NATURAL LANDSCAPING FOR LOCAL OFFICIALS: DESIGN AND MANAGEMENT GUIDELINES

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prepared by northeastern illinois planning commission

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Photos from left to right: tilling and seeding, planting shrubs, both pictures courtesy of Applied Ecological Services, Inc.; Matteson Village Hall, NIPC; burn at Peggy Notebaert Nature Museum, Peggy Notebaert Nature Museum.

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Introduction and Purpose

This guidebook is a component of the Metropolitan Natural Landscaping Initiative, a series of publications, seminars and projects to promote the use of natural landscaping in our region. It is part of the work of Chicago Wilderness, a consortium of over 170 agencies and organizations that is focused on conservation issues in northeastern Illinois, southeastern Wisconsin and northwestern Indiana. In 1999, Chicago Wilderness adopted its *Biodiversity Recovery Plan*, a publication that established the work of Chicago Wilderness by setting over 300 goals and recommendations. Natural landscaping was identified in the *Biodiversity Recovery Plan* as a method for local governments, homeowners and other land holders to increase biodiversity on their own property.

There are a number of benefits associated with natural landscaping. Natural landscaping reduces the need for herbicides, does not require the use of pesticides and fertilizers, all of which typically end up in water bodies through stormwater runoff, decreasing water quality. In addition to enhancing aesthetics and providing educational opportunities, the practice of natural landscaping decreases the demand on water supply and improves air quality. Natural landscaping also provides for increased diversity of wildlife, including butterflies, birds and other species.

In many cases, local government officials will serve as a permitting entity for private developments or will contract out the work of design, installation, and maintenance of natural landscapes. This guide has been prepared for those who make landscape decisions, and landscape staff that conducts maintenance work itself.

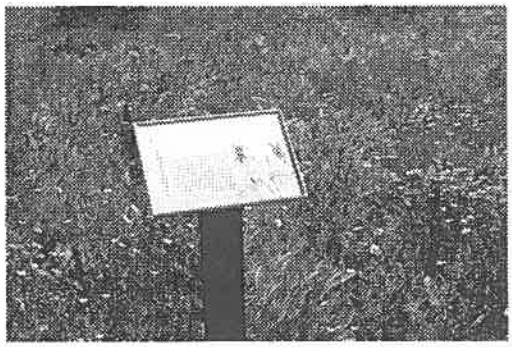
The purpose of this guide is to introduce those who have made a commitment to install, or permit natural landscaping in their community, to installation and maintenance considerations. It is not intended to be exact "how to" instructions, as this is still an evolving practice and we are continually learning more in this field. This guide is an informative piece that emphasizes proper site assessment and design, plant selection, site preparation, plant installation, long-term maintenance and information on controlling invasive plants and weeds. A significant portion of the guide describes maintenance techniques to ensure the integrity of the original design intent.

This guide serves as an accompaniment to *Natural Landscaping for Local Officials: A Source Book*. This guide expands on the installation and maintenance techniques already described in the *Source Book*. The *Source Book* contains information such as current landscaping costs, plant lists, nurseries and plant sales.

Since natural landscaping is not yet in the mainstream of landscape design, the necessary experience of qualified contractors must be clearly stated. Previous experience and references are crucial, e.g., how many years of experience has

this company had with this specific application? Contract specifications for natural landscaping need to be clear on the requirements of the project. Other considerations include compliance with certain seed mixtures and seed bed preparation, weed control specifications, and warranties on the work and plant material.

To engage citizens and even municipal employees on natural landscaping, the Corporatelands Program provides excellent educational materials as part of the Metropolitan Natural Landscaping Initiative. Sample news briefs and newsletter articles help to inform others on the benefits of natural landscaping, and encourage them to do this in their own backyards. It is also a good idea to post signs, describing your landscaping project and letting visitors and users know that this is a landscape that will take time to get established, and that it will be worth the wait.



Interpretive sign at Tellabs

Installing any type of landscaping takes a commitment to nurture the plants and allow them to grow the way nature intended. Contrary to belief, there is no such thing as "no maintenance," but with a commitment to natural landscaping, maintenance requirements that stress the environment are reduced or eliminated. The rewards of natural landscaping are many, including cleaner air and water, and providing habitat for the fauna in this region. In addition to increasing biodiversity, natural landscaping provides us with seasonal interest and gives our region its unique identity.

Chapter 1: Design and Installation

Site Inventory and Analysis

Prior to beginning a design, an inventory of existing conditions must be completed. Plants will have a higher rate of survival if planted within the conditions for which they are best suited. Most nursery catalogues include plant descriptions that specify whether a plant prefers full sun or shade, and soil preferences such as well drained or wet soil.

It is important to identify conditions and plants that currently exist on the site, and to determine any plant material to be saved or removed. Looking at existing plant material will help to determine the prior plant community, and will give clues on what will grow best on the site. Plant material to be preserved must be protected during the installation process, as heavy equipment will compact the soil and can adversely affect the existing plants. Plants to be removed include invasive non-native species, or species that are diseased and unhealthy and/or present a safety issue.

Knowledge of what was present at the site prior to European settlement in the 1800's can provide clues as to what will grow best on the site. Natural landscaping is not intended to be a restoration project, but it is helpful to learn what was present at the site prior to the region's settlement. Surveyor's notes describing the plant material on the site at that time and historical topographic maps are available at public and academic libraries. There are also mapping services online that can provide information, and many maps are available in a digital format to use with Geographic Information Systems (GIS). (Visit http://www.edrnet.com for Environmental Data Resources, Inc.) Sanborn fire insurance maps, which date back to 1867, can provide clues as to development of the property. Aerial photos dating back to the 1930's can also be used as a source of information. A local ecologist can also determine what vegetation was historically present in a specific area.

