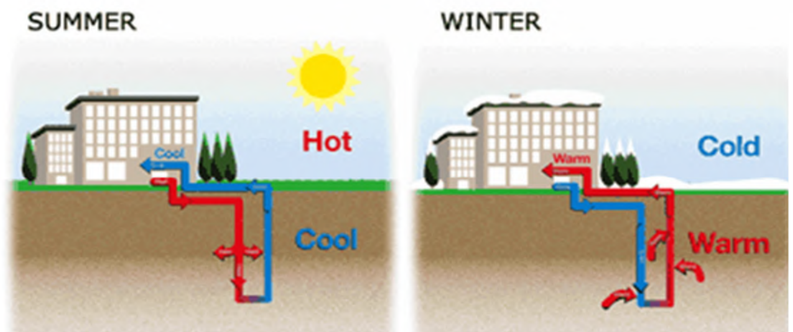
Cass School District 63 GeoExchange System

Project Construction Cost
Concord Elementary & Cass Junior High Schools
$9.4 Million

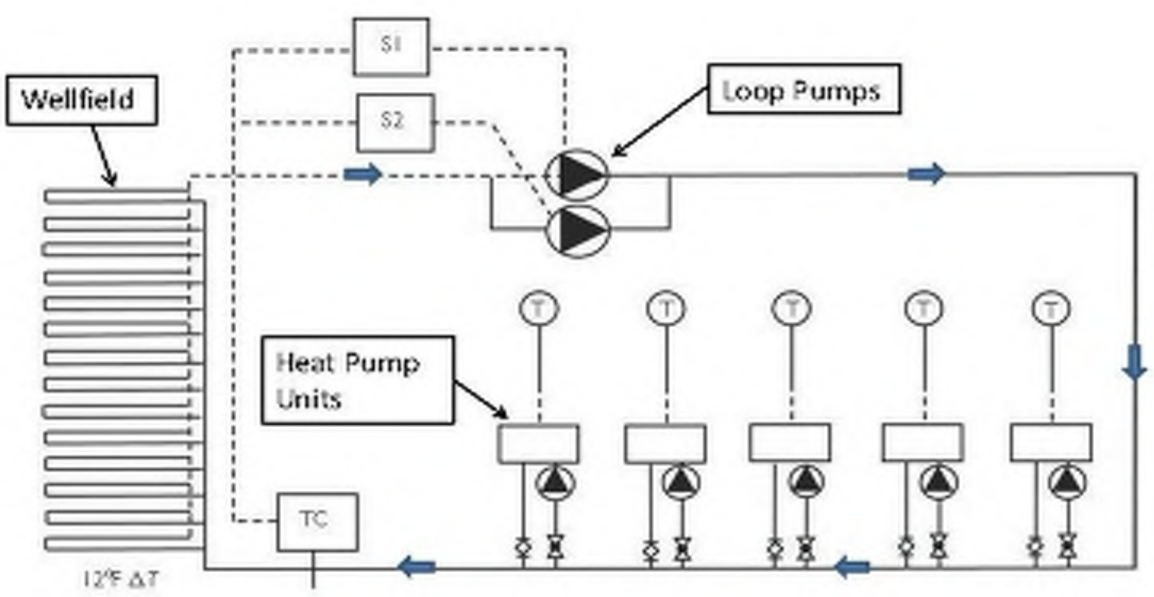
The renovation of the heating, ventilating, and air conditioning systems includes individual geo-exchange heating/cooling systems to serve Concord Elementary School and Cass Junior High School. This system is the most energy efficient and has the lowest life cycle cost of any HVAC system resulting in the best long-term solution for the district.

System Overview

Sometimes called “geothermal”, the term “geo-exchange” is more appropriate. The system consists of a closed loop piping system filled with a solution of water and propylene glycol which is used to transfer heat to and from the earth. In the summertime, the heat that is normally rejected to the air during the air conditioning process is instead transferred to the piping system which transfers the heat to the earth. In the winter, this stored heat is extracted by the piping system and transferred back to the building to provide building heating. It is this “saving” of the energy that makes a geo-exchange system so energy efficient.



GeoExchange System One-Pipe Diagram



The geoexchange water/glycol solution is circulated by the Loop Pumps in a closed loop continuously around the building and through the Wellfield. The Heat Pump Units each have their own circulation pump that operates whenever the compressor in the unit operates. If the Heat Pump Unit is in heating mode, its individual pump operates pulling a little water from the main loop from which it recovers heat and adds additional heat from the compressor to heat the space. If the Heat Pump Unit is in cooling mode, its individual pump operates pulling a little water from the main loop to which the compressor rejects its heat as it operates to provide cooling to the space. The Heat Pump units can share energy between themselves – if one is in cooling mode and rejecting heat to the building loop, another that is in heating mode can use that heat.

Wellfield Design

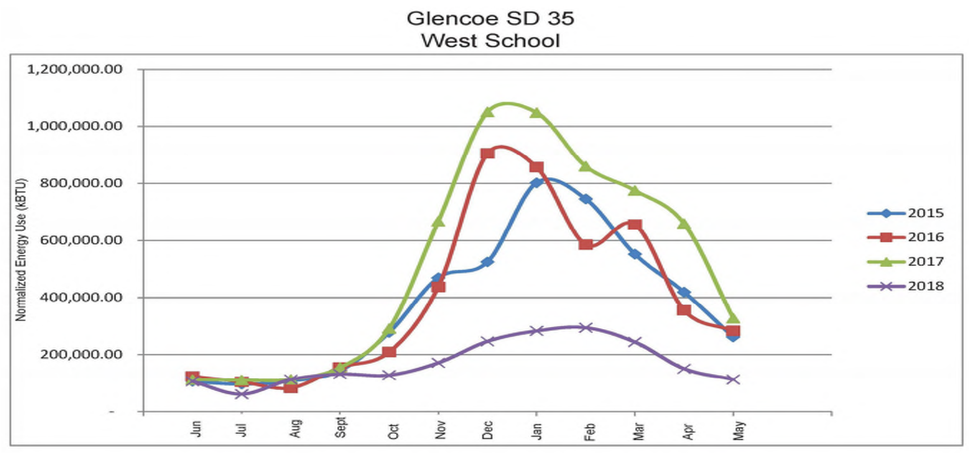
The Concord wellfield will be (32) boreholes and the Cass Jr. High wellfield will be (40) boreholes. Each borehole is 5” diameter at 500 ft. depth to provide for installation of a continuous closed loop using 1-1/4” piping with a U-bend fitting at the bottom. The High Density Polyethylene (HDPE) piping has a manufacturer’s 50 year warranty and will never corrode. After installation of the piping in the borehole, the hole is completely filled with an elastic grout that seals the hole to prevent ground water from entering the aquifer and to enhance the transfer of heat from the piping to and from the surrounding earth.

Heat Pump Units

The Heat Pump Units are very similar to the heating/cooling unit at your home except that there is no gas burner and instead of the compressor being outside in a condensing unit, the compressor is inside the unit, similar to your refrigerator. When the unit is called upon to do cooling, cold refrigerant is sent to the air coil just as in your home unit, but when it is called on to do heating, the refrigerant cycle is reversed and hot refrigerant is sent to the air coil.

Energy Efficiency

Below is a graph of the energy usage of a typical retrofit geoexchange system. West School in Glencoe, Illinois had a hot water heating system with 25% of the school air conditioned. The vertical axis is total energy used (electric and gas). The three lines above show energy usage before the geoexchange system, the one line below shows energy usage after. Cooling was added to 100% of the school and the building saved $16,500/year in energy cost.



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