SUSTAINABLE MAINTENANCE CALENDAR

UPDATED: 10/22/2013

Sustainable Maintenance Guide and Calendar

NOW with enhanced SNOW content!

This guide is intended to equip Illinois Landscape Contractors Association (ILCA) members with all the tools necessary to implement a sustainable maintenance program. It takes into account the constraints of a landscape company in regards to costs, time, equipment, personnel, and horticultural knowledge. The guide is written so any landscape company can apply these maintenance principles to almost any commercial or residential landscape and improve the positive impact on the environment without sacrificing quality.

The premise of this guide is for when a contractor interacts with a client or inherits a property and the property owner/manager is unwilling to change any significant portions of the landscape. They do not want to plant or remove large sections of plant material, turf, or hardscaping. The irrigation system will remain as well as existing water features.

The following seasonal schedule demonstrates how a maintenance contractor can implement sustainable landscaping practices into the landscape. Over time the landscape will become more sustainable and affordable to maintain even with the same landscape design.

The guide is organized as a monthly handbook that doubles as a checklist. Each month, crews are equipped with specific instructions on what actions will be completed that month in order to maintain a healthy, regenerative, and successful sustainable landscape.

This is a guide written by contractors for contractors. The guide addresses horticultural principles and Best Management Practices instead of concentrating on features and renovations.

Every sustainable journey begins with the first step.

FOREWORD

It's January and you are alone in your office trying to get ready for the upcoming season. Most of the office staff has not yet returned from the Winter break and you appreciate the quiet. As you take a sip of your coffee and look at the snow forecast, the phone rings.

"Hello, My Landscaping Company," you answer.

"Hi, it's Mary Miller from Mockingbird Lane; happy holidays."

The Millers have been maintenance clients for seven years. They have two kids, ages 8 and 13 and a dog. They are great clients but with a modest budget. They leave water for the crews and tip them at the end of the year.

"I was hoping you could help me out with our New Years' resolution this year", Mary says. *" We all committed, as a family, to be more 'green'. We aren't doing anything major but just examining all the little areas in our life where we can make a difference. Is there anything you can do to help us make our resolution come true?*

"Well, um," you respond fumbling for the most recent issue of *The Landscape Contractor* magazine that you remember had an article on organic fertilizer. *"We could think about installing a couple of rain barrels for recaptured water, put in a bio-swale, or maybe rip out that driveway and replace it with some permeable pavers,"* you continue.

She pauses. *"Thanks but you know our budget. All of those sound great but we can't pay much more than we are currently paying for the maintenance. We love the work you do but Is there anything you can do to go a little greener without changing our current level of service?"* she asks.

This is the moment when you become either a spectator or participant in the sustainable landscaping movement. A customer has asked if you have the ability to change your maintenance practices to become more environmentally-friendly. If you say "no" you may lose the client. If you say "yes," you must deliver. What's it going to be? Yes or no? This is the moment when sustainability happens.

JANUARY

Turf

- ❑ Perform proper machine maintenance. Appendix #1-"Machine and Tool Maintenance"

Perennials

- ❑ Perform proper tool maintenance. Prioritize equipment maintenance concentrating on hand or electric equipment whenever possible.

Trees and Shrubs

- ❑ Prune disease susceptible species (ex. American Elm) that can only be pruned in the dormant season. Appendix #2- "Pruning Trees and Shrubs"
- ❑ Dormant prune all appropriate trees and shrubs. This improves the health and appearance of the plants and reduces maintenance costs. Appendix #2- "Pruning Trees and Shrubs"
- ❑ Inspect for and remove all invasive plant species. This removes competition for the natives and helps protect the local eco-systems. Appendix #3- "Invasive Plant Species"

Snow

- ❑ Repair any broken snow equipment so that proper function and safety are ensured.
- ❑ Inspect property for any damaged plant materials that may have occurred and repair accordingly.

January Sustainability Tip

- Monitor winter precipitation accumulation amounts. This helps determine spring moisture needs for the plants.

FEBRUARY

Turf

- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.
  - o Concentrate on landscape maintenance equipment.

Perennials

- ❑ Review last years' maintenance needs to determine what changes can be made to reduce long term maintenance costs. Appendix #4 "Perennial Maintenance"

Trees and Shrubs

- ❑ Continue dormant pruning and invasive species removal.

Snow

- ❑ Inventory deicing agents to reduce the amount of materials stored onsite.

General

- ❑ Prioritize equipment maintenance concentrating on hand or electric equipment whenever possible.

February Sustainability Tip

- 👍 Job cost each property and route list to determine what can be done to save time, materials and fuel while still meeting customer expectations.

MARCH

Turf

- ❑ Remove debris accumulated over winter to reduce disease.
- ❑ Inspect blades on a daily basis throughout the mowing season and sharpen as needed.
- ❑ First cut at 2" and remove clippings in order to reduce the threat of disease.

Perennials

- ❑ Remove previous years' growth prior to bulb development and mulch back into bed using a mower or chipper.
- ❑ Apply locally produced leaf mulch in the planting beds instead of wood chip mulch. Wood chips are a less desirable alternative in planting beds.
- ❑ Physically remove weeds by hand pulling, hoeing or cultivating.

Trees and Shrubs

- ❑ Apply dormant oil to control overwintering insects on shrubs and trees as the temperature climbs to above freezing.
    - o Mechanical or hand removal of pests should be done before any spray treatments.
- ❑ Use organic pesticides and fertilizers.
- ❑ Apply locally produced leaf mulch or shredded bark in the tree rings. Wood chips are a less desirable alternative unless completely free of inorganic debris or disease. Do not over mulch or allow mulch to touch the bark of the trees.

General

- ❑ Recommend the homeowner performs a soil test and implements formal recommendations provided by the soil tester, Appendix #5 "Soil Testing and Facilities." = potential up sell
- ❑ Repair any damage on-site from plowing and any broken snow plow equipment.
- ❑ Look for a desirable location on-site to compost or recycle landscape waste materials. Place compost or landscape waste in a location away from high use areas due to odors.
- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.
- ❑ Connect downspout to rain barrels and cisterns.

APRIL

Turf

- ❑ Over-seed with diverse and high-quality seed mix. Consult the homeowner to ensure no pre-emergent was used.
- ❑ Apply compost tea with fish oil and humates only if necessary. Appendix #6 "Sustainable Turf Care."

Perennials

- ❑ Physically remove weeds by hand pulling, digging or cultivating.
- ❑ Begin weeding by cultivating or hoeing the planting area. This practice needs to be consistently done every two weeks until mid-June to be effective.
- ❑ Scout for common April invasive species such as garlic mustard. Appendix #3 "Invasive Plant Species."

Trees and Shrubs

- ❑ Scout for plant health problems on entire landscape (ex. tent caterpillar). Monitor crabapples and hawthorns for infection of apple scab and rust diseases. Appendix #8 "Integrated Pest Management."
- ❑ Remove any dead plants or dead branches to reduce disease.
    - o When possible, mechanical or hand removal of pests should be done before any spray treatments.
- ❑ Root feed plants with a compost tea injection or organic fertilizer application.

Irrigation

- ❑ Start irrigation system. Check all equipment for proper operation. Set controller.
- ❑ Perform an irrigation system audit. Appendix #7 "Irrigation Management" = potential up sell
    - o Create a site plan and develop a weekly watering schedule and monthly inspection schedule. Appendix #7 "Irrigation Management"

General

- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.

April Sustainability Tip

- Try to use the landscape waste onsite as mulch or compost. Use a permitted landscape waste recycling/composting facility. Use a facility that creates sustainable byproducts (mulch, compost) if hauling offsite.
- Use an organic fertilizer if compost tea is unavailable.

MAY

Turf

- ❑ Apply an organic-based granular fertilizer (early in May for best results).
- ❑ Raise mower blades to 3."
- ❑ Catch clippings only when unsightly.

Perennials

- ❑ Continue to weed and cultivate every two weeks to control for weeds in planting beds.
- ❑ Use organic stakes or discarded tree branches to stake perennials (ex. peony).
- ❑ Opportune time to check and hand prune vines to maintain aesthetic value.

Trees and Shrubs

- ❑ Scout for disease and insect issues. Appendix #8 “Integrated Pest Management.”
- ❑ Amend soil around plants instead of using synthetic fertilizer.
- ❑ Prune flowering trees and shrubs after they are done flowering to prevent removal of flowering buds. Appendix # 2 “Pruning Trees and Shrubs”

General

- ❑ Continue with: irrigation system start ups, audits, site plans and watering and inspection schedules. Appendix #8 “Integrated Pest Management”
- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.
- ❑ Encourage the client to reduce excessive annuals in favor low maintenance perennials.

May Sustainability Tip

- Use bulk materials instead of bagged products.
- Save your back. Use a long-handled push hoe for manual weeding. The longer the handle, the less strain on your back.
- In severe cases, consider a non-selective herbicide to eradicate weed populations and then maintain with the before mentioned procedures. This practice promotes better use of time spent on each site. Communicate with the homeowner before applying any herbicide to determine their comfort level.

JUNE

Turf

- ❑ Spot spray post-emergent herbicide only when weed pressure dictates verses blanket spraying on a calendar date.
- ❑ Hand-pull weeds when quantity allows.

Perennials

- ❑ Continue to cultivate every two weeks to control for weeds in planting beds.
- ❑ Re-edge beds to discourage perennials from invading the turf and vice versa.

Trees and Shrubs

- ❑ Continue to scout for disease and insect issues.
- ❑ Prune trees and shrubs at their proper time with correct cultural methods. Appendix # 2 "Pruning Trees and Shrubs."
- ❑ Root feed plants with a compost tea injection or organic fertilizer application instead of using a synthetic fertilizer.

General

- ❑ Inspect irrigation system. Verify all components are operational and adjust watering schedule as needed.
- ❑ Monitor newly installed plants and supplement watering as needed.
- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.

June Sustainability Tip

- 👍 Avoid use of black plastic and landscape fabrics in planting beds.

JULY

Turf

- ❑ Apply compost tea with fish oils and humates.
- ❑ Raise mower blades to 3 ½".
- ❑ Stop catching clippings.
- ❑ Scout for and hand pull crabgrass. Apply post-emergent herbicide only as needed.

Perennials

- ❑ Continue cultivating and hand pulling weeds.
- ❑ Re-edge beds to discourage perennials from invading the turf and vice versa.

Trees and Shrubs

- ❑ Continue to scout for disease and insect issues.
- ❑ Prune trees and shrubs at their proper time with correct cultural methods. Appendix # 2 "Pruning Trees and Shrubs."

Snow

- ❑ Research deicing products and talk to your suppliers. Consider various families of deicers including:
  - Rock salts (NaCl): popular deicer. Salt can damage turf and harm plant material. Salt accumulates and causes the soil structure to break down and cause compaction. Salt runs off into waterways and can harm wildlife and aquatic plants. Salt is damaging to vehicles and asphalt. Salt is not effective in temperatures below 15 degree Fahrenheit.
  - Calcium chloride (CaCl2) and magnesium chloride (MgCL2): these are typically less corrosive than rock salt and work in temperatures below 15 degrees.
  - Liquid deicers: combined with liquid deicers is a better alternative than straight salt. Salt usage can be dropped by 25-30% which has economic and environmental impacts.

General

- ❑ Inspect irrigation system. Verify all components are operational and adjust watering schedule as needed.
- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.

July Sustainability Tip

- Price out the cost of installing low-maintenance plantings in place of high cost turf and shrubs and present the findings to the customer.

AUGUST

Turf

- ❑ Spot spray post-emergent herbicide only when weed pressure dictates.
- ❑ Do not catch clippings.

Perennials

- ❑ Remove weeds by hand pulling only as needed.

Trees and Shrubs

- ❑ Prune trees and shrubs at their proper time with correct cultural methods. Appendix # 2 "Pruning Trees and Shrubs."

Snow

- ❑ Create a deicing plan for each site. The best deicer for that site will consider: 1. the product is the most cost effective option for the site 2. the product is desired by the client given their use of the site 3. the product has environmental benefits. That will help you match the proper deicer to the site.
- ❑ Coat rock salt with a salt brine solution (where appropriate). The liquid on the salt keep the salt on the paved surfaces where it belongs. The combination also allows it to be used in colder temperatures.
- ❑ Pre-treat paved surfaces with a liquid brine solution prior to the snow event. This will melt snow when it lands. This creates less snow on the surface. Liquid brine is less corrosive and will last for a few days.

General

- ❑ Inspect irrigation system. Verify all components are operational and adjust watering schedule as needed.

- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.

August Sustainability Tip

- 👍 Compare the cost of upgrading the irrigation system to the resulting savings. Present the findings to the customer.

SEPTEMBER

Turf

- ❑ Core aerate. Top-dress with locally produced organic material.
- ❑ Over-seed with diverse and high-quality seed mix.
- ❑ Apply compost tea with fish oil and humates.
- ❑ Lower blades to 3".