Soil

Matching plant material and the appropriate type of soil is critical for a higher success rate of plant material. Plant preferences range from well drained soil, which has higher amounts of sand, to wet soil, which contains more clay or organic matter. Soil maps can provide general clues as to the type of plant materials that were present at one time, and also what will grow best now. The presence of hydric soils, for example, determines the location of an existing or former wetland. The Natural Resources Conservation Service (NRCS) is responsible for collecting and distributing soils information, and is currently working towards making all of its soil information available digitally. (Visit http://www.nrcs.usda.gov/)

It is important to do on-site inspections of soils

as NRCS maps are often at a scale that miss many localized soil types. Also, the site may have been severely impacted by either removal of the soil, or through depositing unwanted soil. Establishing native plants on soils that are not original to the site and have been "engineered" (placed by heavy machinery) is more difficult. Alleviating soil compaction is the best solution when working with engineered soils.

A thorough soil analysis will show the pH and other nutrient levels. Well established stands of buckthorn, a highly invasive non-native shrub, have been shown to greatly enrich the soil with nitrogen. This can present problems with establishing native vegetation, which does poorly on enriched soils, when planting in buckthorn infested areas. Also, compacted clay sub soils may cause temporary "perching" of the water table which may create conditions better suited for plants that perform better in wetter conditions.

There are soil testing kits available, or soil testing labs that can analyze soil types based on samples sent to them. Conducting simple borings down to 18 to 24 inches in several areas can reveal any clay layers that are hidden under several inches of topsoil. A clay layer will prevent water from infiltrating into the soil. These areas are most suitable for species that tolerate standing water or periodic flooding. Emergent or wetland species will typically do well in standing water, while wet prairie species will generally tolerate flooding as well as summer droughts.

Light

Determine the light conditions on your property. Observe your site to note how much light the property will receive. Areas receiving less than six hours or no afternoon sunlight should be reserved for woodland plantings. Areas receiving afternoon sun or more than six hours of sunlight should be left for prairie plantings or other sun loving species. Areas in between woodland and prairie (areas receiving only morning sun, dappled afternoon sunlight, or between three to six hours of sunlight) can be landscaped with savanna plantings, or those species that live in the transition between prairie and woodland. These species are fairly adaptable to a range in sunlight conditions.

Topography and Hydrology

In addition to soil and light conditions, it is important to note the existing topography and hydrology. What are the drainage patterns and how does the water drain? Does the site face

Matteson Village Hall incorporates existing topography and water to provide a pleasant landscape and image

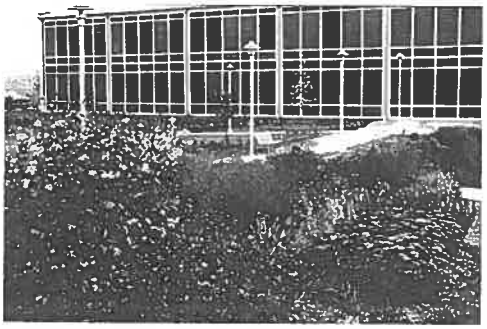
north, south, east or west? Where is the sun and shade in the morning or afternoon? Are there any existing water features, such as a stream, wetland, or lake? Once again, to ensure success, it is best to work with what is present on the site. How has the site been hydrologically altered? Are there any drainage or erosion problems that require special attention? Rapid, un-natural fluctuations in water level can encourage invasive species such as reed canary grass.

Mild erosion can be solved by planting proper plant material. Erosion control fabrics should be used for erosion prone sites that have 10 to 15 percent slopes. For slopes that are more than 15 percent, plugs should be installed rather than seed. It is also recommended not to do any sowing of seed during dormancy (winter) in areas prone to erosion. Other solutions may be needed to solve severe erosion problems, and are beyond the scope of this guide.

Surrounding Area

It is also important to observe surrounding properties or off-site areas and determine what impact these properties can have on a new installation. If an adjacent area is infested with an invasive species, maintenance of the new plantings will be more critical. Also, the source of any water flowing onto the site may present problems if it is coming from a highly fertilized area such as turf, or from streams infested with purple loosestrife or reed canary grass. An area surrounded by impermeable surfacing can be subject to flooding.

Are there any views to promote or screen? Native tree and shrub masses can be installed as a visual screen to unfavorable views.



Employees are able to enjoy views of the landscape at Matteson Village Hall

Other considerations that are used in any planting plan include architectural style, position of windows, doors, paths, and utilities. Utilities should be located before any digging begins.

Plant Selection: The Landscape Plan

After conducting a thorough site inventory and site analysis, it is time to begin thinking about the layout of the landscape. As mentioned previously, it is very important to select the proper plant material for the site conditions. Once again, a local ecologist or nursery can help with plant selection. There are several items that should be considered when selecting plants. Prairie plants will thrive in full sun, and woodland plants do best in shade. Shade is an important issue when it comes to proper flowering and reproduction of woodland plants. These

plants need at least 15 to 25 percent of available sunlight reaching the ground to flower and fruit. In denser shade, the plants will perform poorly. Make sure that when selecting plant materials that their preferences are met where they will be planted. Other conditions to consider, besides light, include soil moisture and soil content. Consider other influences on the site, for example, will these plants be installed along a roadway where road salt will be used, or in vegetated drainage swales that transport salt laden water to detention areas? Salt tolerant species are required for these conditions.

