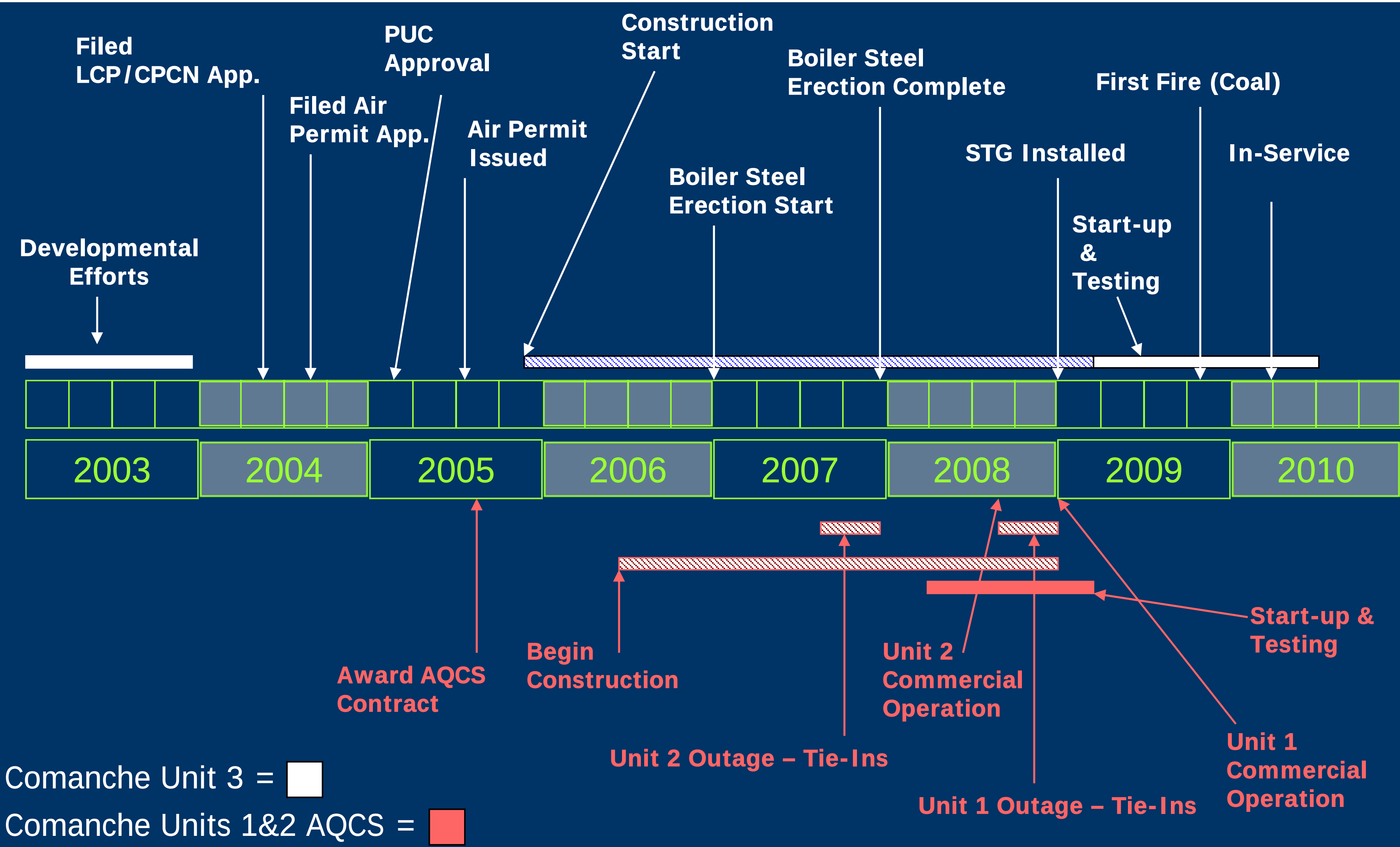
Comanche Unit 3

Comanche Project Milestones

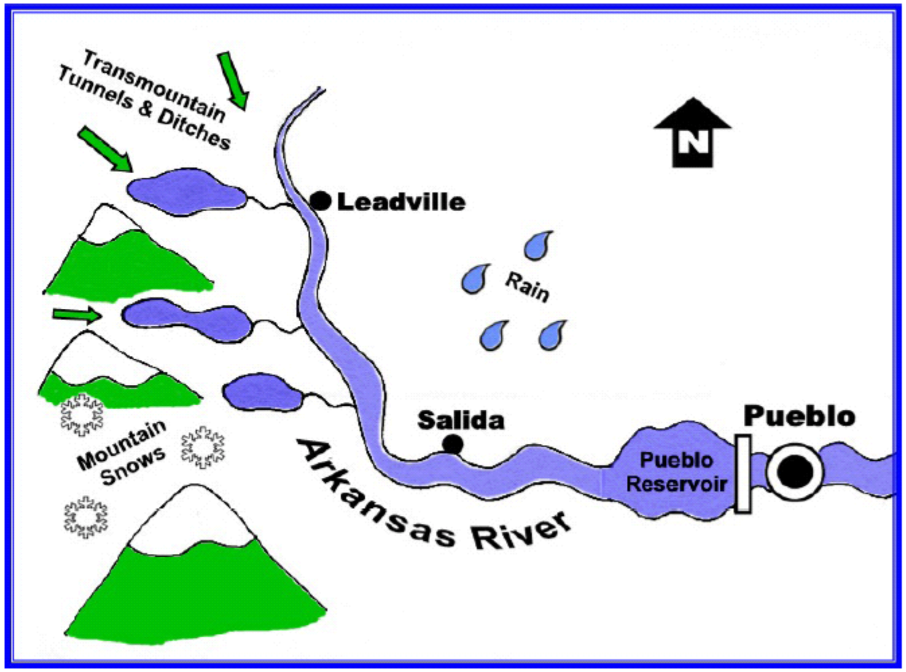


Pueblo’s Water Supply

•Pueblo’s water supply originates high in the Rocky Mountains above Leadville.

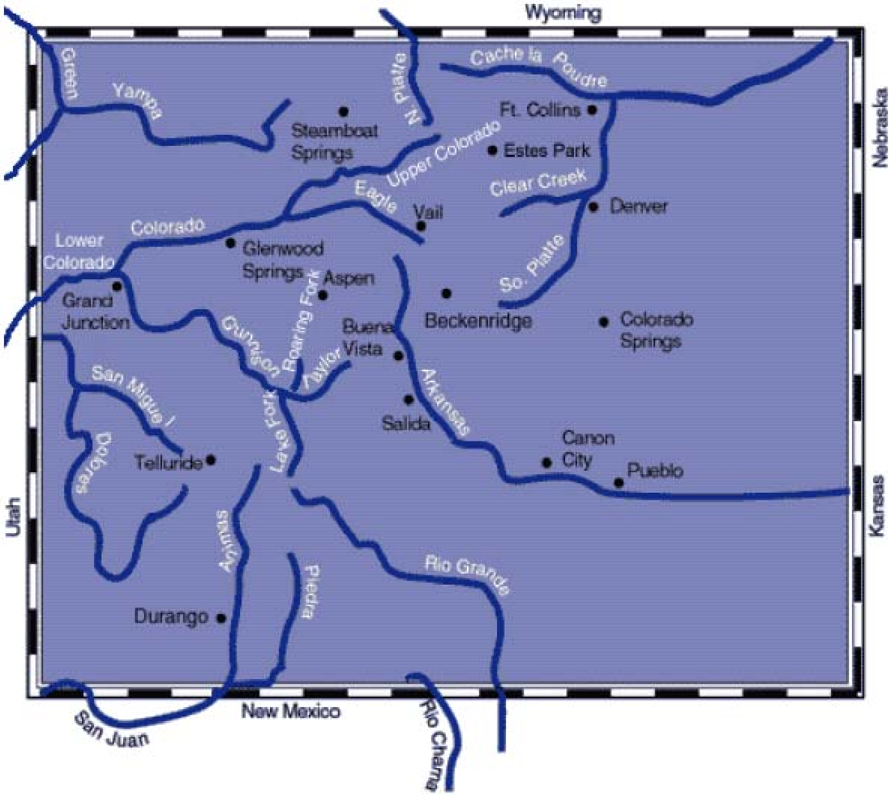
•Water from the high mountain watersheds flows into the Arkansas river.

