Environmental stewardship & your maintenance plan: *SET AN EXAMPLE*

>> SUNRISE over the Nation's Capitol Cup Lacrosse event.

Environmental stewardship is now common in all aspects of our lives. Just look around you while you are reading now; there likely is an example close by. Recycling receptacles, energy efficient lighting, and low-volume water fixtures; the transition to "green" is no longer just a fad that is dictated by a person's political affiliation or geographic region. Protecting the environment is recognized as a moral responsibility.

Sports field and parks maintenance departments are realizing that going "green" is not a complex issue. Rather it is a basic use of simple conservation. Ironically, maintenance budgets are becoming financially "green" by adopting new methods and technologies to reduce waste in order to save the environment.

For sports field and park maintenance departments considering options to become more environmental friendly, it can initially seem as a daunting task. But to start, there are five pieces of a maintenance program that can have the largest environmental impact: nutrient management, pesticide usage, equipment fleet management, irrigation practices, and field paint. Focusing on these five elements will initiate the "green" direction of a program. Let's examine each of the pieces and explore the potentials for evolution in the maintenance program to protect the environment and to save money.

> Soil testing 4-5 times a season can illustrate to a manager the need for macro and micro-nutrients.

NUTRIENT MANAGEMENT

Environmental Impact: It is possible for some fertilizer nutrients to leach through the soil via storm water and irrigation when used incorrectly or in excess

Evolution Potential for Maintenance Programs: Technologies in both granular and liquid fertilizers allow managers to exert more control over their plant-feeding pro-

gram to avoid wasted fertilizer that could potentially pollute.

Many granular technologies are based around the timed "release" of nutrients. Some are controlled by chemical formulations, some have special "coatings," and others use basic mineralization. All of these different release methods provide turfgrass managers with control over the quantity of each nutrient they want to provide a growing turfgrass plant.

The fertilizer's known technology, along with historical data for soil temperature fluctuation and weather conditions, can be combined using computer graphs to create an efficient, season-long granular program, eliminating waste and over-fertilization.

In addition, regular soil testing provides a base line of plant available nutrients in the soil and will supply the estimated nitrogen release (ENR) from organic matter present. Soil testing 4-5 times a season can illustrate to a manager the need for macro and micro- nutrients. Tracking the ENR provides the ability to cut back on nitrogen inputs as the soil microbes break down the organic matter and release nitrogen.

The slow release technologies, accompanied with regular soil testing provide managers the ability to reduce their over all inputs and ultimately reduce costs on fertilizers and on fungicides needed to control plant diseases caused by deficient or excess fertilizers.

Liquid fertilizer and bio-stimulant use is growing in the sports field maintenance industry because of the increased growth control they provide to managers.

Foliar fertilizers are readily available for the plant to absorb and use quickly and efficiently to reduce the total amount needed. Foliar fertilizers are able to supplement fungicide programs and help the grass plant withstand diseases and traffic as well.

Bio-stimulants provide an avenue of natural, healthy growth that reduces the need of mineral fertilizer. Because of environmental stresses (drought, excess rain, heat) and physical stresses (traffic, mowing, compaction), the turfgrass plant is not always able to perform its natural growth and development processes. Bio-stimulants are organic products that use plant hormones to promote growth while aiding in plant metabolic processes such as respiration and photosynthesis.

Overall, the usage of foliar fertilizers and bio-stimulants gives managers the ability to grow a stronger, healthier plant by using less material and providing non-harmful, naturally plant-occurring compounds.

PESTICIDES

Environmental Impact: Historically, some pesticides have been non-selective in the "good" or "bad" pests that they can kill, earning a connotation of fear for the word "pesticide."

Evolution Potential for Maintenance Programs:

Fungicides are important in the battle to combat turfgrass diseases. Stress conditions from weather and foot traffic make the grass plant susceptible to invasion from disease pathogens. *Fungi*?

cides aid in the battle against the attack of diseases during these stress times.

Advancing science allows us to understand why these pathogens can adversely impact the plant. For simple examination, we can use a human analogy: A human who has a balanced diet, hydrates, exercises regularly, and gets adequate rest has high energy levels and a strong immune system that can fend off infections and diseases naturally

Likewise, a healthy grass plant has some of the same natural responses and energy reserves to fend off disease and consequently withstand more traffic. Balanced fertilization, proper water amounts and timing, continued soil aeration, and appropriate mowing height; all are steps toward a healthy plant with strong cell walls, deep roots, and energy levels to withstand stresses and diseases.

