quad had a deeper green color with good growth. This product is slow release because it's primarily non-soluble nitrogen and contains iron.

The next step was to begin using it on our recreational fields. On one of these fields we applied the bio-solid at 1 lb/1,000 sq ft rate on half the field and a more expensive bone meal, blood meal, feather meal animal byproduct type organic fertilizer on the other half of the field at the same rate. We deliberately left this field with just that one application for 1 year to examine the effectiveness of the two different products. It was very difficult to see any big difference between the two sides of the field. The notable thing for me from this little experiment was that neither side of the field showed significant change in growth and color until late in the 10th month. I'm not saying we should fertilize once a year but I was trying to quantify the value of these products, because the cost is not the same for each.

One problem with the bio-solid type is that it has no potassium and excess phosphorus. When used in expansive soils (sandy soil or soils that freeze and thaw) it can leach phosphorus into ground water. We countered the potassium problem by blending the bio-waste with a chicken manure 3-2-3. The leaching problem was addressed by lowering the rate and increasing the frequency.

In our part of the country we don't have serious problems with leaching, our soils are heavy with silt and clay and we don't experience ground freezing or snow. We are now fertilizing all of our fields with this blend. This includes the athletic game and practice facilities that are hybrid bermudagrass. Timing of applications can be critical due to the nature of the product. Soil temps must be high enough to digest the material into a usable form (nitrate) for the plant.

>> **BUDGET CONCERNS** led to using organic fertilizer products.

I like to do my last applications in mid-fall and the first in mid-March. This helps to eliminate leaching and the waste of money.

>> **BY FEEDING MICRO-ORGANISMS** Davis was creating a living system in the soil that produces carbon, with an even flow of nutrients to the plant.

We fertilize the high use athletic facilities every 6 weeks at low rates and recreational fields three to four times per year. What drove me to this program is the high costs of synthetic fertilizer. As the price for oil climbed higher the price for petroleum-based products like synthetic fertilizer also rose. I found a great savings for our shrinking budget and it came along with environmental benefits.

SAVINGS ON PAINT

Another high cost area of athletic field maintenance was our paint budget. Along with that were many environmental concerns. We use more than 1,000 gallons of paint each year. We had local contracts for paint that is produced in the Sacramento area. As paint prices increased I started to search for paint that is designed specifically for athletic fields. I found that for a small percentage more I could purchase athletic field paint designed for painting on turfgrass. Although this was great field paint I was still concerned about the release of volatile organic compounds (VOC) being allowed into the atmosphere. I was also concerned about long-term effects to ground water using this type of paint product. In addition the product comes in 5-gallon buckets. After several years we had an abundance of these buckets. The bucket is another petroleum-based product that I had trouble finding ways to recycle. I checked with our campus recycling and refuse supervisor and found no way to recycle, other than to reuse of the buckets.

Then I discovered a paint manufacturer, Eco Chemical, which was developing a new paint product that could be shipped in a box instead of a bucket. This product is in two parts, a paste and a powder; you just add water and mix. The paint is shipped in a cardboard box that weighs 25 pounds. Each box can make up to 20 gallons of paint. One pallet of this product is equivalent to 900 gallons of paint. The environmental advantage is less container

>> **BOXED PAINT** saves Lucas storage space and eliminates having to dispose of old buckets.

waste and lower shipping cost. Most importantly this paint contains no VOC's.

UC-Davis was selected by this company to do some early beta testing of this product. We used this paint in comparison with two other products on our athletic fields. In addition we did some side-by-side line testing on a field. In some of the line tests we also mixed a plant growth regulator to suppress growth of the turf, allowing the paint to last longer. The athletic turf paint looked a little bit brighter than the other paints in the beta test. Over 1-week duration the differences were only slight. After the beta testing some adjustments were made by the manufacturer to allow brighter pigments. We did not have any problems with clogged nozzles.

We found that the new product is compatible with a plant growth regulator and we use it for several different applications to use less paint and therefore less labor. We can store a 1-year supply in a small area, about 20% of the area of the 5-gallon buckets. This paint has a longer shelf life, because it is in a dry formulation. We have found that even after 2 years the paint is still just as effective as with first shipped. We have also noticed less build-up in the soil at the crown of the turfgrass plant, as compared with the traditional paints we used in the past. I would like to see some scientific studies of this aspect to confirm our observation.