•Pueblo Reservoir along with other reservoirs on the Arkansas ensures a long-term reliable water supply for Pueblo.



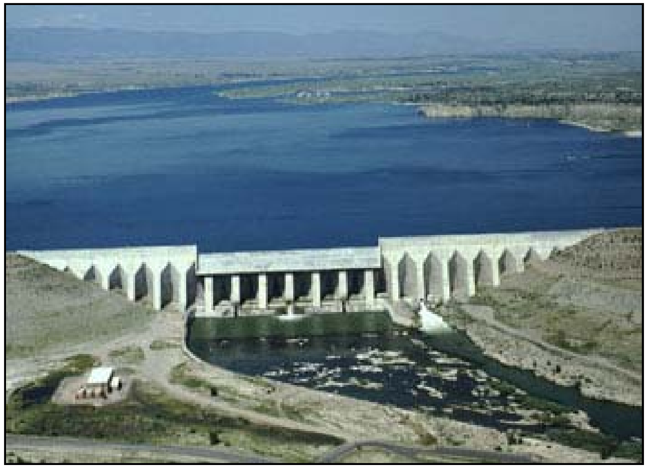
Colorado Climate

- The continental divide which runs through the Rocky Mountains extends from the south to north boundaries of the state.
- Annual precipitation 17 inches
- Majority of the precipitation received by high peaks and mountain ranges.
- There are 4 major river systems that originate in Colorado: Colorado, Rio Grande, Arkansas, and the Platte.
- 40% of Colorado's area is made-up of the eastern high plains which has a semi-arid climate.
- The majority of Colorado's population lives on the eastern plains adjacent to the foothills.
- Multi-year drought is common to the eastern plains.



Comanche's Water Supply

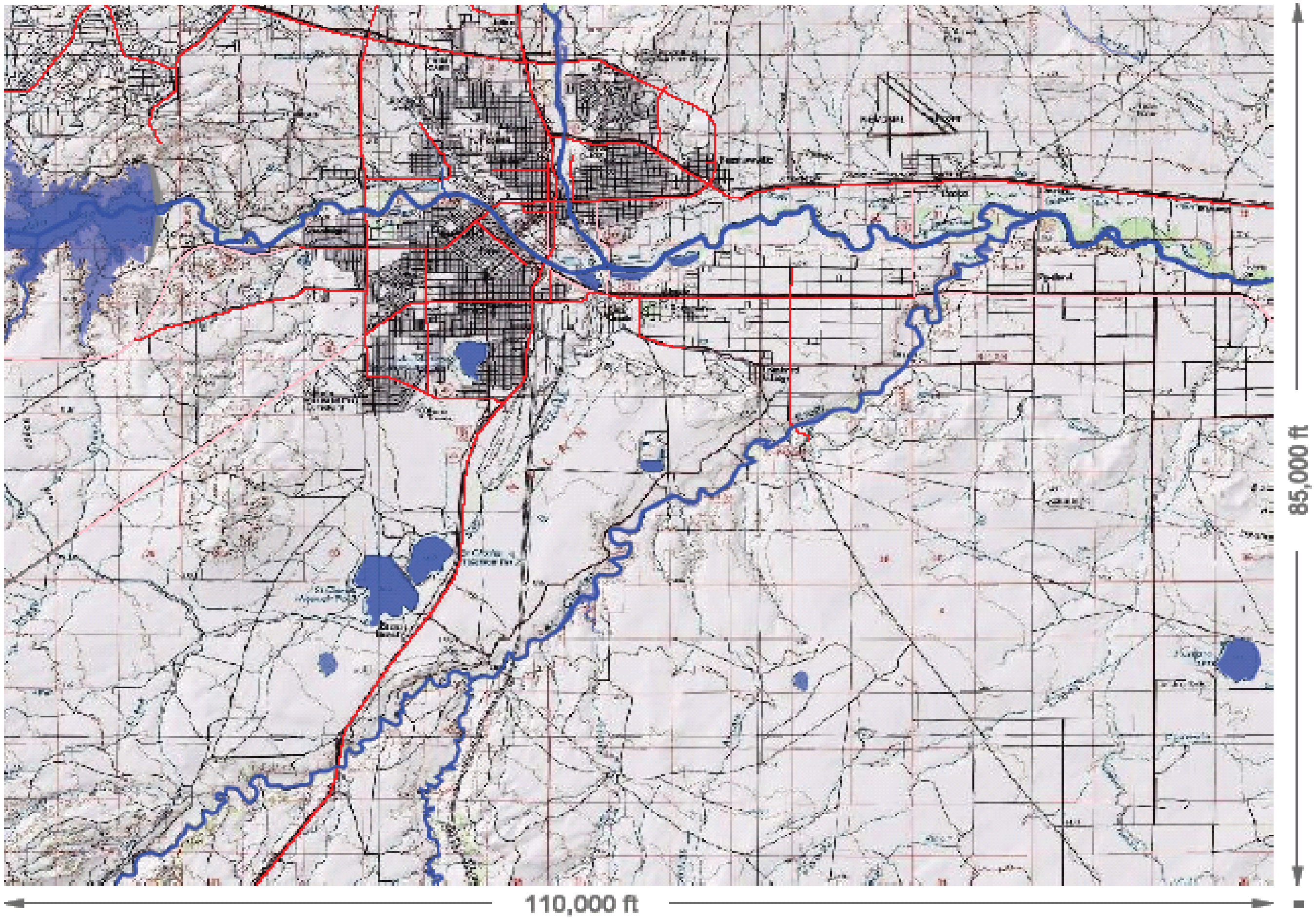
- 8,700 acre-feet/year for existing Units 1, 2
- Hybrid (Parallel) cooling utilized for Unit 3 reducing contract amount to 6,000 acre-feet/year
- Contract term through 2035 for Units 1, 2 with option to extend in 5-year increments starting in 2035
- Contract term for Unit 3 through 2060!