Insecticides. Advancements in insecticide technology are providing some of the most dramatic environmental differences for managers of sports fields and parks. For example, a grub control product that has come to the market is from a new chemistry class that requires no signal word on the label. The chemistry is based on a naturally occurring substance found in the bark of Ryania, a tree and shrub species. This technology is not required by the EPA to include a safety signal word on the label after acute toxicology testing showed no harm to humans, birds, or fish.

Equipment companies are now producing hybrid mowers that require up to 40 percent less diesel fuel and are comparable in cost to conventional mowers.

Therefore, grubs, one of the most common and destructive insects on cool season turfgrass, can now by treated without any danger to the environment or patrons on the fields or in the parks.

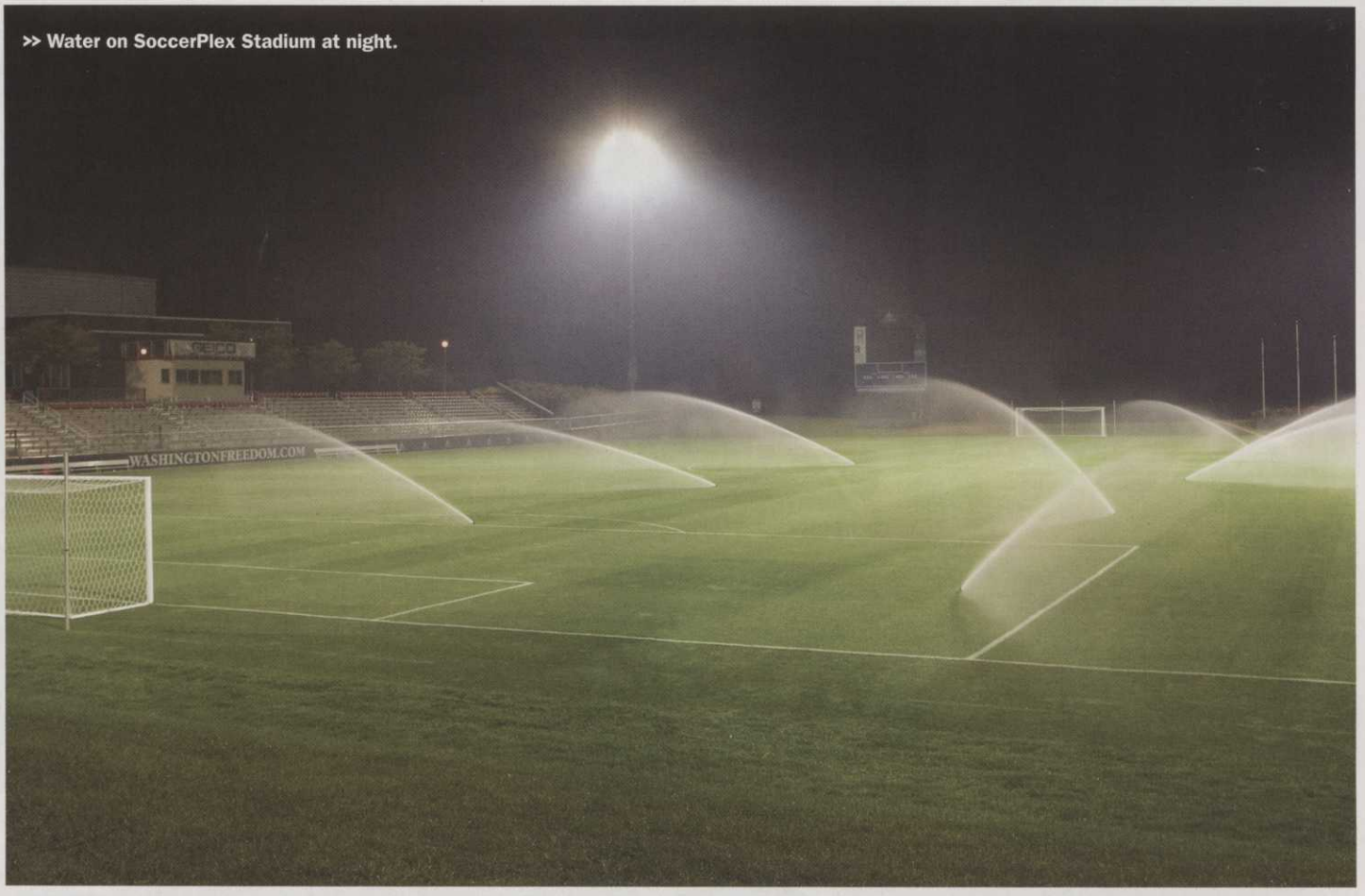
Other products and companies are involved in creating natural occurring technologies as well. Even natural substances such as garlic oil and cedar oil can be used to reduce populations of nuisance insects such as gnats, ticks, and ants.