Perennials

- ❑ Remove weeds by hand pulling as needed.
- ❑ Re-edge beds to discourage perennials from invading the turf and vice versa.
- ❑ Split and transplant large and underperforming perennials.

Trees and Shrubs

- ❑ Remove dead or damaged branches as needed.
- ❑ Prune trees and shrubs at their proper time with correct cultural methods. Appendix #2 "Pruning Trees and Shrubs."
- ❑ Root feed plants with a compost tea injection or organic fertilizer application.

Snow

- ❑ Develop a snow plan for each site. The snow plan will include
  - ☐ Determine what equipment will be used for the site and how that equipment will approach the site. Plow trucks, skidsteers, and front end loaders may be used given the needs of the site.
  - ☐ Discuss with the property manager how best to store equipment onsite. Keep in mind that the equipment should be easily accessible.
    - o Consider a backup plan for various types of snow events (ex. wet snow will clog machines)
  - ☐ Where will snow piles be placed during periods of high volume. The lowest area is the ideal location to relocate snow (detention or retention pond).
  - ☐ Consider plant material when identifying a snow storage site

General

- ❑ Inspect irrigation system. Verify all components are operational. Adjust watering schedule as needed.

- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.

September Sustainability Tip

- Ask yourself if you are using the right tool for the task and right size equipment for the job site. Using equipment that is too large or small can cost you time and money. Perform an inventory of all tools your maintenance crew uses.

OCTOBER

Turf

- ❑ Lower blades to 2 1/2" for the last cuts of the season.
- ❑ Consider reattaching grass-catchers for leaf removal.

Perennials

- ❑ Remove annual and herbaceous plant material and mulch or compost on-site.

Trees and Shrubs

- ❑ Remove dead or damaged limbs as needed.
- ❑ Prune trees and shrubs at their proper time with correct cultural methods. Appendix #2 "Pruning Trees and Shrubs."

General

- ❑ Perform proper machine and tool maintenance for increased efficiency and reduced emissions.
- ❑ Check plants for adequate moisture levels.
- ❑ Shut irrigation system down for winter. Make recommendations for system upgrades for following year.
    - o Update irrigation site plan.

Snow

- ❑ Prepare for the season by performing proper machine maintenance and investigating organic alternatives to de-icing agents.
- ❑ Review all snow personnel routing and determine the most efficient route plan. Use an internet mapping program to make sure fuel and time are on your side during a snow event.
- ❑ Meet with snow personnel to review the snow operations plan and procedures.
- ❑ Identify what sites will require hand-shoveling of walks and drives. Hand-shoveling should be utilized when possible as long as it does not interfere with public safety or the safety of the snow personnel.

October Sustainability Tip

- Price out the cost of replacing plants with high maintenance needs with ones that will thrive on their own. Consider increasing the number of plants in each bed to help with weed control. Present findings to the customer.

NOVEMBER

Turf

- ❑ Remove leaves from turf every 10 days by mulching/recycling them onsite. Reduce or eliminate dependence on municipal leaf removal.
- ❑ Do not mow turf when frost is present.
- ❑ Leave turf areas clean and free of all landscape debris in order to reduce disease.

Perennials

- ❑ Apply leaf compost as species require.
- ❑ Trim down weak or broken plants. Leave the plant if it will remain standing over winter.

Trees and Shrubs

- ❑ Prune trees and shrubs at their proper time with correct cultural methods. Appendix #2 "Pruning Trees and Shrubs.

General

- ❑ Perform proper machine and tool maintenance for increased efficiency and reduced emissions.
- ❑ Ensure irrigation system is shut-down to prevent freezing.
- ❑ Update irrigation site plan.
- ❑ Disconnect downspout from rain barrels and cisterns to prevent ice damage. Reconnect downspout to overflow system.

Snow

- ❑ Route plow trucks and shovel crews to save fuel and labor costs.
- ❑ Evaluate each site to determine the most efficient procedure for snow removal.
- ❑ Place snow stakes on properties to prevent damage from equipment and to identify fire hydrants.

November Sustainability Tip

- Price out the cost of replacing weak and diseased trees and shrubs compared to continuing treatment and present the findings to the customer.

DECEMBER

Turf

- ❑ Winterize landscape machinery.

Perennials

- ❑ Develop a perennial maintenance plan for the following year based on the success/failure of previous year's beds.

Trees and Shrubs

- ❑ Begin dormant pruning. Thin shrubs to reduce the size of mature shrubs.

General

- ❑ Perform proper machine maintenance for increased efficiency and reduced emissions.

Snow

- ❑ Reevaluate operations to determine what changes can be made to save time and materials.
- ❑ If deicing products are used, use as little as possible and use liquid melting agents. Liquid melting agents should have organic materials to melt ice. Avoid over salting as it has environmental and economic drawbacks.

December Sustainability Tip

- Send an email to the client to summarize the changes in your annual maintenance program.
  - Highlight the successes.
  - Follow up with the client on the costs presented by you for replacement of high maintenance plant material in the following year.
  - Thank them for their business and wish them happy holidays.

APPENDICES

NOTE: Each appendix is a starting point for information on the identified subject. The authors' intent is to add and update information over the life of the calendar. Better guides, resources, and best management practices will result over time. These materials should be added to these appendices to replace outdated information. In addition, readers should not hesitate to add their own information to supplement or replace what is provided by the authors. This is a living document that will evolve with time and better practice.

Appendix 1
Machine and Tool Maintenance

Appendix 2
Pruning Trees and Shrubs

Appendix 3
Invasive Plant Species

Appendix 4
Perennial Maintenance

Appendix 5
Soil Testing and Facilities

Appendix 6
Sustainable Turf Care

Appendix 7
Irrigation Management

Appendix 8
Integrated Pest Management

Appendix 9

Acknowledgments
Colorado Front Range Sustainable Landscaping Coalition: www.frslc.wetpaint.com
Sustainable Sites Initiative (SITES): www.sustainablesites.org
Larry Cammarata, Green Management Consultant, Brickman
Ed Beaulieu, Chief Sustainability Officer, Aquascape
The Midwest Ecological Landscaping Association (MELA): www.melaweb.org
Bob Posthuma, Greater Earth Organics
Rob Osier, Russo Outdoor Power Equipment
Roy Diblik, Northwind Perennial Farm
Stan Holat, Autumn Tree Care Experts, Inc.

Author

The ILCA Sustainable Landscaping Committee

Formed by ILCA Board resolution in 2009, the mission of the Sustainable Landscaping Committee is to develop programs and initiatives that educate and inform the green industry on sustainable landscaping practices. The Committee is comprised of contractors and suppliers to the landscape industry who want to implement sustainable practices. It is part of a growing national effort in landscaping to create aesthetically pleasing landscapes while improving and conserving the environment.

Committee Members

Tom Lupfer, CLT
Chairman, Sustainable Landscaping Committee

President, Lupfer Landscaping
8737 Ogden Avenue
Lyons, IL 60534
Phone (708)352-2765
Fax (708)443-5242
tlupfer@sbcglobal.net
www.sustainablelandscapinginc.com

Sustainable Landscape Committee: Draft I

Jim Gorsline, Scott Byron & Co.
Mike Martin, Muellermist
Catalino Mendoza, Midwest Groundcovers
Jessica Riedell- CLT, Brickman
Barb Schwarz, Nature's Perspective Landscaping
Dave Singler, Rolling Landscapes
Mark Toms, Western DuPage Landscaping
Christa Orum-Keller- Board Liaison, Midwest Groundcovers

Sustainable Landscape Committee: Draft II
Jim Gorsline, Scott Byron & Co.
Catalino Mendoza, Midwest Groundcovers
Jessica Riedell- CLT, The Brickman Group
Barb Schwarz, Nature's Perspective Landscaping
Dave Singler, Autumn Ridge Landscape and Design
Mark Toms, Western DuPage Landscaping
Jeff Swano, Dig Right In Landscaping, Inc.
Brandon Losey, Ringer's Landscape Service Inc.
Ed Beaulieu, Aquascape
Kevin Hebert, Kevin's Rain Gardens
Trish Beckjord, Midwest Groundcovers

Lisa Fiore- Board Liaison, Fiore Nursery and Landscape Supply

Appendix 1
Machine and Tool Maintenance

NOTE: Each appendix is a starting point for information on the identified subject. The authors' intent is to add and update information over the life of the calendar. Better guides, resources, and best management practices will result over time. These materials should be added to these appendices to replace outdated information. In addition, readers should not hesitate to add their own information to supplement or replace what is provided by the authors. This is a living document that will evolve with time and better practice.

ILCA®
ILLINOIS LANDSCAPE CONTRACTORS ASSOCIATION

Maintenance of Small Equipment

Start up of Equipment

- Change oil
- Replace oil filter
- Check/replace spark plugs
- Lubricate/grease fittings
- Sharpen blades where needed
- Check air cleaners and filters
- Replace fuel filter

Daily Maintenance

- Check all oil levels. Fill as needed
- Grease fittings as needed
- Check for fuel or oil leakage. Correct as needed
- Check and clean air filters
- Check all bolts and nuts for tightness. Tighten as needed
- Check blades for sharpness. Sharpen as needed
- Clean out debris around belts
- Clean debris under any decks
- Check tire pressure and inflate as needed

Weekly Maintenance

- Inspect for cracks in frame or other steel parts
- Inspect all belts for wear, adjustment and alignment. Replace as needed
- Replace/sharpen blades
- Inspect and tighten all hydraulic hoses where needed
- Inspect breaking system and repair as needed

Monthly Maintenance

- Inspect all tires and replace as needed
- Change engine oil
- Change oil filter
- Clean and re-gap spark plugs. Change as needed

Annually Maintenance

- Change hydraulic oil
- Replace fuel filter
- Replace air filters
- Replace fuel filter
- Completely inspect machine for excessive wear of all parts. Replace as needed
- Remove battery and clean battery box, cables and battery terminals

Source: The ILCA Sustainable Landscaping Committee

Appendix 2

Pruning Trees and Shrubs

ILCA

ILLINOIS LANDSCAPE
CONTRACTORS ASSOCIATION

UNIVERSITY OF MINNESOTA
EXTENSION
WW-00628 Reviewed 2009
http://www.extension.umn.edu/distribution/horticulture/dg0628.html

Pruning Trees and Shrubs

Mike Zins and Deborah Brown, Extension Horticulturists

Pruning is a horticultural practice that alters the form and growth of a plant. Based on aesthetics and science, pruning can also be considered preventive maintenance. Many problems may be prevented by pruning correctly during formative years for a tree or shrub.

REASONS FOR PRUNING

1. **Prune to promote plant health.**

   - Remove dead or dying branches injured by disease, severe insect infestation, animals, storms, or other adverse mechanical damage.
   - Remove branches and branch stubs that rub together.

   Avoid topping trees. Removing large branches leaves stubs that can cause several health problems. It also destroys the plant's natural shape and promotes suckering and development of weak branch structure.

2. **Prune to maintain plants; intended purposes in a landscape, such as:**

   - encouraging flower and fruit development,
   - maintaining a dense hedge, or
   - maintaining a desired tree form or special garden forms.

3. **Prune to improve plant appearance**

Appearance in the landscape is essential to a plant's usefulness. For most landscapes, a plant's natural form is best. Avoid shearing shrubs into tight geometrical forms that can adversely affect flowering. Alter a plant's natural form only if it needs to be confined or trained for a specific purpose. When plants are pruned well, it is difficult to see that they have been pruned! Prune to:

- control plant size,
- keep evergreens well-proportioned, or
- remove unwanted branches, waterspouts, suckers, and undesirable fruiting structures that detract from plant appearance.

4. **Prune to protect people and property.**

- Remove dead branches.
- Have hazardous trees taken down
- Prune out weak or narrow-angled tree branches that overhang homes, parking areas, and sidewalks — anyplace falling limbs could injure people or damage property.
- Eliminate branches Eliminate branches that interfere with street lights, traffic signals, and overhead wires. **REMEMBER, *DO NOT*** attempt to prune near electrical and utility wires. Contact utility companies or city maintenance workers to handle it.
- Prune branches that obscure vision at intersections.
- For security purposes, prune shrubs or tree branches that obscure the entry to your home.

PRUNING BEGINS AT PLANTING TIME

Pruning is really the best preventive maintenance a young plant can receive. It is critical for young trees to be trained to encourage them to develop a strong structure. (See Figure 1 on page 2)

Too many young trees are pruned improperly or not pruned at all for several years. By then it may become a major operation to remove bigger branches, and trees may become deformed.

At planting, remove only diseased, dead, or broken branches. Begin training a plant during the dormant season following planting.

- Prune to shape young trees, but don't cut back the leader.

- Remove crossing branches and branches that grow back towards the center of the tree.

- As young trees grow, remove lower branches gradually to raise the crown, and remove branches that are too closely spaced on the trunk.

