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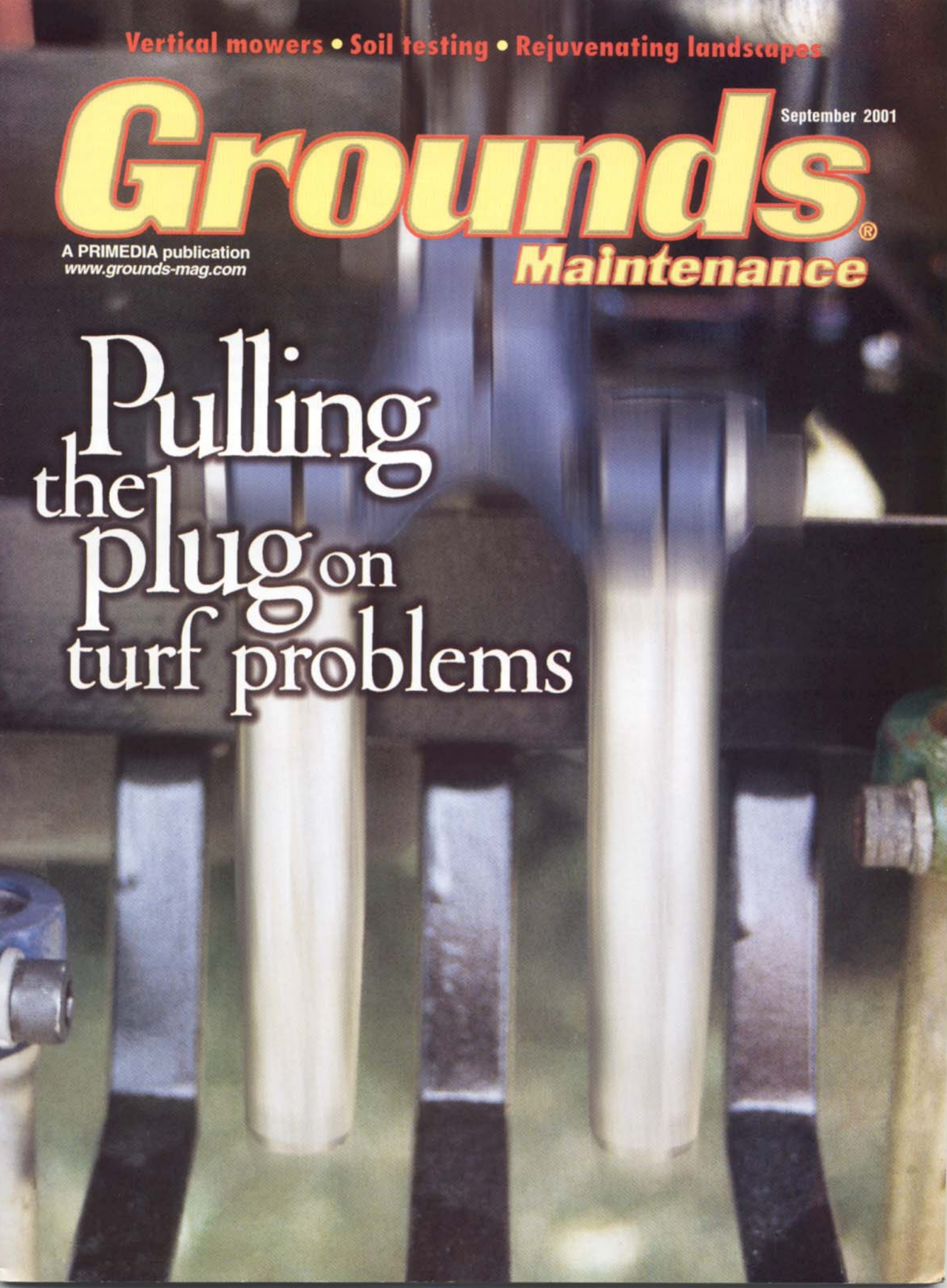

Pulling the plug on turf problems

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Front cover: Graphics manipulation by Jennifer Ray.

