Innovative Master Planning in the Fast Lane

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Purpose of Presentation

TO DESCRIBE HOW UT:

- "Fast-Tracked" a Utility Master Plan
- Used "Real Time" modeling to plan

DESCRIBE OUR KEYS TO A QUICK MASTER PLAN

Background

- 100% power, heating and cooling requirements for 20 million sf and 150+ buildings

$50 million Annual Budget

- Power Plant
  - 135MW of on-site Combined Heat and Power (62 MW Peak)
  - 1.2 million lb/hr of steam generation (300K Peak)
- Chilled Water
  - 45,000 tons capacity in 4 plants (33K Peak)
  - 4 Million Gallon/36,000 ton-hr TES Tank

New Campus Master Plan

New Medical School

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

Master Plan Completed on April 2013

Phase 1 - 1,000,000 square feet Scheduled Completion on June 2016

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

Methodology

- **Develop Utility Master Plan in 3 months for new space**
  - **Using projected building type & actual energy use/GSF for existing campus buildings**
    - **Estimate peak electrical, steam and chilled water needs**
  - **Factor in eventual build out of 2.2 million SF for Phase 2**
  - **Factor in additional 1 million new square feet in new Engineering Building and Graduate School of Business**

Projected Loads

- **Main Campus Load Growth**
  - **6,000 Tons**
- **Phase I**
  - **Dell Medical School**
  - **7,000 Tons, 6 MW, 30,000 lbs/hr**
  - **Hospital**
  - **2,800 Tons, 30,000 lbs/hr**
- **Phase II – Medical School**
  - **– 5,100 Tons, 4 MW, 25,000 lbs/hr**

Over Arching Objectives

- **New chilling station**
  - **Capacity & efficiency enough to prevent negative impact to campus**
  - **Expandable to address subsequent phases of district**
- **Prevent power plant expansion**
- **Prevent a conflict between Peak Steam and Peak Power**

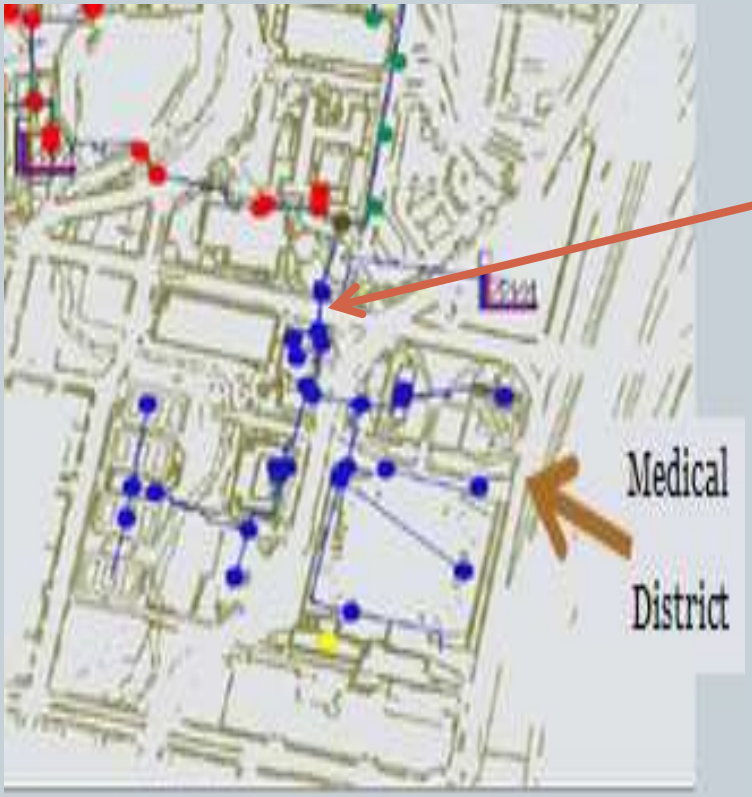
Next Steps

- **Hired 7T, COWI and REO to:**
  - **Update the existing Termis chilled water model**
  - **Create a new Steam to Hot Water Model**
  - **Plan routing for distribution system**
    - **Pipe size & specifications**
  - **Analyze potential plant sites**

