1.0 Executive Summary

The Slippery Rock University Student Union was designed by the architects and engineers with the intent to deliver a comfortable environment inside and outside of the building in hopes of creating a central gathering place of the campus. While occupant comfort was a major design condition, building performance and energy conservation was equally as important in striving to achieve LEED Silver Certification. In the following report, the existing mechanical design will be researched, evaluated, and redesigned.

The existing mechanical design is comprised of five rooftop air handling units with energy recovery that supply the majority of the occupied spaces with the proper heating, cooling and ventilation. The electrical and IT rooms are cooled by a separate ductless split system due to the excessive internal heat loads caused by the equipment. Three additional make-up air units are located on the roof supplying the kitchen with ventilation air. The energy recovery units utilize a water heat transfer system to exchange heat between the units to further decrease wasted energy within the system and are also equipped with variable frequency drives.

The campus steam plant provides the SRU Student Union with steam to heat the water used in the hot water heating system for the VAV boxes with hot water heating coils. The cooling is provided through the water source heat transfer system that is tied into two closed circuit coolers located on the roof.

In the report, a different method of providing the building with heating, cooling and ventilation is explored. The topic of redesign is to change three of the existing air handlers with energy recovery to a dedicated outdoor air system with active chilled beams. The systems overall performance created an annual savings of $5,985.71 with an additional first cost of $41,934.88 for a simple payback period of 7 years.

An additional system was also added to the mechanical design. The use of an evacuated tube system for solar hot water was designed and evaluated. With the combination of the cost savings from the existing portion of the green roof and the government incentives, the new system has a net savings of $15,336.50. However, without the incentives, the system does not appear to be economically feasible.

The structural implications of replacing composite steel deck with precast hollowcore planks were also evaluated. The overall consensus of the structural analysis seems that the precast planks could be used however coordination and planning could potentially become an issue. The first cost analysis of the system saved $83,287.75 and also accelerated the construction time of the structure.