- Remove multiple leaders on evergreens and other trees where a single leader is desirable

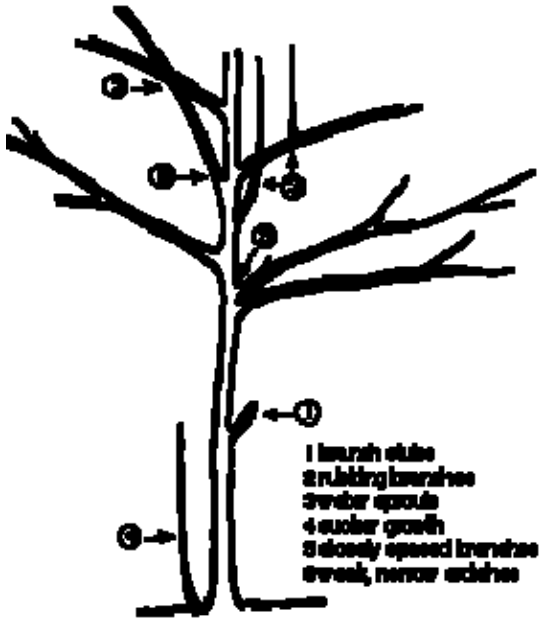
Pruning young shrubs is not as critical as pruning young trees, but take care to use the same principles to encourage good branch structure.

- When planting bare root deciduous shrubs, thin out branches for good spacing and prune out any broken, diseased, or crossing/circling roots.

- When planting bare root deciduous shrubs for hedges, prune each plant to within 6 inches of the ground.

- Newly planted shrubs require little pruning if they were container-grown or were dug with a soil ball.

Figure 1. Prune this young tree to remove:



PRUNING LARGE ESTABLISHED TREES

Leave the pruning of large trees to qualified tree care professionals who have the proper equipment. Consider the natural form of large trees whenever possible. Most hardwood trees have rounded crowns that lack a strong leader, and such trees may have many lateral branches.

The three most common types of tree pruning are:

1. **Crown Thinning-**selectively removing branches on young trees throughout the crown. This promotes better form and health by increasing light penetration and air movement. Strong emphasis is on removing weak branches. (Don't overdo it on mature trees.)

2. **Crown Raising —** removing lower branches on developing or mature trees to allow more clearance above lawns, sidewalks, streets, etc.

3. **Crown Reduction —** removing larger branches at the top of the tree to reduce its height. When done properly, crown reduction pruning is different from topping because branches are removed immediately above lateral branches, leaving no stubs. Crown reduction is the least desirable pruning practice. It should be done only when absolutely necessary.

PROPER BRANCH PRUNING

- To shorten a branch or twig, cut it back to a side branch or make the cut about 1/4 inch above the bud.

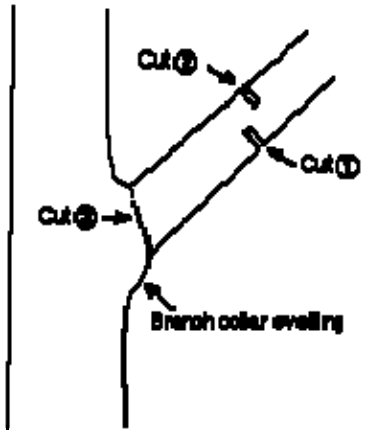
- Always prune above a bud facing the outside of a plant to force the new branch to grow in that direction.

Figure 2. Pruning small branches

Pruning large branches (Figure 3, below)

- To remove large branches, three or four cuts will be necessary to avoid tearing the bark. Make the first cut on the underside of the branch about 18 inches from the trunk. Undercut one-third to one-half way through the branch. Make the second cut an inch further out on the branch; cut until the branch breaks free.

- Before making the final cut severing a branch from the main stem, identify the branch collar. The branch collar grows from the stem tissue around the base of the branch. Make pruning cuts so that only branch tissue (wood on the branch side of the collar) is removed. Be careful to prune just beyond the branch collar, but **DON'T** leave a stub. If the branch collar is left intact after pruning, the wound will seal more effectively and stem tissue probably will not decay.



- The third cut may be made by cutting down through the branch, severing it. If, during removal, there is a possibility of tearing the bark on the branch underside, make an undercut first and then saw through the branch.

- Research has shown wound dressing is not normally needed on pruning cuts. However, if wounds need to be covered to prevent insect transmission of certain diseases such as oak wilt, use latex rather than oil-based paint.

TIMING

The late dormant season is best for most pruning. Pruning in late winter, just before spring growth starts, leaves fresh wounds exposed for only a short length of time before new growth begins the wound sealing process. Another advantage of dormant pruning is that it's easier to make pruning decisions without leaves obscuring plant branch structure. Pruning at the proper time can avoid certain disease and physiological problems:

Pruning at the proper time can avoid certain disease and physiological problems:

- To avoid **oak wilt** disease **DO NOT** prune oaks during April, May, or June. If oaks are wounded or must be pruned during these months, apply wound dressing to mask the odor of freshly cut wood so the beetles that spread oak wilt will not be attracted to the trees.

- To avoid increased likelihood of **stem cankers**, prune honey locusts when they are still dormant in late winter. If they must be pruned in summer, avoid rainy or humid weather conditions.

- Prune apple trees, including flowering crabapples, mountain ash, hawthorns and shrub cotoneasters in late winter (February-early April). Spring or summer pruning increases chances for infection and spread of

the bacterial disease **fireblight.** Autumn or early winter pruning is more likely to result in drying and die-back at pruning sites.

- Some trees have free-flowing sap that “bleeds” after late winter or early spring pruning. Though this bleeding causes little harm, it may still be a source of concern. To prevent bleeding, you could prune the following trees after their leaves are fully expanded in late spring or early summer. Never remove more than 1/4 of the live foliage. Examples include:
  - all maples, including box elder
  - butternut and walnut
  - birch and its relatives, ironwood and blue beech.

Trees and shrubs that **bloom early** in the growing season on last year’s growth should be pruned immediately after they finish blooming:

apricot	clove currant	Juneberry
azalea	flowering plum	lilac
chokeberry	or cherry	magnolia
chokecherry	forsythia	early blooming spirea

Shrubs grown primarily for their **foliage** rather than showy flowers should be pruned in spring, before growth begins:

alpine currant	dogwood	purpleleaf sandcherry
barberry	honeysuckle	smokebush
buffaloberry	ninebark	sumac
burning bush	peashrub	

Shrubs that **bloom on new growth** may be pruned in spring before growth begins. Plants with marginally hardy stems such as clematis and shrub roses should be pruned back to live wood. Hardier shrubs such as late blooming spireas and smooth (snowball) hydrangeas should be pruned to the first pair of buds above the ground.

PRUNING HEDGES:

After the initial pruning at planting, hedges need to be pruned often. Once the hedge reaches the desired height, prune new growth back whenever it grows another 6 to 8 inches. Prune to within 2 inches of the last pruning. Hedges may be pruned twice a year, in spring and again in mid-summer, to keep them dense and attractive. Prune hedges so they’re wider at the base than at the top, to allow all parts to receive sunlight and prevent legginess.

RENEWAL PRUNING FOR OLDER OR OVERGROWN SHRUBS:

Every year remove up to one-third of the oldest, thickest stems or trunks, taking them right down to the ground. This will encourage the growth of new

stems from the roots. Once there are no longer any thick, overgrown trunks left, switch to standard pruning as needed.

PRUNING EVERGREENS:

With few exceptions, evergreens (conifers) require little pruning. Different types of evergreens should be pruned according to their varied growth habits.

- **Spruces, firs and douglas-firs** don't grow continuously, but can be pruned any time because they have lateral (side) buds that will sprout if the terminal (tip) buds are removed. It's probably best to prune them in late winter, before growth begins. Some spring pruning, however, is not harmful.

- **Pines** only put on a single flush of tip growth each spring and then stop growing. Prune before these "candles" of new needles become mature. Pines do not have lateral buds, so removing terminal buds will take away new growing points for that branch. Eventually, this will leave dead stubs.

  Pines seldom need pruning, but if you want to promote more dense growth, remove up to two-thirds of the length of newly expanded candles. Don't prune further back than the current year's growth.

- **Arborvitae, junipers, yews, and hemlocks** grow continuously throughout the growing season. They can be pruned any time through the middle of summer. Even though these plants will tolerate heavy shearing, their natural form is usually most desirable, so prune only to correct growth defects.

USE THE RIGHT TOOLS FOR PRUNING

The right tools make pruning easier and help you do a good job. Keeping tools well-maintained and sharp will improve their performance. There are many tools for pruning, but the following will probably suffice for most applications:

- A good pair of **pruning shears** is probably one of the most important tools. Cuts up to 3/4 inches in diameter may be made with them.

Pruning shears

- **Lopping shears** are similar to pruning shears, but their long handles provide greater leverage needed to cut branches up to 11/2 inches in diameter.

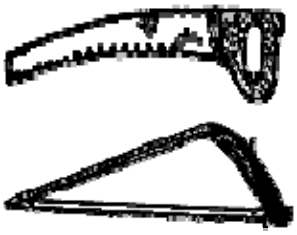
Lopping shears

- **Hedge shears** are meant only for pruning hedges, nothing else. They usually cut succulent or small stems best.

Hedge shears

- **Hand saws** are very important for cutting branches over 1 inch in diameter. Many types of hand saws are available. Special tri-cut or razor tooth pruning saws cut through larger branches — up to 4 inches in diameter — with ease.

Hand saws



- **Pole saws** allow for extended reach with a long handle, but they must be used carefully as it's difficult to achieve clean cuts with them.

- Small **chain saws** are available for use on larger branches. Operators must wear protective clothing and exercise caution when using them. Never use chain saws to reach above your shoulders, or when you are on a ladder.

Mike Zins and Deborah Brown are Extension Horticulturists with the University of Minnesota Extension Service.

This publication is based on an earlier version written by Mervin Eisel, former Extension Horticulturist.

Appendix 3
Invasive Plant Species

ILCA
ILLINOIS LANDSCAPE
CONTRACTORS ASSOCIATION

Introduction and Overview on Controlling Invasive Species

Learning to identify invasive plant species and watch for them is an important step in controlling them. The sooner invasive plants are detected, the easier and cheaper it is to control them. Management costs escalate when invasive populations are allowed to spread.

Invasive plant populations quickly explode after disturbance to soil; decreasing their numbers prior to embarking on a project, is a good way to avoid this dramatic increase.

Require the cleaning of equipment before it comes onto a new job site to prevent the movement of seeds of invasive species caught on tire treads and undercarriages.

Avoid using invasive species in landscape designs. If there are invasive species in an established planting which the property owner is not willing to eliminate, be responsible and remove and destroy seed heads of these invasive plants. Work with clients to find non-invasive or native alternatives for invasive landscape plants. Before choosing a native plant alternative, first think about the characteristics of the invasive plant you are replacing. For example, if you like the showy fruits of Asian bittersweet, try replacing it with American bittersweet.

All non-native species are not bad. Many non-native species do not cause problems in the areas where they are introduced and can be important for agriculture, horticulture, medicine, or other uses.
The species of concern are those that become invasive, taking over native ecosystems and crowding out native species. It is often difficult to know in advance if a new species that is introduced will become invasive, so great caution should be used when importing or planting new species.

Cutting, hand-pulling, or mowing are not always the best ways to control invasive species. This is true in some instances. Small infestations of some species, such as garlic mustard, can be removed by hand-pulling. However, hand-pulling for large infestations leaves large patches of disturbed soil, and often seeds from the seed bank will germinate and re-colonize areas where garlic mustard has been removed. Properly-timed cutting or mowing can also control some species, however, perennials such as Canada thistle should not be cut or pulled. Removing only part of the plant will only stimulate growth and produce more plants. Combining cutting with herbicides can be an effective method of treatment for many species.

Actions you can take:

- Learn how to identify the invasive plants that are in your area. Early detection and eradication of small infestations and prevention of new infestations are the most cost-effective ways to manage invasive plants.
- Make sure that seeds are not stuck to your clothes or equipment in order that you do not introduce or spread these plants to other areas. Clean soil and debris off your vehicle, equipment and your foot gear between sites.
- Don’t specify or plant invasive species. Find native or non-invasive alternative species to plant instead.

(From Midwest Invasive Plant Network)

Definition of Invasive Species

As defined by Illinois DNR, Strategic Plan for the Illinois Invasive Plant Species Council, 2007

> "With respect to a particular ecosystem, any species that is not native to that ecosystem, including its seeds, spores, or other biological material capable of propagating that species AND whose introduction does or is likely to cause economic or environmental harm."

As defined by the Midwest Invasive Plant Network

> "An invasive plant is a plant that is not native and has negative effects on our economy, environment, or human health. Not all plants introduced from other places are harmful. The term "invasive" is reserved for the most aggressive plant species that grow and reproduce rapidly, causing major changes to the areas where they become established."

As defined by the City of Chicago

> "An invasive species is one that is usually non-native to an ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health, for example, by:
>
> - out-competing native species for resources and pollinators
> - altering the ecology of natural areas
> - weakening or damaging equipment and infrastructure
> - spreading pathogens and parasites
> - reproducing rapidly
>
> Invasive species spread over large areas of the landscape and have few, if any, natural controls, such as predators or diseases, to keep them in check."

