

Comparing Nutrient Losses Via Runoff from a New Golf Course and the Golf Course Site's Previous Native Condition.

Steve Starrett
Kansas State University

Objectives:

1. Compare nutrient loading via surface water runoff from a new golf course versus the site's previous native prairie condition.
2. Investigate the new golf course's impact on surface water quality during construction and during golf course operations.

Start Date: 1998

Project Duration: 5 years

Total Funding: \$118,155

Information is needed concerning the effect that a golf course has on the movement of sediment and nutrients into surface waters during construction and operation. We have set up four monitoring stations on Little Kitten Creek (the major stream) and its tributaries to collect water samples, measure runoff discharges, and collect precipitation data. Water samples were tested for total nitrogen, total phosphorus, and sediment concentrations. Surface water runoff amounts were studied so that mass transport of nutrient and sediment could be analyzed.

We continued our efforts in collecting samples and analyzing data. We had more pre-



The Colbert Hills Golf Course was carved out of tallgrass prairie near Kansas State University. Water quality of the new golf course will be compared with the natural tallgrass prairie.

cipitation than normal and were able to collect many water samples to describe the profile of stream water quality during golf course operation. We divided the data set into three subsets: pre-construction (native conditions), during construction, and during operation. At the main stream leaving the golf course, 28, 138, and 87 surface water samples were collected for the three periods, respectively.

Data analysis showed that golf course construction has the greatest impacts on surface water quality with average concentration of 3.94 mg/L, 0.93 mg/L, and 2,754 mg/L for total N (TN), total P (TP), and sediment (TSS), respectively. This compares to 1.18 mg/L, 0.39 mg/L, and 477 mg/L for pre-construction period.

During operation, sediment content was reduced significantly to an average of 397 mg/L, lower than that at native prairie condition, due to the turfgrass. The average during operation concentrations of TN and TP were 2.38 mg/L and 0.67 mg/L, much lower than those during the construction period, but still higher than those under native prairie condition.

Data correlation analysis explained the sources of nutrient in streams. At the main stream leaving the golf course, correlation coefficients between TSS and TN and between TSS and TP are 0.87 and 0.89 in pre-construction period; 0.84 and 0.92 during construction; and 0.16 and 0.55 during operation. Assuming a small, but constant, fraction of input from rainfall, the excellent correlation between TSS and TN, TP at pre-construction and during construction periods explains that the magnitudes of concentration of TN and TP change with the magnitude of TSS.

Particulate nitrogen and phosphorus absorbed by sediment particles and

brought down to streams in runoff events are the major source of nutrient in streams in these periods. We related fertilizer applications with nutrient concentration in streams and found, for most cases during the 1.5 years monitoring period, impacts of fertilizer applications on stream flow nutrient level were minimal. There were a few cases, however, that spikes of nutrient level were coincident with fertilizer applications.

Less sediment in streams during operation is a contribution of golf course to environment. Slightly higher average concentration of TN and TP than that under native prairie condition is expectable. Only a few samples have TN and TP concentrations exceeded the acceptable levels. We therefore believe that golf course operation, as a whole does not pose immediate threat to aquatic system.

We will continue to collect surface water samples in order to have a better understanding of the impacts of golf course operation on surface water quality. As more data are collected, we will be able to determine the mass transport of nutrient through surface runoffs.

Summary Points

- Construction has a greater impact on surface water quality than operation of the golf course.
- During operation, sediment content in streams was greatly improved, even better than that under native conditions.
- The average concentrations of TN and TP were still higher, but acceptable.
- The majority of nutrient in streams were from sediment in pre- and during construction periods.
- A few cases were observed when spikes of stream nutrient concentrations coincident with fertilizer applications.