

PLANNING FOR EXPANSION BY PHASING CONSTRUCTION

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De-Carbonizing the Campus: Planning, Tools & Technologies

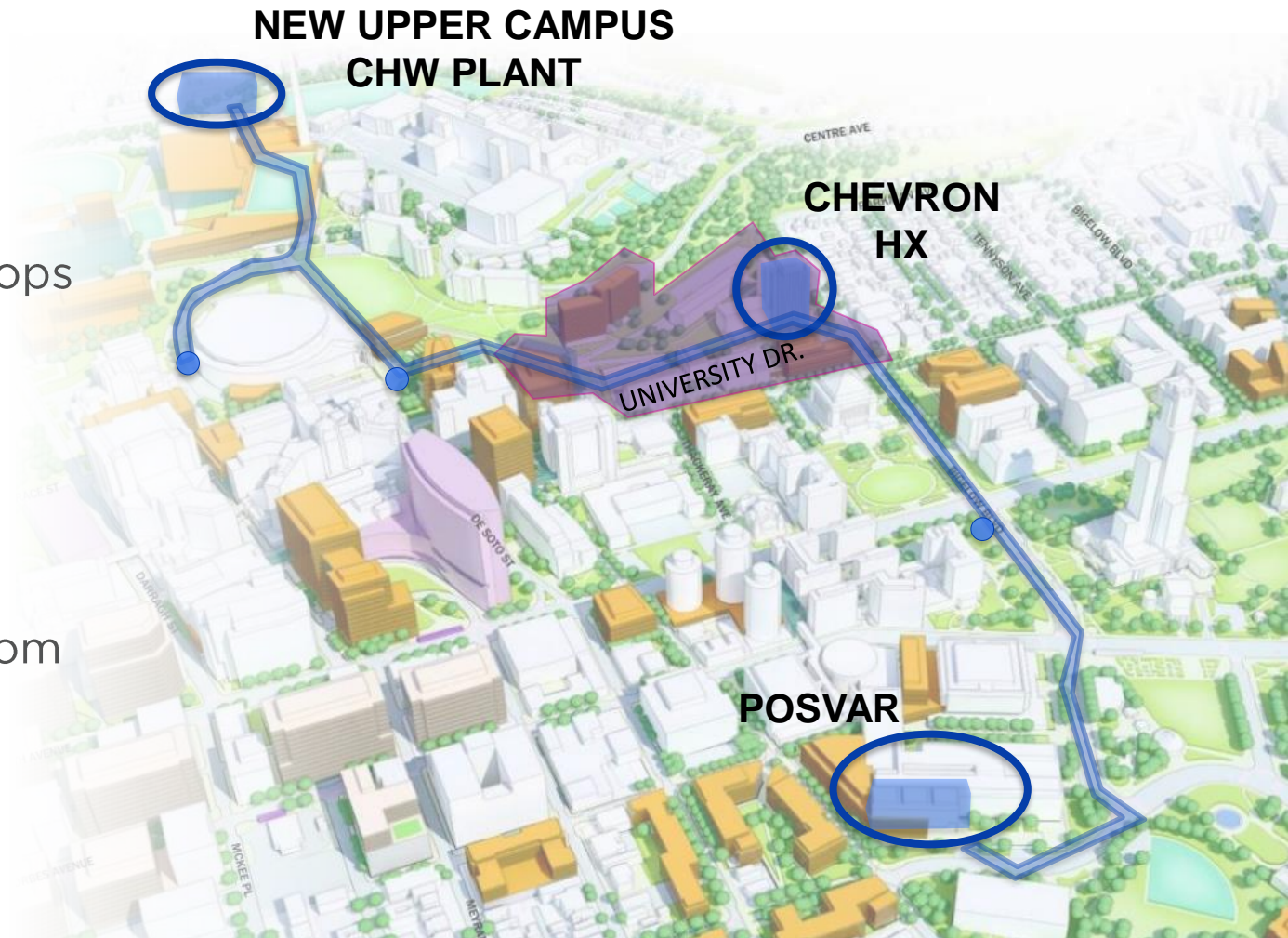
CampusEnergy2023

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Gaylord Texan Resort & Convention Center | Grapevine, Texas