Additionally, new turfgrass plant genetics creating stronger and healthier plants that can withstand more damage from diseases and insects. The stronger plants raise the threshold for treatment from pesticides completely.

EQUIPMENT

Environmental Impact: A fleet of maintenance equipment, mowers, utility vehicles, and tractors, among others, rely on pe-

>> Water on SoccerPlex Stadium at night.



>> **KEVIN TROTTA,** left, of the Global Sports Alliance and Jerad Minnick.

troleum products to operate. Gasoline, diesel fuel, oils, and grease are all big expenses. Additionally, operating such a large fleet of equipment constantly emits exhaust into the air during a workday.

Evolution Potential for Maintenance Programs: Hybrid and electric technologies are no longer advancements solely owned by car companies. Equipment companies are now producing hybrid mowers that require up to 40 percent less diesel fuel and are comparable in cost to conventional mowers. Not only do the hybrid mowers dramatically eliminate emissions, but it also requires less maintenance with less fluid changes and the engine running at less rpm's decreases noise pollution. In addition, vegetable-based hydraulic fluids and greases reduce petroleum dependence, along with reducing the risk of hydraulic leaks onto the grass and shop spills. As more machines are designed to burn engineered fuel, bio-diesel will continue to grain strength and popularity

WATER CONSERVATION/ WATERING EFFICIENCY

Environmental Impact: Water is our earth's most valuable resource. Overuse and waste of water not only impacts our overall water quality, it also adds to disease pressure on stressed turfgrass and washes fertilizers through the soil more quickly.

Evolution Potential for Maintenance Programs: When considering water conservation and irrigation, turf managers should strive to water efficiently and purposefully.

The effects of improper timing for watering are harmful. Not only is water wasted but the likelihood of disease outbreaks increases because of prolonged periods of leaf wetness.

Overwatering is also harmful. Roots are damaged when overwatering takes place as the water reduces the air space in the soil and the nutrient food bank is lost because the water washes them through the soil profile.

Improvements in weather forecasting resources to monitor weather conditions provide valuable information for reaching

>> **RYAN BJORN** painting a logo.

maximum watering efficiency. Wind speed and direction, humidity, and UV index are all factors that lead to evapotranspiration (ET). ET is the term used to describe the amount of water lost from the soil during a given day. Monitoring the precipitation forecast in combination with the actual ET and ET forecast, can help determine whether to wait an additional day for irrigation or until a rain event. Larger or busy facilities should consider the merits of a paid subscription weather service as well as employing real-time consulting services to be able to make better decisions on watering. The money savings from skipping only a few watering cycles will pay for the subscription.

Additional technology such as rain and wind sensors should be used in a water conservation program as well. These sensors can be installed on irrigation satellites to stop watering if sufficient rainfall has been received or if wind is gusting as to cause the water to blow off target. High-efficiency irrigation heads should replace aging irrigation heads that are leaking at the base seals and water pressure should be monitored in order to use the correct nozzles to reduce misting. Aggressive aeration also helps with water penetration so that less water is required to soak into the soil and lessens run off.

New paints are now available with low or no VOC content.

Water is a vital natural resource, and everything must be done to use it efficiently.

PAINT

Environmental Impact: Sports field paint historically been considered at least somewhat environmentally "safe" as these water-based paints break down relatively quickly. However, the colorant in these paints still holds VOC's (volatile organic compounds) that could be harmful for the environment. These VOC's are known pollutants to the environment that do not break down quickly.

Evolution Potential for Maintenance Programs: A soccer field has nearly .50 mile of lines to be painted each week. A football field has over .75 miles of lines before numbers, hash marks, and logos. Because of this large volume of paint being used, it is important to be mindful of the VOC content that is being added to the environment. New paints are now available with low or no VOC content. Your sales or paint manufacturer can give you the exact VOC content of the products you are using.

According to studies at Colorado State University and North Carolina State University, well maintained turfgrass sequesters up to .45 tons of carbon from the atmosphere per year. So the turfgrass in a park or large sports facility has the ability to remove the carbon amount equivalent to the emissions of driving a car from Washington, DC to Los Angeles, CA 45 times.

