



# New York Police Academy

College Point, New York

## Final Report

# East Campus Ground Source Heat Pump Re-Design w/ Photovoltaic Array Analysis & Construction Evaluation

Prepared for: Professor William Bahnfleth, PhD, PE

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**Abstract**



## New York Police Academy College Point, New York

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### Information

- ◆ Architect: Perkins + Will
- ◆ Occupant: NYPD
- ◆ Size: 1,000,000 SF
- ◆ Overall Cost: \$656,000,000
- ◆ East Campus: Academic/Office Space
- ◆ West Campus: Physical Fitness/ Central Plant
- ◆ Architecture: Modern w/ Strong Geometric Forms
- ◆ Sustainability: Projected to USGBC LEED Silver

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### Construction

- ◆ Turner Construction Company and STV Inc. will lead as joint General Contractors.
- ◆ New York Department of Design and Construction will be responsible for overseeing the progression of the Project.
- ◆ 2,400,000 gross square feet of construction space. (Includes buildings, football field, track, parking lots, landscaping, muster courts.)
- ◆ Construction Dates: 10/1/2010- 12/31/2013

### Mechanical

- ◆ Mechanical Engineers: WSP Flack + Kurtz
- ◆ Ventilations needs met by 63 AHUs
- ◆ AHUs Capacities: 3,000 CFM-30,000 CFM
- ◆ Total Cooling Load: 3,305 Tons
- ◆ Total Heating Load: 1,396 bHp
- ◆ Hydronic Water System
  - ◆ (8) 1350 bHp Chillers
  - ◆ (3) Water-Tube Boilers
- ◆ Due to the size of the building WSP Flack + Kurtz decided to house a central utility plant in the West Campus. The central utility plant will be responsible for hydronic needs of the entire Academy.

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### Structural

- ◆ Structural Engineers I: Robert Siman Assoc.
- ◆ Structural Engineers II: Guy Nordenson Assoc.
- ◆ Foundation: 16' 100 ton capacity steel piles have been installed throughout the site to provide foundational basis.
- ◆ 14" Deep Structural Slab on Grade set on piles
- ◆ Steel Super Structure that must conform with AISC Specifications.
- ◆ Steel Decking/ Concrete slab floor system.

### Lighting/Electrical

- ◆ Electrical Engineers: WSP Flack + Kurtz
- ◆ Total Electrical Load: 864,93W
  - ◆ 18% Lighting, 19% Power, 63% HVAC
- ◆ 460/208V 3-Phase High Voltage system stepped down to 120/208V 3-Phase Low Voltage System
- ◆ 4580kW Emergency Power Potential
- ◆ Natural Daylighting heavily used along perimeter of building. East campus includes large central atrium for lighting of interior lobbies.

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Mechanical Option  
Senior Thesis 2010- 2011

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## **Executive Summary**

This report is a senior thesis capstone design project for The Pennsylvania State University's Architectural Engineering Department. This report is a culmination of a yearlong architectural engineering analysis of the New York Police Academy (NYPA). Specifically, this report focuses on the mechanical systems of NYPA. An analysis has been done regarding the designed mechanical system as well as a proposed redesign which consists of a ground source heat pump system along with an electrical photovoltaic array. The systems were also analyzed from a construction management standpoint.

The New York Police Academy is a building project which is to start construction in October of 2010 and be completed by the end of 2013. This Academy is intended to consolidate the New York Police Department's training and academic center into one campus. The NYPA is going to be built in College Point, New York, which is a subsection of Queens, New York. The total site consists of 2,400,000 gross square feet which will consist of an East Campus Building, West Campus Building, football field, outdoor track, muster court, parking lots, and landscaped areas. There will be an exposed drainage ditch that will symbolically and physically separate the East and West campus. The East Campus Building will house the academic and office spaces of the academy. The West Campus Building will house the athletic facilities, training facilities, and the central mechanical plant.

The air conditioning needs of the building will be met by 63 chilled water Air Handling Units (AHUs). The capacity of the AHUs range from 3,000 CFM to 30,000 CFM. The 63 Air Handling Units will be housed in different sections of the campus. A central utility plant located in the West Campus will serve the AHUs. There are five water tube boilers that are located in the central plant that will be responsible for introducing the hot water for the entire campus. Along with the boilers there will be six chillers that will supply all the cold water needs of the Academy. The central plant serves both the East and West Campus.

After analyzing the existing mechanical system, a proposed alternative mechanical system was explored. The major design proposal is to incorporate a ground source heat pump (GSHP) system to serve the East Campus building. The proposed design alternative will be compared to the actual designed systems in areas such as energy efficiency and cost. Aside from the mechanical system, there were other proposed systems. In regards to the electrical system, a photovoltaic array located on the roof of the West Campus was designed and evaluated. Also the construction and economic impacts of these proposed systems were analyzed.

Overall, it was discovered that implementing a GSHP system along with the photovoltaic array could help significantly reduce utility costs. Also it was estimated that the pay back period for these system would be 16 years. Implementing these system would increase the first costs of the building. However, it is believed that the benefits of reduced energy use, utility costs, and reduced emissions would suggest that these alternatives could be beneficial for the New York Police Academy.