University of Pittsburgh Comprehensive Chilled Water Program

- New 15,000-ton CHW Plant
- Posvar CHW Plant Renovation
- Chevron Heat Exchanger
 - Connect the Upper and Lower CHW Loops
- Extensive CHW Distribution
 - 7,000 Trench FT Of 36" / 24" CHW
 - 5KV Ductbank
 - Central Greywater Collection Systems
 - Extreme Elevation Changes
 - Transition Loads On University Drive From Upper To Lower Campus Loops

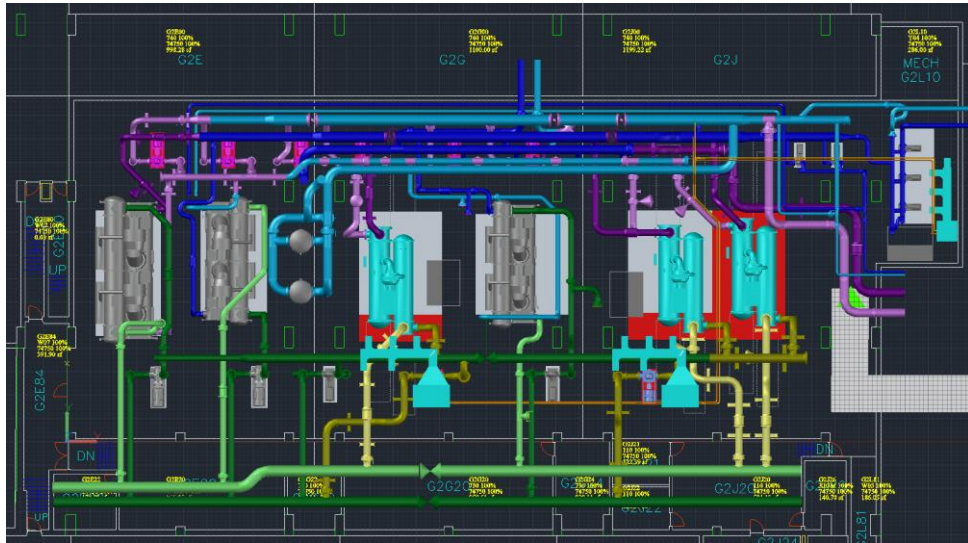
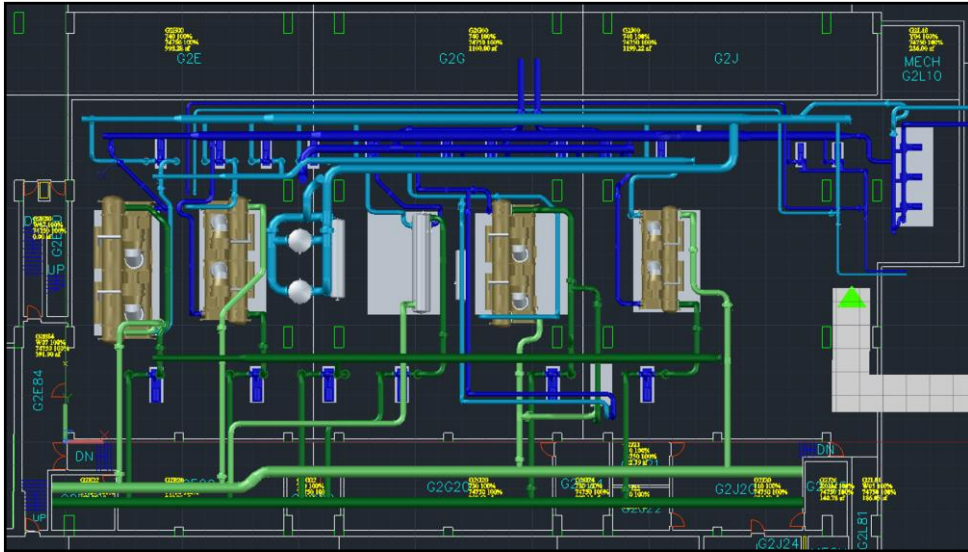