In summary it is important to look at the systems we use daily and how they impact our budget and environment. By using the more eco-friendly products for fertilizer and painting it has reduced not only our budget but also labor spent to achieve the same quality for our athletes. These are only two examples of the many things we can do to work toward a more sustainable future in sports turf management. ■

Mark Lucas is sports turf manager for the University of California, Davis.

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Synthetic turf field bases ARE IMPORTANT!

Editor's note: This article was written by Dan Sawyer, CEO of Brock International, which manufactures synthetic turf field base systems, and Grove Teates, president of Alpine Services, Inc., builder of natural turf and synthetic turf athletic fields.

A **SYNTHETIC TURF FIELD** is only as good as the base it's built on. Yet the base is often sacrificed in the essence of time, and may not be properly designed and inspected. Spending time on base design, from writing a tight specification, contractor pre-qualifications, and construction oversight avoids costly, complicated and sometimes catastrophic field failures that can arise. Base design and field validation are the most important components of any field, proven by the number of base-related failures.

A great base starts with a great specification, one that specifies a high level of excellence for all potential bidders, and one that is *inspected* and *enforced* during the construction process.

A high level of experience. As the synthetic industry has matured in the past decade, it is not difficult to find contractors who have built not one or two, but have successfully done dozens of properly built field projects. These are the types of contractors you want to bid your project, so set your prequalification based upon excellent grading, compaction, people, etc. Be aware that a contractor may have built many fields, but not necessarily many good fields—volume does not equate to excellence. Take the time to check his consecutive references.

The planarity spec for the field should be tight. This is not a parking lot, but something much more precise. A spec-

A great base starts with a great specification, one that specifies a high level of excellence for all potential bidders, and one that is *inspected* and *enforced* during the construction process.

THE PRIMARY GOALS OF A PROPER BASE ARE:

- **STABILITY.** The sub-base must be properly compacted to greater than 95% standard proctor in order to support the relevant loads on the field, which are the athletes themselves, and the occasional maintenance equipment.
- **DRAINAGE.** This is a tricky one and where pre-qualifying contractors is essential.
- **PLANARITY.** This is the trueness of the surface.
- **HEAVING.** A 6 to 8-inch stone base will NOT be enough weight to stabilize the soil.

ification of +/- ¼ inch over the *plane of the field* is achievable by a qualified laser grader (be sure to check the quality of the laser system). The laser source should be accurate to at least 10 arc seconds at 3,000 feet; it should have been calibrated within the past 6 months.

Wording of the specification is important: *within* ¼ inch over the plane of the field is really + or – 1/8 inch from absolute; +/- 1/4" *from* absolute is a total tolerance (deviation) of ½ inch—a significant difference that most designers are unaware of (see diagram). The issue is significantly magnified if a designer still uses a horizontal distance of 10 feet.

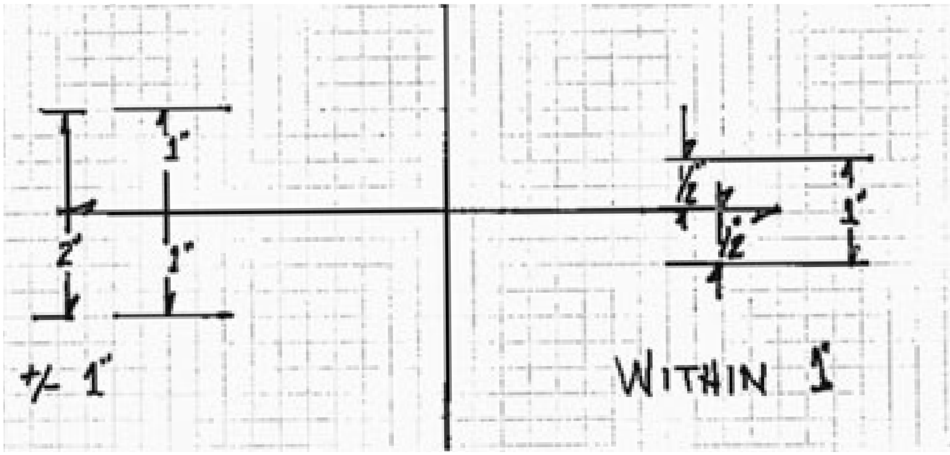
Make sure the specification includes proof rolling of both the sub grade and the top surface. Note that 95% compaction on stone means that the stone has been crushed and hydraulic conductivity has been compromised. The designer must be very specific concerning the number of passes with a given weight roller.

