Surface and Subsurface Water Quality Data Collection and Model Development for a Watershed Scale Turfgrass System

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Objectives:

1. Collect, evaluate, and quantify surface and lateral water quality (i.e., nitrate N, ammonium N, phosphorus) from a golf course using a watershed approach.
2. Evaluate the water quality impact of transitioning from potable to rclaimed water for irrigation.
3. Develop a computer model designed specifically for turfgrass systems based on an existing watershed scale water quality model.

Start Date: 2000
Project Duration: 3 years
Total Funding: $74,800

The primary objectives of this project are to: 1) collect, evaluate, and quantify surface and lateral water quality specifically nitrate, ammonia, and phosphate from a golf course using a watershed approach, 2) evaluate the water quality impact of transitioning from potable to reclaimed water for irrigation, and 3) develop a computer model designed specifically for turfgrass systems based on an existing watershed scale water quality model.

A watershed scale water quality monitoring and analysis program was initiated in the spring of 1998 to quantify the amount and quality of water exiting a golf course in central Texas. A section of Morris Williams Municipal Golf Course in Austin, TX, managed by the City of Austin Parks and Recreation Department (PARD), was selected as the study site for the project.

The selected section of the course is ideal for studying surface water, as the section has only one inlet and one outlet for runoff, thus the boundary conditions are easily monitored. The topography is such that the contributing area (29 ha) contains 10 greens (0.73 ha), 7 fairways (8.23 ha) and 7 tees (0.30 ha).

Researchers with the USDA-ARS are conducting on-site monitoring of water quality from a creek running through a municipal golf course in Austin, Texas.

Dr. Kevin King with the USDA-ARS points out a water sampling device used to measure water quality on a municipal golf course in Austin, Texas.

The greens, fairways, and tees represent 32% of the total area and are managed at a moderate level, typical of most municipal courses in the U.S. The contributing area also contains approximately 6.5 ha of reduced-management rough, with the remainder comprised of unmanaged trees and shrubs.

Baseflow water samples are collected on a weekly basis while storm flow samples are collected during high flow. Current collected data from this research site suggest significant contributions of nitrate in the surface runoff from this course.

Based on grab sample data, the golf course contributes a significantly increased concentration of nitrate and nitrite to baseflow exiting the course. Baseflow through the course reduced ammonium concentrations, and the course had little effect on phosphate concentrations. Seasonal trends of nitrate and nitrite in the baseflow were observed. Nitrate and nitrite concentrations were consistently higher than at the upstream site, with differences being greater from fall to spring (period of turf dormancy). Phosphate concentrations were similar at both sites and steady throughout the year.

Current advances in model development for turfgrass include the ability to simulate: 1) hydrology on a subdaily time-step, 2) slow release fertilizers, and 3) thatch growth and decay. Enhancements are continually being developed and incorporated into the modeling framework.

Future research plans include continued water quantity and quality collection and analysis and model development.

Summary Points

- Levels of ammonium nitrogen were lower at sites sampled downstream of the golf course, whereas phosphorus concentration were not affected.
- Nitrate and nitrate concentrations were consistently higher at sites downstream of the golf course.
- Work will continue to refine prediction model.