After determining what plants will grow well on the site, consider the design intent. Designs should be consistent with local ordinances that often include guidelines on height and plant species. (Note: if ordinances discourage natural landscaping, this may be an opportunity to revisit them. The *Source Book* contains sample ordinances.) Will this be a more formal design, or will it be a naturalized mix of species? Decide what will work best with the building, park, or other facility, and on the design intentions. The design can be a mix of formal and informal, with the more formal plantings installed close to the building, and a naturalized planting surrounding the retention pond or other open areas. From the perspective of enhancing biodiversity, a natural approach is preferred. However, even in a naturalized area, a mowed edge or path through a site will give the appearance of being a well maintained landscape.

More showy plants are planted in mass near the building at Tellabs

There are different categories of native plantings.

* A naturalized planting is a combination of seeds and live plants that are designed using aesthetic criteria, but also are designed to function like a natural system.
* Native tree and shrub beds are planted in masses to screen or buffer views. This mass of trees and shrubs is not necessarily a naturally occurring ecosystem, but they do provide habitat.
* Another method is to create native perennial beds that are planted in a traditional manner. These plantings are done in masses for a bold and colorful appearance and are typically designed by entrances or signs. Spring, summer and fall blooming species provide a showy display during the growing season.

Landscaping with native plants is typically thought of as installing a plant community, such as prairie, savanna, woodland, etc., rather than individual species. Natural areas provide examples of plants that already function together.

Where circumstances allow, prescribed burning is a recommended method of management, and

is discussed further in **Chapter 2**. Keep in mind that local regulations may prohibit burning. If burning will be conducted on the site, it should be factored in during the design phase. Plan for fire safety when placing plants. Prescribed burning can occur safely around parking lots and picnic areas, but do keep this in mind during design. A mowed buffer strip of at least 20 feet, or permeable paving, can provide a useful fire break between the planting and any buildings or other areas needing protection. On the other hand, planting an annual crop that has been denuded of seed will help carry the fire through a wildflower area.

Do not install any plant material that is not tolerant of fire in the areas that will be burned. Fire intolerant species include pines, spruce, hemlock, balsams, and all young saplings and trees. Fire tolerant species include burr oak, white oak, and shagbark hickory.

There should be an adequate mix of grasses to allow for burning to be most effective. A general guideline is a mix of 60 percent grasses to 40 percent forbs. These percentages are a general guideline and are dependent on the particular site. Consulting an ecologist or other expert in natural landscape management can help create the proper species mix. In woodland areas, burning is necessary to remove leaf litter periodically to provide adequate conditions for seed germination. Some species, such as sedges, will not be able to reproduce in areas that are not burned because the seeds to do not receive enough sunlight.

Other considerations for plant selection include color preferences, height and seasonal interest. Different species bloom at different times during the season, so it is important to know what will be blooming at what time, and whether these colors and textures are complementary. Most wildflower colors are already complementary, blooming in shades of violet, blue, yellow and white. Nursery catalogues and plant books contain information on blooming times and flower color. Particularly in a formal planting, make sure to have plants that fill in when others have bloomed and gone dormant. The same sources contain information on plant height. It is generally desirable to have shorter species in front of a planting bed, and taller species in back. Some of the taller species may shade out the shorter species. It is common in a native planting, as in other plantings, for some species to adapt to the site conditions quicker, and they could dominate other plant species. The growth time and level of aggressiveness of certain species is known, and should be factored into the design and selection phase. Nutrient rich soils will also contribute to unnatural plant size and aggressiveness. Competition is important to maintaining plant diversity. A diverse initial sowing of species will better provide this competition. There will be some plant succession that will take place. Succession of certain species is also dependent on the proportions of grasses to forbs that are installed in the initial planting. Prairie grasses can be aggressive and outcompete forbs if the mix is wrong.

One of the highlights of natural landscaping is that there is seasonal interest all year long in terms of color and structure. Many species turn into shades of gold and brown in the fall, and retain their seed pods through winter. If winter interest is a requirement in the design, select plant material that does not die to the ground during freezing weather.

The seasonal interest of different species will influence the maintenance plan, as some maintenance activities, such as mowing, will have to occur around flowering or fruiting times of different species.

As native plants may take approximately three years to get established (five years if planted only by seed), it is important to consider how the design will look when it is first installed. After installation, native plants spend their energy on establishing their root systems. One of the important decisions to make when installing a native landscape is to install either plugs or seed.

Plugs provide more immediate results

* By planting plugs, native plants require a shorter time to get established. There is also the satisfaction of seeing immediate results after planting.
* Plugs are a better way to establish more formalized areas because there are fewer problems with weed seeds and spacing, and there is better control over plant development.
* Plugs are recommended on sites that are smaller than 1000 square feet. Although plugs have more of a visual impact, and are established sooner, there is a higher cost to installing plugs over seed.

Plugs require more frequent watering than seeded installations, until establishment. There is also an issue of causing more soil disturbance when installing plugs, thus stimulating more weed growth. Seed causes little soil disturbance.

Another common practice of providing instant impact is to install a fast growing, colorful, short lived species, preferably native, that will dominate the landscape the first growing season. As these plants die off, they will be replaced by the colorful beauty of the native plants that are getting established.

Plant stock should be purchased from local nurseries, and its origin should be from locally collected seeds or cuttings. Some nurseries obtain their plant material from other parts of the country, so make sure that the plants originated in and are native to the geographic area. This will help preserve local species of insects and birds that co-evolved with these plants, and

also ensure that the plants will thrive.

Plants should not be obtained from the wild, as wild collection is disruptive to the natural area, and in the cases of rare and endangered species, this practice is illegal.