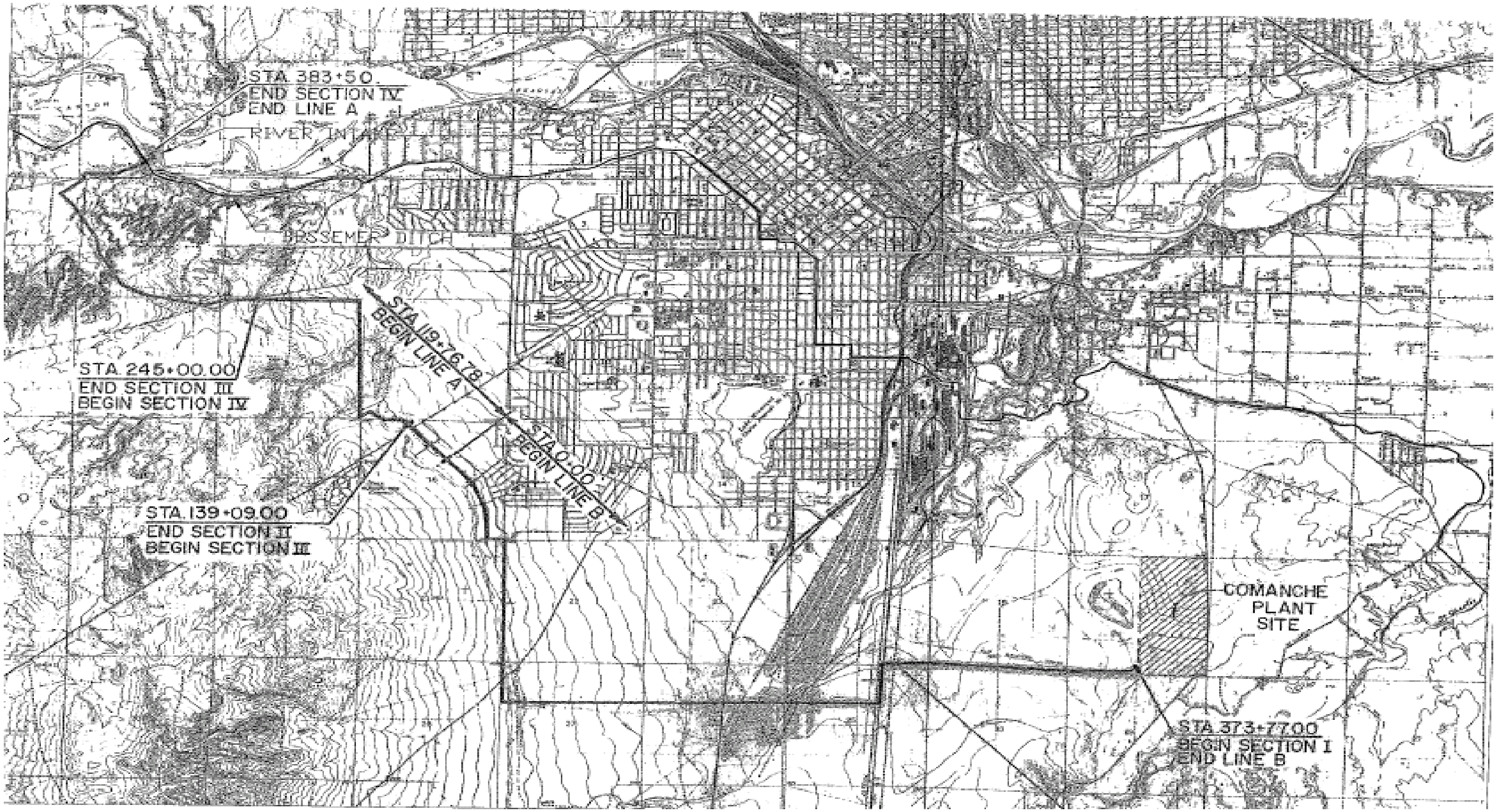
Pueblo Board of Water Works

Pueblo Reservoir

Map of Pueblo Area



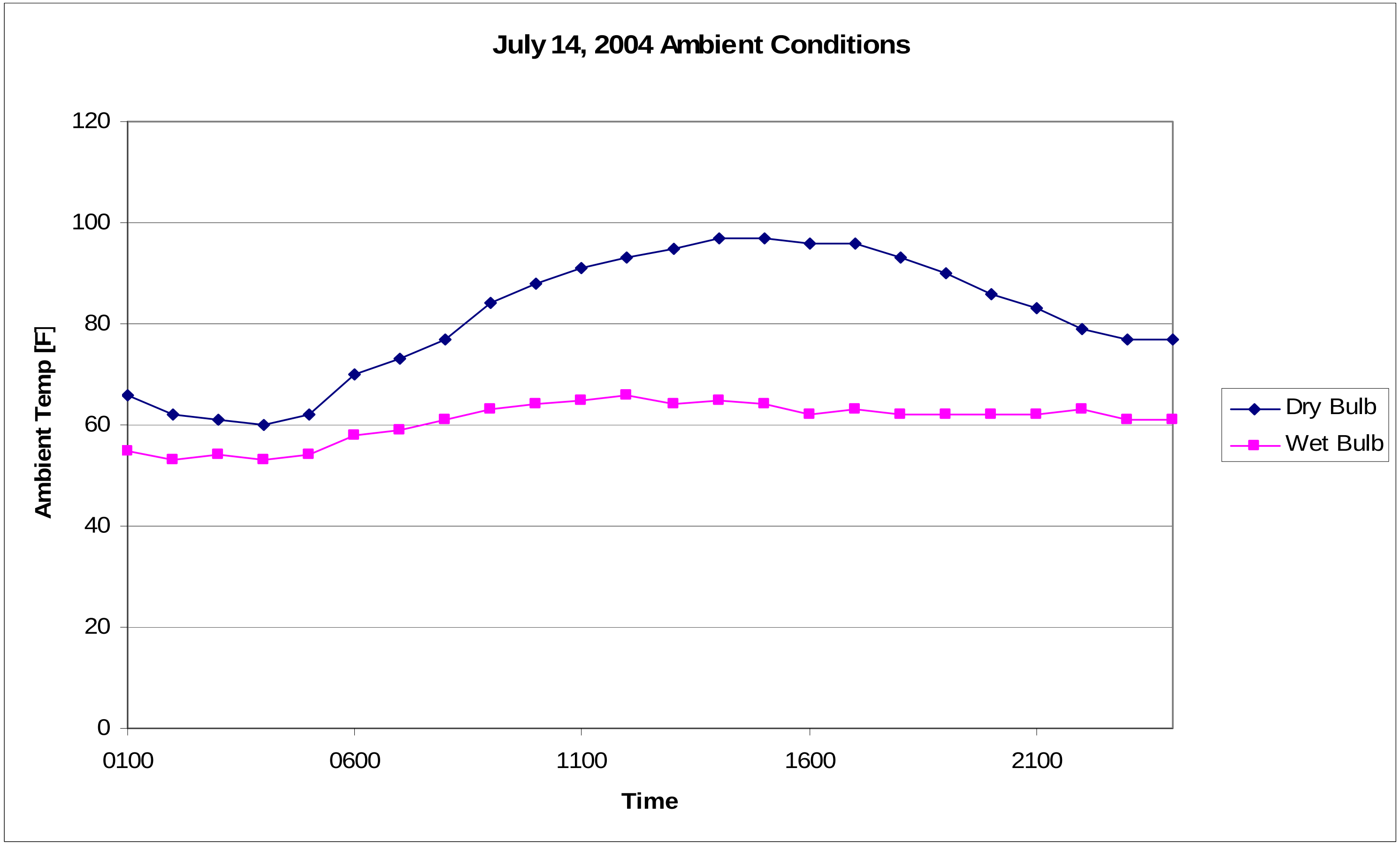
Raw Water Transport Line



Proposed Low Water Use Plant

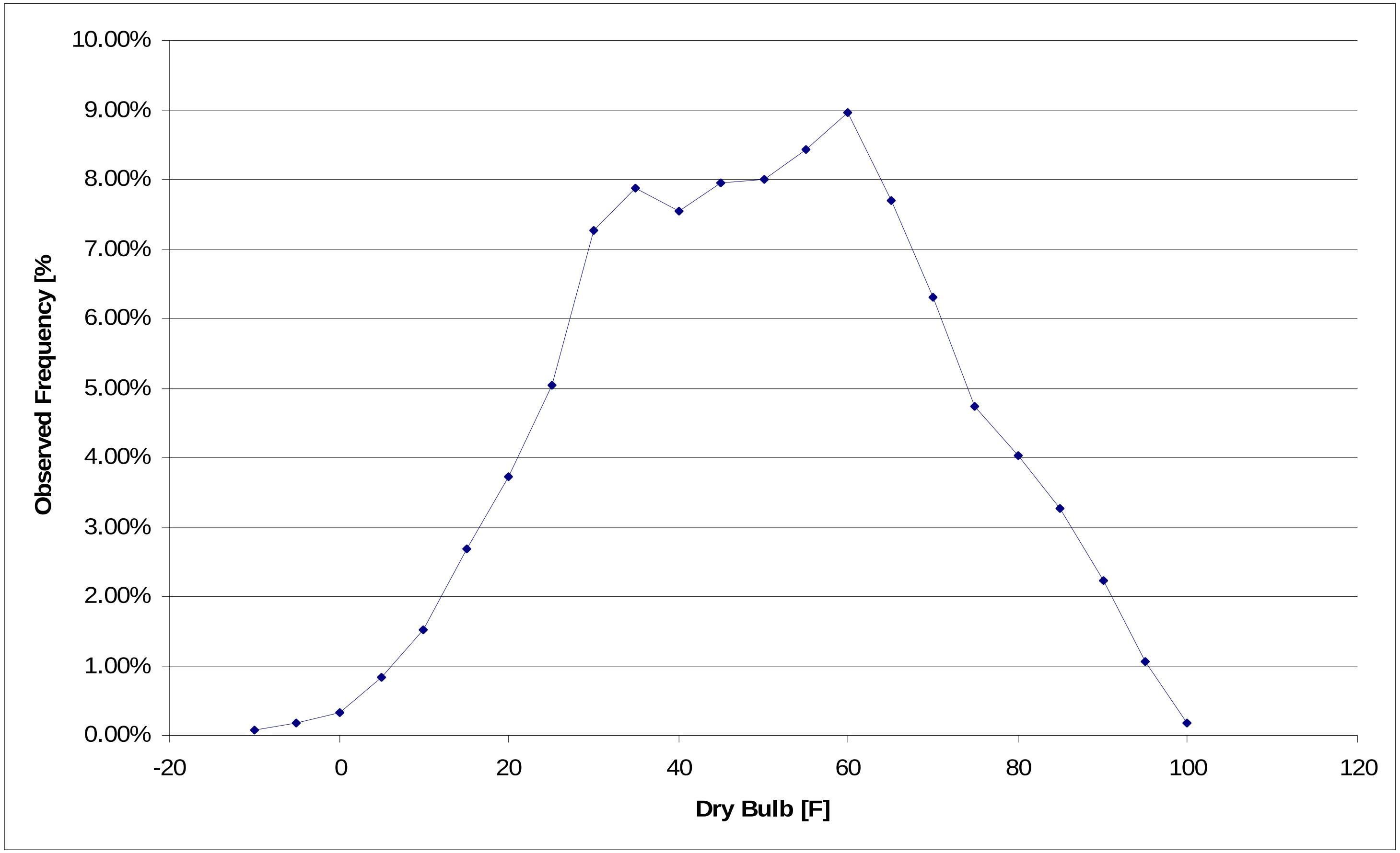
- **Installing low water use technologies ensures unit efficiency and water conservation**
  - Cooling tower and air cooling systems- design to operate in parallel
  - Comanche 3 will consume 4,750-5,500 acre feet annually (about 50% water savings)
  - Below 55ºF - ACC alone can handle full heat rejection of plant.