Definition of Native and Non-Native Species

Native

> A native species is one that occurs naturally in a particular place without human intervention. Species native to North America are generally recognized as those occurring on the continent prior to European settlement.

Non-native

> An organism is considered non-native when it has been introduced by humans to a location outside its native or natural range.

Common Invasive Species and Substitutions (MIPN)

Species Name	**Common Name**	**What to Substitute**
Euonymus alatus	Burning Bush	Aronia arbutifolia, Aronia melanocarpa, Itea virginica, Rhus copallium, Euonymus atropurpureus
Lonicera Maackii, Lonicera morrowii, Lonicera tatarica, Lonicera x bella	Amur Honeysuckle, Morrow's Honeysuckle, Tatarian Honeysuckle, Bell's Honeysuckle	Amelanchier, Kolkwitzia, Sambucus canadensis, Stephanandra
Lythrum salicaria	Purple Loosestrife	Liatris spicata, Lobelia cardinalis, Asclepias incarnata
Rhamnus cathartica, Rhamnus	Common Buckthorn, Glossy	Carpinus caroliniana, Corylus

frangula	Buckthorn	Americana, Thjua occidentalis

USDA

Agencies & Organizations
http://www.invasivespeciesinfo.gov/resources/il.shtml

Councils and Task Forces
http://www.invasivespeciesinfo.gov/resources/ilcouncil.shtml

Laws and Regulations
http://www.invasivespeciesinfo.gov/laws/il.shtml

Management Plans
http://www.invasivespeciesinfo.gov/toolkit/il.shtml

Invasive and Noxious Weeds List
http://plants.usda.gov/java/noxious?rptType=State&statefips=17

Top Ten Abundant Invasive Plants
http://www.eddmaps.org/tools/statereport.cfm?id=us_il

Midwest Invasive Plant Network

Mission: To reduce the impact of invasive plant species in the Midwest.

http://mipn.org/

Landscape Alternatives for Invasive Plants of the Midwest
http://mipn.org/MIPN%20redraft2.pdf

New Invasive Plant Species Identification Chart
http://mipn.org/Final%20Invasive%20Species.07%20high%20res.pdf

A Field Guide to Invasive Plants of the Midwest – available for $3.00

City of Chicago

http://www.cityofchicago.org/content/dam/city/depts/doe/general/NaturalResourcesAndWaterConservation_PDFs/InvasiveSpecies/LandbasedInvasivePlantBrochure2009.pdf

http://www.cityofchicago.org/city/en/depts/doe/supp_info/invasive_species.html

http://www.cityofchicago.org/content/dam/city/depts/doe/general/NaturalResourcesAndWaterConservation_PDFs/InvasiveSpecies/AIS_Flyer_2009_lores.pdf

http://www.cityofchicago.org/content/dam/city/depts/doe/general/NaturalResourcesAndWaterConservation_PDFs/InvasiveSpecies/PressReleaseInvasiveSpeciesAddendumApril72009.pdf

Chicago Botanic Garden

http://www.chicago-botanic.org/research/conservation/invasive/chicago/index.php
(I think this is one of the better lists)

http://www.chicago-botanic.org/research/conservation/invasive/index.php

http://www.chicago-botanic.org/research/conservation/invasive/whatis.php

Morton Arboretum

http://www.mortonarb.org/tree-plant-advice/article/867/invasive-trees-shrubs-and-vines.html

Chicagoland Wilderness / Northern Illinois Invasive Plant Partnership

http://www.chicagowilderness.org/NIIPP.php

http://www.niipp.net/

http://www.niipp.net/control_management.php

Illinois Department of Natural Resources

http://dnr.state.il.us/orep/ctap/invasive/

http://dnr.state.il.us/orep/ctap/invasive/page1.htm

http://dnr.state.il.us/orep/ctap/invasive/table1.htm

Little Things, Big Problems: Video Series on Invasive Species
National Park Service, in partnership with the Great Lakes Restoration Initiative, has released a series of four, 5-minute videos discussing the impact of invasive species on people and communities as well as what the public can do to prevent their spread. The following videos are available at the Great Lakes Restoration YouTube Channel, http://www.youtube.com/user/Gr8LakesRestoration:
Emerald Ash Borer
Spotted Knapweed
Invasive Plants In Our Parks
Aquatic Invaders

Appendix 4

Perennial Maintenance

ILCA

ILLINOIS LANDSCAPE
CONTRACTORS ASSOCIATION

Choosing the right plant for a site is equally dependent on site characteristics, functional needs and on aesthetic impact. A planted site on which the plants fail, because they are growing in conditions for which they are not suited, will require replanting or re-landscaping. This process in itself is a non-sustainable practice from an ecological, maintenance and cost perspective.

Ultimately choosing plants matched to the cultural conditions of the site will produce a more durable landscape with reduced costs in terms of survivability, and maintenance costs including replacement, weed control, pruning and disease treatment.

Typical site condition considerations include:

- Soil type
- Moisture levels / Drainage
- Light levels / Exposure – prevailing winds, protection, morning / afternoon sun
- Hardiness Zone

Choosing plants which not only thrive on the site, but which can perform multiple site functions creates a more sustainable planting solution. Consider choosing plants which can offer shelter for wildlife, mitigate runoff situations, provide drainage solutions in the form of rain gardens or reduce maintenance costs such as pruning, weeding, chemical applications or mowing.

Begin plant choice decision making by inspecting the site to assess the above mentioned site characteristics. Taking a soil test is an excellent preliminary evaluative tool. Appraise design and client requirements and site characteristics to arrive at successful and functional plant choices. Use plant databases to search for suitable plants by searching by the site characteristic requirements.

Plant Database Resources include:

- Chicago Botanic Garden
  http://www.chicagobotanic.org/plantinfo/pp/index.php

- Illinois' Best Plants
  http://www.bestplants.org/

- Landscape Plants of the Upper Midwest
  http://www.midwestlandscapeplants.org/index.cfm

- Missouri Botanic Garden
  http://www.mobot.org/gardeninghelp/plantfinder/Alpha.asp

- The Morton Arboretum
  http://www.mortonarb.org/tree-plant-advice.html

- Ohio State University

http://plantfacts.osu.edu/

- University of Illinois Plants
  http://woodyplants.nres.uiuc.edu/

- USDA Natural Resources Conservation Services
  http://plants.usda.gov/characteristics.html

Appendix 5

Soil Testing and Facilities

ILCA®
ILLINOIS LANDSCAPE
CONTRACTORS ASSOCIATION

Soil testing and thorough evaluation of site conditions provide the basis for proper plant selection and longevity, and decreasing replacement rates. Minimizing turf area and applying no-mow seed mixes saves not only time and resources, but ultimately decreased need for mowing, fertilization and irrigation.

Despite advances in the safety and chemistry of pesticides, the public perception of pesticide use is a double edged sword. On one hand, the control of pests is viewed as a necessity. On the other hand most wish to reduce or even eliminate the use of chemicals altogether. Many people are becoming more concerned about the long term effect chemicals of all kinds have on the environment and human health.

In the world of landscapes, the key to the reduction of chemical use is found in the soil. By focusing on creating healthy soil conditions, the need for pesticides and other chemicals is greatly reduced. Plants thrive and water management becomes more efficient because good soil structure maximizes the soils ability to both absorb water and drain off excess water.

By creating a soil environment where micro and macro biological activity are abundant, we see a positive influence on the flora, water quality and quantity in the landscape. In addition, we see overall higher quality of plant material being grown and maintained. Finally, we see a reduction in synthetic inputs to maintain the landscape.

The long term benefit for creating a healthy soil environment is that overall site costs are reduced – cutting nitrogen by 25% or more, eliminating fungicides (and other pesticides), reducing or eliminating aeration services, and reducing water consumption.

An Introduction to the Components of a Soil Test

Listed below are the elements of a soil test and some related definitions and general information.

Total Exchange Capacity (TEC)
Refers to a soils ability to hold and exchange nutrients. A TEC of 20 can hold twice the amount of a TEC of 10. A balance of nutrients in the soil is critical; TEC is used to factor the amount of nutrients we apply.

Desired Ca: Mg Ratio 69:11
Calcium and magnesium are primarily responsible for a soils physical structure, but are also critical to a plant's development. Calcium loosens soil, while magnesium acts as the glue to tighten soil. Soils that have 69% calcium and 11% magnesium are naturally mellow and crumbly. Many soils in NE Texas have both

high Ca and Mg levels. For every percentage point Ca is over 69%, the same amount of Mg that is being tied up, causing a tightening affect on the soil.

pH
We are not concerned about the pH as much as we are about what nutrients cause the high pH in our soils. An excess or deficiency of any one of the nutrients in the soil can increase or decrease the pH reading. Calcium, magnesium, potassium and sodium all have an effect on the alkalinity of a soil. Our goal is to balance the soil that, in turn, will lower the pH closer to 6.5. A pH of 6.5 is desired because this is where most nutrients are more readily available.

Humus Content, Percent
This test calculates humus and not organic matter. The difference is that leaves, roots, and sticks are not accounted for in the percent given. The humus percentage given is the amount of active humus that is providing nutrients to your plants. Higher humus gives soil a buffer to provide whatever deficiencies may be lacking. Humus percent also determines how much nitrogen will be released over a growing season. An ideal soil will have 5% humus.

Base Saturation Percent
This tells us the total amount of positively charged nutrients (cations) in a soil. The total percentage of each cation equals 100%. Base saturation identifies a soil's balance of nutrients and overall fertility.

Calcium
In our heavy gumbo soil we would like to see the Ca percent at 69%. It is common to see Ca in the 75% - 85% range in our area. We use sulfur to drive calcium down. The high Ca takes up a majority of the space in the soil, preventing the efficient uptake of other nutrients. Calcium is needed to feed the microorganisms and affects the permeability of plant cell walls and the thickness of stems.

Magnesium
Mg is important for photosynthesis and acts as the glue in a soil. Too much Mg in a soil causes compaction and tightness, creating major problems. The desired percentage is 11%. Many soils have a low Mg level at around 4% - 7%. The actual amount of Mg in a soil can be figured by subtracting 69% from the percentage of Ca found on the soil test, then adding that figure to Mg percentage. This demonstrates the amount of Mg that is being tied up by Ca and unavailable to a growing plant. But, until Mg is above 11%, the Mg will be a limiting factor as a plant nutrient.

Potassium
Desired value is 5%, but we like to see it closer to 7% for lawns and trees. Potassium is the most critical factor in a lawn's ability to withstand wear and tear. In trees, potassium helps give stalk strength. Potassium has been referred to as

the poor man's irrigation, because potassium will help a plant through droughts more than any other nutrient.

Sodium
Normally sodium is not a concern. Some neighborhoods have salt problems caused by watering incorrectly, causing the salt to accumulate. Watering for short periods of time frequently can cause a sodium build-up. We recommend one inch of water a week, without causing excessive runoff. This schedule will flush the harmful salts out of the root zone. Major problems arise when sodium is higher than potassium. Sodium and potassium are similar elements and plants will take sodium up instead of potassium, causing cells in the plant to die.

Supplementary Information

Other Bases
Micronutrients Boron, Iron, Manganese, Copper and Zinc are calculated in parts per million, not in the Base Saturation Percent.

Exchangeable Hydrogen
This represents the amount of space hydrogen takes up on the soil particles. The more exchangeable the hydrogen, the more room there is for nutrients to push hydrogen aside and attach themselves.

Anions
Negatively charged ions, such as Nitrogen, Sulfate and Phosphate.

Nitrogen
A calculated value from the release of humus. Nitrogen is necessary for the formation of every cell. A large amount of available nitrogen - as found in synthetic fertilizers - causes the humus to burn out and creates rapid unhealthy growth in plants.

Sulfate
Desired value of 50 p.p.m. Excessive sulfates above 150 indicate a drainage problem. Sulfur and sodium are the most soluble nutrients that will remain in the soil. Sulfur is used to balance the Ca and Mg ratios.

Phosphate
Phosphate is the workhorse of plant nutrition because it has to be there for cell division and growth, for photosynthesis and for energy utilization. Phosphate is a nutrient that creates problems when it is supplied as a synthetic fertilizer. It has a triple negative charge, with a strong attraction to Ca to form tricalcium phosphate. The way we overcome this quick tie-up is by supplying phosphate from an organic fertilizer.

Cations

Positively charged ions, such as Calcium, Magnesium, Potassium, & Sodium. The listings for cations designate the pounds per acre found and the desired pounds per acre, which is used to calculate the Base Saturation Percent, which is what we are interested in correcting.

Traces (Boron, Iron, Manganese, Cooper, Zinc)
Trace elements are essential nutrients that need correcting when they become the limiting factor. The major elements must be corrected before the minor trace elements begin to work their wonders.

