covered with a turf blanket. Since we have only one, field 4 remained uncovered.

"Before a game was played at the complex in 2001, we knew a huge challenge was waiting. It started with over 12 inches of snow that fell in early December of 2000 on unfrozen ground. Despite the snow cover, temperatures remained warm enough to keep the ground from freezing, so there was some melting at the soil surface. Then more snow fell in January and temperatures dropped, turning the melted layer beneath the snow into a layer of ice. Approximately 10 inches of snow covered the turf until early March."

April 11, 2001, Field #3: Here's how it looked after snow mold and ice layer damage.

As the snow began to melt in March and the turf became visible, it became apparent that the middle acre of the amended soil fields was severely damaged from snow mold disease and winter desiccation from the ice layer. Vos says, "Nearly 70 percent of the turf in this section of these two fields (mainly perennial ryegrass) was dead. Though our other fields were less stressed entering the winter, they also suffered turf loss, but it was less extensive and concentrated in the heavily used areas."

Obviously, a full season of play was already scheduled. The Iowa Boys High School State Championships were set for June 1-2, with a 138-club team tournament scheduled for the second and third weekends of June, and the Iowa Girls High School State Championship set for the fourth June weekend.

Vos says, "Our goal was to have a safe, consistent turf surface on all eight fields by May 19 for the high school regional playoffs. We considered resodding the dead sections of the amended soil fields, but costs and soil compatibility factors prohibited it. So I developed an aggressive renovation program. We attacked the dead turf areas with slice aeration, slit seeding of perennial ryegrass at 4 pounds per thousand square feet, broadcasting pre-germinated Kentucky Bluegrass at 3 pounds per thousand square feet, dragging in the seed, sweeping up debris, rolling, applying starter fertilizer and irrigating. I opted for a heavy rate of bluegrass despite the slower establishment rate to gain a better base for long-term playability. We rotated the turf blanket over the heavily damaged areas of fields 3 and 4 and applied additional fertilizer and a liquid nutrient mix at 14-day intervals."

June 1, 2001: Field #3 after turf recovery is now a quality playing surface ready for Iowa high school boys' state championships.

Play was suspended on fields 3 and 4 from April 23 until May 19. The nearly 40 games scheduled for them were moved to the other six fields during that period. Vos notes, "The cooperation of our field users was excellent, even though changes in game times were needed to accommodate all the play. Weather conditions also cooperated. The turf responded even better than we had anticipated. We had a safe, good quality playing surface by our target date."

Vos didn't stop there. Extra applications of granular 18-2-18 fertilizer, liquid fertilizer at .10 of a pound, and the nutrient package were applied as needed to spoon feed the turf through July. He says, "From May 19 through June 30, 70 games were played on fields 3 and 4 alone. Then, 30 days later, the national college recruiting tournament drew 96 teams to spread 144 games over our eight fields. The turf held up well with only minimal damage."

The already aggressive maintenance program was stepped up one more notch throughout 2001. Aeration was increased, especially in the areas that had shown damage. More frequent fertilizer applications were calculated for steady turf growth on a field-by-field, area-by-area basis. The overseeding rate was increased in both slit seeding and broadcast applications, using an extra 1000 pounds of seed over the season, nearly double the normal amount.

Vos says, "By the end of the 2001 season, the turf had matured and we had achieved approximately 90 percent of our pre-damage density. The private school tournament had been discontinued and the NAIA was on its regular rotation to a different area, so we were able to close down play close to November 1. We did our normal winter preparation of aeration, fertilization, and topdressing and applied a combination of two snow mold preventative products. November of 2001 gave us excellent recuperative weather, so all the fields were in good condition when December's winter conditions closed in. We had a winter season of moderate temperatures and little snow cover. The fields were in top shape for spring of 2002."

Vos credits the work of his six-person staff (one full-time, five seasonal) in making the renovation so successful. He says, "They're dedicated to providing the best possible playing conditions and will do whatever is asked, and then some, to make that happen."