As maintenance programs continue to evolve to reduce carbon inputs, sports fields and parks will be able to improve the overall quality of the environment and save money. Certainly there are many more parts of a program where environmental protection can be found. But examining the standard approach in each of these five areas begins the journey toward long-term results for environmental protection. In addition, facilities will save money along with providing a more quality experience for the visitors and players who frequent the fields and parks. Yet most importantly, the environmental stewardship sets an example for the young patrons of the parks to follow. These young patrons are the sports field and park managers of the future that will carry on your example of environmental stewardship. ■

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>> **CORE CULTIVATION (above)** coupled with sand topdressing **(below)** is a common practices for alleviating surface compaction and improve drainage. Photos provided by Alec Kowalewski and James Crum.

>> **Above: TWO INCHES** of sand topdressing accumulated on a native soil athletic field over two consecutive growing seasons, photo provided by Ed Everett.

>> **Above: STANDING WATER ACCUMULATES** on the sidelines of a well-managed athletic field without drain tiles despite a significant sand layer developed from frequent topdressing applications.

Selecting the proper topdressing material for your athletic field

BENEFITS OF SAND-BASED ATHLETIC FIELD SYSTEMS include a foundation that is not only resistant to compaction, but also capable of maintaining stability and rapid infiltration during periods of heavy rainfall. However, sand-based athletic fields are particularly susceptible to organic matter accumulation. Effects of excessive organic matter accumulation on sand-based turfgrass systems include decreased infiltration and hydraulic conductivity, diminished air filled porosity, which compromises gas exchange, and reduced root development and growth.

Core cultivation and vertical mowing coupled with frequent sand topdressing applications are often used to combat organic matter accumulation. Sand topdressing can also be used to improve the physical characteristics of native soil athletic fields high is silt and clay, which would otherwise provide relatively slow infiltration, have poor stability during periods of saturation and be liable to compaction. Aggressive sand topdressing (as much as 1.0-inch applied over 3.5 months), or sand-capping, can provide a cost-effective alternative to complete field renovation.

Research conducted at Michigan State University, East Lansing, MI and case study analysis have determined that intercept drain tile installation and a cumulative topdressing depth of 2.0-inhces can substantially improve native soil athletic field drainage and playability for $66,000 to 72,000 (estimates include irrigation and drain tile installation, as well as topdressing material and application). For field managers with substantial budget restrictions, topdressing alone can significantly improve playability and drainage; however, these fields will likely develop standing water along the sidelines and in low lying areas during periods of heavy rainfall.

SELECTING THE PROPER TOPDRESSING SAND

The amount of topdressing material necessary to develop a 2.0-inch sand layer over a standard high school football

Table 1

	Topdressing Material Recommendations for Athletic Field Use[w]	Alternative recommendations and specifications	
		USGA (2004) root-zone[w]	ASTM (2004) root-zone[w]
	Sieve fraction sand particle diameter (% retained)		
Fine Gravel (>2.0 mm)	<5%	<3.0	< 20.0
Very Coarse Sand (1.0-2.0 mm)	5-15%	≤ 10.0	< 20.0
Coarse Sand (0.5-1.0 mm)	20-30%	≥ 60.0[x]	25 to 50
Medium Sand (0.25-0.5 mm)	30-45%		> 25.0
Fine Sand (0.1-0.25 mm)	10-18%	≤ 20.0	< 10.0
Very Fine Sand (0.05-0.1 mm)	2-5%	≤ 5.0[y]	< 5.0
Silt (0.002-0.05 mm)	2-5%	≤ 5.0[y]	< 5.0
Clay (<0.002 mm)	2-5%	≤ 3.0[y]	< 3.0
Cost of material meeting these recommendations[z]	$30 per 1,000 lbs	$20-25 per 1,000 lbs	

field equates to roughly 600 tons, costing $12,000 to $36,000 depending on material specifications and availability. Field managers should be aware that not all topdressing material will provide the results they are looking for, i.e. improved infiltration rates and surface stability. For instance, topdressing sand containing excessive amounts of course particles, and poorly graded sand, which may be as cheap as $10 per 1,000 lbs, will compromise stability. Sands containing more than 10% silt (0.002 to 0.05 mm) and clay (<0.002), on the other hand, will compromise drainage (Table 1).