Chilled Water Model at Peak Conditions

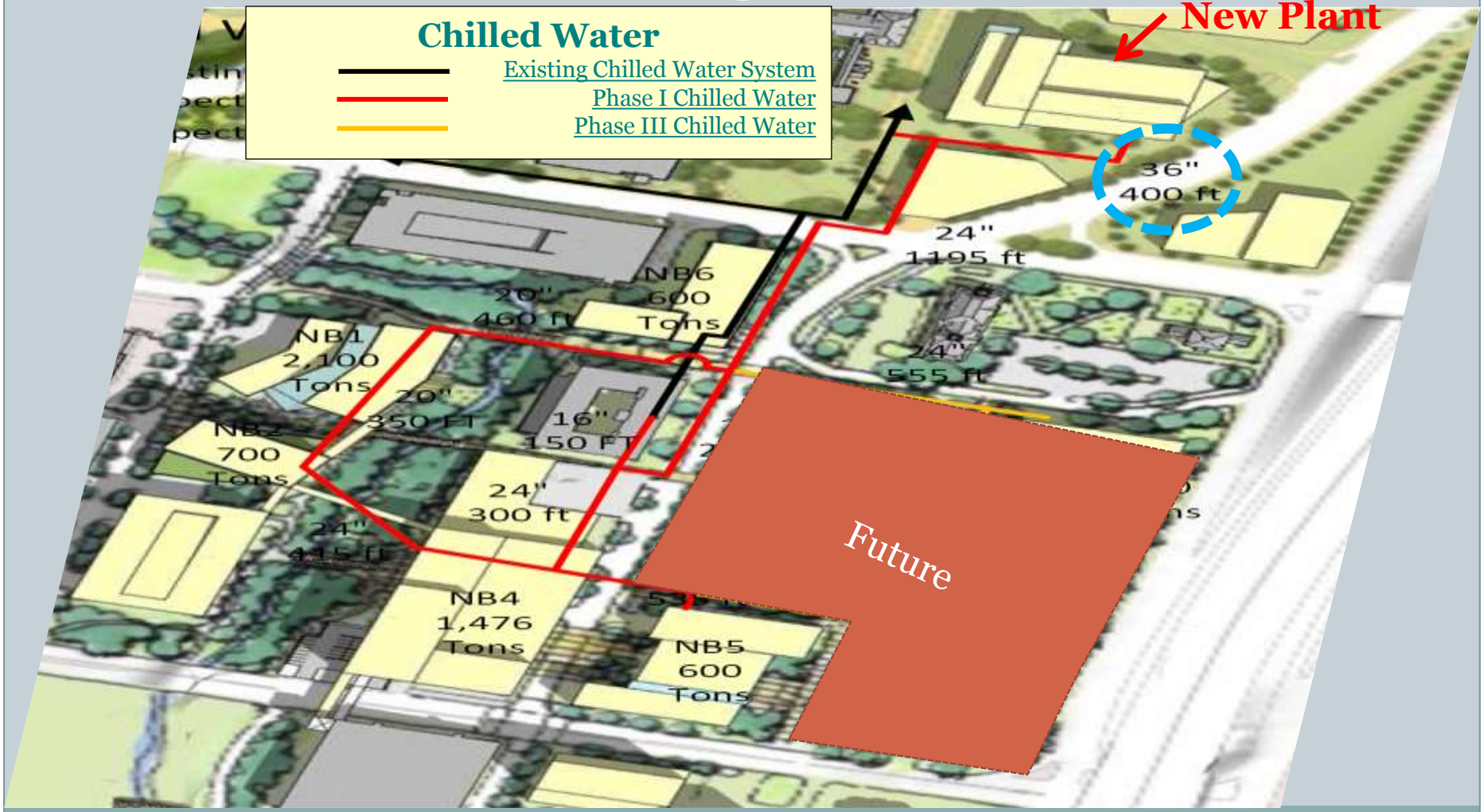
Chilled Water Issues

- Main Campus Does Not Help

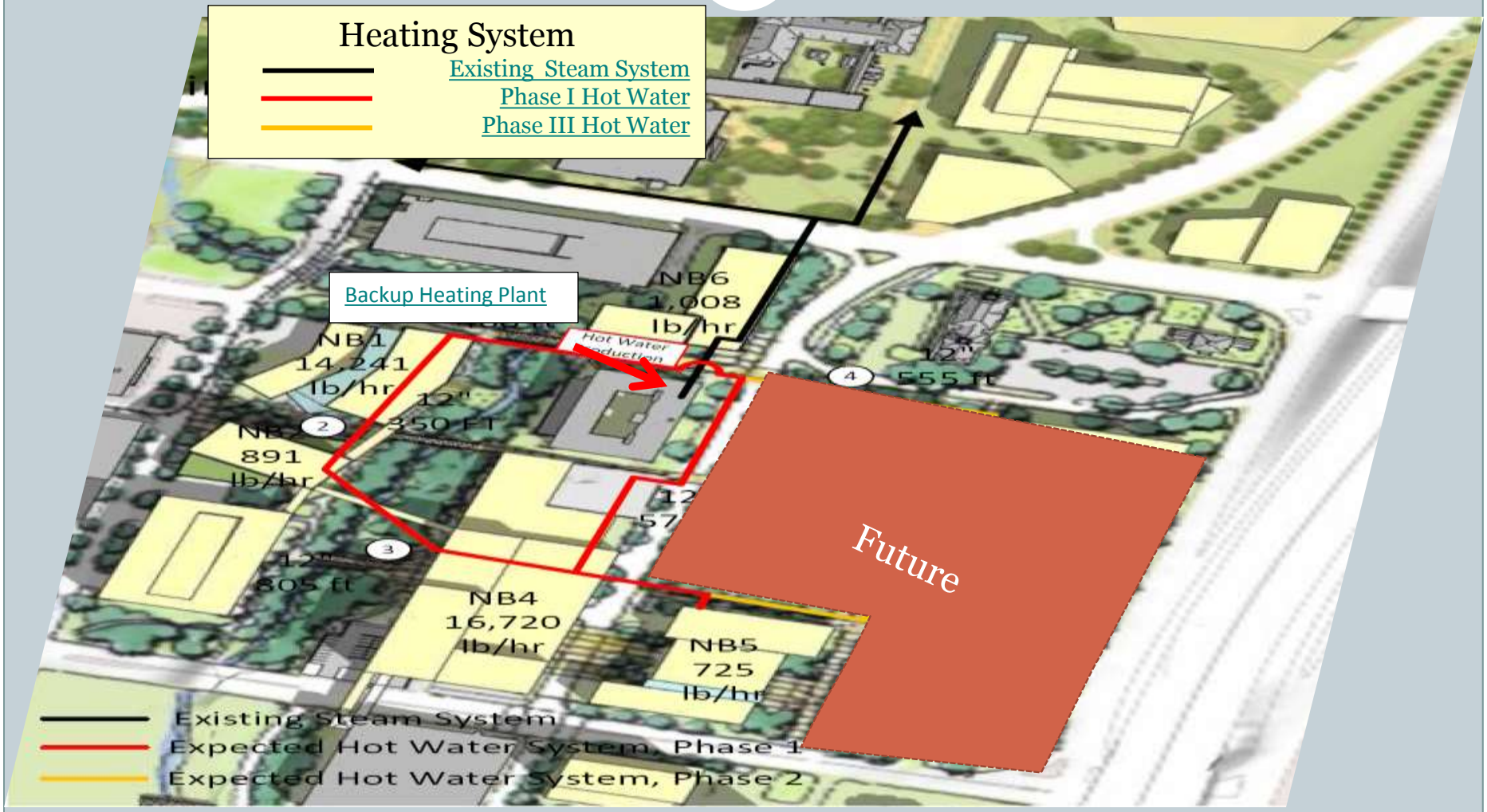


- **Chilled Water to Medical District limited by 16” pipe**
  - **2,500 Tons Maximum**
  - **ERC & NUR consume 1,200 Tons**
  - **Only 1,300 Tons available**

Cooling System



Heating System



Graduate School of Business

Heating System Scenarios

	Connected		Disconnected		SUM
	Building	[lb/hr]	Building	[lb/hr]	[lb/hr]
Reference					163,080
Scenario 1	BELO	454			
	GDC	877			
	CLA	756			
	AHG (Total)	4000			167,922
Scenario 2	EERC	22,267	ENS	1,606	188,583
Scenario 3	GSB	2,360			
	AT&T	4,840			
	Med. School - NB1	14,241			
	Med. School - NB2	891			
	Med. School - NB4	16,720			
	Med. School - NB5	725			228,360
Scenario 4	Med. School - NB6	1,008			
	Med. School - NB7	8,545			
	Med. School - NB8	8,654			
	Med. School - NB9	15,767	ERC	4,449.7	
	Med. School - NB11	1,576	DCP	593.7	258,867
Scenario 5	New GSB	4,341			263,208

Cooling System Scenarios

	Connected		Disconnected		SUM
	Building	[Tons]	Building	[Tons]	[Tons]
Reference					31,500
Scenario 1	IAC	1500			33,000
Scenario 2	BELO	500			
	GDC	1500			
	CLA	600	RAS	147.5	35,453
Scenario 3	EERC	3400	ENS	259.5	38,593
Scenario4	GSB	1000			
	AT&T	800			
	Med. School - NB1	2100			
	Med. School - NB2	700			
	Med. School - NB4	1476			
	Med. School - NB5	600	TTC	15	45,254
Scenario 5	Med. School - NB6	600			
	Med. School - NB7	1300			
	Med. School - NB8	800			
	Med. School - NB9	2400	ERC	429.5	