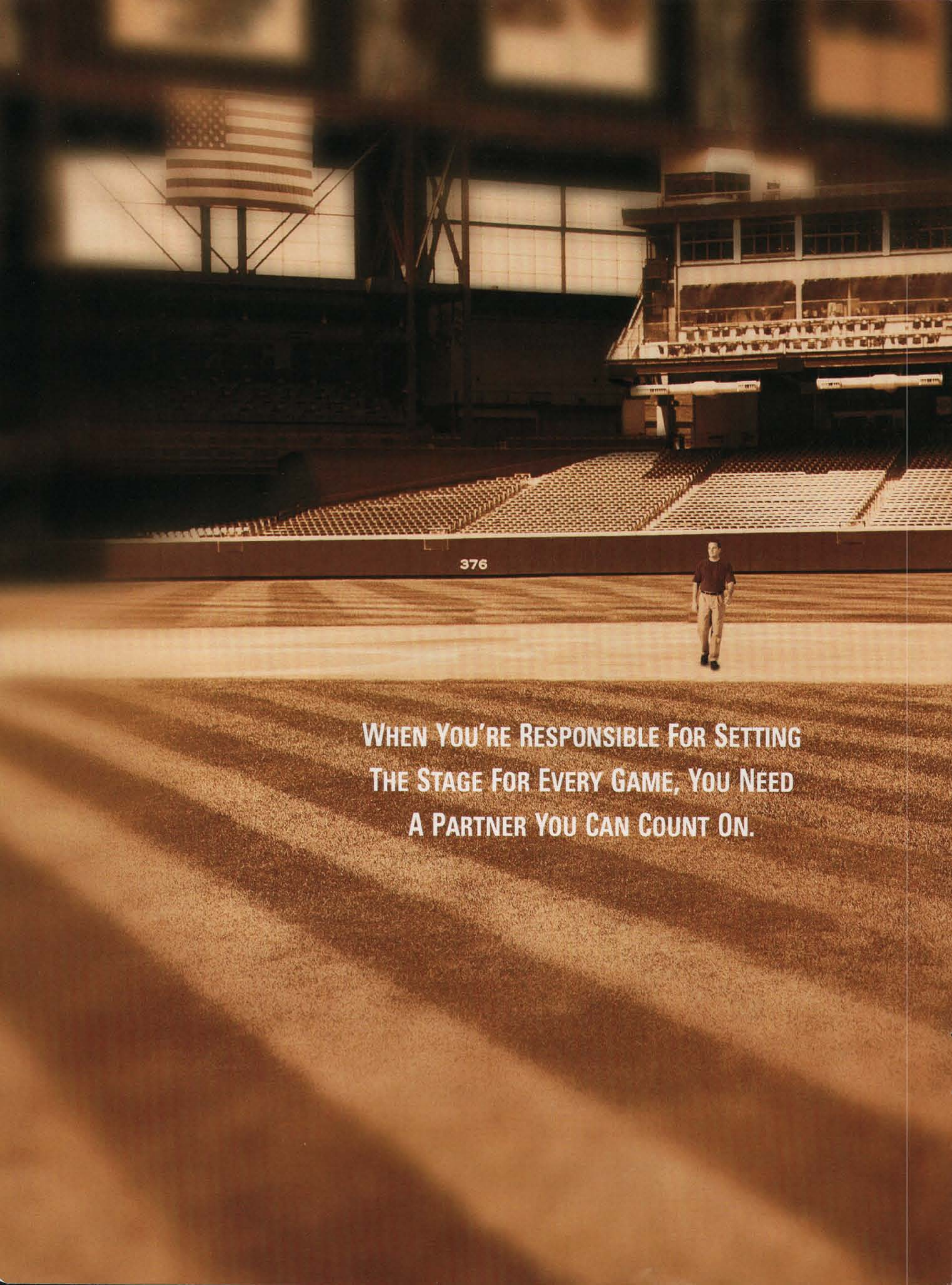
While all this was taking place, Vos also was overseeing a 10-member staff (one full-time, nine seasonal) and the program for the 64-acre, 17-ball diamond complex at Muscatine's neighboring Kent Stein Park. This facility also features a picnic area, horseshoe courts, and fishing. Keeping the equipment in shape to handle all this is athletic facilities technician Randy Moeller, who splits his time between the two facilities. Vos also handles the ballfield maintenance at two other City parks.