Lower Campus Project Scope

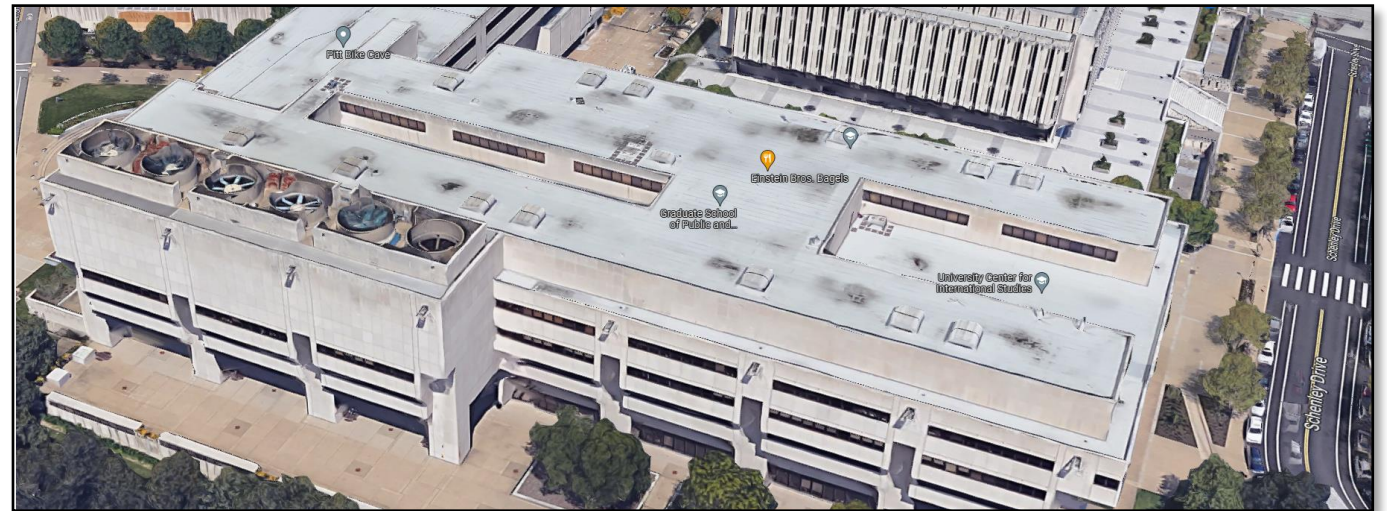
- ▶ This presentation focuses on the Lower Campus Scope
 - Posvar Plant Upgrades
 - Chevron Heat Exchanger Plaza
 - Mazeroski Field
 - Distribution
- ▶ Specifically, the Phasing required to renovate the Posvar CHW Plant



