1 Introduction

Oneida, Tennessee is located in Scott County approximately 60 miles northwest of Knoxville, Tennessee. The study site has been used as a rail-yard since the 1800s. Beginning in the early 1950s, the Tennessee Railway Company began cross-tie treatment at the site and diverted the excess creosote to a holding pond. Cross-tie treatment continued intermittently until 1973 when the Southern Railway Company (now Norfolk Southern Railway Company) purchased the Tennessee Railway Company. Equipment used to treat the railroad ties was removed at this time (ARCADIS Geraghty & Miller, 1997).

The U.S. Corps of Engineers discovered creosote in October 1990 during the construction of a drainage channel along Pine Creek. Initially a groundwater trench was built to prevent further seepage of creosote into Pine Creek (ARCADIS Geraghty & Miller, 1997). After site investigation work was completed, ARCADIS Geraghty & Miller proposed phytoremediation in conjunction with the interception trench as a viable long-term solution to clean up the site (ARCADIS Geraghty & Miller). The objectives of the remediation system were to: 1) control groundwater flow at the site to prevent contaminant transport 2) clean up the soil and groundwater.

Originally, 1036 hybrid poplar trees were planted over two years beginning in 1997. As of November 1999, 927 trees remain. Hybrid poplars were chosen for their rapid growth, large consumption of water, and tolerance of contaminants. The site is now undergoing evaluation for the effectiveness of phytoremediation by Virginia Tech.

Phytoremediation uses plants to aid the breakdown of contaminants as well as control contaminant transport in several manners (Nyer and Gatliff, 1996, pg. 58). Plant roots in the soil increase the transfer of oxygen to the root zone. This, in turn, promotes aerobic biodegradation of the contaminant in-situ. The rhizosphere (root zone) encourages the growth of microbes in the soil that can use the contaminant as a carbon source. Contaminated water can be taken into the plant itself and stored in its structure. As plants lose their leaves or die, the organic matter needs to be collected and transported to an appropriate waste facility so that the contaminant is not reintroduced into the subsurface. Finally, plant transpiration can help to provide hydraulic control of the site during the growing season. Transpiring plants are known to create a

depression in the water table; thus preventing contaminant migration by forcing surrounding groundwater to flow towards the site (Nyer and Gatliff, 1996, pg. 59).

The objective of this study is to quantify evapotranspiration of the poplar trees at the Oneida site. Once this is known, the study will assess the degree to which the phytoremediation system impacts groundwater direction and flow. Approaches to the objective are as follows: 1) determine a water budget for the 1.67-acre site reflecting seasonal changes in storage of the aquifer; 2) determine water use of the poplar trees using White's Equation and comparing groundwater recession curves in winter and summer months; 3) qualitatively assess effects on the water table by the poplar trees and trench using discrete water level data; and 4) develop a groundwater flow model reflecting the transient effects of the phytoremediation system.