Taking Good Soil Samples

1. Use a clean soil probe.
2. Use a new soil sample bag or an unused quart plastic bag.
3. Be sure to label the bag with location and sample number. Use the sample number as the identifying mark on the soil test information sheet.
4. Separate samples should be taken from areas that are known to be treated significantly different from one another; from areas that behave significantly different and from areas that have a different soil structure, or origin.
5. Randomly sample the area, probing 10-15 times total.
6. Provide soil from the 2” down to 6” down (Pull the plug, then remove the top 2” and anything beyond 6” deep.
7. Record the average depth the probe is able to go (note the soil moisture, too (saturated, wet, good, slightly dry or very dry).
8. Record the average rooting depth. (If the roots of the turfgrass come out the bottom of the probe, record the entire length of the core as the depth, if you see roots when you remove all but the top 6 inches, record 6” as the depth. If there are no roots at 6”, remove the top 2” that you are going to discard, if there are roots at that point, record 2”, if there are none at that level, record 1” or less as the root depth.
9. Do not include the thatch level as a part of the measurement. If the thatch layer is greater than 1”, record the depth of the thatch layer as well.
10. Fill out the submission form (Farm should be the site, field should be the general location on the site, sample should be your record name or number. Crop should be turf (note a specific type of turf if you know that & it’s important. Mark if any liming was done and when. Mark building or maintenance for program level. Mark standard test and, if critical, mark salt concentration. At this point do not list anything for fertilizers used unless the client demands a certain type.)
11. Make a copy of the submission form, record information on your records for tracking results.

University of Illinois Extension : Soil Testing Labs

This list is provided for your reference. Call for current fees and services. Request an interpretation of the soil test results. Often labs will provide sample bags prior to you taking a soil sample, if you request sampling information.

H = accepts home samples

I = provides interpretations for home samples

C = accepts agricultural samples

M = test for heavy metals (lead, arsenic)

A&L Great Lakes Agricultural Lab

(H I C M)

3505 Conestoga Drive

Fort Wayne, IN 46808-4413

Phone: (260) 483-4759

Fax: (219) 483-5274

http://www.algreatlakes.com/

Email: Lab@algreatlakes.com

AgriEnergy Resources

(H I C)

21417 1950 E Street

Princeton, IL 61356

Phone: (815) 872-1190

Fax: (815) 872-1928

http://www.agrienergy.net/

Email: gcampbell@agrienergy.net

Alvey Laboratory

(H C)

1511 E. Main Street, PO Box 175

Belleville, IL 62222
Phone: (618) 233-0445
Fax: (618) 233-7292
http://www.alveylabs.com/
Email: alveylab@aol.com

ASM Inc.
(H I C)
2106 County Road 1000 East
P.O. Box 3655
Champaign, IL 61826
Phone: (217) 356-5756
Fax: (217) 356-8609
http://www.asmlabs.net
Email: asm@volomail.net

Brookside Laboratories, Inc.
(H C)
308 S Main St.
New Knoxville, OH 45871
Phone: 419-753-2448
Fax: 419-753-2949
http://www.blinc.com/
Email: Mflock@blinc.com

GMS Laboratories
(H I C M)
23877 E. 00 North Road, PO Box 61
Cropsey, IL 61731
Phone: (309) 377-2851
Fax: (309) 377-2017
http://www.gmslab.com/pages/home
Email: office@gmslab.com

Ingram’s Soil Testing Center
(H C)
13343 Fitschen Rd.
Athens, IL 62613
Phone: (217) 636-7500
Fax: (217) 636-7500
Email: istcl@sbcglobal.net

Key Agricultural Services, Inc.
(H C)
114 Shady Lane
Macomb, IL 61455
Phone: (309) 833-1313
Fax: (309) 833-3993
http://www.keyaginc.com/
Email: keyag@macomb.com

KSI Laboratories
(H C)
202 S. Dacey, Box 497
Shelbyville , IL 62565-0497
Phone: (217) 774-2421
Fax: (217) 774-2866
http://ksilab.com/
Email: ksilabdbrummer@consolidated.net

Mississippi Valley Soil Testing Lab
(H C)
1074 Broadway
Hamilton, IL 62341
Phone: (217) 847-3539/1-800-768-8305
Email: mvsoil@mchsi.com

Mowers Soil Testing Plus, Inc.
(H C)
117 E. Main Street
Toulon, IL 61483
Phone: (309) 286-2761
Fax: (309) 286-6251
http://www.mowersplus.com/
Email: aholmes@mowersplus.com

Soiltech, Inc.
(H I)
22256 3375 East Street
Arlington, IL 61312
Phone: (815) 638-2522
Fax: (815) 638-2522
http://www.soiltech.com/
Email: ebart@mtco.com

Southern Illinois Soil Lab
(H C)
375 N. Old US Rt. 66, PO Box 448
Hamel , IL 62046
Phone: (618) 633-1811
Fax: (618) 633-1810
Email: sisl@madisontelco.com

Sparks Soil Testing Service
(H C)
1200 N. Kickapoo, Box 841
Lincoln , IL 62656
Phone: (217) 735-4233

Fax: (217) 735-4626
Email: Sstlinfo@aol.com

Spectrum Analytic, Inc.
(H I)
1087 Jamison Rd.
Washington C.H., OH 43160
Phone: 740-335-1562
Fax: 740-335-1104
http://www.spectrumanalytic.com/
Email: Vernon@spectrumanalytic.com

United Soils, Inc.
(H C : Must request interpretation of results)
111 S. Crystal Lane
Fairbury, IL 61739
Phone: (815) 692-2626
Fax: (815) 692-4483
http://www.unitedsoilsinc.com/
Email: agronomist@unitedsoilsinc.com

Universal Analytical Laboratory, Inc.
(H C)
15006 State Route 127
Carlyle, IL 62231
Phone: 618-594-2627
Fax: 618-594-2637
http://www.ualab.com/
Email: Ualab@ualab.com

Waters Agricultural Laboratories

2101 Highway 81
Owensboro, KY 42301
Phone: 270-685-4039
Fax: 270-685-3989
http://www.watersag.com/frame.htm
Email: rhonda.c@watersag.com

Appendix 6

Sustainable Turf Care

ILCA

ILLINOIS LANDSCAPE
CONTRACTORS ASSOCIATION

Compost tea helps establish and maintain a healthy environment for vibrant plant health. It is an excellent treatment when used on a regular schedule for trees, shrubs and turf. It adds to profitability and is on the leading edge of "green" and sustainable management practices. It is very easy to implement in landscape programs. The process works like this;

1) Compost tea requires a machine/device to aid in production. Compost tea machines can either be purchased or built from scratch.

   Purchase a machine: www.greaterearthorganics.com

   Build: http://www.uos.harvard.edu/fmo/landscape/organiclandscaping/index.shtml

   Purchase compost tea: contact local suppliers who produce and sell their own compost teas.

2) You will need basic 110v electricity and water.
3) Use 4 gallons of good compost and "microbe foods" per 250 gallon batch.
4) Fill tank with water and turn on machine, add compost and microbe foods.
5) Let it run for 24 hours.
6) Transfer compost tea to application vehicle and apply.
7) Clean machine and start another batch.

Note: research is still being conducted on efficacy of adding iron/pre-emergent to compost tea.

The Liquid Biological Amendment (compost tea) is applied to turf, trees, shrubs and flowers. It can be used for both regular maintenance and new plantings. When planting, a good practice is to inject the root-ball and drench the planting hole before backfilling. This markedly decreases the transplant shock and will get plant off to a great start.

The cost of making compost tea is very reasonable. Purchased machines cost around $4250 and will last longer. Built machines depend on the cost of material. They will be cheaper than a purchased machine but may not have the same durability. You will need approx. 16 quarts of high quality compost (about 15 – 20 lbs.) and foods to stimulate and grow the beneficial microbes. There are several recipes available or you can buy a 6 lb. bag of pre-mixed soluble powders. It will usually consist of kelp, humates, whey, nut, and vegetable flours. The compost costs around $20 per batch and the foods cost $50 per batch. Electricity and water are nominal, as the machine runs on a small ½ horsepower electric air blower. $70 per batch = 28 cents per gallon, application rates vary but are outline below.

As an overview, the whole concept is based on the fact that plants and soils have a very symbiotic relationship with microbes. The health, beauty, stress tolerance and disease resistance of the plants are greatly enhanced by establishing and maintaining a thriving microcosm around the root zone. When we can successfully mimic the most ideal natural conditions for a particular plant, not only does nature do our work for us, but we can achieve the highest level of plant and soil vibrancy. Most users also report large reduction in water usage due to greater root mass and the water holding properties of the soil.

High quality compost is unique in that it is a storehouse of highly beneficial, naturally occurring microorganisms. These organisms were very active during the composting process, but when the food resources run out, they mostly all go into a state of dormancy. Good compost contains tens of thousands of species of all members of the "Soil Food Web" consisting of bacteria, fungi, protozoa and nematodes in a "stored" state. The compost tea brewing process extracts these organisms and multiplies the microbes. Once activated and introduced to the soil, their interrelationships in the soil and on plants are responsible for nutrient cycling, disease and pest control, moisture modulation and a host of other functions. When all the members of the microscopic communities are present and working together as they would in a naturally healthy environment, our work towards healthy and beautiful landscapes become more certain, all while improving the greater environment that our efforts may impact.

Most purchased machines make about 250 gallons of compost tea per day. Apply at a rate of 20 – 80 gallons per acre (0.5 – 2 gallons per 1000 sq. ft.) ranging in frequency from weekly to 3 or 4 times a year depending on a soil test and your objectives.

Lupfer Landscapings Sustainable Turf Care Program

Year 1

Month	Action
April	Perform soil test and complete recommendations
April	Core aerate, top-dress and over-seed
April	Apply compost tea with fish oil and humates
May	Spot spray post-emergent herbicide
June	Apply organic based granular fertilizer
July	Apply compost tea
August	Spot spray with post-emergent herbicide
September	Core aerate, top-dress and over-seed
September	Apply compost tea with fish oil and humates
October	Apply compost tea
Trees	Root feed each tree and shrub four times
Trees	Enlarge tree rings to 100 square feet or more and amend soil

Year 2

Month	Action
April	Perform soil test and complete recommendations.
April	Apply organic based granular fertilizer
May	Apply compost tea with fish oil and humates.
May	Spot spray post-emergent herbicide.
July	Apply compost tea.
September	Core aerate, top-dress and over-seed.
September	Apply compost tea with fish oil and humates.
Trees	Root feed each tree and shrub three times.

Year 3

Month	Action
April	Perform soil test and complete recommendations.
April	Apply organic based granular fertilizer
May	Apply compost tea with fish oil and humates.
May	Spot spray post-emergent herbicide.
July	Apply compost tea.
October	Apply compost tea.
Trees	Root feed each tree tree and shrub twice.

COMPOST TEA LAWN CARE PROGRAM for 125,000 square feet (2.9 acres)

This makes 500 gallons of sprayable liquid to be applied at 4 gallons per 1000 sq. ft

Item	Quantity	Cost per batch (500 gal.)
COMPOST TEA	250 gal. water	
Seed Compost	15 quarts	20
TEA Complete	1 bag (5.5 lbs.)	50
Liquid Fish	2.5 gallons	37.5
Humic Acids	6 lbs.	80
Water (dechlorinated)	247 gallons	0
Total Liquid	500 gallons	
	Total cost	$187.50
		divided by 125 (1000 sq. ft.)
		= $1.50 per 1000 sq. ft.

Note: Ideal application frequency is 4 - 8 times per year depending on season length and desired results. Higher rates and increased frequency will hasten improvement. Fish oil and humic acids can be limited to every other application. Cost per batch of tea without fish oil and humic acid is $70.00 which in the above example **= $0.56 per 1000 sq. ft.**

XYZ Landscaping
1234 Mockingbird Lane
Anytown, IL 60000

Proposal for Sustainable Turf Care- 2011

XYZ Landscaping shall furnish all labor, equipment, materials and supervision required to properly maintain the landscaped areas in an attractive condition in accordance with the terms of the contract.

1. WORKFORCE AND PERFORMANCE

1.1. All workmen shall be under the supervision of a Certified Landscape Technician, as conferred by the Professional Landcare Network, with a minimum of five years experience.
1.2. All work is to be performed in accordance with standard horticultural practices. The appearance and health of the landscape shall be considered over methods and procedures.
1.3. All work is to be performed with the utmost concern for the safety of the customer, the public, and the employees of XYZ Landscaping.
1.4. All work shall be scheduled to assure that horticultural tasks are completed at the proper times. Schedules may vary throughout the year as weather conditions dictate.
1.5. XYZ Landscaping shall replace or repair anything damaged by its' employees except; electric fences, cable lines, landscape lighting, and when core aerating, sprinkler caps. We will repair sprinkler heads and lighting fixtures if they are damaged.
1.6. XYZ Landscaping has included a certificate of insurance for Workmens' Compensation, General Liability, and Auto Liability Insurance with this contract.