Even more fields may be on the drawing board and they are needed. The adult soccer leagues have added Saturday evening play to their weekend schedule and youth participation is increasing at all levels. A 17.2-acre site has been donated to the City that would provide enough space for four more soccer fields and a parking area. Vos looks forward to the additional challenge.

Vos is constantly tweaking the maintenance program to produce even better results. He says, "We used more liquid fertilizer applications this spring to better match nutrient delivery to plant needs and achieve balanced growth, without those little bursts of activity. We're applying plant growth regulators to all of the turf on one of the fields and monitoring not only turf growth, but also turf health. We've always followed environmentally friendly IPM practices and, because of the success of this program, plan to eliminate all preemergent applications and deal with the few annual grassy weeds as they occur."

Selling the program

Vos notes that communication is an essential component of the overall program. He says, "First, we communicate openly within our staff, including them in the planning and decision-making processes. Then we strive to communicate to our public, to our user groups, to our supervisors, to other city staff. We need to not only tell them what we need and want to do, but also why it's important. Whether it's banning practices on our fields or shutting off play temporarily to tackling renovation, we've always stressed the why. When the public understands we're taking these steps to provide a safe, uniform, high quality playing surface for their kids they're much more willing to support our efforts." **ST**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Timing is Everything

What's wrong this picture II

BY DR. JEFF KRANS

This is a follow-up article to "What's Wrong with this Picture?" in the May issue, page 30. There I addressed two management strategies. One strategy was based on the concept of bringing your turf to game-ready status as soon as possible, then holding quality until game day. The other strategy stood on the concept of delaying game-ready status of the turf and peaking just before game day. Using turf biology as a guide, I concluded that you should delay your quest for game-ready quality and peak just before game day. How does a field manager achieve this objective?

There is no universal management schedule that will achieve the above stated objective for all fields in a uniform manner. Each and every field is unique in that they have a definable location and composition (zone of climatic adaptation, soil composition and grass community); type and sequence of sports played, and most importantly, game schedule.

These criteria make-up the field's profile. A field manager must schedule field activities based on the principles and concepts of plant and soil science in concert with the field's profile. In addition, a field manager should have a clear picture of their anticipated end product.

Now some managers may say that their end product is obvious: high quality sports turf. But what exactly is meant by high quality sports turf? Sports turf experts have addressed this question and generally agree on a list of criteria. A high quality sports turf will have solid traction, low surface hardness, high traffic tolerance, and true ball response properties. Translated into turf characteristics, the field should have high verdure (high leaf and stem biomass below the height of cut), prodigious lateral stem development, and a deep and extensive root system.

Achieving these turf characteristics is a challenge within itself, but achieving these characteristics on time is an even greater challenge. Because all field profiles are different, attaining these surface features must be based on turfgrass growth and development principles that will provide a guide rather than a schedule of activity.

Figure 1. Bermudagrass turf cut at 3/4 inches causing prostrate growth and shortened leaf sheaths and blades. A gradual increase in height will layer biomass and build verdure.

Building verdure

Building verdure is one of the key turfgrass features in sustaining a safe and playable field. Past research studies have reported that the level of verdure is highly correlated to wear tolerance. In common sense terms, this can be interpreted as "the more you start with, the more you end up with."

Of course species selection plays a role in biomass accumulation, but what cultural practice can be used to promote verdure in all species? One of the most powerful tools to create verdure is height and frequency of cut. Mowing provides the manager with the opportunity to stimulate and layer biomass. This is achieved by adjusting mowing height during the course of the growing season. Within the mowing height tolerance range of any species, mowing should start at the low end of the range, then move upward. The early low mowing height stimulates dormant axillary buds to break dormancy as well as reduce leaf sheath and blade lengths (Figures 1 and 2).

Figure 2. Bermudagrass turf cut at 1 1/2 inches causing upright growth and elongated leaf sheaths and blades.