Prairie seeds can be sold as Pure Live Seed (PLS), and the seeds still have dispersal parts attached that help the seed adhere to the soil. Since the seeds are not cleaned, there may be some problems feeding them through a seed drill. Most prairie and woodland seeds germinate more quickly if they go through a cool, damp period of approximately 30 days (depending on the species) prior to planting. This is called stratification, and it can be done by placing seeds in a plastic bag, mixed with moist sawdust, sand, or peat moss, and placed in a refrigerator. For spring germination, seed should be sown in the fall , or cold damp stratified prior to spring sowing. There are a number of species, such as sedges and many of the spring flowering plants, that perform best if sown fresh before they have a chance to dry.

Site Preparation

The first step in installation is preparing the planting beds. It is important that they be properly prepared and weed free before planting.

* For a farm field (corn, soy or other annual crop field), disking the soil before planting is all that is necessary to prepare the site. However, to eliminate soil disturbance and to minimize weed growth, a recommended method is to herbicide the existing vegetation in early summer, followed by burning, and another late summer herbicide application. Seed can then be sown in late fall.
* If there is vegetation present, there are several methods to remove existing plant material that will not be preserved. The site should be prepared for up to one year before seeding.
* Fallow fields or pasture areas will need to be treated with herbicide several times and mowed or burned periodically to remove any aggressive non-native vegetation.
* Areas that are infested with thistle, sweet clover, or teasel can be controlled during site preparation by mowing before they are able to flower.

If the existing vegetation is turfgrass, it does not necessarily have to be removed. The turfgrass can be herbicided and burned, and the native seeds drilled directly into the sod. To keep the sod layer from being too thick for the drill, mow the turfgrass before applying herbicide.

Other plants that need removal can be removed mechanically by pulling. In a large area, the plants can be killed using an herbicide. When an herbicide is used, new plants cannot be installed for two weeks after an herbicide application. In some instances, an herbicide application for a few seasons will help ensure elimination of any weeds prior to installation. Extra care in herbicide application must be taken near any body of water.

In smaller areas, another method to remove herbaceous plants is to place black plastic sheets over the existing plants, held in place by ply-

wood. The plastic should be in place for two months or more. There are some recommendations for rototilling the site after removing the plastic, however this may stimulate weed growth. Overall, rototilling is not recommended. A no till drill can be used to install seed without the need to rototill.

With some invasive species, a combination of herbiciding and burning is most effective to completely eliminate the rootstock. Herbiciding works more effectively after the plant material is weakened by a burn. In general, when herbicides are used, select a product that is as environmentally-friendly as possible.

Any trees that will be saved need to be protected to avoid the possibility of root compaction by heavy machinery. Stakes with tape or exclusionary fencing should be placed around the dripline of the tree. Vehicular traffic or storage of materials should be prohibited within the dripline. Any planting that will be done within the dripline should be done by hand.

If the site surrounds new construction, topsoil that was removed for building construction should be replaced. As in many construction sites, the soil is severely compacted. This must be corrected before planting. It is important to not leave the soil exposed for a long period of time prior to or during planting, as exposed soil can lead to erosion. All soil piles must be protected with silt fence, straw, soil berms, etc. The addition of organic matter, such as leaf or mushroom compost, will help to improve the condition of the soil, however this is not necessary to achieve a successful native planting. Too much organic matter can encourage weed growth.

Planting

The best times to sow seeds are from early fall to mid spring. Fall sowing is a dormant seeding and should not be done earlier than mid-October in this region, as the seeds may germinate and then die during the winter. In addition, it is not advisable to plant small seedlings past the middle of September. The seedlings will not have enough time to develop their root systems, and may succumb to frost. When seeding in the winter, the freeze and thaw cycle helps to improve seed contact with the soil. It is best to spread the seed when there is no snow cover to ensure soil contact. If the seed is not stratified, an early spring sowing, just as the snow is melting, should provide the stratification necessary for germination. Spring sowing should be completed before May 15.

Installation of shrubs. Photo courtesy of Applied Ecological Services, Inc.

With container grown plants, the root stock should not be significantly smaller than the container, nor should the plants be root bound. If the rootstock does not fill the pot, shake off extra soil before planting. If the roots are pot bound, cut and pull apart the roots before planting.

When planting plugs, if mulch will be applied to the site, it is easier to first install the mulch, and then plant. This will prevent any damage to the new plantings when installing the mulch. With seeding, however, it is recommended that a very light mulch be applied after the seeds have been planted to ensure good soil contact. A recommended mulch is a weed free oat straw layer that is typically applied at 2000 pounds per acre, one-fourth of an inch thick. Straw helps to retain moisture, holds seeds and soil in place, and helps to keep weeds down.

A mulch of weed free clean straw should be applied after seeding

Planting is best done on an overcast day, but as this is difficult to manage, keeping the plant material moist prior to planting is most important. Watering and keeping the plant material in a shady location prior to planting will help to ensure success. Also, when the plant material is transported from the nursery to the site location, the plant material must be protected and covered to keep from drying out. Plugs should be planted when they are thoroughly moist. Do not remove plants from the containers until they are ready to plant to further prevent any moisture loss.

The spacing between plants varies according to mature size, but approximately one plant per square foot is recommended. There are instances when plants should be planted closer together, such as on a slope, or if there is a desire for instant effect. Larger, deep rooted plants, such as prairie dock, can be planted further apart.