PRIMARY GOALS

The primary goals of a proper base are:

Stability. The sub-base must be properly compacted to greater than 95% standard proctor in order to support the relevant loads on the field, which are the athletes themselves, and the occasional maintenance equipment. You are not building a parking lot designed to support huge static loads, nor are you building a road. But the base does need to be stable enough for moderate vehicles for short durations. Ensure that proof rolling is part of the specification for both the sub-grade AND the stone layers. This will also avoid the finger-pointing after a base is approved, and subsequently disturbed when the turf is laid. If the base is compacted properly, then it should not shift during turf installation. Some more rigid underlayment systems also help protect the base during turf installation, since tire loads are not directly on stone.

Drainage. This is a tricky one and where pre-qualifying contractors is essential. Drainage and compaction are conflicting interests. On the one hand, you want water to flow efficiently through the base material, which means open pores and spaces in the rock. But compaction will decrease the pore space and thereby decrease drainage. And overworking the stone can lead to "choker layers" forming, which cause ponding. So how do you get a base that is both compacted AND drains well? That is the art of building a stone base, and not everyone can do it.



Planarity. This is the trueness of the surface. The sub-base and surface should be on grade to specified tolerances as described above. This can be simply checked using simple devices. Having a laser on a machine does not guarantee quality. Owner confirmation of the specifications of both surfaces is most important. Specifications should be no greater than +/- ¼ inch when measured vertically over the plane of the field and must also state that the vertical distance is measured from the "absolute" plane. Good grading is enhanced by using dual, high-end readers mounted on a wide blade (the wider the better, see photo). Improper grading shows through the turf in terms of crooked lines and other visible defects. The greatest turf on earth can look terrible over a poorly graded base. Conversely, average turf can look fantastic over a great base.

Heaving. A 6 to 8-inch stone base will NOT be enough weight to stabilize the soil. In addition, having a stone base below the field that is designed to store water for environmental reasons only compounds the problem of frost heaving, since it is the water that is freezing and causing the problem. Alternative methods described below should be considered in northern climates if frost heaving is an issue.

BASE DRAINAGE

There are two basic strategies to approaching the base drainage issue. The more traditional method is to remove a depth of existing material, dispose of it, and replace it with a more stable stone material. The idea is to allow the water to permeate through the turf, "store" it in the stone base, and then let it outflow off the site. Specifying the proper stone, minimizing the segregation of it during handling and placement is important, as well as over-compaction.

The second and growing trend is to use a prefabricated base "panel" or board that replaces much of the stone and drainage work required with a stone base. The idea is to move the water laterally to the perimeter drains within the board, negating the need for stone to conduct water to a drain system. Some systems offer the drainage and stability of a stone base, but can increase frost protection by acting as an insulator. A 1-inch thick panel may offer the equivalent insulation as 10 inches of stone when the stone is dry, and far more when the stone is wet, since water is a temperature conductor. Some boards also incorporate shock-absorbing qualities to increase the safety and longevity of the field. The panel systems may cost more at the outset, but they are used under multiple turf cycles, so cost savings are realized down the road. They can also be simpler and faster to build. However, the base below them still needs to meet the compaction and planarity requirements as stated above.

Although the surface directly below the panel system does not need vertical drainage, it must be solid and stable in order for the system to work. Planarity should not exceed +/- ¼ inch over the plane of the field (total ½-inch tolerance), but tighter is even better. In no case can *the total tolerance from absolute exceed the thickness of the drain board*; to exceed the total tolerance when measured against the board thickness means that the board will be installed in a hole or depression deeper than the height of the panel/board and the water cannot escape, regardless of the drain characteristics of the drain board.

for installing turf over a board system, and has had experience in using your chosen drain system.

In today's economy, more contractors bid on synthetic turf projects than the industry has historically experienced in the past. Many of these contractors have little or no experience in building good bases; many designers do not know how to write meaningful specifications. Beware, the lowest bidder may mean the lowest quality, the greatest risk, and will often cost you MORE money in the end unless pre-qualifications are both stringent and enforced, and the specification is tight. There is no reason why you can't get both a quality and an affordable field, that is built on time, when you demand due diligence of your designer, contractor, and drain supplier. ■

The supplier of the panel or other drainage system should have a good inspection and quality assurance program and assist the designer and builder in executing a proper foundation for their system. Installing turf over these systems is also a different procedure, so make sure the turf supplier has best practice recommendations

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Water-saving tips for sports fields

***Editor's note:** The author is Rain Bird's area specification manager for the Southeast region.*

THERE ARE MANY WAYS that sports turf managers can save water while still keeping their fields in top condition. Some of the tips I offer relate to system design. If the right product isn't specified for the right application, or at the manufacturer's recommended spacing and pressure, the system may use too much water. Other tips involve regularly evaluating system performance and then making any necessary changes to improve performance moving forward.