As time progress towards game-day, height should be adjusted upward until the designated game height is reached. The practice of low-to-high cutting height adjustments will promote verdure development by layering or concentrating shoot biomass below the height of cut. However, as previously stated, not all fields can be treated the same and a low cutting height on a cool season turf during peak heat stress would not be recommended. In this case, a higher summer time cutting height should be adopted to sustain a more vigorous turfgrass plant. Once the stress subsides, the appropriate mowing height strategy can be used. In this and other cases, the field manager must always weight each decision and draw compromises as required.

TABLE 1: Turfgrass seeding guidelines for sports fields

Turfgrass common name	Lbs. per 1000 sq. ft	seeds per sq. inch
perennial ryegrass	7 to 9	13 to 19
Kentucky bluegrass	1 to 1.5	10 to 14
tall fescue	7 to 10	10 to 13
bermudagrass (hulled)	.5 to 1.0	10 to 12

Another cultural practice that affects shoot biomass is nitrogen applications. As stated in the May 2002 article, an aggressive nitrogen application should be avoided early if there is not an early game scheduled. Early application should only meet the need of achieving a closed canopy. As the game-day schedule approaches, nitrogen applications can be increased to achieve the anticipated growth that will be needed to recuperate from post-game defoliation and divoting. In the context of overall fertility management, proper nutrient balance, levels, and pH levels should never be compromised.

Creating a wide-ranging network of lateral stems (tillers, stolons, and/or rhizomes) is also a key component of a safe and playable field. One of the most direct relationships of lateral stem density and a cultural practice application is seeding rate (Table 1, and Figures 3 and 4). Research studies have repeatedly shown that a seeding rate beyond the recommended level retards lateral stem development in all turfgrass species. Applying only the recommended seed number per unit area may be difficult for some managers, as quick cover (due to high seeding rates) is usually interpreted as a successful planting.

Mowing on low end

On established fields, mowing at the low end of the cutting height range, light vertical mowing or spiking, and core cultivation can increase lateral stem density. All of these practices stimulate the growth of dormant axillary buds at or near the soil surface. The breaking of dormant buds in response to these practices is due in part to enhanced light penetration and the cutting or wounding of stem tissue. These signals are the triggers that tell the plant to make a developmental change. The stimuli that enact the biological changes occur at the hormonal level.

A turf community that increases its lateral stem density will have greater verdure and more growing points for leaf production. Similar to the cutting height strategy, these cultural practices should be used during the off-season to position the turfgrass community for recuperation. When recuperation is needed, nitrogen applications can stimulate the needed growth.

An extensive and deep root system is another turfgrass feature of a safe and playable field. Several cultural practice strategies have been proven to increase root mass and depth. One of the most critical practices is water management. Researchers have shown that deep and infrequent irrigation promotes a deep root mass. When water is applied deep into the soil profile, the turfgrass plant will adjust it root development and grow a deep and more massive root system.

Determining deep and infrequent water management is not always an easy task. The best approach is to watch the turfgrass plants for signs of temporary wilt (daytime wilting that will disappear by the next morning) before the next irrigation. Your goal is

Figure 3. Bermudagrass seeded at 1/2 lbs. per 1000 sq. ft. causing seeding to elongate internodes and begin lateral stem production.

Figure 4. Bermudagrass seeded at 2.0 lbs. per 1000 sq. ft. causing upright growth and a lack of internode elongation. Lateral stem production will be inhibited.

to irrigate to meet the needs of the plant based on signs from the plant.

Another effective practice for increasing root depth and mass is core cultivation. Core cultivation creates voids or space for roots to occupy as well as improves the water drainage and gas exchange. No matter what the turf condition, age or soil composition, core cultivation is an essential maintenance practice for a healthy turf and deep root system.