Seeding is recommended for larger areas. Seeds can be broadcast by hand, or applied with a spreader. The soil should be lightly scarified before sowing seed. The seed should be raked in (although not necessary in the fall), rolled with a lawn roller, and then a light mulch of weed-free straw applied. A seed drill is a piece of equipment that can be used to install seed. Some of the drawbacks of a seed drill include the expense of the machinery, the requirement to use clean seed, and the appearance of planted rows. It is also not the recommended method for species that require sunlight to germinate, such as sedges and small seeded species like gentians. It is an excellent way, however, to get good soil to seed contact. The depth of drilling is different for grasses than for forbs, so the seed

should be sown in two applications--one for grasses and one for forbs.

Installation of seed. Photo courtesy of Applied Ecological Services, Inc.

Hydroseeding is another method to install seed. In conventional planting, this method uses a mixture of seeds, mulch and fertilizer that is sprayed onto the soil. With native plantings, it is recommended to install the seed by hand, and use hydromulch. Seeds that are mixed with hydromulch do not make good seed to soil contact and can dry out. Fertilizer is not recommended for native plantings. If renting the equipment, inspect it for any remaining seed from a previous job. This seed can contaminate the site.

When using seed, consideration should be given as to how the material will be kept in place until it is established. A rain event can wash away the seed, or pool the seed, resulting in bare spots, and other areas where the planting is too thick. Using a roller to establish good seed to soil contact will help. Also, a nurse crop of annual rye or oats can provide soil stabilization while the native plants take root. In addition, a nurse crop helps to control weeds and retain soil moisture.

Once the plant material is installed, it is very important to water. Water should be applied immediately after planting, and then at least every two to three days for the entire first growing season. Watering is especially important when planting plugs because they are more at risk of drying out very fast. If watering cannot be insured, seeding is a better option. Plugs need deeper, less frequent watering to encourage deep rooting, or they may develop shallow roots with shallow, frequent watering.

Plants that were properly selected and planted will not require fertilizers. If fertilizer is applied, unwanted weed species will benefit. In wet areas, fertilizers will encourage algae growth.

There are inoculations of some organisms and bacteria that are beneficial to new plantings. Micorrhizae fungi benefit many upland prairie plants such as big bluestem and Indian grass. Prairie legumes benefit from rhizobium bacteria. Native plant nurseries supply inoculums of both micorrhizae fungi and rhizobium bacteria, although supply may be limited.

Chapter 2: Post-Installation Management and Maintenance

The very nature of the time that plant material takes to mature is inherently a challenge. The success of some planted communities can be measured early, whereas others, such as woodlands, can take decades.

Identification of Long Term Management Responsibilities

The typical guarantee for plant material is one growing season. As native plants take longer to establish than conventional landscaping plant material, a two year guarantee on the plant material can be requested in the contract. The contractor should replace any plant material that did not survive, or is in decline, two years into the planting. Please note that this additional guarantee may increase the installation costs. Maintain the two year guarantee on the replacements, and continue to monitor the site. As native plants are established, maintenance should be minimal. If there are any concerns about the plantings after the initial contractor has completed the work, including replacements, a periodic consultation with the contractor, trained ecologist, or native plant specialist can help to maintain the site and address any problems at an early stage.

Preparing a maintenance bond is recommended. This legal agreement is a guarantee on landscape materials and workmanship and provides recourse if problems arise.

Request a three to five year management plan from the contractor. Close monitoring of the new plantings must be done to control any weeds that take over the planting. There is a better success rate when any problems are quickly addressed and corrected. Invasive species can become a problem even after the plantings are established. To achieve consistent monitoring, it is best done by the same company who is familiar with the site.

Monitoring and record keeping can track successes and problems. Recommended guidelines for monitoring include

* completing an inventory of all naturally landscaping areas,
* establishing permanent photographic locations to document vegetative cover, erosion problems or other maintenance concerns, and
* completing routine inspections to observe the planting for invasive species and any other issues such as soil erosion.

Recommended maintenance can vary, and it depends on the particular site, plant community, and particular invasive species that are affecting the site.

Performance Criteria

The following is a list of criteria for the installation. If at any time these criteria are not met, a

remediation plan should be developed and the situation corrected.

* After the first season of growth, the site should be completely covered with vegetation. At least 75 percent of the plugs, root stock and tubers should be present and alive. If seeded, the cover crop should be dominant.
* During the second growing season, at least 25 percent of species planted by seed should be present and alive.
* By the end of the third season, 75 percent of the seeded species and 90 percent of the plugs should be established.

The first year following planting

It is critical to control weeds after the initial planting to prevent a larger problem later on. Hand weeding may not be an option for larger sites, but will work on some smaller installations. Weeds should be pulled when the soil is moist, and with the least amount of disturbance to the soil. Disturbances in the soil can encourage the growth of non-native species. Weeds can also be cut near the ground with pruners. It is important to control weeds before they are able to go to seed.

Purple loosestrife is an attractive but invasive weed. For images of other invasive weeds, visit http://dnr.state.il.us/lands/education/ExoticSpecies/photogallery.htm

It is important to identify which weeds are perennial weeds, and which are annuals. Perennial weeds need to be herbicided as soon as they are identified, and should be herbicided for the first three years of the planting. Annual weeds should disappear with mowing.

Mowing is a more practical solution for large sites, but spot herbiciding perennial weeds is still necessary. By keeping the plants at a height of four to six inches in the first year, the seeds of invasive species will not be able to develop and be released, and this allows sunlight to reach the young plants. Mowing should be done before any weeds are able to set seed, which happens when they are about 6 to 10 inches in height. Using a flail type mower is best because the cuttings are more finely cut and can serve as mulch, without smothering the new plantings. The last mowing of the year should keep the plants, including weeds, at a height of 8 inches to protect the new planting. Wetlands can be mowed as well, as long as the mowing equipment will not damage the soil. Towards the end of the first year of the growing season, stop mowing the site.