2. SCOPE OF WORK

2.1. Turf shall be maintained to sustain an attractive appearance and good health, deep roots and uniform density
2.2. Contractor shall manage turf using a natural program to the greatest extent possible.
2.3. Contractor will perform soil testing to determine the maintenance requirements for under this contract.
  2.3.1. Soil analyses must include: macro nutrient requirements, pH level and recommendations, organic matter percentage and soil structure or composition.
  2.3.2. Soil samples will be collected and submitted in accordance with recommended laboratory procedures.
  2.3.3. All product applications and soil amendments will be prescriptive and in response to needs identified by soil test or monitoring results.
2.4. Contractor shall strive to achieve an organic matter percentage of 4.5% or higher on high-use/high-visibility turf, and 3.5% or higher on general use turf.

2.5. The pH level for all turf areas will be maintained between 6.5 and 7.0 to encourage optimum nutrient availability for turf grasses.

3. TURF MAINTENANCE

3.1. Mowing

3.1.1. Mowing height shall be between 2 ½" and 3 ½" depending on weather conditions with height being raised and lowered with the temperature.

3.1.2. Mowing height may be set to two inches (2") for the first mowing of the season and clippings bagged, if practical, to remove diseased plant material.

3.1.3. The direction of mowing pattern shall be varied to minimize rutting.

3.1.4. Mowing will not take place when frost is present.

3.1.5. Contractor shall leave a minimum 'no-mow' buffer zone of ten feet (10') around waterways, ponds and lakes unless otherwise directed by the client.

3.2. Grass clippings

3.2.1. Grasscycling is the return of grass clippings to turf to provide nutrients and organic matter for the soil. Contractor shall leave grass clippings on the turf, unless unsightly, and is encouraged to use mulching mowers to reduce clumping and aid in the decomposition process.

3.2.2. Removed clippings must be disposed or composted at contractor's expense.

3.2.3. Grass clippings must be swept or blown from paved areas, and shall not be piled or accumulated near sewer inlets or other buildings and structures.

3.3. Edging

3.3.1. Turf adjacent to pavement and other impervious surfaces or obstacles shall be edged vertically or trimmed with a string trimmer.

4. AERATION, THATCH REMOVAL & OVERSEEDING

4.1. Aeration Program

4.1.1. Aeration loosens compacted soils, a condition resulting from the frequent use of turf areas, heavy mechanical equipment and overwatering. Aeration allows nutrients into the ground, permits gas exchange with the atmosphere and improves soil permeability for water retention.

4.1.2. Turf may be aerated as frequently as needed. Preferred time is early fall

4.1.3. Aeration shall be by plug/hollow core or shattered tine method, to a depth of at least three inches (3").

4.1.4. Aeration should be accompanied by top dressing applications of leaf compost and over-seeding whenever possible.

4.1.4.1. Top-dressing consists of applying a ¼" to ½" layer of organic material to the turf, lightly de-thatching the area to break up the cores and integrate the new material into the existing soil and then a light raking to remove any debris.

4.2. Thatch Program

4.2.1. Thatch is a dense mat of un-decomposed rhizomes, stolons and roots that can inhibit nutrients, water and air from entering the soil. Thatch formation is associated with the use of fast-release synthetic fertilizers and light frequent irrigation.

4.2.2. This organic turf maintenance program is expected to improve soil conditions and turf health, thereby reducing thatch problems.

4.2.3. Thatch exceeding one-half inch (½") thickness must be dethatched by use of a vertical mower. All accumulated material will be removed by Contractor for disposal.

4.2.4. Thatch removal should occur in late summer or early fall, whenever grass is actively growing.

4.2.5. This should only be done if a thatch problem is identified. Other cultural methods can reduce the problem with less of an environmental impact

4.3. **Seeding Program**

4.3.1. As lawns mature, they will eventually begin to show signs of aging and die-off. Regular seeding produces a thicker, denser turf that crowds out weeds and alleviates the need for chemical weed controls.

4.3.2. Contractor will select the grass species and cultivars for seeding purposes that are most appropriate to site conditions and the expected use of the site.

4.3.2.1. Only turf-type cultivars of the following species may be considered for seeding turf areas: Kentucky Bluegrass, Tall Fescue, Creeping Red Fescue and Perennial Rye.

4.3.2.2. In general, a reliance on cultivars with high drought, disease, and wear tolerance is preferred.

4.3.3. Overseeding can occur when soil temperatures are conducive to germination, around 55°, according to the following schedule:

4.3.3.1. 1st seeding: Mid-April spot seeding thin areas and bare patches of soil.

4.3.3.2. 2nd seeding: Early fall general overseeding of entire turf with an average rate of four to five pounds per thousand square feet (4-5 lbs/1000 ft^2) per year.

5. FERTILIZATION

5.1. **Overview**

5.1.1. Organic fertilizers are preferred for a natural program because they supply nutrients to meet the long-term needs of the turf, improve organic matter content, encourage beneficial microbes, lower salt accumulation associated with synthetic fertilizers and reduce the net amount of fossil fuels used to maintain turf.

5.1.2. Nutrients will be applied on a prescription basis only, as indicated by soil testing results, with the exception of nitrogen. Nitrogen should be applied in the following amounts:

5.1.2.1. High quality/high visibility turf – annual nitrogen requirement of four to five pounds per thousand square feet (4 to 5 lbs. N/1000 ft^2), depending on level of use.

5.1.2.2. Low importance turf – annual nitrogen requirement of three pounds per thousand square feet (3 lbs. N/1000 ft^2).

5.1.3. For bidding and nutrient budgeting purposes, Contractor shall assume that on areas where grass-cycling is practiced, one pound of nitrogen per thousand square feet is returned to the turf annually (1lb. N/1000 ft^2). This

will be counted against the annual nitrogen requirement, and thus will not need to be supplied by the contractor.

5.2. **Granular Fertilizer Requirements**

5.2.1. Fertilizers must:

5.2.1.1. Be composed primarily of plant or animal matter and free of weeds, pathogens or other material that is insufficiently decomposed,

5.2.1.2. Contain at least 50% water insoluble nitrogen (W.I.N.) and

5.2.1.3. Be granular, pelletized or other appropriate solid form.

5.2.2. Fertilizers shall contain no phosphorous unless otherwise indicated by soil testing results or necessary for the establishment of newly seeded or freshly soded areas. Where phosphorous is indicated, the nitrogen-to-phosphate ratio must be five to one (5:1) or greater.

5.2.3. Composts may be used on areas of stressed turf or when preparing soil for grass seeding or sod. Compost should be derived primarily from plant materials with minimal amounts of animal manure due to the potential for high phosphorous content.

5.2.4. Weed and feed products containing any type of pesticide are prohibited under this contract.

5.3. **Granular Fertilizer application protocols**

5.3.1. Fertilizers may not be applied more than four times a year and should be applied according to the application schedule below:

5.3.1.1. Fertilizer should be applied during the weeks of May 1st - 15th, June 1st-15th, July 1st-15th and September 1st-15th.

5.3.2. Fertilizers shall be applied using drop or broadcast spreaders to evenly distribute product.

5.3.3. Fertilizers must be swept or removed from paved or hard surfaces to limit runoff into local waterways and storm sewer systems.

5.3.4. Fertilizers should be applied at least twenty-four (24) hours before any anticipated rainfall.

5.3.5. Fertilizers should not be applied on extremely hot or dry days.

5.3.6. Fertilizers may not be applied within twenty-five feet (25') of streams, rivers, lakes, ponds or other waterways.

5.3.7. Notification and signage must be provided for fertilizer applications in accordance with the Illinois Lawn Care Products and Notice Act (415 ILCS 65).

6. COMPOST TEA

6.1. **Overview**

6.1.1. Compost tea helps establish and maintain a healthy environment for vibrant plant health. The beauty, stress tolerance, disease resistance and overall health of the turf are greatly enhanced by establishing and maintaining a thriving microcosm around the root zone. Once introduced to the soil, the biology interacts in the soil and on the plants which is responsible for nutrient cycling, disease and pest control, moisture modulation and other beneficial functions.

6.1.2. Compost tea will be applied on a prescription basis only, as indicated by soil testing results. Once soil biology is restored, treatments can be cut back to maintenance levels.

6.1.3. For bidding and nutrient budgeting purposes, Contractor shall assume that on areas where compost tea is applied, ½ pound of nitrogen per thousand square feet is returned to the turf per application (½ lb. N/1000 ft^2). This will be counted against the annual nitrogen requirement, and thus will not need to be supplied by the contractor.

6.2. **Compost Tea Requirements**

6.2.1. There are several compost tea recipes available. But it should usually consist of compost, kelp, humates, sugars, whey, nut, and/or vegetable flours.

6.3. **Compost Tea Application Protocols**

6.3.1. Apply at a rate of 80 gallons per acre, or 2 gallons per 1000 sq. ft. ranging in frequency from weekly to 2 to 4 times a year depending on a soil test and your objectives.

6.3.1.1. The compost costs around $20 per batch and the foods cost $50 per batch: $70 per batch = 28 cents per gallon material cost.

6.3.2. Brewer and application equipment shall be cleaned after each 'batch' or at least every 48 hours when in continuous use.

6.3.3. Application equipment shall be dedicated for use in applying compost tea or watering only.

7. WEEDS, TURF DISEASE & PEST CONTROL

7.1. **Overview**

7.1.1. Turf problems are often the result of soil conditions, poor turf density, improper maintenance practices and low microbiological activity. A natural program recognizes the conditions that are most conducive to turf growth and focuses on managing those conditions to alleviate weed, disease and pest pressures before any product is applied.

7.1.2. Weeds, disease and pests will, to the maximum extent feasible, be controlled through cultural, physical/mechanical and biological methods. These include, but are not limited to:

7.1.2.1. Mowing
7.1.2.2. Aeration
7.1.2.3. Grass selection
7.1.2.4. Overseeding
7.1.2.5. Restricting access to turf
7.1.2.6. Proper soil pH and nutrient balance

7.2. **Pest Control Requierments**

7.2.1. Where pests cannot be adequately managed by the methods described in 7.1.2, Contractor shall use least-toxic pest management strategies.

7.2.2. Contractor must obey all local, state, and federal posting laws prior to the application of any product containing a pesticide

7.2.3. Contractor is prohibited from using pesticides registered as US EPA Toxicity Category I under 40 CFR 156.62 and 156.64, indicated by the signal word “DANGER” on the pesticide label, on the property.

7.2.4. An exemption from 7.2.1 through 7.2.4 may be granted only upon written request.

7.2.5. In the event of an emergency situation the provisions of 7.2.1 through 7.2.5 are waived.

7.3. **Pesticide Application Protocol**

7.3.1. All pesticides will be applied in accordance with the pesticide label, applicable federal laws and the Illinois Pesticide Act (415 ILCS 60).

7.3.2. Pesticides shall be used in response to a verified turf disease or pest problem, and will not be applied preventatively.

7.3.3. All pesticide applicators must be licensed by the Illinois Department of Agriculture for Turf and Ornamental applications.

7.3.4. Contractor shall employ anti-drift measures, including low-volume spray nozzles and anti-drift agents.

7.3.5. Spraying shall not occur on days when wind speed exceeds ten miles per hour (10 MPH) or when the wind speed exceeds the threshold indicated on the pesticide label, whichever is lesser.

7.3.6. Pesticides shall not be applied within twenty-five feet (25’) of streams, rivers, lakes, ponds and other waterways or within the distance indicated on the pesticide label, whichever is greater.

7.3.7. Notification and signage must be provided for all pesticide applications in accordance with the Illinois Lawn Care Products and Notice Act (415 ILCS 65)

8. RECORDKEEPING & NOTIFICATION (Optional, mostly for municipalities)

8.1. **Recordkeeping**

8.1.1. Contractor shall maintain records of all activities involving the use of lawn care products applied to turf covered by this contract. This includes, but is not limited to, fertilizers, compost, soil amendments, pesticides and US EPA minimum risk pesticides under 40 CFR 152.25. .

8.1.2. Each record shall include the following information:

8.1.2.1. Date and location of application

8.1.2.2. Purpose of application

8.1.2.3. Product description and total quantity used

8.1.2.4. Name and title of City/Village official approving application (when applicable)

8.1.2.5. Alternative measures considered

8.1.2.6. Follow-up recommendations or programmatic changes to improve turf quality or soil health and reduce future problems.

8.1.3. Pesticide records must be maintained in accordance with Illinois law and the provisions of this contract

8.1.4. Records shall be submitted to the City/Village on a monthly basis or whenever requested by City/Village manager OR Buildings/Grounds Manager

8.2. **Notification**

8.2.1. Contractor must inform City/Village manager OR Buildings/Grounds Manager prior to any intended lawn care product application, allowing sufficient time to obtain City/Village approval, when applicable, and to notify the public in accordance with Illinois state law.

8.2.2. Contractor OR City/Village is responsible for posting signs in accordance with the Illinois Lawn Care Products and Notice Act (415 ILCS 65).