Design Day

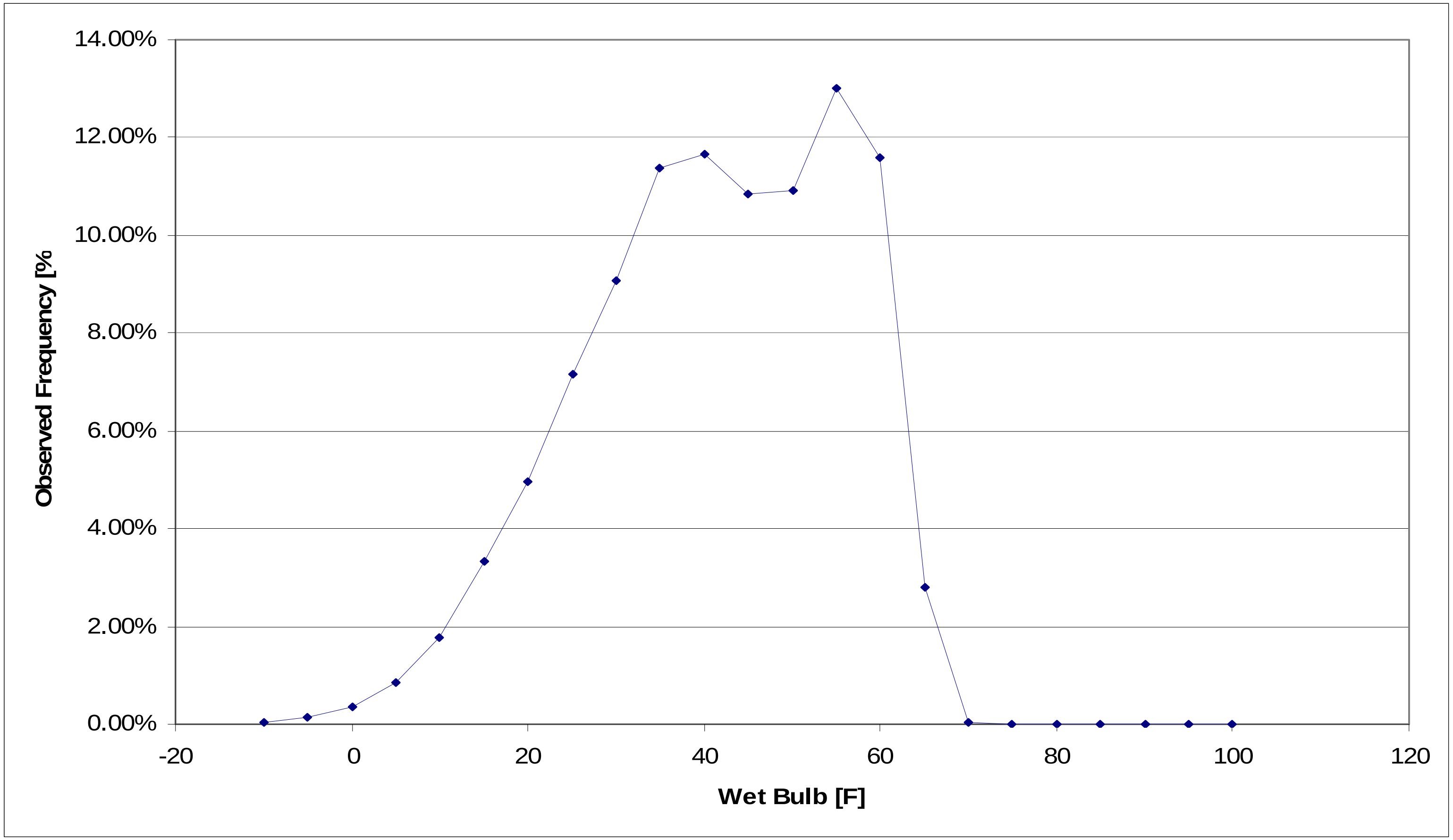


July 14, 2004 Ambient Conditions
Ambient Temp [F]
120
100
80
60
40
20
0
0100
0600
1100
1600
2100
Time
Dry Bulb
Wet Bulb

Dry Bulb – Frequency of Occurrence

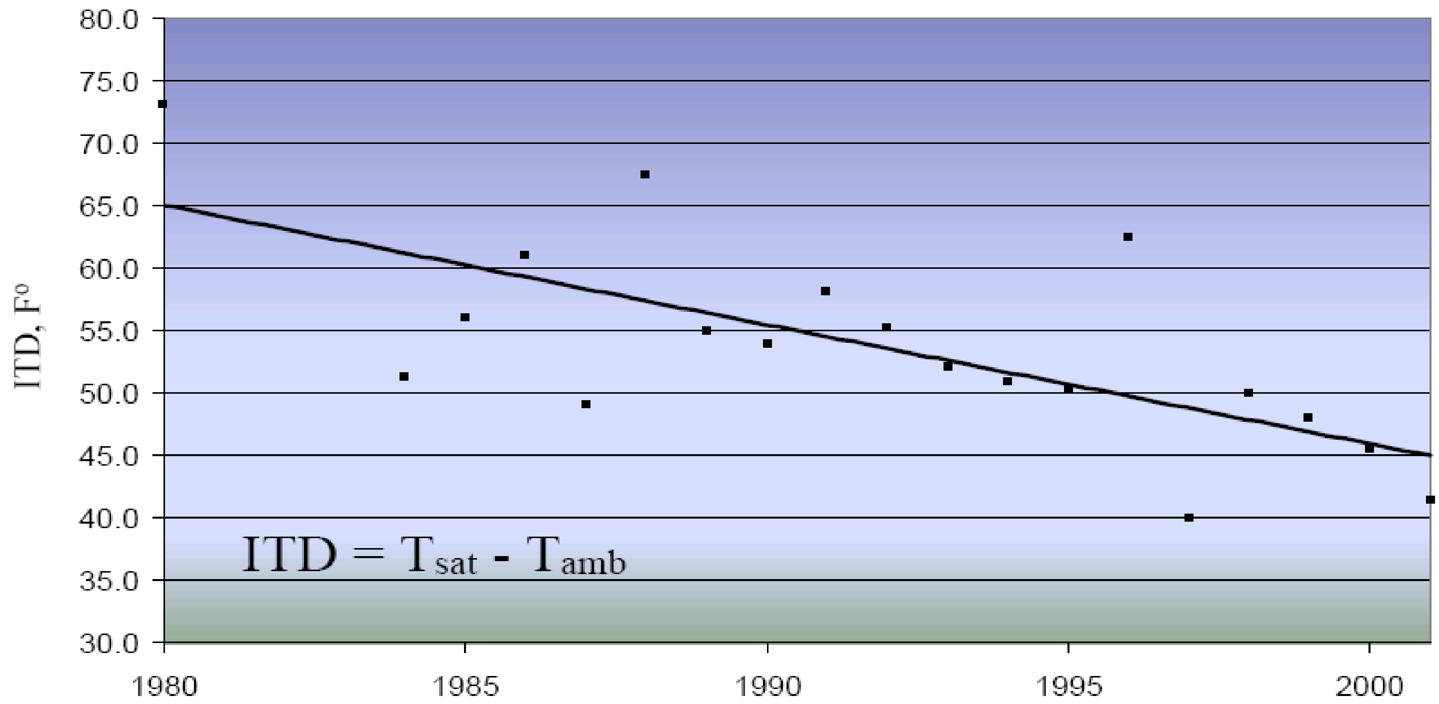


Wet Bulb – Frequency of Occurrence



GEA Power Cooling Systems, Inc.

