Supporting A Fast Track Mission-Critical Campus Healthcare Expansion

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New Campus Master Plan

5.5 million SF Completed June 2012

New Medical School

Master Plan Completed April 2013

Phase 1
1 million square feet

Table 2a. **Dell Medical School Program**

PROGRAM ELEMENT	GSF
Education and Administration Building	75,000
Research Building and Vivarium	240,000
MOB Phase 1	200,000
Parking Structure (1,000 spaces)	325,000
Intra-Professional Education (IPE)*	+/- 50,000

*Not included in Phase 1 planning budget.

Table 2b. **Teaching Hospital and MOB Program**

PROGRAM ELEMENT	GSF
Hospital (220 beds)	480,000

Phase 2 - 1,200,000 square feet in 5 to 10 years

Methodology

Develop Utility Master Plan in 3 months

- Used building type & actual metered energy use per GSF for existing campus buildings
  - Estimate annual & peak energy& water needs
    - Determine plant total capacity & rate impact
  - Used Termis chilled water and steam model
    - Size and plan distribution system
- Include build out of 2.2 million SF for Phase 2&3
- Include 1 million more new square feet on the campus

Over Arching Objectives

- New chilling station
  - Capacity & efficiency enough to prevent negative impact to campus
  - Expandable to address subsequent phases of district
  - Continue philosophy of loops & redundant service
- What is impact of other new space?
- Avoid power plant expansion
- Avoid conflict between Peak Steam and Peak Power

Projected Loads

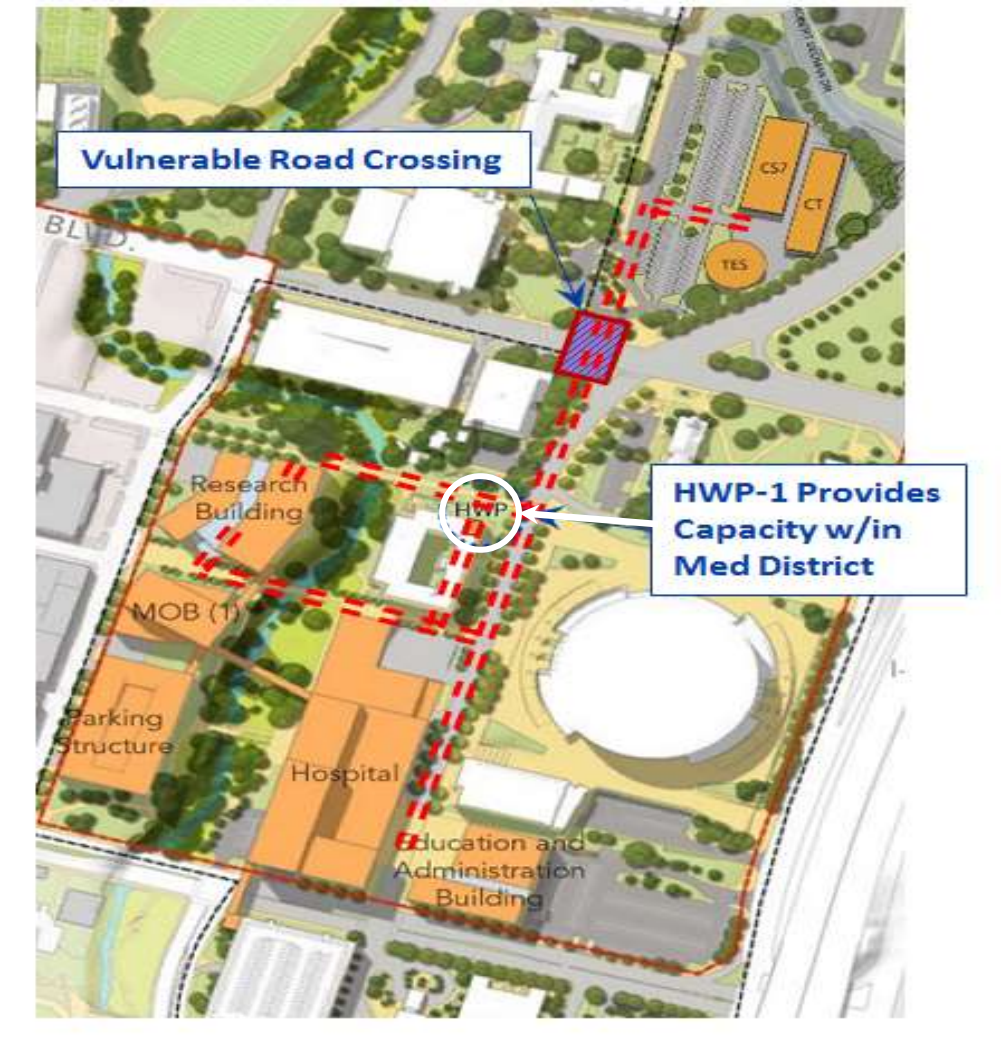
- Main Campus Load Growth
  - 6,000 Tons
- Phase I
  - Dell Medical School;
    - 7,000 Tons, 6 MW, 30,000 lbs/hr
- Hospital
  - 1,700 Tons, 30,000 lbs/hr
- Phase II- Medical School
  - 5,100 Tons, 4MW, 25,000 lbs/hr

Capacity

- Chilled Water System
  - 15,000 tons chilled water
    - 6 -2,500 ton chillers
    - 5° F approach cooling tower
    - Expandable to 20k tons
  - 5.5 million gallon TES
    - Stratified Water
    - Dedicated pumping
    - More than 5 MW load shifting capacity

Capacity

- Chilled Water
  - Proven Existing System
  - Tunnel + Direct Buried
  - Station Redundancy
- Heating Water
  - New System
  - Fuel Diversity
  - Geographic Diversity
- Single Points of Failure
  - N+1 pumps and tower cells
  - Looped Piping
  - Main tie main switchgear



Resiliency

- Multiple Water Sources
  - Recovered
  - Reclaimed
  - Irrigation
  - Domestic
- O&M Considerations
  - Bridge crane and monorails
  - Standardize components
  - Catwalks
- PLC Control Systems
  - Programming for failure

Efficiency

- Water
  - Recovered Water System
  - Heat Pump Chiller
    - 17,000,000 gal/year + Chemicals
- Gas
  - Heat Pump Chillers
    - $287,000/ year
- Electricity
  - Optimization
    - Maintain the "Sweet Spot"
    - Pumping in harmony
  - Up to 25,000,000 kWh/year savings vs. conventional plant

SUMMARY
CS7 / TES-2 BENEFITS

- Lower campus annual kW/ton
  - 4 years at .64 kW/ton annual average
  - New plant expected at .55 KW/ton
- Offset 6 MW of peak demand
  - Avoids additional CHP capacity need
- Improves campus hydraulics
- Off-loads plants in need of renewal
- Room for expansion
  - 5,000 tons more
  - 1,800 tons / 30 MMBtu with HPC's
  - 12 MMBtu via boiler