FOUNDATION HOUSE, NEW YORK, GEOTHERMAL HEAT PUMP

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INTRODUCTION

The Foundation House, planned to house half a dozen nonprofit foundations, will be constructed on 64th Street just east of Central Park in Manhattan, New York. It is in a Landmark District and designed by the architectural firm of Henry George Greene, AIA of Scarsdale, NY (project architect, David Wasserman). The 20,000-square foot building of five floors above ground and two below, will illustrate how energy-saving technology and environmentally sensitive construction methods can be economical. The heating and cooling system, including refrigeration requirements for the freezers and refrigerators in the commercial kitchen, will be provided by geothermal heat pumps using standing column wells. The facility is the first building on the island of Manhattan to feature geothermal heating and cooling. The mechanical system has been designed by Laszlo Bodak Engineers of New York City with the assistance of Carl Orio's firm of Water & Energy Systems corporation of Atkinson, New Hampshire. The two 1550-foot standing column wells were drilled by John Barnes of Flushing, NY.

STANDING COLUMN WELLS

Two 1550-foot, 6-inch diameter wells were drilled into the bedrock below the building at a cost of $100,000 (Figure 1). No serious problems were encountered during drilling and the wells were each completed in five to six days. The 58°F water in the wells will be used to provided both heating and cooling using heat pumps. The standing-column well method takes water from the bottom of the well, passes it through the heat pumps, and then returns it to the top of the well. This vertical movement of water and heat exchange is called a standing column well and provides a convenient and effective heat transfer method as well as the ability to control the Reynolds number of the water/bore surface transfer and a method to create apparently higher transmissivity coefficients. Based on experience by the Water and Energy Systems Corporation, 50 to 60 feet of water column is needed per ton (a nominal 12,000 Btu/hr of cooling) of building load (Orio, 1994). Thus, approximately 30 tons will be obtained from each well for the total estimated building load of 60 tons. It should be noted that the standing column method works best with non-corrosive and non-scaling water, as the water is used directly in the heat pumps. Fortunately, the water in these wells has a low dissolved solids content.

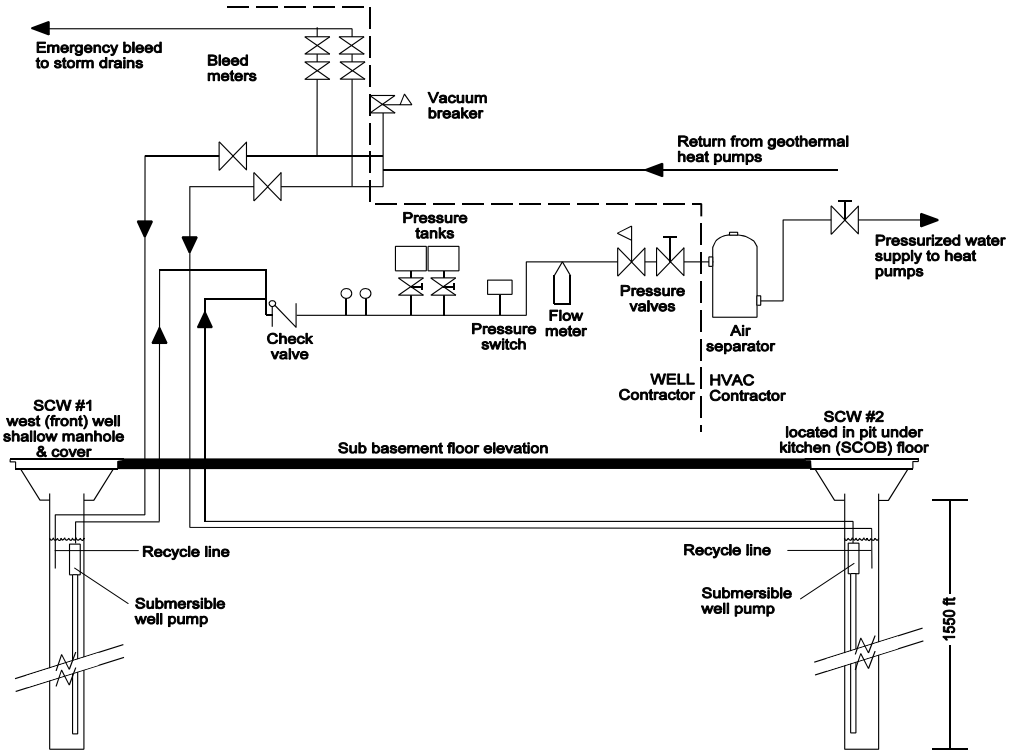

Figure 1. Foundation House standing column well and heat pump system.

The project has also provided information for the U.S. Geological Survey. Their scientists were invited to spend two days probing the underlying 400-million year-old mica schist bedrock. Video cameras and gamma-ray sensors were sent most of the way down the six-inch-diameter holes, providing them with a view of the rock formations, faults and cracks that allow water to percolate through the otherwise solid rock. This information will be used to assist future drilling projects.

HEATING/COOLING SYSTEM

Geothermal heat pumps, manufactured by Climate Master Corporation, will be installed in various function zones in the Foundation House. Each heat pump either extracts energy (heating) from the earth-water system or returns energy to the earth (cooling). Economic advantages are accrued by the winter use of "free" earth energy plus the stored summer heat. Rejected summer heat from air conditioning is readily transferred to the relatively cool bedrock, making the air conditioning more efficient. Summer heat is rejected and stored in the bedrock, without the need for external air condensers, without their familiar attendant noise and without their visible roof-top presence. Quiet geothermal heat pumps have no separate heat rejection devices in this design.

As no fossil fuels are consumed the geothermal heat pumps do not have burning gas emissions. If a fossil fuel heating system had been used at the Foundation House substantial annual carbon dioxide emissions would have been the results. Emissions of carbon dioxide with fossil fuel consumption could have exceed 300,000 lbs of carbon dioxide for oil and nearly 175,000 lbs for natural gas annually.

ACKNOWLEDGMENTS

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REFERENCE

Orio, Carl D., 1994. "Geothermal Heat Pumps and Standing Column Wells." Geothermal Resources Council Transactions, Vol. 18, Davis, CA, pp. 375-380.