Timing of an herbicide application is crucial, as well as knowing the specific weed or insect and using the appropriate method. Some herbicides are plant specific and it is necessary to research the best herbicide to apply on each non-native to be eliminated. When herbicides are necessary, they can be applied with a wand or sponge applicator to control the growth of an invasive species, rather than spraying an entire area.

Aggressive weeds such as Canada thistle and quack grass respond to a spot herbicide application, although there may need more than one herbicide application to be effective. The leaves of some species, such as hybrid cattail, can be crushed in early spring, or cut over the winter months. Crushing in early spring will weaken the plant that is using its energy in developing leaves, making an herbicide application more effective. With winter cutting, higher spring water levels will drown the remainder of the plant that was cut over the winter.

Biennial weeds can often be controlled by allowing the plants to grow until the seed is set, cutting the plants and removing them. For biennials, seed formation means the plant will soon die, and by removing the plants and seeds, these weeds will be eliminated.

If there is a nearby field full of weeds, maintain a mown strip of five to ten feet to help prevent any unwanted seeds from contaminating your site.

Management in the second year

In the second year of growth, succession within the native plantings will begin to take place. Plants that have adapted to the site will begin to thrive. Watering is only necessary in times of drought.

Since most native grasses and forbs are warm season plants, a spring burn in March or April will help to control any cool season non-native plants. Historically, wetlands did not burn naturally as often as upland prairies, but with the presence of invasive shrubs, burning may be required more often. Burning the entire site for wetlands and prairies is recommended annually for the first five years.

For some invasive species, a later burn is recommended. For example, to control reed canary grass, a burn in May or June, when it is about to flower or is flowering, is most effective. (An herbicide application will also be most effective at this time.)

If there are any bare areas on your site, or where plants need to be replaced, an option is to collect the seed of existing plants. This should be done before burning, and then the seeds can be spread by hand in the bare areas after burning.

Seed harvesting from existing plants

If burning is not a viable option, mowing can still be used as a management tool. In the second year, the first mowing should be done in late spring or early summer. During the rest of the season, maintain a height of 6 to 12 inches.

Three years and beyond

Three years after planting, native plants really begin to flourish above ground, and will flower more profusely. As with any landscape, the site should be monitored for the growth of invasive species, and as mentioned earlier, immediate removal will prevent larger problems. Removing invasive plants can be done manually, or by spot applications of herbicide. Burns are recommended for the first five years, and then burns can be conducted every two to four years. At the end of the second year, or beginning of the third year, it is not recommended to burn between May 1 and July 15. Divide the plantings into sections, and only one section should be burned at a time to allow refuge for animals and insects. By varying the timing and types of burns, higher plant diversity is achieved. This also provides different effects in the landscape. Each section of the landscape, however, should be burned every three to four years.

Supplemental sowing can add species that need a more stable environment to become established. This is a time to plant more conservative species.

If burning will not be done at all on the site, mowing is still an effective alternative, and will be the main management technique. Ideally, it is best to allow the native plants to set seed in the fall, and to mow in early spring. This will provide insect and small mammal refuge, seed for birds, and winter interest in the landscape. Mow in late March or April as close to the ground as possible. When managing a site with mowing only, rake the clippings so that there will not be a build up of debris on the ground. This will also expose the soil to light and heat. However, if the site is wet in the spring, mowing should be done in late fall.

Integrated Pest Management

To control invasive species, Integrated Pest Management (IPM) is a method of weed and pest control that works with natural cycles to most effectively remove undesired species with a minimum of environmental impact. Pesticides and herbicides are damaging to the environment, and IPM recommends the minimal use of chemicals, but recognizes that sometimes it is the only method of removal. There are cultural, mechanical, and biological approaches that can be used before resorting to the use of chemicals. Cultural and mechanical approaches apply to crops, and include crop rotation and tillage to control weeds. The biological approach is to introduce an appropriate competitive species to control the problem species. An example of this is the introduction of the Galerucella beetle, a leaf eating beetle that eats the leaves of purple loosestrife, to control the spread of this invasive plant. For pest management information, the National IPM Network is a partnership that maintains the latest pest management information. The web address is http://www/ipm.iastate.edu/ipm/nipmn. Current information on problem species and solutions can be obtained by state. By keeping the desired plant material

healthy and weakening any weed species, the use of herbicides can be minimized or not used at all.

In the Midwest, the SAFER Pest Control Project focuses on the reduction of pesticide use, particularly in and around schools, and implementing the use of other alternative methods of control. They maintain a resource center of books, journals, fact sheets, etc., to educate different audiences on pest control. The website for the Safer Pest Control Project is http://www.cehn.org/cehn/resourceguide/tsp ep.html.

Invasive Plant Species Management

Many species are far more aggressive and invasive than in years past. A more specific means of irradicating invasive species from a prairie must be implemented. Many times, mowing and burning alone will not have an impact on non-native species (e.g., Canada thistle, brome, quack grass). Spot herbiciding very early in the establishment phase should be used in conjunction with selective mowing or burning to eradicate significant outbreaks of invasive non-native species.

Burning as a management tool

Burns that were set by Native Americans or caused by lightning were part of the natural landscape for centuries. Prairie and woodland burns help to clean debris, allowing sunlight to reach new growth on the forest floor. Some plants need the heat of the fire for their seeds to germinate. Native trees, such as burr oaks, have a thick bark that withstands burning. Prairie plants have long, extensive root systems that allow for burning above the soil. In present day restorations and native plantings, a controlled burn can help prevent the growth of invasive species, as some are unable to tolerate fire. Using a properly trained crew and equipment, burning as a management tool is recommended for large sites, and is possible on small sites, and near areas such as parking lots.

