The Future of Turfgrass Management and Underground Water Quality

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NUTRIENTS and pesticides are an integral part of any turfgrass management program. High quality turf depends on them to ensure aesthetic value and function. In spite of this dependency, the use of fertilizers and pesticides throughout the country has been criticized. Turf on golf courses, lawns, athletic fields, cemetaries, and other sites that are given adequate fertility and pest control usually has good to excellent quality, but some cities have challenged whether the need for excellent quality turf is worth the perceived environmental risk associated with fertilizers and pesticides.

Significant concern has been expressed about the effects nutrients and pesticides have on the quality of water percolating through and running off from it. In the March 18, 1985, issue of *U.S. News and World Report*, Senator Dave Durenberger (R-Minn.) of the National Water Alliance, stated, "When you combine poor soil conservation with the new fertilizers everybody puts on their lawns, you have real problems. The fertilizers and pesticides run into the streets, then into the storm sewers, and from there into the drinking water intakes and our rivers."

Most of the available information concerning urban-surburban watersheds is limited to the quality of water emanating from impervious surfaces (roads, sidewalks, parking lots, etc.). Most studies indicate that water quality tends to decline as urbanization increases, due to the movement of undesirable materials in runoff from these impervious surfaces. Little is known about the quality of runoff from pervious surfaces (grassed areas) in urban-surburban watersheds. With the dramatic increase in nutrient and pesticide use (due to the increase in golf courses and in particular the growth of the professional lawn care industry), in such watersheds, the quality of runoff and percolated water may be affected.

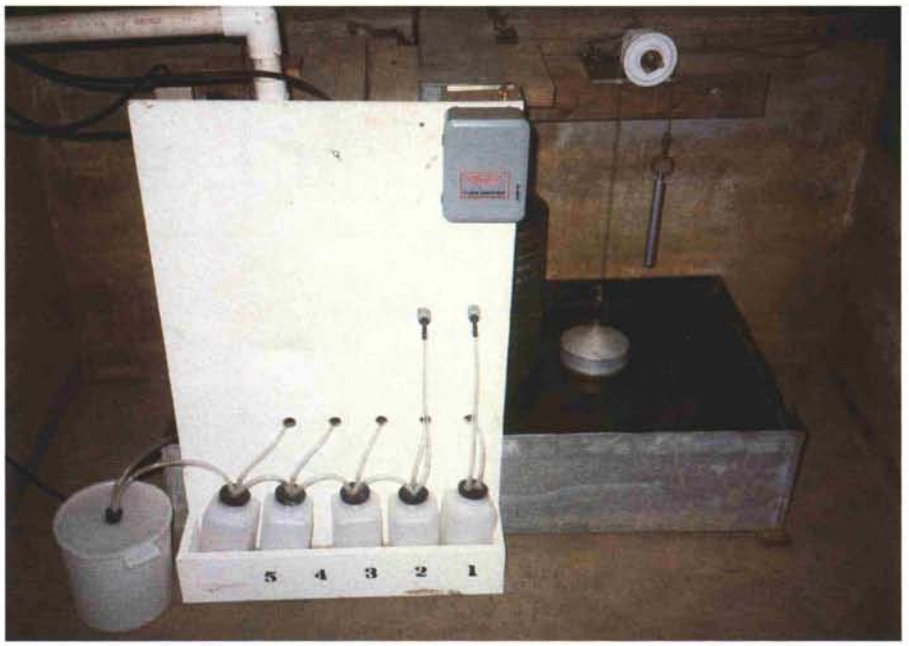
Most research over the past 25 years pertaining to the nutrient and pesticide content of surface water has been conducted in relationship to agricultural lands. In cases where water quality has declined because of nutrient and/or pesticide movement in water or eroded sediment, the use of grassed buffer strips between treated fields and bodies of water has significantly reduced the problem. These studies only provide indirect evidence of the impact that grassed areas have on water quality. Only by monitoring the quality of water emanating from and through well-managed turfgrass sites can the direct impact of nutrient and pesticide use be determined.

A WATER QUALITY research center has been developed at Penn State University to assess the effects of nutrients and pesticides on the quality of percolation and runoff water. The center has 12 sloping plots, each with an automatic irrigation system and an automated collection system at the bottom of the slope. Four lysimeters per plot have been installed approximately seven inches under the surface in each slope. Nutrients and pesticides have been applied according to label recommendations, and subsamples of runoff and lysimeter water have been taken. These samples are currently being analyzed by the Penn State University pesticide laboratory.

Different establishment methods were used when the turf on each slope was installed. Some of the plots were sodded with a Kentucky bluegrass blend, some seeded according to extension recommendations and some with a seed mixture similar to that used by building contractors (having a high percentage of temporary species).

A concrete catch basin (7′ x 7′ x 4′ deep) is set at the bottom of each slope, and aluminum-sided buildings served with electricity are positioned on top of each basin. On the plot side of the building, a concrete weir intercepts runoff and directs it through a chute into the building. As the runoff enters, it is directed through a splitting device that provides a subsample for analysis and proportions the remainder into a galvanized collection tank on the floor of the catch basin. The collection tank has a partition that divides one-third of the tank from the rest. Runoff is proportioned by the splitter into the larger side of the tank. The partition in the tank has a standard hydrologic v-notch through which water can flow from the larger to the smaller side of the collection tank. A float, connected to a potentiometer, rises whenever water flows through the v-notch (the water level is maintained at the bottom of the notch at all times). The electrical signal created by the potentiometer is recorded on a data logger in another building at the site. This signal is scanned every 60 seconds by the data logger to monitor flow rate from each slope. The data logger is coupled to a recording device that in turn is connected to a microprocessor, which converts the electrical signal to gallons per minute of flow. By accumulating the data from all the scans, the total runoff is also calculated. Sensors from a complete weather station at the site are connected to the data logger as well as to a thermocouple buried at one inch below the surface. The irrigation system can deliver three inches per hour, which is equivalent to a storm of a 125 year frequency in central Pennsylvania.

AFTER the system was established, the hydrological characteristics of each plot were determined. The rate of runoff from seeded plots sometimes exceeded by 15 times the amount from sodded plots. As time passed this difference has increased, primarily because of thatch under sodded plots and an increased density of the surface stand. As the organic matter content under sod has increased, the soil structure has changed, and the infiltration rate has become three to four times greater. Compared with thin, poor quality turf, turf of high quality (dense and having some thatch) seems to substantially reduce the velocity of runoff. Perhaps as the poorer quality turf improves from fertilizers and pesticides,



(Top) Overview of runoff plot areas — June, 1986.

(Above, left) View inside building at the bottom of each slope. Collection bottles float-potentiometer device, and subsample apparatus.

(Above, right) Drawing samples of water from underground lysimeters.

the rate of runoff will continually decline.

Although this research is only beginning, the initial hydrological information relative to high quality turf appears to be very positive. This hydrological information will be useful to civil engineers as they design storm water collection systems. In the past, runoff data from pasture research has been used to estimate the rate of runoff coming from turfed areas. It appears that pasture runoff information overestimates runoff from high quality turf sites by a considerable margin.

High quality fresh water is one of this nation's greatest natural resources; it has become a top priority of government and industry. The turfgrass industry is quite possibly looking down the double barrel of increased water use restrictions and broadened regulation of nutrient and pesticide use. Only through research can a record be established from which a meaningful dialogue can be forged with those who have doubts.