM_SEPT_2003_DRAFT.pdf

5) *Waste Not, Want Not: The Potential for Urban Water Conservation in California,* Pacific Institute, November 2003. http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf

6) *WaterWise Council of Texas.* http://www.waterwisetexas.org/

7) *San Antonio Water System Conservation Program.* http://www.saws.org/conservation/

8) *ET and Weather Based Controllers CUWCC Web Page.* http://www.cuwcc.org/Irrigation_Controllers.lasso

9) *Smart Water Technology Initiative Web Page.* http://www.irrigation.org/swat1.asp

10) *Austin Green Gardening Program.* http://www.ci.austin.tx.us/greengarden/

11) *City of Corpus Christi Xeriscape Landscaping.* http://www.cctexas.com/

12) *Texas Cooperative Extension for El Paso County.* http://elpasotaex.tamu.edu/horticulture/xeriscape.html