Properly trained crews conduct a burn at the Peggy Notebaert Nature Museum

Permits from state or local agencies are required to conduct a burn. In Illinois, a permit is required from the Illinois Environmental Protection Agency (IEPA). Additional permits may be required by the county or municipality. The burn itself must be done by trained personnel. Burn training for maintenance staff is available through organizations within Chicago Wilderness. Chicago Wilderness also has infor-

mation on communicating to the public about burning, and also has a burn training manual for those who go through burn training. It is advisable to notify neighbors or employees, particularly those with respiratory illnesses, of an upcoming burn, so that they can then take necessary precautions. In general, burns should occur in the spring and fall, when air quality is good. This timing is also when native plants are going dormant and ground conditions are relatively dry.

Weather conditions are critical to a controlled burn. Considerations include temperature, wind speed, wind direction, humidity and fuel load. Five to twenty miles per hour is the recommended wind speed for the fire to spread along the ground, and still be controlled by a burn crew. Wind direction is critical for determining which way the burn will move, and should avoid roadways and homes.

Headfires that flow with the wind are beneficial at eliminating taller, woody vegetation from a prairie. Backfires are slower, lower, and more effective to root kill stands of invasive weedy species.

Humidity will also affect a burn, as high humidity can prevent a burn from being successful, and low humidity can make a burn too intense. The fuel load, which is the debris on the ground that will be burned, can also affect the success of a fire. If there is not sufficient fuel, the fire may die out before burning all the material. Sites that contain a lot of native grasses burn most dramatically. There is a correlation to the height of the plant material being burned and the height of the flame. Care should be taken to address specific site conditions, such as power lines and other electrical equipment. These topics are addressed in burn training.

Chapter 3: Special Applications

Natural landscaping is encouraged as a practice where water quality needs to be improved or protected. Water quality is negatively affected by soil erosion and pollutants, such as fertilizers and herbicides. It is desirable to limit the use of chemical fertilizers and herbicides when there is a possibility that there could be runoff into a water body. If necessary, there are herbicides available to use in wetlands and other areas that can run off into a water body. Different licensing requirements apply for using herbicides in these areas.

To improve water absorption, and to help retain stormwater on the site, hard surfaces can be replaced with porous alternatives such as crushed granite or mulch. For parking lots, brick pavers and similar products reduce stormwater runoff, and provide a more aesthetically pleasing alternative to concrete or asphalt. New permeable materials are continually being introduced to the market. Depressed islands and swales in parking lots that are vegetated with native plants also provide for filtration and absorption.

Stormwater Facilities

Best management practices for stormwater incorporate working with natural hydrologic cycles for managing stormwater. Native landscaping for stormwater management has several principal advantages. The deep roots allow greater water infiltration, thereby reducing stormwater runoff. Native plants and their roots also are effective in filtering and transforming many of the pollutants found in stormwater from parking lots, streets and other impervious surfaces. Native plants also hold the soil in place better than shallow rooted turf grass, a particular advantage along the edges of detention basins. Native plants also discourage nuisance Canada geese populations which have become ubiquitous around conventional turf grass detention basins.

A naturally vegetated swale at Tellabs

Calculations involving drainage area, slope, soils and other determinants are used in the design of swales. "Bioswales" include a perforated underdrain placed within a trench. Native plants are installed over the trench and help to absorb water and pollutants. Care should be taken during plant selection to choose plant material that can tolerate fluctuations in water

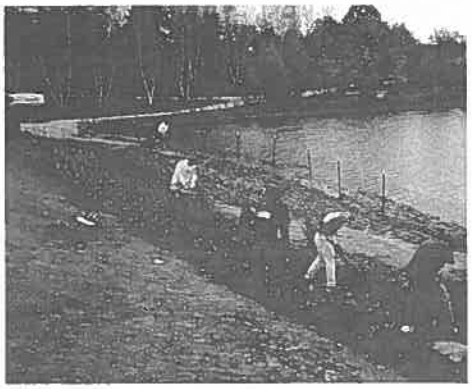
levels, and contaminants such as salt. During installation, it may be difficult for plant material to get established if there are any major storm events, and if possible, runoff should be diverted until the plant material is established. Use of an annual nurse crop and erosion control fabric will also help to hold soils while the native seeds get established.

For large areas, a system of filter strips of native vegetation and level spreaders, or trenches, can be installed to absorb runoff. The level spreaders are placed along the contours of the site, and help to distribute runoff.

Planting along shorelines

Detention basins, lakes, wetlands, and streams need a buffer of natural landscaping to absorb the chemicals and nutrients that are contained in runoff. The width of the buffer varies, but the recommended minimum width is 25 feet. A wider buffer will be more beneficial. Check with local ordinances as they have required buffer widths that can range from 25 feet to 100 feet, depending on circumstances. Natural landscaping also helps to protect against erosion that typically occurs with a turfgrass shoreline. A buffer of tall grasses will also protect any new plantings along the shoreline from being consumed by geese, and will provide habitat for other species. Water temperatures can also be mitigated by providing areas of shaded water.

Some states require permits when planting or removing aquatic vegetation. For example, Wisconsin requires permits for any chemical, mechanical, or biological removal of plant material. The local aquatic plant management coordinator for the Wisconsin Department of Natural Resources must be contacted before beginning any management activities. (In Illinois, no permits are required for removal.)



Crews install shoreline plantings at the Chicago Botanic Garden. Photo courtesy of Applied Ecological Services, Inc.