POSVAR CHW PLANT - Phasing Challenges

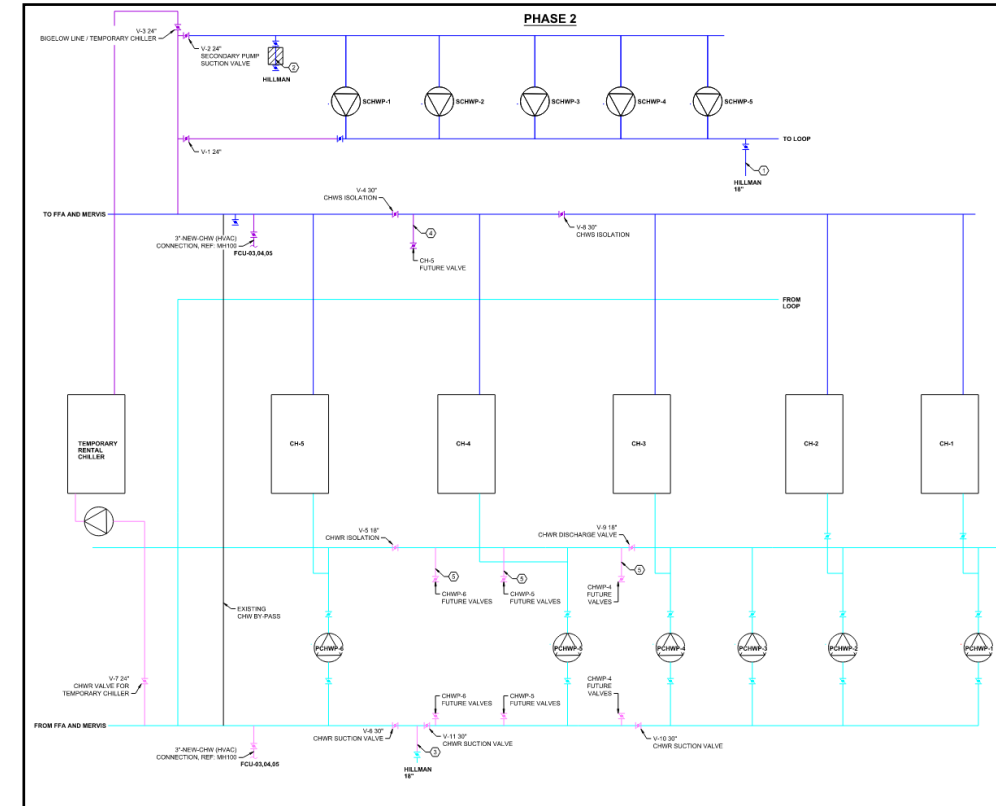


- Conversion of plant operation from Primary/Secondary to **Variable / Primary**
- Installation of 3 x 2250-ton chillers & associated equipment
- Increase capacity of 3 cooling towers to 2250s and convert fans to direct drive
- Final Plant size of 13,500 tons



POSVAR CHW PLANT - Phasing Challenges

- Designing with phasing in mind rather than trying to incorporate phasing at the end of the process. Included Phasing Plan with contract documents.
- Developed a 4-Phased approach to complete the work by keeping required number of chillers online with redundancy to meet seasonal campus loads including accommodations for temporary chillers.
- Phased approach reduced shutdown time, expensive large hot tap connections and multiple construction crews in a congested area within the plant.
- Designed the conversion of Primary/Secondary to Variable Primary with only one limited plant shutdown due to CHW demands



POSVAR CHW PLANT - Phasing Challenges

- Phasing Plan Sample from Contract Documents

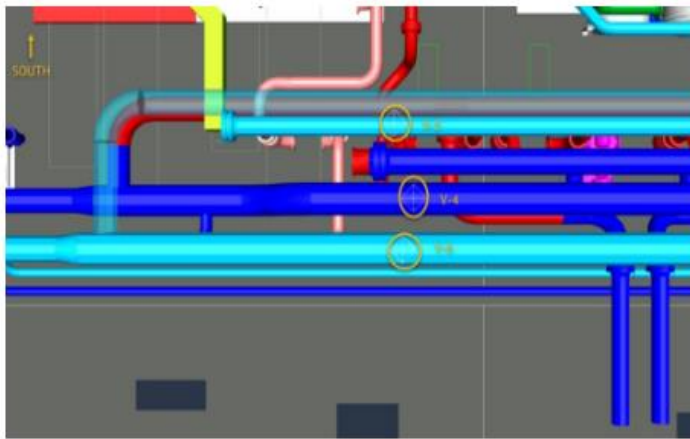


Figure 1: Locations of new isolation header valves. V-4, V-5 and V-6

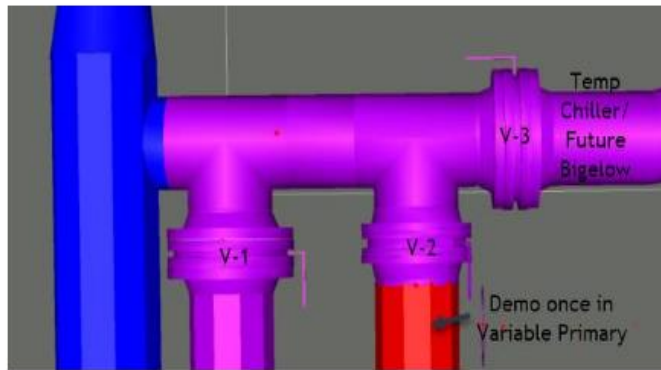


Figure 2: Jumper for variable primary conversion along with valves V-1, V-2 and V-3