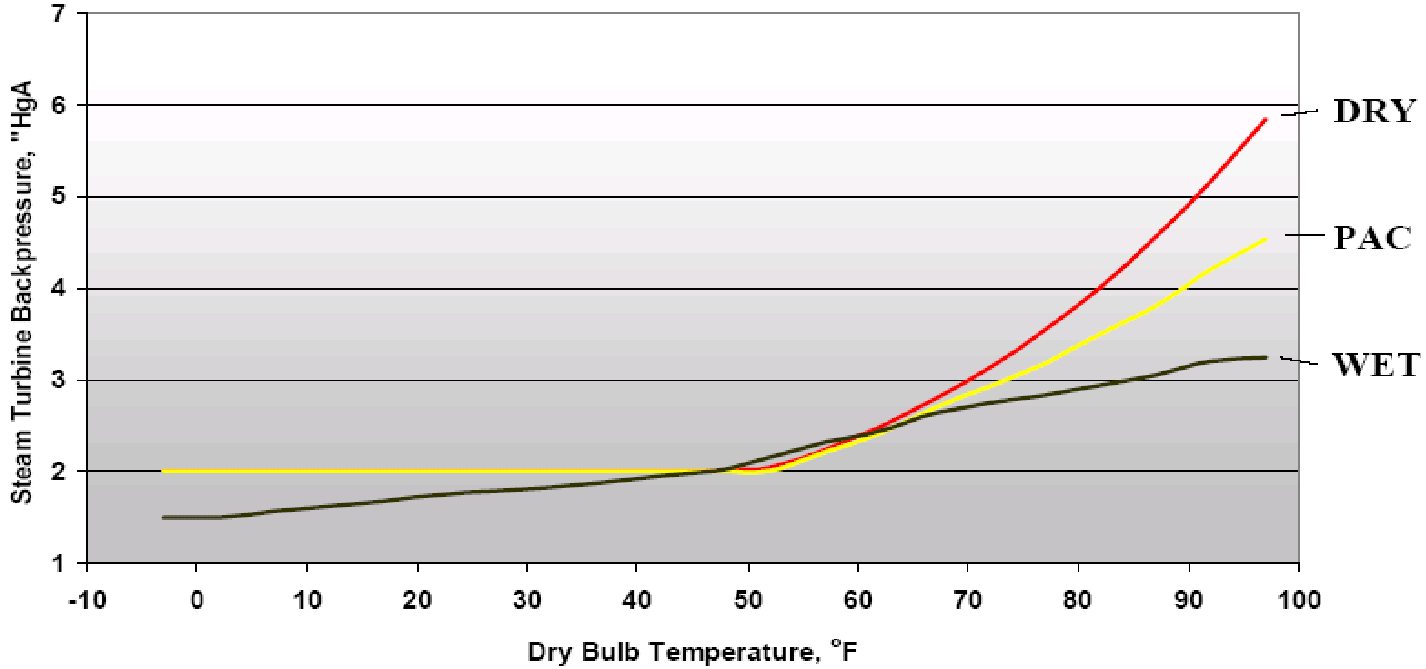
Dry Cooling ITD Trends



Xcel Energy

GEA Power Cooling Systems, Inc.

Cooling System Comparison
(Typical STG Backpresure Profile)