When planting along a shoreline, it is important to select plants that can tolerate certain water levels and wave action. It is equally important to survey the existing vegetation on the property. Any non-native plants along the shoreline should be removed, or the planting will be taken over by aggressive non-natives.

Aquatic plants include submerged, floating and emergent species. Submerged plants grow in water depths where sunlight is still able to penetrate. Floating plants have roots that reach the soils of the bottom of the water body, with leaves and flowers that float on the surface of the water. Emergent plants have roots at the

waters edge, generally tolerating water at a depth of 3 feet, and grow above the water surface. Emergent plants help to prevent erosion of the waters edge, and include many different species of wildflowers, sedges, grasses, shrubs and trees. Emergent plants should only be planted in shallower water or along the muddy edge. Young emergent plants cannot tolerate deep water initially, and need time to migrate into deeper water.

Erosion control measures are necessary when establishing a shoreline. Specific blankets are available which will hold soils, seed and plants in place while they become established.

Wetlands

Wetlands are important for reducing floods, filtering pollutants, and for groundwater recharge and discharge. Wetlands are protected under federal, state and county laws. If a wetland is present on the site, the local countywide stormwater agency or Soil and Water Conservation District may have information on required permits for doing any alterations to the site. A site survey is very important in restoring or creating a wetland. The success of restoring or creating a wetland relies heavily on the hydrology of the site. Determining the locations of drain tile and drainage ditches is critical. Any rapid fluctuations in water level can negatively affect some plant species. Surrounding land cover, slopes and soil are important factors that influence water level.

A buffer around a wetland should be included in the design. Depending on the size and quality of the wetland, the recommended buffer is 30 to 100 feet. If there are conflicting land uses nearby, such as a shopping mall or roadway, the buffer should be expanded.

A created wetland can provide beauty, habitat, and stormwater retention. Donor seedbanks from wetlands that will be destroyed can be a source of wetland plants. It is recommended to use only small amounts of soil from the donor wetland to reduce cost and to prevent weed seeds from being transplanted.

Submergent and floating aquatic plants are typically planted as rhizomes and tubers. If there are no water control structures in the wetland, it is best to plant after a heavy rain, or during a rain period. The rhizomes and tubers should be planted at the same soil level as they were previously growing, and the water level should stay consistent. They should be planted at appropriate distances apart, depending on the mature growth of the species.

To prevent wildlife such as geese from eating the new plants, a buffer of tall grasses should be included in the wetland planting. Use of netting may be required when plants are young. If muskrats are present in large numbers, a removal plan should be in effect.

Some shrubs can be installed as cuttings. It is best to collect cuttings from late fall to early spring, before the buds start to burst. The cut-

tings can be placed in moist soil, and must be kept moist until they have developed a root system.

Weed free straw is the recommended mulch for wetlands. Compost and manure are not recommended due to the addition of nitrogen.

Golf Courses

Golf courses are large expanses of open space, but typically golf course management uses large amounts of chemicals and water to maintain the grounds. Starting in 1991, the Audubon Cooperative Sanctuary Program for Golf, formed by Audubon International, has helped to provide guidance in golf course management. The program educates maintenance staff, club personnel and industry professionals on environmental planning, wildlife and habitat management, chemical use and water conservation. By designing and managing golf courses wisely, and in cooperation with golf course staff, everyone benefits. More information is available at http://www.audubooninternational.org/programs/

Sustainable lawns

There are situations where lawns are desired, and there are methods to create a more sustainable lawn that requires less mowing and maintenance. Some native species give the appearance of a Kentucky blue grass lawn, but do not require the irrigation and care of Kentucky blue grass. By using a "low mow" species mix, mowing frequency can be decreased. Low mow mixes include species that are deeper rooted, allowing the lawn to stay greener longer, and more diverse. Usually, several species are used in the mix.

By allowing the grasses to go dormant during summer droughts, water use will be reduced. The grass will be light brown in appearance, although it will become green again once the rains resume.

The type of landscape equipment used during maintenance activities will also help in reducing pollutants, and make the lawn areas more sustainable. Gas powered equipment produces significant pollution. By switching from gas powered mowers and edgers to manual or electric equipment, pollution is significantly reduced. An electric, mulching lawn mower allows clippings to be left on the lawn.

When applying fertilizer, use one that is low in phosphorous, and apply in August or September. Organic fertilizers are also available. Use precautions to keep the fertilizer from entering any body of water. Keeping the grass at a height of 3 fi inches will help the grass survive hot weather, and prevent the invasion of weeds. Weeds can be pulled by hand, rather than by using an herbicide. If grubs become a problem, August is the best time for treatment. A little tolerance of allowing the landscape to be less than perfectly green and manicured helps to alleviate the need for so many herbicides and pesticides.

Other sustainable ideas

Installing rain gardens, rain barrels, and cisterns are additional ideas for using water responsibly. Rain water can be directed into a rain garden by downspouts or swales. By planting wetland or other plants that thrive in wet conditions, the rain water is absorbed through the roots of the plants. Cisterns can be set up to collect rainwater from the roof, and the water can be used for watering the landscape, or for water features such as reflecting pools or fountains. To keep the rainwater clean, it is advisable to add a mesh cloth on the gutters to keep leaves and other debris out of the gutters.

Green roofs are vegetated roof tops that help absorb rainwater, and also reduce the heat island effect in urban areas. Drought and wind tolerant plants perform best in rooftop gardens. In addition to the environmental benefits, there is also the creation of an extra outdoor facility.

Green roof on City Hall. The City of Chicago Department of the Environment can provide information on the installation and maintenance of green roofs.

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