DESIGN TIPS

• Use a variable frequency drive (VFD) pump. VFD pumps adjust pump motor speed based on the demand of the irrigation zones that are running. Not only can this save water, but will also save on electricity.

• Pay strict attention to zoning the irrigation system (how the system is sectioned or divided) for these reasons:

• Fields with specific areas that incur heavier use should be zoned accordingly. For example, the centers of football, soccer or lacrosse fields typically endure more wear and tear. When it's time to re-seed or re-sod these areas, having them on a separate zone allows you to water them as needed and eliminates unnecessary watering of the perimeter.

• Sunny and shady areas should be zoned separately so you can apply more or less water to each respective area. If there are sunny areas combined with shady areas in the same zone, many sports turf managers will water according to the needs of the sunny areas, which then results in overwatering the shaded ones.

• Low-lying areas should also be zoned separately to minimize or eliminate run-off that can create boggy conditions in those areas.

Large area sprinklers as water conservation devices

By Phil Robisch CLIA, CID, CWCM-L, LEED AP

Editor's note: The author is Product Technical Resource Manager, Hunter Industries Inc.

QUITE OFTEN people will see large expanses of turf in parks and on athletic fields, and think of how wasteful they are in regard to water. That perception is increased when they see the irrigation system running, and spraying large amounts of water into the air. What they don't understand is that those lush, green turf areas are more than just important recreational sites, they are air purifiers, contaminant filters, oxygen producers, air conditioners, and carbon sinks. They also provide us with pleasing green space, so important to human happiness, and help to offset the effects of hardscapes and buildings in our urban environment.

What about the water they use? Yes, water is needed to keep these surfaces in top shape, but the water used is for a good cause, as evidenced by the paragraph above. Everyone agrees that we need to clean our air, sequester carbon, offset the heat we create when we develop land, and provide safe play surfaces, and sports turf does all these things extremely well. The perception of some is their reality, and that is water is being wasted. But is it true? Professionally managed, well-maintained sports turf, watered by a professionally designed, installed, and maintained irrigation system actually uses water very efficiently, and that is what we will explore here.

Perception: Large rotors spraying great amounts of water are inefficient.

Fact: Manufacturers of sports turf sprinklers spend huge amounts of engineering, testing, and development time, and money to produce emission devices that rate in the excellent category as far as irrigation efficiency, as defined by the Irrigation Association. A properly designed and installed irrigation system operating at the appropriate pressure distributes water with a high degree of **uniformity**, ensuring the system only needs to run for the optimum amount of time to provide adequate water. Inefficient sprinklers that do a poor job of applying water must run for extended time to make sure the driest area receives enough water to keep it green, while wetter areas are overwatered—sometimes by more than twice what they need. Concerning the large amounts of water coming out of the sprinkler, just remember, they are covering a greater amount of area when compared to spray sprinklers as well.

Perception: Large rotors operate for long periods of time compared to spray sprinklers, and that wastes water.

Fact: Large rotors do run for much longer times than typical spray sprinklers, and they need to. Small area spray sprinklers apply water at a high application rate, generally around 1.5 inches per hour. Some are much higher than that as well, but just imagine a rain storm that measured 1.5 inches in one hour; that's a lot of rain, at a rapid pace. Spray sprinklers by their nature apply a lot of water quickly, and only need to run for a short time to get the job done. Large rotors by comparison apply water at very slow rates, normally in the range of .5 inches per hour, one third the rate of sprays. They do need to run three times longer than spray sprinklers to apply the same amount of water to an area, but they do it with greater efficiency. Not only is their distribution of water superior to spray sprinklers, but the lower application rate ensures more of the water is absorbed by the soil, and is available for the plants. Soils in general cannot accept water at high rates, so some of the water applied by spray sprinklers may not reach its intended destination—the rootzone.

Irrigated turf for sports fields serves a variety of good purposes, and the supplemental irrigation of these spaces helps contribute to these benefits. Irrigation efficiency is the key to the responsible use of our water resources, and large area rotors are important tools in the professional manager's arsenal. ■