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Greening our grounds

Rejuvenating older landscapes creates beauty and saves resources. But it also can save you a lot of "green."

By Jeff Lettau and Launa Morasch,
Pacific Northwest National Laboratory

Rejuvenate the landscape, save energy and decrease water use. These goals may seem contradictory at first glance, but at Pacific Northwest National Laboratory (operated by Battelle Memorial Institute for the U.S. Department of Energy in Washington state) we have learned that you can rejuvenate an old landscape while simultaneously decreasing water and energy consumption. The recipe for success? It's no mystery. Focus on best practices in grounds management and apply science to landscape challenges.

By learning better ways to grow trees, grass and landscape plants, we have reduced water use by 30 percent for a savings of around $70,000 a year in water alone. In addition, the irrigation system requires electricity to run the pumps, and through this effort, we conserve about 200,000 kilowatt hours of electricity a year, amounting to about $8,000 in savings.

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The simple step of switching to sprinkler irrigation from flood irrigation saved water and resulted in healthier trees.

Background

The Pacific Northwest National Laboratory traces its history back to 1965 when the Battelle was contracted to build and operate the laboratory near the Hanford Site north of Richland, Wash. The campus was landscaped at that time and was lovely for many years. However, by the year 2000, the 35-year-old landscape of the by-now-named Pacific Northwest National Laboratory was showing its age. The sycamore trees were suffering from an outmoded watering system that discouraged broad root growth; many lawns had years of thatch build up; and compacted, water-resistant soil required ever increasing amounts of water just to maintain vegetative cover. Overgrown shrubs and trees blocked visibility in some of the parking lots, creating safety problems, and their roots were cracking the concrete. Some oak trees in the parking areas were diseased and several had died. These problems were spread over 110 acres of landscaped campus, which surrounded 20 buildings.

Recognizing these problems, we developed a master plan for the grounds. Each year, segments of the plan will be implemented. The goal of the plan is long-term economic and environmental sustainability, reducing irrigation water use by 50 percent and lowering energy use as well.

To accomplish these goals, we have changed many long-held practices. We use different watering and lawn-care procedures, low-maintenance plants (mostly ones native to the area) and seek energy efficient and environmentally friendly equipment, such as mulching mowers.

To begin, we researched state-of-the-art techniques for grounds management and began testing them. We attended seminars on groundskeeping and learned how to apply the information to the laboratory's landscape. We audited

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An outmoded flood irrigation system caused trees to limit their rooting to small areas. Changing over to sprinklers resulted in a larger irrigated area (see photo, page Contractor 1), which prompted the trees to expand their root systems.

water use in all areas to establish a baseline to evaluate water-reduction methods. With this data in hand, we could evaluate changes to landscaping practices for their impact on water use.

Trees

One of the first things we did was replace the old flood-irrigation system on tree lines with sprinklers on automatic timers. The flood irrigation system had caused the mature London plane sycamore roots to clump rather than spread out (see photo, above). Replacing over 580 bubble-head sprinklers with impact sprinklers spread the water out over a larger area. The root growth of the trees followed (see photo, page Contractor 1). At first, we had to run the automatic sprinklers more often because the trees went into shock when the flood irrigation was shut off. However, over time, the new system allowed us to reduce watering time from more than 72 hours per week to around 42 hours. With further root-system development, we've now reduced watering to 21 hours a week, with good results. The automatic system also allowed us to water in early morning when water loss from evaporation is lowest.

So far, water use has dropped by around 37 percent. The cost to install the sprinkler system was amortized within 18 months. The payback is healthier, more disease-resistant trees because the tree roots cover a broader area, absorbing more water, more efficiently. A side benefit of this watering plan is a green belt beneath the tree line to control dust (a serious problem in our arid climate) and hold in moisture.

In addition to the problems with the tree-lined streets, aged and ailing oak trees were growing in the parking berms in many areas. We replaced these oak trees with 'Urbanite' ash trees. This variety is better suited to the local climate and has a long track record of good health in our area. Because the 'Urbanite' ash is a much taller tree with broader foliage than the oaks, they will give more shade and reduce the cooling load on adjacent buildings during hot summer months.