Comanche Station Looking South

Comanche Station Looking East

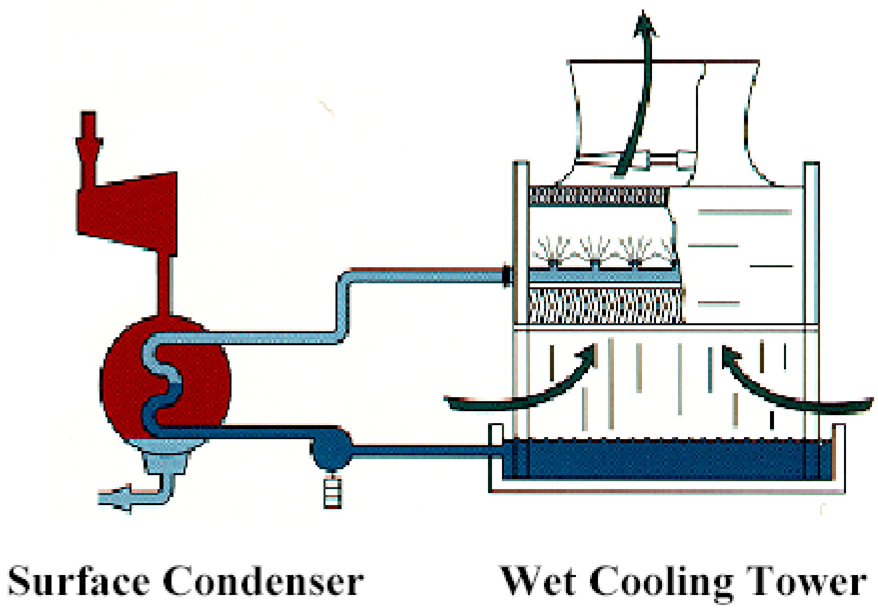
Comanche Expansion Project

Comanche Expansion Project

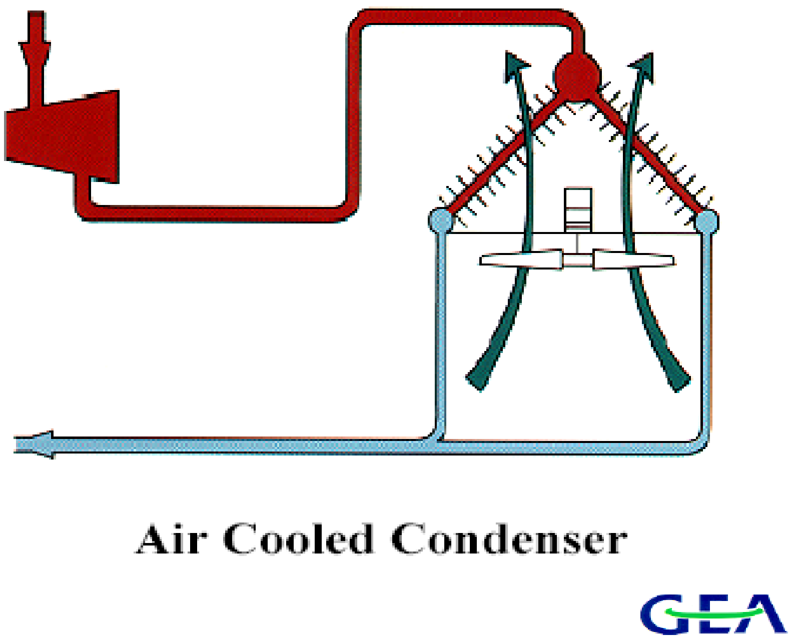
Water Use Optimization

Cooling Types

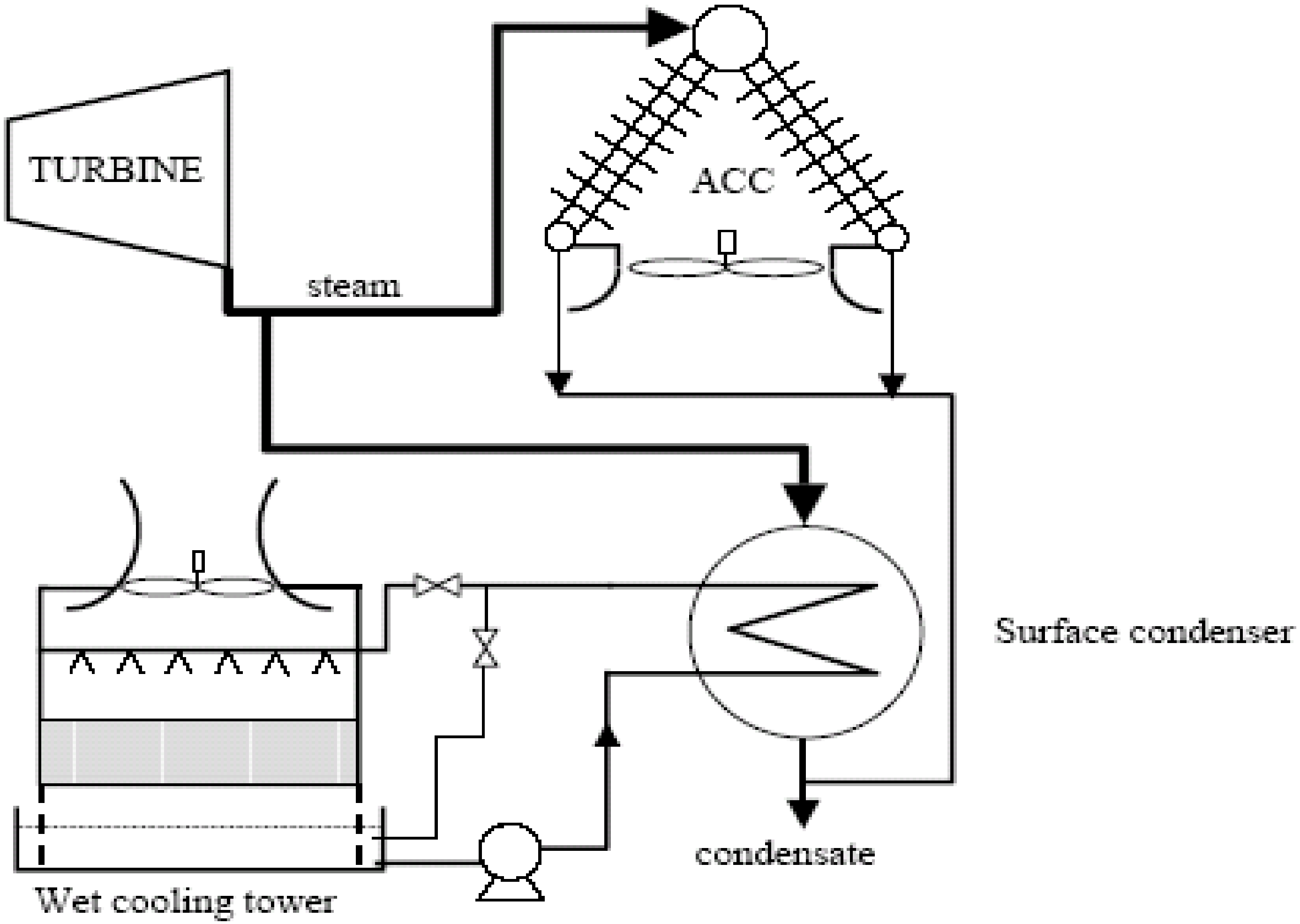
Wet Cooling



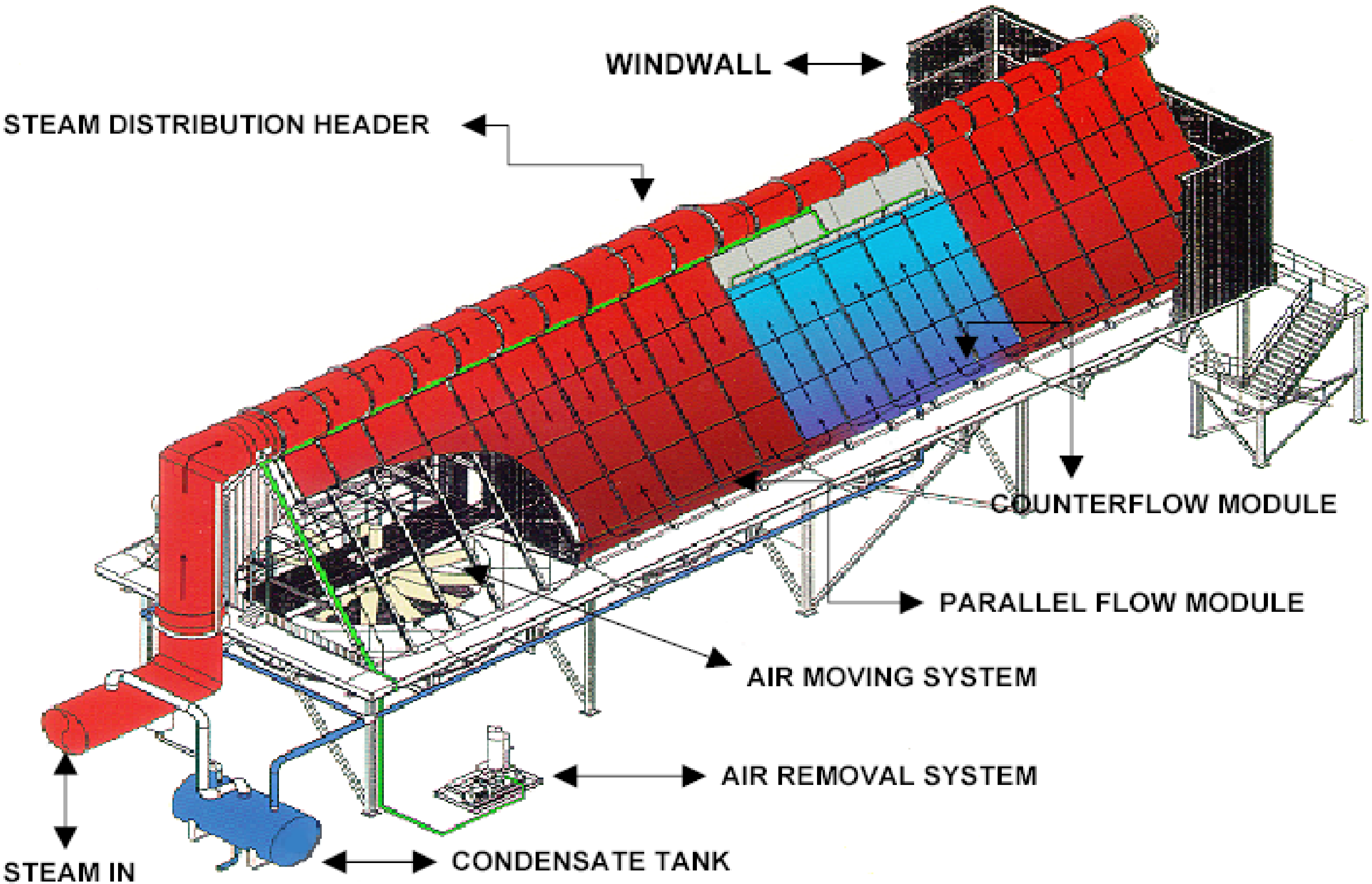
Dry Cooling



Parallel Cooling Schematic



Air Cooled Condenser



Xcel Energy

GEA Power Cooling Systems, Inc.

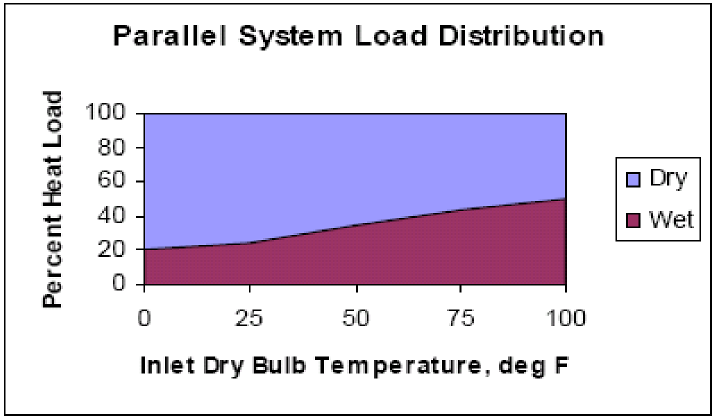
Relative Annual Water Use
Primary Cooling System Options

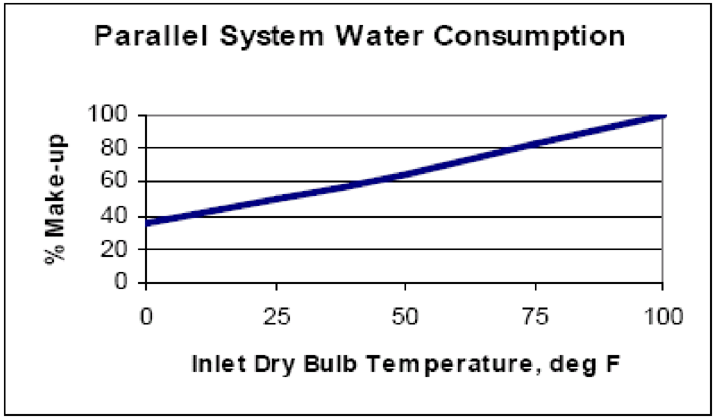
	Plant Usage*
Wet Evaporative Cooling Tower	100%
Air Cooled Condenser	< 5%
Wet/Dry PAC SYSTEM®	15 – 85% Range

* Includes Water Losses and Steam Cycle Makeup.
Excludes GT Inlet Chilling.

