1.2 Executive Summary

The South Patient Tower at INOVA Fairfax Hospital is a thirteen (13) story, 239,000 square foot patient tower addition located in Falls Church, VA. The addition was built to provide additional patient bedrooms, some staff offices, a new kitchen and café, as well as a future clinical space.

This document is a collection of research, official documentation, and the data that were collected for the South Patient Tower primarily to analyze the effects of a mechanical system redesign. The goal of this thesis project was to design a new chilled water plant to help provide more energy efficient measures to the South Patient Tower. It was also a primary goal to analyze the effects of the centralized chilled water plant on the life cycle cost and on other building systems and components to evaluate the feasibility and economic impact that the redesign would have on the building.

The original mechanical design met all of the design criteria of the South Patient Tower at a minimal cost to the owner. The system that building is comprised of is a constant volume with reheat that includes purchased chilled water and steam that serve the four (4) 50,000 CFM air-handling units on located on the fifth floor and three (3) 10.7 MMBTU steam to hot water heat exchangers. Hot water is then supplied to the AHUs and the rest of the heating devices within the building. The kitchen and café are served by an independent air-handling unit.

The redesigned system will only affect the source of the chilled water and the purchased steam will remain the same as in the existing design. Due to the ability to optimize a chilled water plant with other mechanisms such as dedicated heat recovery chillers and condensate recovery, the study was performed and compared on cost and energy consumption when compared to the existing purchased utilities. The chilled water plant will consist of three (3) 380 ton chillers to provide for N+1 redundancy, two (2) 380 ton cooling towers, a dedicated heat recovery chiller to offset the steam consumption and an air-handling unit condensate recovery system to offset the consumption of make-up water in the cooling towers.

Multiple alternatives were considered for the plant design and the most efficient and economical choice was found to be a variable primary flow, centrifugal chillers with a 100 ton heat recovery chiller and the air-handling condensate recovery system. The effects this plant has on the electrical and structural systems were also evaluated. It was found that additional electrical equipment was necessary and additional reinforcing in the concrete slab was necessary. The overall redesign will cost an additional **$919,779**. Although it increased the capital cost, a 30-year life cycle cost shows **$2.65 million** savings when compared to the baseline, and reduces overall energy consumption by **14 MMBTU** annually. It also decreases emissions compared to the baseline by around **4%.**