8.2.3. Contractor OR City/Village is responsible for notifying the public in accordance with the Illinois Lawn Care Products and Notice Act (415 ILCS 65).

9. Definitions

9.1.1. *Contractor* – shall mean a person, firm, corporation, or other entity, including a governmental entity that enters into a professional services agreement with the city to apply pesticides or perform other pest management activities on property that is owned, controlled or operated by the City.

9.1.2. *Least-toxic pest management* – refers to pesticides, soil amendments or landscape enhancements that pose minimal risk to people, wildlife and the environment and are primarily derived from natural products or processes for the purposes of managing weeds, disease, insects, small rodents and other turf pests. These include, but are not limited to: horticultural oils, insecticidal soaps, herbicidal soaps or foams (such as Waipuna), mulching, biological controls (such as nematodes, compost tea/mychorrizal inoculations, *Bacillius thuringiensis*) and US EPA minimum risk pesticides under 40 CFR 152.25 pesticides

9.1.3. *Pest* – shall mean any plant, animal, insect, virus, bacteria or other microorganism that is, or has the potential to be, injurious to other living organisms or property. Pests may include but are not limited to insects, weeds, rodents and fungi.

9.1.4. *Pesticide* – shall mean any substance intended to control, destroy, repel or attract a pest. Pesticides include, but are not limited to, herbicides, fungicides, insecticides, rodenticides and any other compounds and organisms, naturally occurring or otherwise, requiring registration or exempt from registration under the *Federal Insecticide, Rodenticide and Fungicide Act* (7 U.S.C. 136) and subsequent regulations under 40 CFR 150-189

Developed by: Safer Pest Control Project, Steve Pincuspy, Chip Osborne, and Tom XYZ

Appendix 7
Irrigation Management

ILCA
ILLINOIS LANDSCAPE
CONTRACTORS ASSOCIATION

Included in this appendix is an overview of an irrigation audit, examples of site plans, theory on watering schedules, and an inspection check list. Detailed information on these topics can be found on the Irrigation Association's web site at Irrigation.org.

The goal of a sustainable irrigation system is to lessen the demand of potable water the irrigation system uses by ensuring all of the irrigation system components are operating properly, creating an efficient watering schedule based on landscape need, inspecting the irrigation system on a regular basis, and moving away from the "set and forget" mentality to a more pro-active approach to irrigation management.

Information on management and scheduling is taken from the Irrigation Association's Irrigation Best Management Practices and can be found under the resources tab on their website.

Watering schedules must take into consideration state and local codes and restrictions.

Landscape irrigation audits must be conducted b a landscape Irrigation Auditor certified by the Irrigation Association.

11: Irrigation System Management

11.1 Spring start up

11.1.1 Check for leaks

11.1.2 Check equipment for proper operation

11.1.3 Check all heads for proper coverage

11.1.4 Set Schedule on controller

11.1.4.1 Check local codes / ordinances for watering restrictions

11.1.4.2 Turf 1” precipitation per week

11.1.4.3 Plantings ¾” precipitation per week

11.1.5 Make recommendations for efficient upgrades

11.1.5.1 “Smart Controllers”

11.1.5.2 Rain sensors, ET sensors, Soil moisture sensors

11.1.5.3 Isolate plantings from turf

11.1.5.4 Change from sprinkler heads to drip (where applicable)

11.1.5.5 If new customer, recommend audit

11.2 inspections

11.2.1 At least monthly

11.2.3 Check equipment for proper operation

11.2.4 Check all heads for proper coverage

11.2.5 Adjust schedule on controller as season / climate / temperature dictate

11.2.5.1 If no sensing, manually adjust

11.2.5.2 Typical worst month August

11.2.5.3 Turf 1 ½” per week

11.2.5.4 Plantings as dictated per plant type

11.2.6 Review / implement upgrades

11.3 Winterization

11.3.1 Remove water from system

11.3.2 Review system performance

11.3.3 Note problems / repairs for spring

Source: ILCA Sustainable Landscaping Committee

Recommended Audit Guidelines

The Irrigation Association has developed a set of minimum guidelines to create a standardized procedure to perform an audit of a landscape irrigation system. ASABE standards have been reviewed and incorporated wherever possible. Consultation and review of the guidelines has been conducted with many irrigation auditors, contractors, statisticians, educators, irrigation consultants and the Irrigation Association Certification Board. The usage and application of these guidelines is at the discretion of others. The Irrigation Association offers the guidelines without warranty or obligation.

September 2009

Irrigation Audit Guidelines

The guidelines were developed by the Irrigation Association and are intended to function as recommendations in the auditing of landscape irrigation systems. They have been designed to aid irrigation professionals in fieldwork procedures, techniques and performance calculations.

Recommendations and projections from the guidelines and their accuracy depend upon the quality of measurements and data provided by the individual user. The Irrigation Association makes no warranty, implied or expressed, as to the results obtained from these procedures.

Step #1 Pre-audit inspection

- Irrigation system should be in optimal working condition prior to performing a test.
  Verify that the irrigation system complies with local codes.
  Identify operational defects or deficiencies.
  Assure that corrections have been made.

Step #2 Auditing procedures

- Maximum wind allowable during audit = 5 mph or less (ASAE S398.1). Wind speed should be monitored and recorded every five minutes during the audit test.
- Audit should reflect normal operating conditions. If normal operating conditions occur at odd hours, some assessment of the impact of these conditions should be made on the tested conditions
- Pressure tests should be conducted at normal operating conditions at the sprinkler using the appropriate pressure testing device at the beginning and end of each zone audited.
- All catch devices must be uniform in size and shape. Larger collectors give better repeatable results.
- Catchments for a test area should be documented to facilitate repeatability.
- A minimum of 24 catch devices should be used. Research (Vinchesi, et al., Irrigation Show 2007 and 2008 proceedings.) shows that smaller sprinkler spacing may require more catch devices to improve statistical accuracy.
- The catchments along the edge of the zones should be placed 12 to 24 inches in from the edge.
- Minimum catchment device spacing
  - For fixed spray sprinklers – near a head (within two to three feet) and half-way between the heads.
  - For rotor sprinkler heads spaced less than 40 feet on center – near a head (within two to three feet) and every one-third of the distance between the heads.
  - Rotor heads spaced greater than 40 feet on center – near a head (within two to three feet) and every one-fourth of the distance between the heads.
  - Unusual or irregularly shaped areas:
    - For rotor sprinklers – uniform grid of catch devices, 10 to 20 feet on center spacing (i.e., baseball infield, golf green).
    - For spray sprinklers – uniform grid of catch devices, 5 to 8 feet on center spacing (i.e., curvilinear areas without defined rows of sprinklers).
- Test run times must be consistent and appropriate for the sprinkler type and arc.
- When the test area contains multiple stations, the test run times for each station or zone must be adjusted to achieve a matched precipitation rate across the test area.

- The volume in milliliters should be approximately one and one-half times the throat area of the catch device in square inches. For example if the throat area of the catch device is 20 square inches the average volume of water should be 30 ml (20 x 1.5 = 30).
- "Linking" (using information from one station or zone and applying to another) may be used when there are a large number of sprinkler zones that are identical, i.e. the same sprinkler head, nozzle, spacing, operating pressure and irrigating similar soil and plant types. The auditor may elect to perform catch device tests on one-third to one-half of the sprinkler zones to get an average value that could be applied to all sprinkler zones that are identical.
- The following data should be documented and recorded:
  - Sprinkler head locations
  - Sprinkler head spacing
  - Sprinkler make, model and nozzle size
  - Approximate catch device locations
  - Catchment readings
  - Test run time
  - Meter readings if available
  - Pressure readings with locations
  - Wind speed readings
  - Soil types and root zone depths
  - Date and time of testing

Step #3 Performance calculations

To calculate the precipitation rate using milliliter readings:

$$PR_{net} = \frac{3.66 \times V_{avg}}{t_R \times A_{CD}}$$

PR_{net} = station precipitation rate {in./h},
V_{avg} = average catch volume for station {ml},
t_R = testing run time {min},
A_{CD} = catch device throat area {$in.^2$}.

To calculate the low-quarter distribution uniformity:

DU_{LQ} = Low-quarter distribution uniformity {decimal}.

$$DU_{LQ} = \frac{\text{Average Catch of Lower Quarter}}{\text{Average Catch Overall}}$$

When calculating the base irrigation schedule it is recommended to use IA scheduling methodology and procedures as presented in the Golf Irrigation Auditor and Landscape Irrigation Auditor manuals.

NOTICES

Copyright

Disclaimer

No representations are made with respect to the contents of the Turf and Landscape Irrigation Best Management Practices. Furthermore, the Irrigation Association reserves the right to revise the document and to make changes to the content from time to time without obligation to notify any person of such revision.

THE INFORMATION CONTAINED HEREIN IS PROVIDED ON AN "AS IS" BASIS, WITHOUT WARRANTY OF ANY KIND, INCLUDING WITHOUT LIMITATION THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE ACCURACY, COMPLETENESS OR QUALITY OF SUCH INFORMATION AND ANY USE MADE OF IT IS ASSUMED BY THE USER.

NEITHER THE IRRIGATION ASSOCIATION NOR ANYONE ELSE WHO HAS BEEN INVOLVED IN THE CREATION, PRODUCTION OR DELIVERY OF THE INFORMATION SHALL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, OR INCIDENTAL DAMAGES (INCLUDING PROPERTY DAMAGE, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, AND THE LIKE) ARISING OUT OF THE USE OF THE INFORMATION, OR ANY OMISSION IN OR INACCURACY OF ANY INFORMATION EVEN IF THE IRRIGATION ASSOCIATION HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Trademark Notice

Trademarks or trade names are subject to state and federal laws concerning their authorized use or other infringements. The fact that some product marks or names in this document may not bear a trademark symbol does not mean that the product name or mark is not registered as a trademark or trade name. Any queries concerning the ownership or existence of any trademarks or trade names mentioned in this document should be independently confirmed with the manufacturer or distributor of the product.

Distribution Notice

You may freely print copies and distribute this document in whole or in part as long as each part (or the whole) contains the above copyright, disclaimer, and trademark notice. The Irrigation Association grants you permission to use the Practice Guidelines contained herein as a template for establishing specifications that address local needs. THE ENTIRE RISK AS TO THE ACCURACY, COMPLETENESS OR QUALITY OF SUCH INFORMATION AND ANY USE MADE OF IT REMAINS WITH THE USER.

1.4 Qualified Professionals

The implementation of Best Management Practices and Practice Guidelines requires a commitment from qualified irrigation professionals. The Irrigation Association certifies individuals in design, contracting, and management of irrigation systems. Various certifications include:

Certified Irrigation Designer (CID)
Certified Irrigation Contractor (CIC)
Certified Landscape Irrigation Auditor (CLIA)
Certified Landscape Water Manager (CLWM)
Certified Golf Irrigation Auditor (CGIA)

A listing of certified individuals can be found on The Irrigation Association's web site at http://www.irrigation.org.

water will the system use in the peak summer months; and whether you should expect dry spots in your turf during the warmest month of the year.

12. Allow soil moisture in the root zone to deplete to a predefined allowable depletion limit. Then base irrigation schedules on replenishing the soil moisture back to field capacity.

13. Ensure that system can be managed to promote efficient use of water. The system should be designed and managed to accommodate a cycle-and-soak irrigation principle that allows the water to infiltrate instead of running off. Learn how to schedule irrigation cycles to incorporate this principle.

3.5 PG 4 - Practice Guideline for Maintaining an Irrigation System

PG 4 meets the requirements of T&L BMP 4. PG 4 is meant to be a guide to facilitate the development of specifications that address local landscape irrigation needs for proper maintenance of an irrigation system. It is the responsibility of the framers of such specifications to adopt only those guidelines that apply to their local needs and in such a way as to be economical, practical and sustainable for maintaining a healthy and functional landscape without exceeding the water requirements of the landscape.

To ensure that the irrigation system continues to efficiently and uniformly distribute the water, and continues to conserve and protect water resources, the maintenance contractor, owner, manager, or irrigation contractor shall:

1. Establish a periodic maintenance schedule for inspection and reporting performance conditions to the end-user (or owner) of the irrigation system. Report any deviations from the original design. Create a station/zone map for ease of system inspection and controller programming.

2. Periodically review the system components to verify that the components meet the original design criteria for efficient operation and uniform distribution of water:

   a. Verify that the backflow prevention device is working correctly.

   b. Verify that the water supply and pressure are as stated in the design.

   c. Verify that pressure regulators are adjusted for desired operating pressure.

   d. Examine filters and clean filtration elements as required.

   e. Verify proper operation of the controller. Confirm correct date/time input and functional back-up battery.

f. Verify that sensors used in the irrigation system are working properly and are within their calibration specifications.

g. Adjust valves for proper flow and operation. Adjust valve flow regulators for desired closing speed.

h. Verify that heads are properly adjusted – nozzle size, arc, radius, level and attitude with respect to slope.

i. Repair or replace broken hardware and pipe; restore the system to its design specifications.

j. Complete repairs in a timely manner to support the integrity of the irrigation design and to minimize the waste of water.

k. Notify the end-user (or owner) of any deviations from the original design.

l. Test all repairs.