GEA Power Cooling
Systems, Inc.

PAC SYSTEM®
Typical Operating Characteristics





500 MW 2X1 CC w/ Dry Cooling

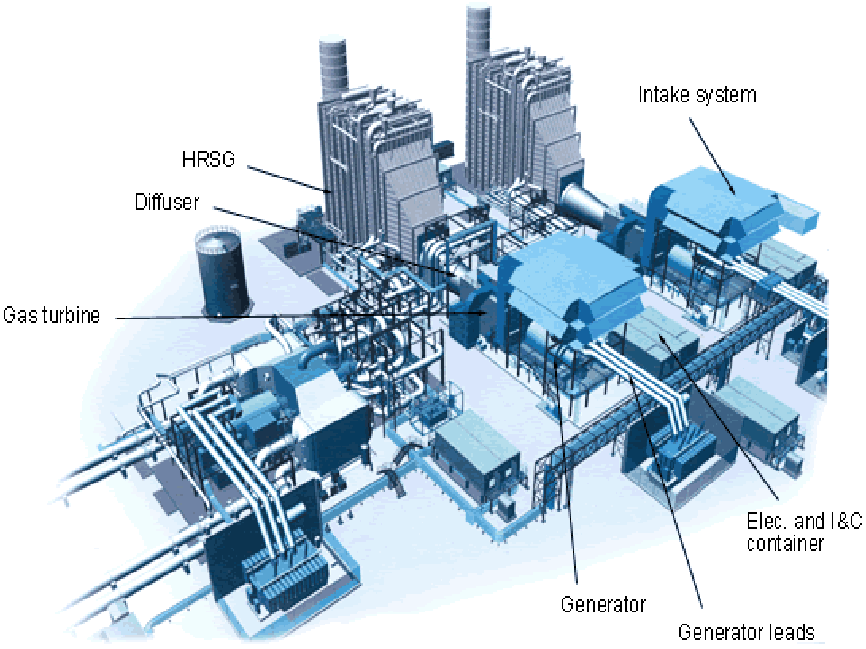
ACC on 2X1 CC

Typical Water Consumption at Full Load	
Winter and summer shown to illustrate additional water consumption due to CT Evap Cooler operation	
Demin Consumption with Evaps on	25.4 GPM
Service Water with Evaps on	98.7 GPM
Total Water Use	124.1 GPM
Avg Amb Temp with Evaps on	80.7 °F
Demin Consumption with Evaps Off	38.6 GPM
Service Water with Evaps Off	8.7 GPM
Total Water Use	47.3 GPM
Avg Amb Temp with Evaps Off	22.5 °F

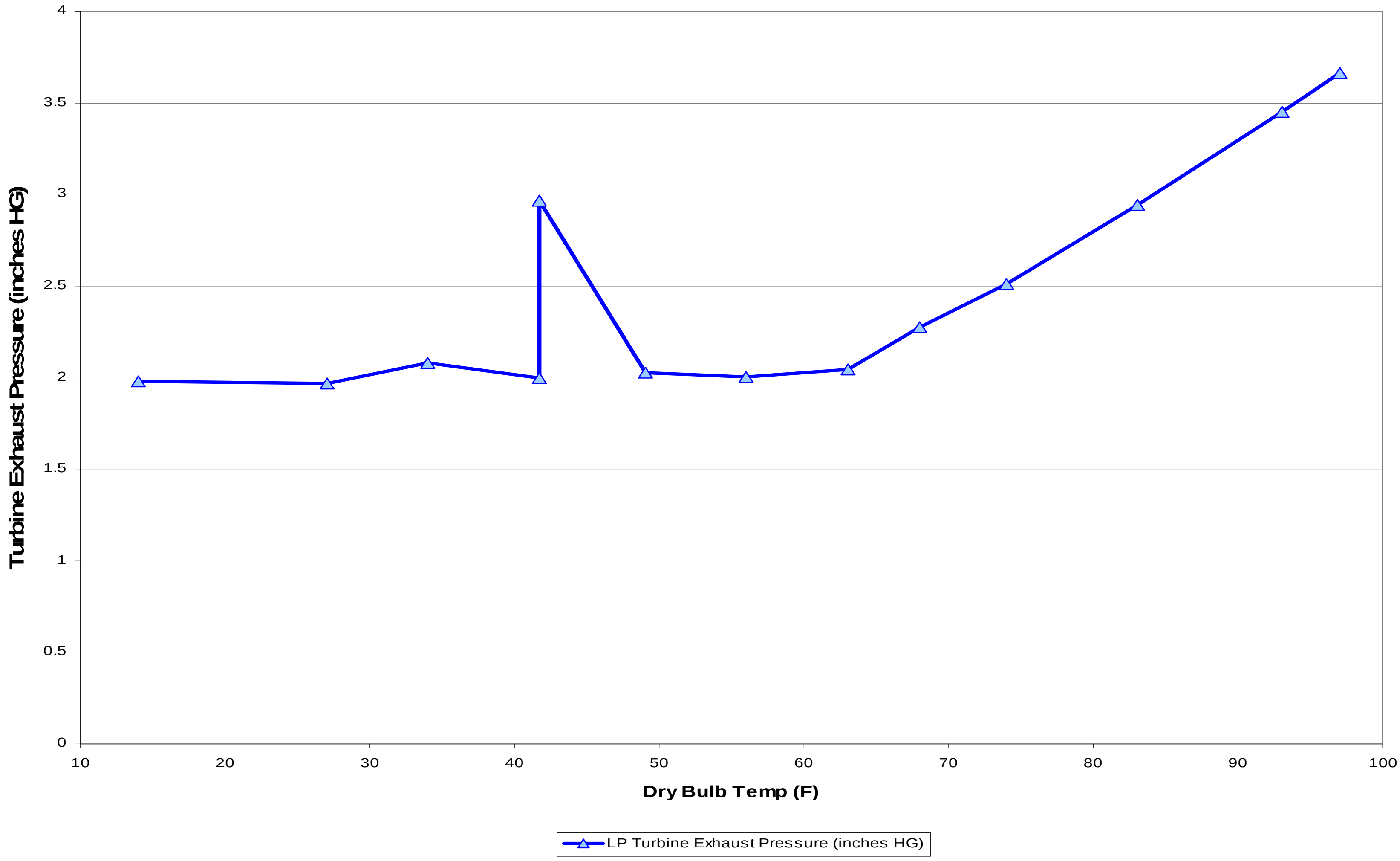
Typical Water Consumption Full Plant Start-up to a 2X1 Plant Configuration	
Full plant start-up from no units running to both CT's on line and the Steam Turbine in normal operation. Approximate time for start-up in 10 hours.	
Demin water consumption indicative of typical blowdown for chemistry control and for steam venting during ACC start-up.	
	Gallons Used
Demin Consumption through Start-UP	**78,231**
Service Water Consumption with Evaps on	**51,422**
Total Water Use	**129,653**

