2004 Denver Annual Meeting (November 7–10, 2004)

Paper No. 165-6

Presentation Time: 2:45 PM-3:00 PM

NOURISHMENT OF WETLANDS ADJACENT TO PENN STATE'S LIVING FILTER PROJECT: IMPORTANCE OF MULTIPLE LINES OF EVIDENCE

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Penn State University treats up to 15,142 m^2/day of sewage effluent by irrigating crops and forests at a 5.08 cm/wk rate. Routine application began in 1983, following 11 years of research and development. Differential weathering of Valley and Ridge folded and faulted carbonate rocks produced karst pans underlain by 3 to 50 m of regolith. Adjacent to one spray field, pans underlie and support 0.06 to 2.9 ha wetlands. Homeowners attributed elevated water levels and property damage to a loading of nearly 363 cm of precipitation and effluent nearby.

Various tools were used to investigate these claims: 1) 17 wetlands were equipped with staff gauges, 2) 31 nested piezometers were constructed containing four monitoring points, 1.5 to 9.1 m deep, and 3) a 30.5 cm contour interval topographic map was produced. Weekly to biweekly water level measurements were made during a year of below normal precipitation followed by 4 years of monitoring, the last two consecutive years being above normal precipitation. Electrical resistivity, shallow-soil temperature and chemical surveys were performed. Hydrogeologic profiles include 10 distinctive, traceable soil textures, deformed by the differential chemical weathering of carbonate rocks. Multiple lines of evidence obtained during two wet years confirmed initial conclusions, which were based upon the first year of data. Effluent did not nourish these wetlands. The combined hydrological catchment of these wetlands was much smaller than the topographical catchment. Pans more distant from spray lines showed earlier, higher water-level responses, requiring an alternate localized source of recharge. Alone, a water table map based upon highest water elevations could be misinterpreted to show lateral flow of effluent to wetlands following the second year of excessive precipitation. However, nearly all nested piezometer data showed surface and perched groundwater to be moving downward. As further proof, NO_3^- (0.1 to 0.8 mg/L), conductivity (22 to 98 µS/cm^2), hardness (6 to 17 mg/L $CaCO_3$) and chloride (3 to 11 mg/L) values from all wetlands were substantially smaller in comparison to applied effluent: NO_3^- (8.7 mg/L), conductivity (888 µS/cm^2), hardness (232 mg/L $CaCO_3$), and chloride (128 mg/L).

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