Lawns

Next, we concentrated on our turf. It was clear that the turf was experiencing significant thatch buildup. However, we also discovered that it was, in many areas, struggling in our sandy soil because of a compacted, water-resistant layer several inches below the surface. This resulted in saturated, anaerobic conditions in the root zone, creating a black layer and a hydrogen sulfide stench. The result was that turf in these spots could root no deeper than about 1 inch (see photo, page Contractor 6), making it vulnerable to burning in hot weather. Before we understood what was happening in our soil, our attempts to deal with the struggling turf largely consisted of applying even more water, which only worsened the situation.

The first step to improve the turf was to aerate it (see photo, top of page Contractor 6). This broke up the compacted layer and allowed sufficient oxygen to enter the soil. Then, we topdressed with sand to help decompose the thatch. Breaking up the compacted soil made it possible for water to percolate through the soil profile and for oxygen to penetrate deeper into the ground. With better soil conditions, the roots followed. This made the lawns more drought resistant by allowing the roots to grow deeper. This, in turn, allowed for less frequent irrigations. These improvements saved more than 30 percent of the water we used on the turf areas.

Lawns in need of restoration were reseeded with turfgrasses selected for the local climate.

Another change we made was to begin using mulching mowers. Returning grass clippings to the lawns allowed us to reduce fertilizer use and also increase moisture retention. Plus, the mulching mowers weighed less and were more efficient than our older mowers. This reduced mowing time by more than 30 percent and conserved a significant amount of fuel. It also should help reduce compaction of the soil because the new mowers are roughly 1,000 pounds lighter than the industrial mowers that we used before.

We raised the mowing height because longer grass has been proven to fair better in drought conditions. Longer grass provides shade for its own roots, slows evaporation, keeps the root crown cool and keeps out weeds. It also supports a more exten-

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sive root system.

Next, we tested the soil to determine what nutrients were deficient and had a local distributor develop fertilizer based on the test results. Understanding the chemistry of the soil allows us to only use those elements needed, restoring deficient nutrients to the soil without adding unneeded or excessive materials.

Also, we began composting leaves and other landscape debris to reuse as soil amendment, which saved dumpster disposal costs and reduced landfill volume, while reducing the amount of fertilizer needed.

Shrubs

Many of the parking berms were planted with evergreen shrubs. Because of their size, they were beginning to block visibilities and were becoming a safety hazard. We replaced these evergreen shrubs with bunchgrass. The bunchgrass is well-adapted to the local climate and requires much less water than the shrubs. It also is resistant to local diseases.

The future

With such great initial results, will we rest on our laurels? Not likely. We've found that managing the laboratory's landscape with "best practices" continues to broaden our vision of what is possible in landscaping.

Our plans for the future include installation of a "smart" watering system with monitors that electronically sense when water is needed. The monitors will sense if it is raining or if the wind velocity is too high for efficient watering. They will be linked to a computer system, which will automatically turn on water only when needed and at the most optimal times for watering. This will reduce evaporation and help concentrate use of the electrical water pumps during off-peak hours.

The smart water system will be integrated with a wireless, handheld computing device so one person at the repair site can test the system. If there is a break in an irrigation line, these devices will reduce the damage inflicted on surrounding structures by reducing the time to find the break.

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The turf sample at right exhibits deeper rooting made possible by aerating the turf.

There are further plans to replace more of the landscape plants with drought-resistant types, including shade trees adapted to the local climate. More shade will lessen the need for air conditioning by reducing the heat island effect created by more than 50 acres of unshaded asphalt.

By applying recent research and experimenting with procedures we have never used before, we have been able to rejuvenate the laboratory's landscape with an eye to efficient, environmentally friendly methods. Continually seeking cutting-edge technologies from leaders in the field of turf and grounds care and adapting those technologies to the laboratory's grounds was a large step in saving energy and decreasing water consumption while rejuvenating the landscape. GM

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A subsurface compacted layer created saturated conditions and shallow turf rooting.

Jeff Lettau is grounds manager and Launa Morasch is technical editor, both at Pacific Northwest National Laboratory (Richland, Wash.).