500 MW 2X1 w/ Wet Cooling

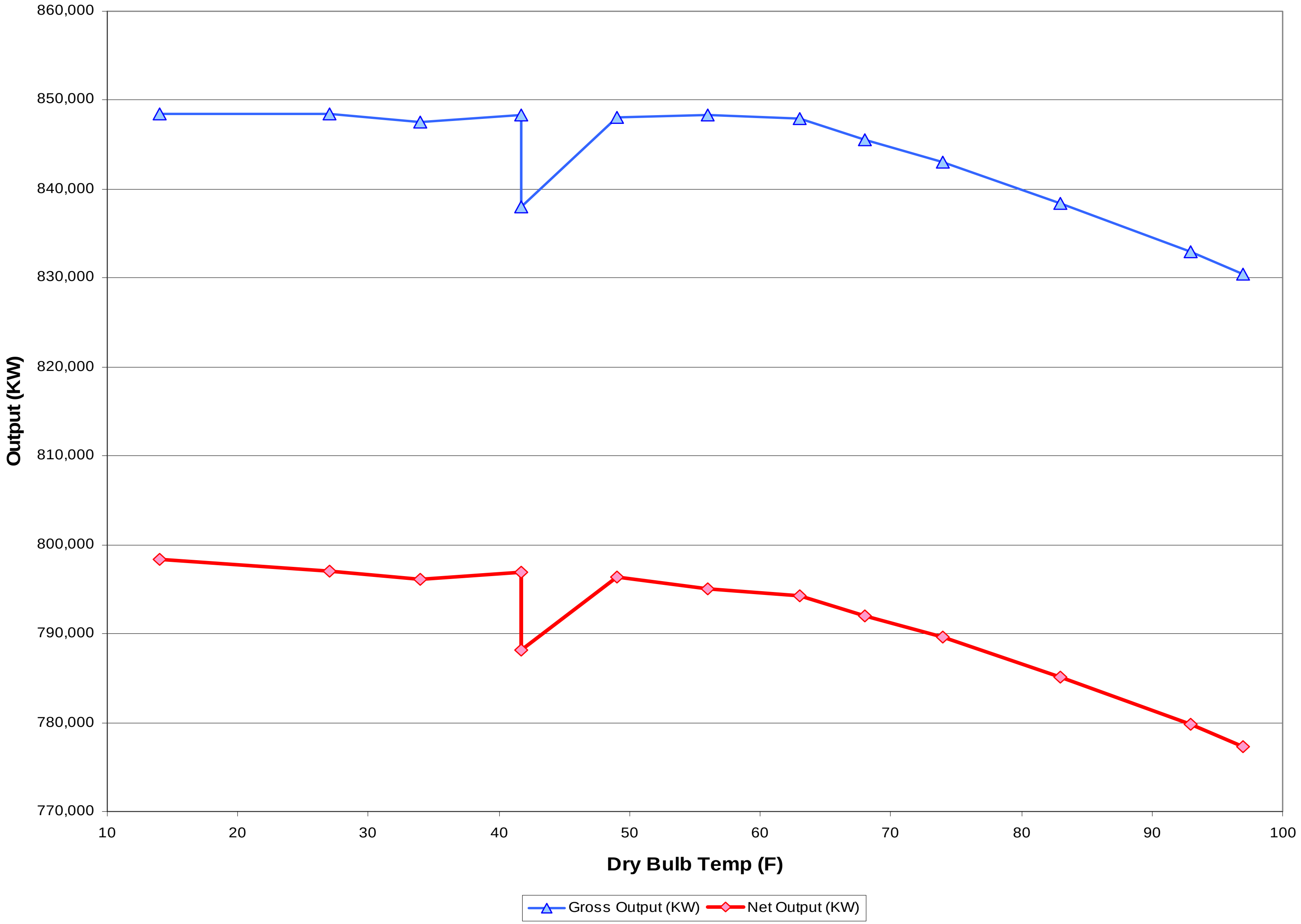
- Cooling Tower Flow 166,166 GPM
- Cooling Tower Makeup Rate at full load 2,330 GPM
- Heat Rate 6,750 BTU/KWH HHV vs. 7,200 BTU/KWH HHV for a CC w/ Dry Cooling
- Aux. Load 10.5MW vs. 16.1MW (plant with ACC)
- Condenser Pressure 1.7 inches Hg vs. 3.5 (plant with ACC) – Dry Bulb 80F Wet Bulb 62F



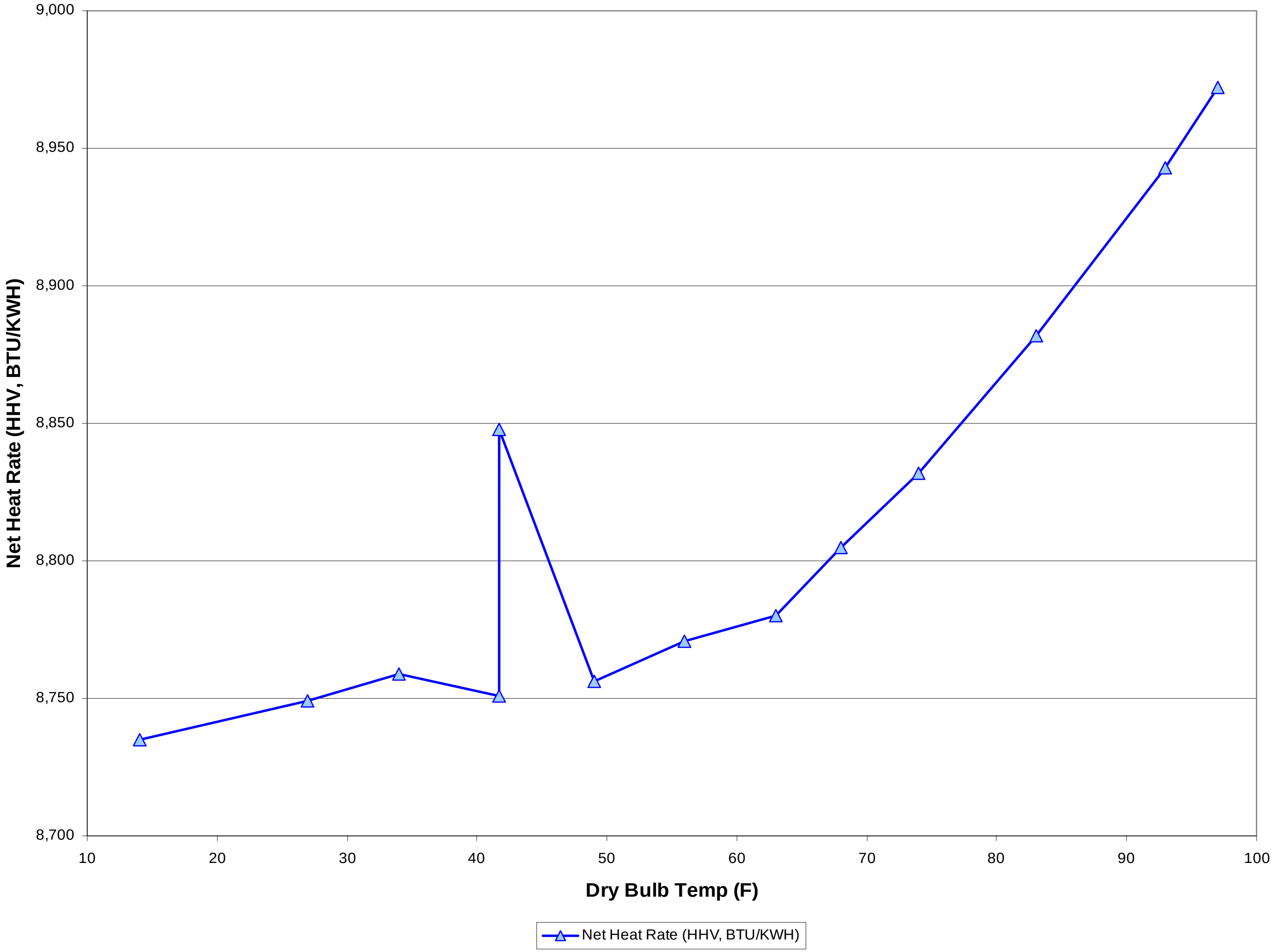
Ambient vs. Backpressure



Ambient vs. Output



Ambient vs. Heat Rate



COM3 Site Looking East

Comanche Station Looking Southeast

Comanche Station Looking North

Comanche Station Looking South

Comanche Station Looking East

Comanche Station Looking North

Air Cooled Condenser (Dry Cooling)

Air Cooled Condenser
03-20-2009

Installation of Circulating Water Pipe

Boiler Foundation
11-03-2006

Questions ?