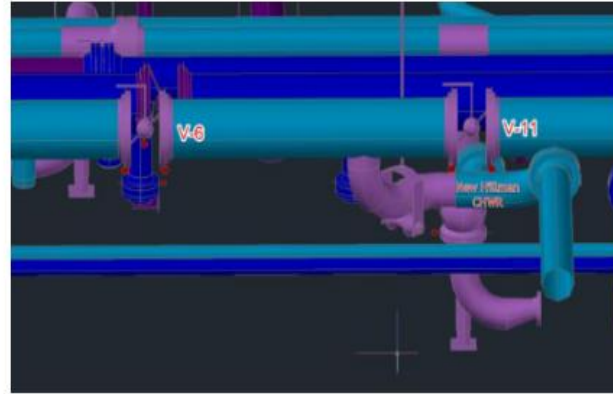


Figure 3A: Hillman tie-in valves

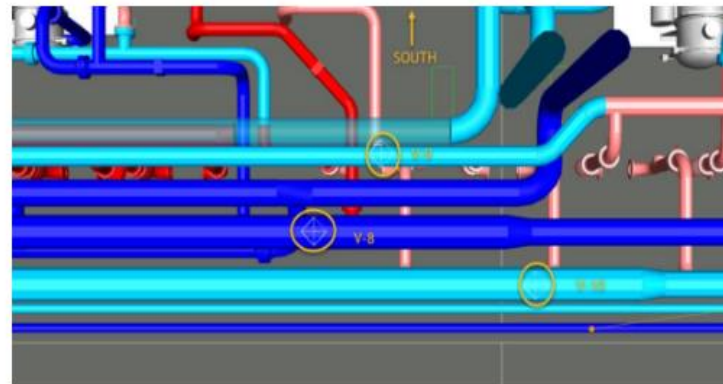


Figure 4: Location of new isolation header valves V-8, V-9 and V-10.

Pittsburgh Posvar Phasing Plan

General

This document is intended to provide a means of phasing the installation of the equipment to be installed under this scope. This is provided as a guide for contractor and Owner review and evaluation. Contractor is responsible for means and methods of equipment installation.

Pre-Phase 1

Cooling tower work and new condenser water piping and connections shall be completed prior to the phasing of the chilled water upgrades listed below. New condenser water taps for CH-5 or CH-6 must be used in Phase 2 for the use of the temporary chiller (if water cooled chiller is used).

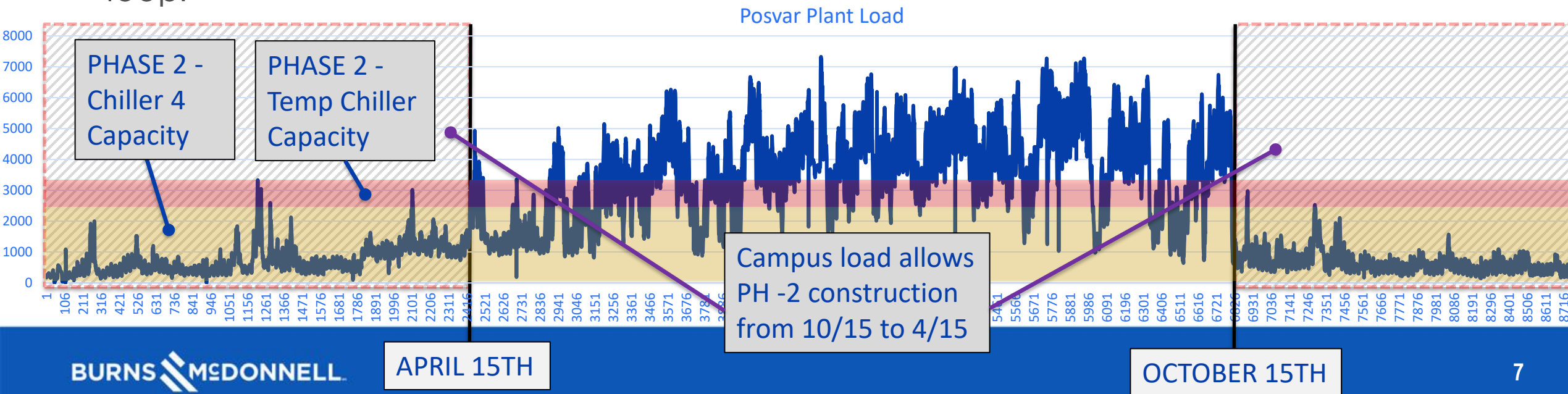
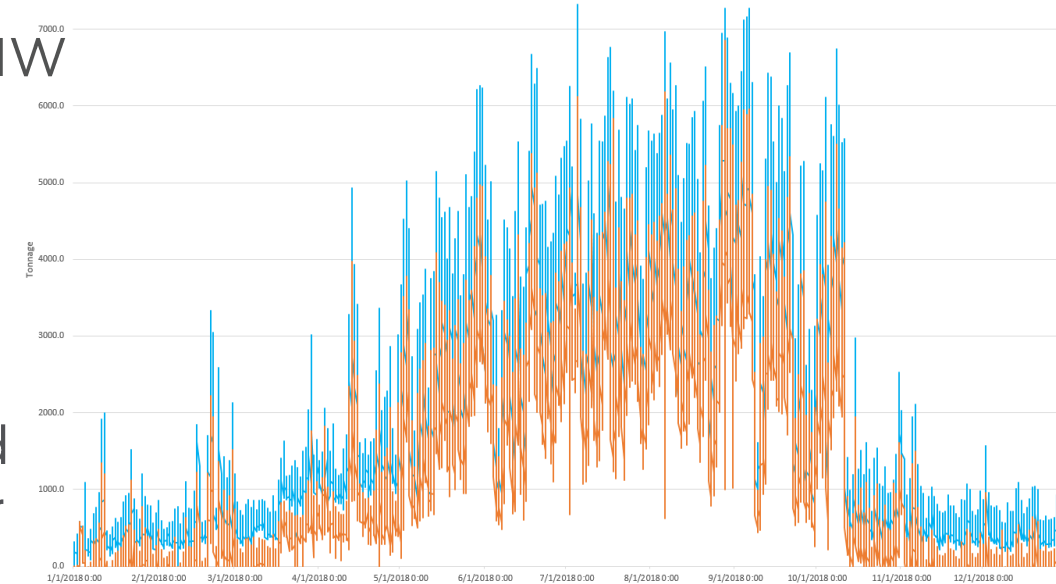
CTBR Scope can also be completed before the chiller phasing.

