

THE MEADOWS PROJECT
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When the idea to build a golf course at Grand Valley State University was first conceived, the Board of Control(Grand Valley's governing body) insisted the golf course be environmentally sensitive and possibly serve as a model for other developments. Long term, consistent and professional environmental monitoring was to be the basis for evaluating our efforts towards these goals. The Water Resources Institute was contracted to provide this service. They had extensive experience in water quality testing, they would be responsive to our needs (both agronomic and fiscal) and they could provide meaningful recommendations. The W.R.I. is a non-profit research institute headquartered at Grand Valley State University.

WATER CHEMISTRY

The first step in our monitoring program was to obtain baseline data prior to construction. Test sites were chosen to represent drainage from/through the golf course and from a "control." Most of the flow at Site Two comes from golf course drainage. It also receives overflow from wetlands on site, groundwater discharges and paved-surface runoff. Site Three receives drainage from one acre of our golf course, but most of its water comes from hard surfaces on campus. The following water chemistry tests were performed at these two sites, on ten dates during 1992:

-pH	-total phosphates
-alkalinity	-orthophosphates
-conductivity	-total suspended solids
-ammonia	-total dissolved solids
-nitrates	-hardness

Baseline data also included surveys of the invertebrate species in our ponds, streams and wetlands, an inventory of vascular plants and trees, and bird counts performed by the Grand Rapids Audubon Club. Additionally, soil tests were done to check for residual agricultural chemicals.

The biological and soil data was gathered before any significant land-use change occurred. And while the water chemistry tests started in February of 1992, only the data gathered until May are truly "baseline," because large scale earth moving began that month.

The water chemistry tests were again performed in 1993, on 20 separate dates, at Sites Two and Three plus from all three ponds on the golf course. The 1993 data summary indicated that while soil erosion was significantly reduced compared to 1992, the quantity of nitrates and phosphorus in the water were of some concern. However, data did not indicate that golf course activities alone were responsible for the higher levels of nutrients. After reevaluation during the winter of 93/94 some changes were made in the monitoring program. These adjustments

made it easier to judge the true influence of our golf course on water quality. Tests for conductivity and hardness were eliminated and the following were added:

- dissolved oxygen
- percent oxygen saturation
- grease and oil
- nitrites

A third test site was also added. This third location (Site One) represents the water quality prior to its entry onto the golf course. The source for Site One is mostly groundwater, with some inputs from stormwater run off from paved surfaces. These tests were conducted on 20 dates in 1994, on Site One, Two and Three.

The 1994 data summary said higher levels of nutrients and solids tended to occur in drainage that came from impervious surface areas and lower levels were somewhat correlated with drainage from vegetative areas. Total dissolved solids, ammonia, nitrates, nitrites and phosphates indicated a decreasing trend when compared with 1993 data. But these trends were true for both Site Two and Site Three. This indicates that while golf course activities may influence water quality, inputs from airborne contaminants, groundwater, and soil-stored nutrients must be investigated.

While the W.R.I. summaries from 1993 and 1994 do indicate trends, the researchers insisted no formal conclusions could be made yet. The study is restricted by a few factors: (1) data collection is limited by time--this project is only three years old and Site One data has only been analyzed for one year, (2) samples are taken and tested with no repetitions (for economic reasons), (3) the unique site conditions make current data useable only for this golf course (site conditions may eventually be "factored-in" so that conclusions and recommendations could be applicable to any golf course).

BIOLOGICAL ASSESSMENT

In August of 1994, the W.R.I. performed a biological assessment of Ottawa Creek to check for possible impacts from golf course activities. Sampling procedures were based on Michigan Department of National Resources' GLEAS Procedure 51; analysis of fish, macroinvertebrates and habitat quality. The results were compared to data from Rum Creek in north Kent County. (Rum Creek is considered a reference stream.) Tests were run downstream from The Meadows and at a site not affected by our golf course.

The evidence did not suggest any measurable changes to Ottawa Creek from golf course inputs. And they noted that any influence from The Meadows is secondary to damage caused by stormwater runoff from the adjacent roadways. This assessment is scheduled to be repeated in 1996 or 1997.

PESTICIDE LEACHING

The question of pesticide leaching from the 100% sand greens was addressed in July of 1994. Because of a cutworm infestation, granular Dursban (2.3% chlorpyrifos) was applied to our #7 green, then watered in. Samples were collected prior to application ("control"), at one-half hour intervals for four hours, one hour intervals for the next six hours and 1.5 hour intervals for 12 more hours. Two final samples were collected one and two days later. The sample site was a tile outlet that drained part of the green and its surrounds. Groundwater levels were high enough to produce a constant trickle of water at the outlet.

Data results were remarkable! Within 30 minutes of application, chlorpyrifos was detected slightly below the practical detection limit of 0.1 ppb. After 1.5 hours the chemical was observed well above detection limits. Detection continued for about six more hours. A substantial increase in levels again occurred between 27 and 50 hours after application. (The maximum levels detected were below .25 ppb. The researcher emphasized that these levels were extremely low.)

This pilot study was initiated to determine the need for more extensive research in this area. It also served as a guide for deciding sampling procedures and timing, and pesticide extraction methods. We plan on repeating this study in 1995.

G.V.S.U. Faculty Research

In addition to the W.R.I. research, two separate projects have been undertaken by Grand Valley faculty.

The Geology Department plans to study changes in the geohydrology and geochemistry as the golf course matures. A variety of advanced geology classes will use The Meadows as a field lab. Each class will perform in appropriate part of the research, so that data will be a compilation of class projects. While they hope to reach some supportable conclusions, the main goal is to enhance the earth science program with hands-on experience.

A microbiologist has also begun research at The Meadows. Because of the unusual greens construction (100% sand based), she wants to study their bacterial populations. She is specifically interested in bacterial populations as natural controls for disease-causing fungi and as indicators of specific environmental pollutants. More background research is necessary before this project begins in earnest. However, preliminary data indicates bacterial population levels in the greens are only slightly less than in soils. This is a very positive finding because many people have suggested the sand rootzone could be uninhabitable by most microorganisms.

RECOMMENDATIONS

If you're interested in monitoring:

- Secure funding outside your normal budget.
- If the property is in development, collect baseline data for one full year before construction begins.
- Include upstream, downstream and "control" test sites from the start.
- Investigate the company that wants to do your monitoring - beware of hidden agendas!
- Contact an outside expert that could help you analyze and interpret the data. Keep their number on file for use if the original data interpretation seems extreme or bases conclusions on conjecture.

Regardless of monitoring plans:

- Educate yourself on water quality issues. Identify the types of aquatic habitats on and near your golf course.
- Find out what natural contaminants (salts, nitrates, phosphates, etc.) can be expected in your water habitats. Could they harm people, plants, animals, or equipment?
- What's the land use history of the property? What about possible man-made pollutants?
- Take steps to protect water quality. A few suggestions are listed; most are cheap and easy to do. (1) Avoid fertilizer and pesticide applications before heavy rain. (2) Apply lower rates of fertilizer to minimize leaching and run-off risks. (3) Never allow fertilizer to be thrown directly into ponds, streams, etc. Establish "no maintenance" zones along these areas or use hand spreaders to apply products. (4) Use pesticides only as needed, not because you always have done it. Follow label directions. Spot treat when possible. (5) Install silt-fence barriers if earth moving activities take place near aquatic habitats.