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Executive Summary

The general purpose of this report is to present the energy savings of a Ground Coupled Heat Pump compared to the Conventional Direct Expansion Cooling System. The objectives of this report are: (1) to assess the GCHP vertical well system that will be capable of rejecting 200 tons of the cooling seasons heating loads. The total load on the system approaches 500 tons, thus the system will be coupled with a cooling tower to reject the remainder of the total system load. The Mirenda Centers located near Philadelphia, Pennsylvania. (2)Also, a structural and lighting design for a mezzanine level in the entry space that will recapture energy that is lost due to **40 foot** high ceilings in the space. The Mirenda Center for Sports Spirituality and Character Development has been constructed since 2010. The redesign includes the combination of **10 zones** of **7 wells in a reverse return configuration** for addition and extraction of heat.

Integrated Master's Criteria: A Life Cycle Cost Analysis was performed for this project, comparing the two different systems. This location of this material can be reference from the table of contents of this document. The cost difference between a conventional Conventional Direct Expansion Cooling System and a Ground Coupled Heat Pump is **$635,788**. The annual cost savings associated with operating the GCHP vs. Air to Air system is **$40,013**. Over a life time of with escalating costs of electricity and interest discount rate of 2.7% the 50 year life time discounted savings is **$1,197,413** and will pay the cost difference back in less than **20 years**.