Phase 1:

- Shutdown plant for 2-3 days and install "jumper" butterfly valve, tee/valve for secondary pump suction and butterfly valve for future Bigelow distribution/temporary chiller (See Figure 2 below)
 - Jumper Valve is V-1 (24")
 - Secondary pump suction is V-2 (24")
 - Bigelow/Temp is V-3 (24")
- Install the taps and valves for the fan coil units to the CHWS and CHWR piping during the shutdown phase.
- Install three header butterfly valves between chiller 4 and 5 operation. These valves are labeled as V-4 (30"), V-5 (18") and V-6 (30") on the flow diagrams.
- Install header valves V-8 (30"), V-9 (18"), and V-10 (30") in this phase if time allows to minimize duration of temporary chiller use in Phase 2. These valves will be used in Phase 3 for partial plant isolation. (Figure 4)
- Install header valve V-11 (30"). This will be used to get Hillman back on service early in Phase 2. (Figure 3A)
- Install butterfly valve V-7 (24") during the total plant shut down which will be used first as the temporary chiller connection, then will be used as the figure Bigelow connection. (Figure 5)
- (Total 11 butterfly valves during shutdown)
- Once valves are installed, plant can resume primary secondary operation with all five chillers available.
- After phase 1 work has been completed and Posvar is fully operational, install the chilled water jumper with V-1 closed. This line will be used to convert the system to variable primary in a later phase. It does not need to be completed during total plant shut down. (See Figure 3)

POSVAR CHW PLANT - Phasing Challenges

- Schedule each construction phase to maintain CHW capacity based on seasonal cooling load
- Prepare phasing valves to keep sufficient CHW capacity online. Supplement early phases with temporary chillers
- **Orange** / **Blue** lines shows difference in CHW load after University Dr. load is shifted from the Posvar loop.





Phase 1

During Full Plant Shutdown:

- Install 12 Large Header Butterfly Valves to Allow for Phased Construction.
- Allows Future Fork to Occur While Keeping Portions of the Plant Online.

Phase 2

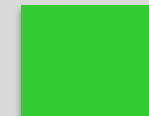


Using Phase 1 Isolation Valves:

- Connect Temporary Chiller for Additional Capacity
- Reconstruct Hillman Distribution Lines
- Install Taps and Isolation Valves in Locations of Future Pumps and Chillers



Phase 3



Using Phase 1 Isolation Valves:

- Rework Piping for Chillers 1 & 2
- Install New Chiller 3 with New Chilled Water and Condenser Water Connections
- Demolish Isolated Primary CHW Pumps
- Install New CHW Pumps
- Add Bigelow Distribution Lines

Phase 4



Using Phase 1 Isolation Valves:

- Convert Plant to Variable Primary
- Demolish Secondary Pumps & Chiller 5
- Replace CW Pump
- Install Remaining New CHW Pumps,
- Install New Chiller 5 & 6

POSVAR CHW PLANT - Schedule

- PH 1 Valving
- PH A Distribution
- Mazeroski Field
- PH 2 - Temp Chillers / Demo Chiller 3
- PH 3 - Install Chiller 3
- PH 4 - Convert to Primary Secondary
- Install CH 5 & 6
- PH B Distribution
- Install HX Building