When shopping for topdressing material have a physical analysis done before selection, look for well-graded sand, with <5.0% fine gravel (>2.0 mm) and ≤ 10% silt+clay. The "Topdressing Material Recommendations for Athletic Field Use" (Table 1) suggest 2-5% very fine sand (0.05-0.1 mm), 2-5% silt and 2-5% clay. Material meeting these recommendations will increase the stability of the sand, without compromising infiltration rates. Materials meeting these standards will likely be a specialized soil blend for athletic field use and cost around $30 per 1,000 lbs. Field managers may also opt to use topdressing that conforms to USGA (2004) rootzone recommendations, which are designed to maximize drainage.

Sands conforming to USGA recommendations may have little to no fine material (<10% very fine sand, silt and clay combined), which may reduce surface stability in comparison to materials conforming to "Topdressing Material Recommendations for Athletic Field Use." However, field managers in locations that receive heavy rainfall may be willing to compromise some stability for maximum drainage. Topdressing material conforming to USGA recommendations will likely be readily available and cheaper ($20-25 per 1,000 lbs) than the specialized athletic field soil blend previously discussed.

PREVENTING SOIL CONTAMINATION

After an adequate sand layer (2 inches) has been accumulated over time, light topdressing (0.25-inches annually) and annual cultivation should be used to prevent the accumulation of organic matter on the playing surface. If hollow or side-eject tines are used for cultivation purposes, special care must be taken to remove soil cores or prevent tines from penetrating to depths greater than the sand topdressing. If native soil is excavated by the hollow tines and deposited on top of the sand layer they must be removed to prevent the drainage system from being compromised by the poorly draining subsoil. A simple alternative to prevent this problem from occurring would be verticutting, which would allow field managers to address organic matter accumulation without disrupting the soil profile. For best results the selected cultivation method should be coupled with sand topdressing, pairing these cultural practices will ensure that the voids created by cultivation are filled with sand, allowing the system to maintain rapid infiltration rates in the long run.

It is important to note that field managers and topdressing suppliers should work together regularly testing material to ensure that topdressing specification remain consistent over time. If a field

>> **Above: IF CORE CULTIVATION DEPTH** penetrates the topdressing layer, or sand-cap **(top photo)**, these cores should be removed to prevent drainage from being compromised by the native soil that is brought to the surface.

>> **Above: WHEN CULTIVATING** a built-up sand-capped field with a sand depth of 2-inches or less, verticutting is an easy alternative to core cultivation that will not disrupt the soil profile.

manager is forced to switch to an alternative topdressing material it is essential to select a material with the same or lower proportions of fine material; fine sand (0.1 to 0.25 mm), very fine sand, silt and clay. Placing material containing a greater amount of fines over your existing sand will result in poor space discontinuity, which will decrease surface infiltration rates and produce a perched water table affect.

COST-EFFECTIVE CRUMB RUBBER USE

Crumb rubber, while being substantially more expensive than sand topdressing ($1,000 per 1,000 kg) has been shown to significantly improve turfgrass wear tolerance in extremely high foot traffic areas, when sand topdressing may no longer be affective. Due to the cost restraints associated with this material application is often restricted to localized high traffic areas, such as sidelines and soccer goal mouths. Current recommendations suggest small-particle size crumb rubber (0.05 to 2.0 mm) applied at a 0.25-inch depth (223 kg per 1,000 ft2) per application until a cumulative depth of 0.75 to 1.0-inch is achieved.

RECOMMENDATIONS

When using sand topdressing to develop a built-up sand-capped athletic field system field managers should strive to apply a 1 inch depth of sand topdressing over a 3.5 month period, with a cumulative depth of 2 inches, which is attainable in as little as two growing seasons. After this depth is achieved apply 0.25-inches of sand topdressing annually, coupled with core cultivation and/or vertical mowing to mitigate organic matter accumulation. When selecting a topdressing material field managers looking to improve stability and drainage should select materials that adhere to "Topdressing Material Recommendations for Athletic Field Use" (Table 1). While field managers looking to maximize drainage should select sand that conform to USGA recommendations for a method of putting green construction (USGA, 2004). ■

>> **THIS PHOTO** illustrates the perched water table affect that can result from applying a topdressing material with a greater amount of fine particles; fine sand, very fine sand, silt and clay, over sand with a greater proportion of coarse material.

>> **CRUMB RUBBER** is an excellent topdressing material for high traffic areas were sand topdressing may no longer affective; however, it is cost prohibitive ($1,000 per 1,000 lbs) in comparison to sand topdressing ($20-30 per 1,000 lbs, depending on specifications and availability).

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