There are multiple pathways to achieve a safe and playable turf. All cultural practices should be applied with anticipation of how the turfgrass plant will respond. Peaking your turf just before game-day should be your ultimate goal. Your geographic location, type of species, soil condition, anticipated end product and game-ready date will determine your schedule. No single management schedule fits all situation, so be prepared to make changes to meet the needs of the plant. Time your cultural practices to position the turfgrass plant for growth, then adjust to promote growth. In all situations, no matter what cultural practices are used, timing is everything. **ST**

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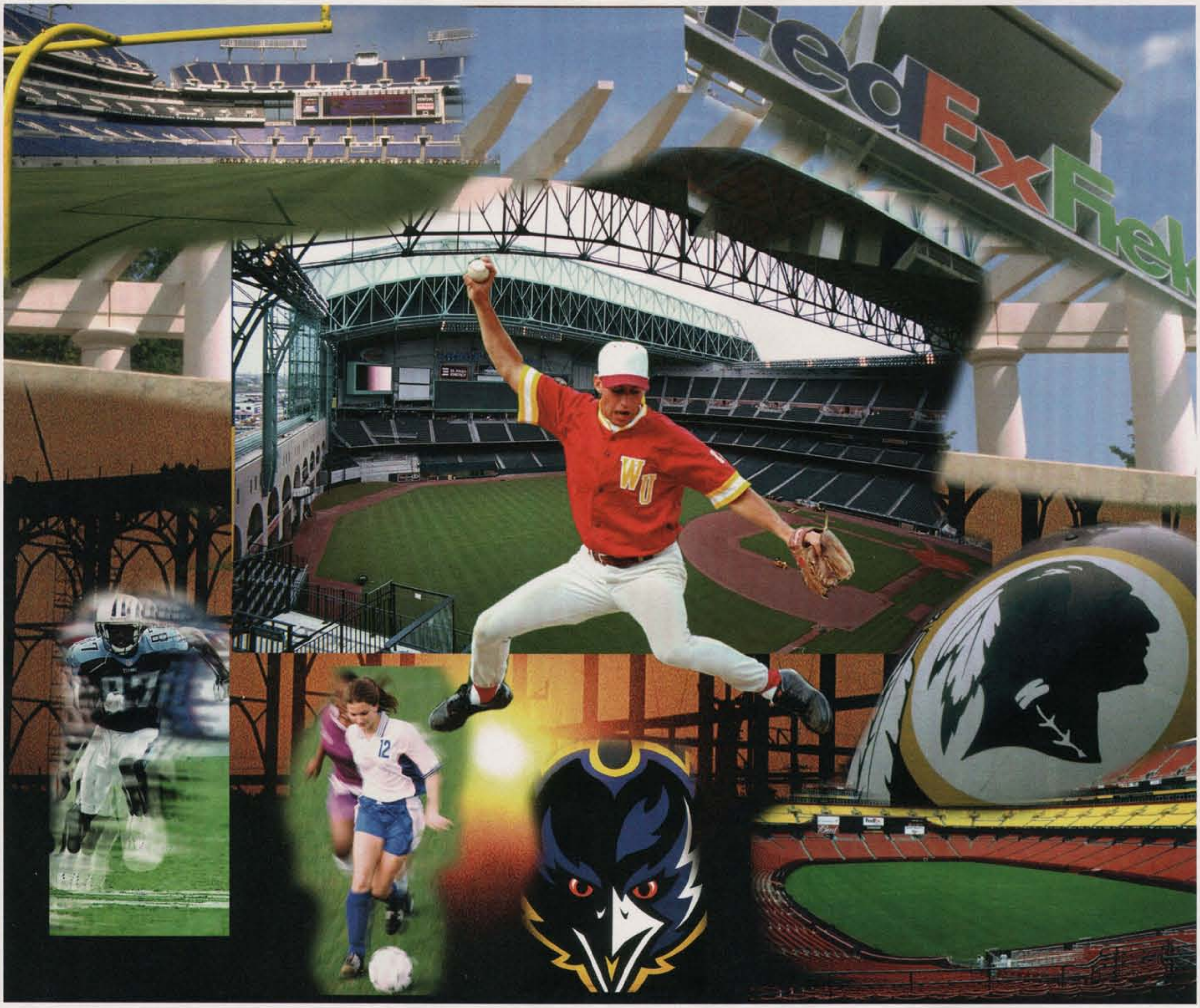

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