3. Ensure that the replacement hardware used for system repairs matches the existing hardware, and is in accordance with the design. Aftermarket replacement nozzles may not match original parts well enough to preserve distribution uniformity and the precipitation rate. Conduct a performance audit every three to five years to assure that the system is working efficiently and with the desired DU_{LQ} and precipitation rate specifications.

4. As plant material matures, trim or remove vegetation as required to preserve system performance. Add additional sprinklers or other hardware as required to compensate for blocked spray patterns or changes in the irrigation needs of the landscape. Ensure that system modifications are in keeping with design specifications and do not cause landscape water demand to exceed the hydraulic capacity of the system.

5. Establish a "winterization" protocol (if required) and a corresponding process for system activation in the spring.

Additional point for an owner to consider is:

1. Ensure that the maintenance contractor is licensed and/or certified (where applicable), is insured, experienced and reputable, and is legally authorized to maintain irrigation systems in your area. Ask the contractor for references of previous work and contact those references to seek information on the contractor's quality of service and timeliness in performing the job.

3.6 PG 5 - Practice Guideline for Managing the Use of Irrigation Water

PG 5 meets the requirements of T&L BMP 5. PG 5 is meant to be a guide to facilitate the development of specifications that address local landscape irrigation needs for proper management of the use of irrigation water. It is the responsibility of the framers of such specifications to adopt only those guidelines that apply to their local needs and in such a way as to be economical, practical and sustainable for maintaining a healthy and functional landscape without exceeding the water requirements of the landscape.

To conserve and protect water resources and the environment, the irrigation schedule shall be changed as required to provide supplemental water to maintain a functional and healthy turf and landscape with the minimum required amount of water.

Figure 3-1 gives an overview of the irrigation scheduling process.

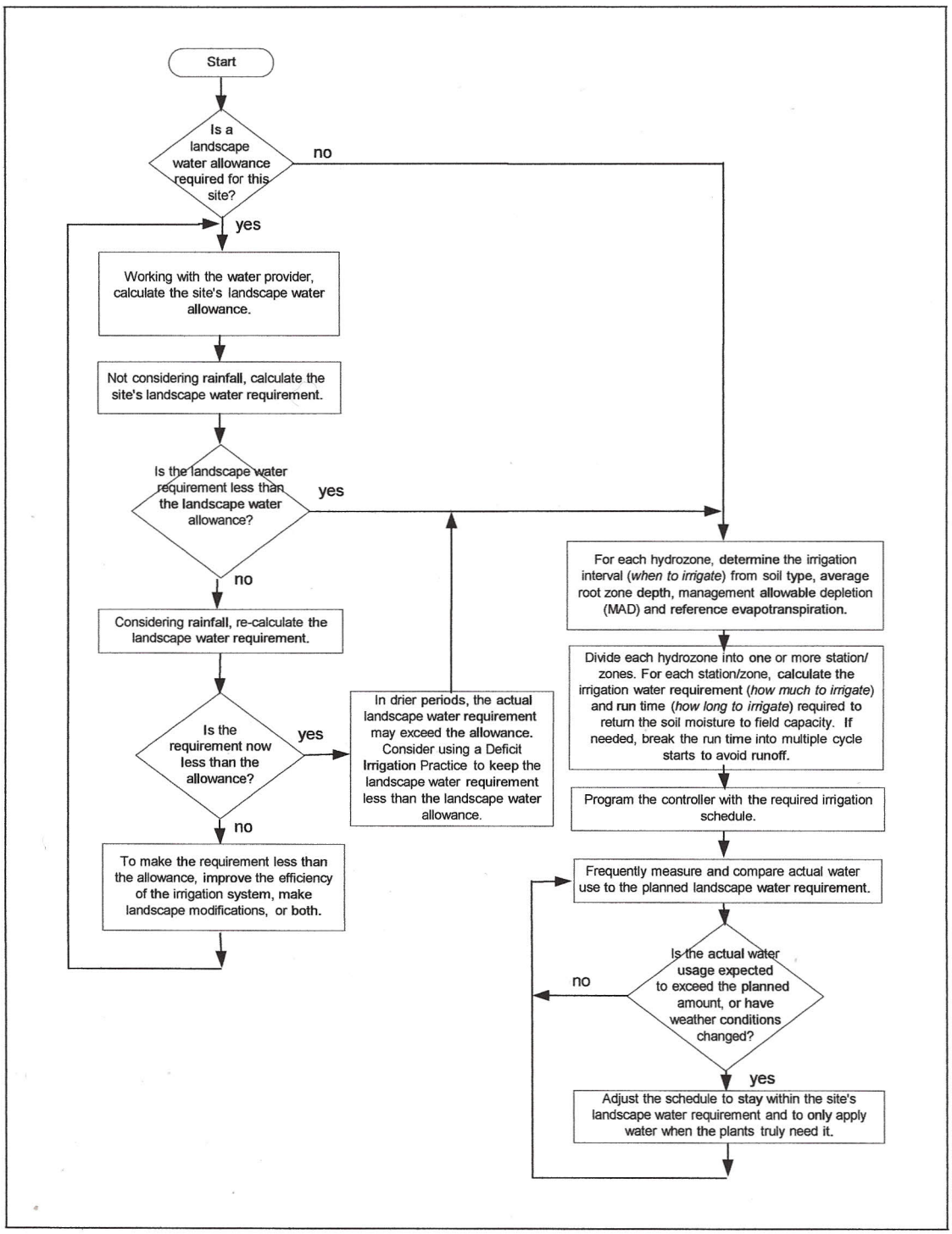
- Landscape irrigation basic concepts,
- Scheduling and water management,
- Establishing quality ratings for irrigation systems,
- Landscape water allowances, and
- Deficit irrigation and drought planning.

To facilitate managing irrigation water use, the irrigation manager, consultant, end-user, owner, maintenance personnel, or contractor shall:

1. Create a site map showing, at a minimum, the location of each point of connection water meter, backflow prevention device, controller, station/zone valves, and landscape area served by each valve.

2. Ensure that a dedicated irrigation water meter has been installed for measuring both the irrigation water flow rate and the volume applied to the landscape. To facilitate managing irrigation water use, the water meter should have an electronic flow rate output signal for interfacing with a remote display or to controllers that can perform leak detection and water management.

Figure 3-1
Landscape Irrigation Scheduling



3. If necessary, perform an irrigation audit to obtain data for creating a base irrigation schedule:

   a. For each hydrozone, identify plant type and microclimate factors. From soil cores, identify the soil texture and soil infiltration rate for the purpose of estimating the available water holding capacity of the soil.[4,5] Determine the average effective root zone depth of the hydrozone.

   b. For each station/zone, measure the actual sprinkler performance including operating pressure, precipitation rate, lower-quarter distribution uniformity and average flow rate.

   c. For each station/zone, recommend a normal operating pressure range. Accurately measure the landscaped area.

   d. For each station/zone, if the soil infiltration rate is less than the precipitation rate then activate the zone valve and record the run time until you first see runoff. Recommend the number of cycle starts and soak time between cycles to avoid runoff.

4. Using data collected from the audit, provide a monthly base irrigation schedule where the frequency of irrigation (*when to irrigate*) is based on replenishing the allowable depletion (*how much to irrigate*) of the soil moisture between irrigations. Base the monthly schedules on the plant type, root zone depth, soil type, infiltration rate, and monthly historical reference evapotranspiration data. Also account for site topography such as slope. Where there is a potential for surface runoff, use multiple repeat cycle start times to allow the water to infiltrate into the soil. If a rain shutoff device or soil moisture sensors are not installed, then also factor in an estimate of effective rainfall.

   Information on scheduling is available from the Irrigation Association.[6]

5. After the system has been placed into service, evaluate the effectiveness of system water management by monitoring and comparing actual landscape water usage to a target design irrigation water budget:

   a. Calculate the design irrigation water budget for normal weather conditions. The design irrigation water budget should be provided by the landscape irrigation designer as one component of the Irrigation Design Package (Appendix B) and based on local historical weather conditions and expected plant water requirements under normal (e.g., non-drought) weather conditions. Base the design irrigation water budget on monthly historical reference

[4] USDA - NRCS Irrigation Guide, Sept. 1997, Pages 2-17 through 2-25.
[5] Miller, Raymond W., Soils in Our Environment, Seventh Edition, Chapters 4-6, 1995, Prentice Hall
[6] The Irrigation Association, Sprinkler System Scheduling, March 2002

evapotranspiration (historical ET_o) data, monthly effective rainfall estimate from monthly historical rainfall, plant landscape coefficient factors, and site factors.

b. Calculate the design deficit irrigation water budget for drought weather conditions. For drought conditions, the irrigation goal is to conserve water while still sustaining the integrity of a majority of the landscape. The normal-weather method for establishing the design irrigation water budget is generally applicable but is modified. The objective is to assign the water reduction required during the drought, rather than meet normal-weather plant water requirements. Focus on water saving techniques for reducing plant water demand including reducing or eliminating fertilizers, changing mowing height, adding or improving mulch, and so forth.

c. Manage the water use of the site. At a minimum, at the beginning and mid-point of each month, monitor water usage by reading the system water meter or flow totalizer. Compare actual water usage to the budgeted amount of water for the month. At mid-month, if water usage exceeds 50% of the current month's irrigation water budget, then modify the schedule to stay within the monthly budget. Frequently adjust the irrigation schedule to meet changing weather conditions.

d. Evaluate System Performance. Periodically, and at the end of each irrigation season (or annually), evaluate water management efficiency and overall irrigation system efficiency. The evaluation can highlight strengths and weaknesses in the performance of the irrigation system and how it is being maintained and managed.

6. Periodically, verify that sensors and other components in the irrigation system are working properly. Inspect the irrigation system during operation.

7. Periodically, visually verify that the plant material is healthy and that soil moisture is adequate. Use a soil probe to evaluate root depth, soil structure and moisture.

8. To further conserve water, the irrigation manager should:

   a. Understand how to use various sensors such as soil moisture and weather sensors to aid in irrigation management.

b. Install a rain shutoff device to stop irrigation during and directly following a significant rain event.

c. Install soil moisture sensors to override the controller's schedule when the root zone is adequately moist. Monitoring soil moisture regularly also helps to reduce the guesswork in establishing proper irrigation intervals for each hydrozone.

d. Install a master valve to stop unscheduled flow of irrigation water.

e. Refer to Appendix C on the benefits of advanced control systems.

f. Use drip/micro-irrigation components for higher distribution uniformity and lower evaporation and runoff.

9. When water supplies are limited, manage the irrigation based on a site-specific Drought Response Plan. The plan should have two primary components, one dealing with landscape cultural practices and the other with deficit irrigation practices:

   a. Landscape Cultural Practices

      There are many cultural practices that can help a landscape irrigation system operator cope with a water shortage, including adjusting mowing height, fertilization practices, use of mulch in planter beds, and amending the soil. The owner should determine the overall priorities of the site and evaluate those areas that deserve the greatest attention. Consult a licensed/certified (where applicable) landscape contractor, extension agent or certified nurseryman for information regarding appropriate cultural practices.

   b. Deficit Irrigation Practice

      Deficit irrigation may be used at the discretion of the irrigation manager. It is most commonly used in response to a drought (or other water shortage). The goal of deficit irrigation management is to apply a reduced amount of water while keeping the plant material alive, but potentially placing the plants in a water-stressed condition.

      It is important to understand that managing plants in a deficit irrigation mode puts them at risk to other environmental and/or biological factors. Careful and frequent observation of the landscape is essential to such an irrigation strategy.

REFERENCES

1. Irrigation Association, Landscape Irrigation Auditor, December 2010.

2. Irrigation Association, Certified Irrigation Designer Manual. December 2000.

3. Irrigation Association, Drip Design in the Landscape, January 2002

4. Irrigation Association, Predicting & Estimating Landscape Water Use. October 2001.

5. Irrigation Association, Sprinkler System Scheduling. March 2002.

6. Manual of Cross-Connection Control, Tenth Edition, 2009. Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California.

7. Miller, Raymond W., Soils in Our Environment, Seventh Edition, Chapters 4-6, 1995, Prentice Hall.

8. USDA - NRCS Irrigation Guide, Sept. 1997, Pages 2-17 through 2-25.

Appendix 8

Integrated Pest Management

Purdue University published a comprehensive and free guide on Integrated Pest Management programs. This is currently one of the strongest resources available on the subject.
http://www.ppp.purdue.edu/Pubs/PPP-74.pdf

Due to length, only the cover and table of contents are included in this guide.

ILCA
ILLINOIS LANDSCAPE CONTRACTORS ASSOCIATION

PURDUE UNIVERSITY

PURDUE EXTENSION

PPP-74

The Role of Pesticides in Urban Integrated Pest Management

The Role of Pesticides in Urban Integrated Pest Management

Contents