	Med. School - NB11	339	DCP	81.2	50,182
Scenario 6	New GSB	1800			51,982

Final Steps

- **Develop estimates of cost for plants, TES and distribution piping**
- **Stand-Alone vs Centralized Analysis**

Latest Master Plan

New Chilling Plant

Utility System Features

- **15,000 Ton Plant w/space for 5,000 future tons**
  - **6 – 2500 ton York YK in parallel flow - all VFD**
  - **5 Degree F Approach Cooling Tower**
- **5.6 million gallon TES**
- **Heating Plants**
  - **2 – 600 ton York YD heat recovery chillers**
  - **Boiler Back-up**
  - **Steam to hot water exchangers**
- **Over 5,000 ft of new pipe**

Keys to Quick Master Plan

- Had the Data to Quickly Project New Building Loads
  - Plants Highly Instrumented and connected to a Historian
  - 130 buildings metered for electricity, steam and chilled water connected to a Historian
- Had the Data to Understand the Pinch Points
  - Peak electrical load was an issue
  - Peak steam load was an issue
  - Had experience with a TES to understand how the asset could be expanded
- Had “Real Time“ Chilled Water Model with Accurate Hourly Operating Data
  - Could Quickly Analyze Peak Conditions Accurately
- Because we had a Good CW Model and because it was Physically accurate and the Steam System was configured in parallel in the same tunnel
  - Could in a matter of weeks develop from scratch a new Static Campus Steam Model to analyze expanding it to attach a Hot Water System

Questions?

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