

A special session on the Lloyd Aquifer

Session Chair

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Introduction

The four papers in this special session (a) provided a review investigations of the Lloyd Aquifer by the U.S. Geological Survey, (b) discussed the recent studies of hydrogeology and the extent of saltwater intrusion in northern Nassau County, (c) the modern characterization of the Lloyd Aquifer in the Nassau and Suffolk counties' groundwater models and (d) the pollution susceptibility of Lloyd wells from the Source Water Assessment Program completed in 2003.

Anthony Chu (U.S. Geological Survey) showed that the Lloyd Aquifer extends under almost all of Long Island. It is present, at depth, except in Northwest Kings, Queens and Nassau counties. The Lloyd unit is also absent from under a small area of the north fork at Orient Point.

Drilling beneath the surface, the Lloyd would first be encountered at a depth of about 100 feet below sea level in the northwest part of Long Island where it is a thin layer of sediment to a depth of over 1500 feet further to the east under the south shore where the thickness can be about 500 feet. The Lloyd is the oldest and lowest hydrogeologic layer under Long Island. It dates back to Cretaceous times between 144 and 65 million years ago. Where it sits on the underlying bedrock, it is a gravel layer but grades upward into sand and silt at its upper surface. It also contains clay layers which cause the horizontal hydraulic conductivity to be one or two orders of magnitude greater than the vertical hydraulic conductivity.

The Lloyd is everywhere capped by a confining unit, the Raritan Clay. Daniel O'Rourke would show that the Raritan Clay under the northern half of Suffolk County is "looser" than the more compact layer under the southern half of the Island.

The Lloyd Aquifer contains about 9% of Long island's potable water and receives about 3% of the total annual recharge to long Island. The total recharge in Nassau and Suffolk counties alone amounts to about 1.3 billion gallons per day; the recharge to the Lloyd, from Nassau and Suffolk counties alone, is then estimated as 39 million gallons per day or 14.2 billion gallons per year. The rain (or snow) water that eventually reaches the Lloyd comes from a narrow strip of ground, usually less than a half-mile wide, along the midline of Long Island. This water may take 500 years to reach the Lloyd and an additional 1500 years to finally pass under the north shore of Long Island. Under the south shore, water seeping through the Lloyd Aquifer is about 8000 years old. The groundwater in the Lloyd is fresh beyond the position of south shore and, where the aquifer exists, a mile or two north of the north shore of Long Island. Under the necks of northeastern Nassau, Fred Stumm showed that the north edge of the Lloyd is found in this area, where it interfingers with, and connects to, a much younger North Shore Aquifer which is Pleistocene in age or between 1.8 million and about 10,000 years old. There is no Magothy under the Necks.

Withdrawal of water from the Lloyd greatly diminished about 1996 when the Jamaica Water District in New York City was closed. In 2003, pumpage from public supply wells amounted to about 3.5 billion gallons or about 25% of the amount of water recharged to the Lloyd from Nassau and Suffolk alone. Current pumping has widened the area of recharge in Nassau County. Fred Stumm reported extensive studies done between 1991 and 1998 in Great Neck, Manhasset and Oyster Bay in northeastern Nassau County. Fifty-six new borings were made in a thirty-square mile area. These were supplemented with additional geophysical measurements both in the aquifer and offshore in Long Island Sound. They document eight separate areas of salt contamination; while the background level of chloride is 5 mg/l and the standard is 250 mg/l, monitoring should consider a well threatened if concentrations reach 50 mg/l.

The Bibliography of Long Island Geology (<http://www.geo.sunysb.edu/lig/#Bibliography>) lists twenty-nine new publications on the topic of the Lloyd Aquifer since 1985. New information has been synthesized into the Nassau-Suffolk Regional Groundwater Model. The model was calibrated to pumpage data from 1994 and revised in 2002. While many more monitoring wells are now available, especially in the Lloyd of northern Nassau County, there are few (9) in Suffolk. Yet, those that are available, like that at the Northport VA Hospital (S-00048) and one at BNL (S-6431) show excellent agreement with the calculated model results.

The most extensive and comprehensive application of the model to date has been associated with the Source Water Assessment Program (SWAP) on Long Island. 1,369 public supply wells were evaluated including the 38 active Lloyd wells in Nassau County and five in Suffolk. The time that it took water to reach these wells was over 100 years for 30 of the 43 indicating a very low susceptibility to any pollution. Some had travel times of more than 500 years. The more susceptible wells (e.g. those with travel times of less than 100 years) were on the Necks in northern Nassau County. In the few instances where contamination of a Lloyd well has been reported, it is likely due to a cracked well casing,