LEADING THE WAY
CampusEnergy2022
Feb.15-18 | Westin Boston Seaport District Hotel | Boston, MA

Thermal Energy Storage (TES) for Resiliency and Capital Offset at the University of Oregon

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UNIVERSITY OF OREGON

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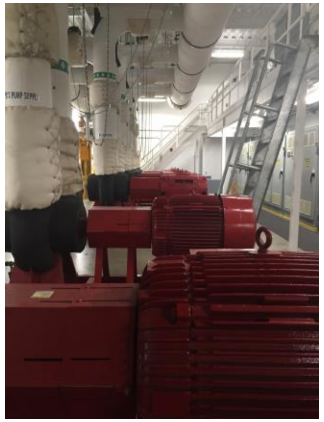
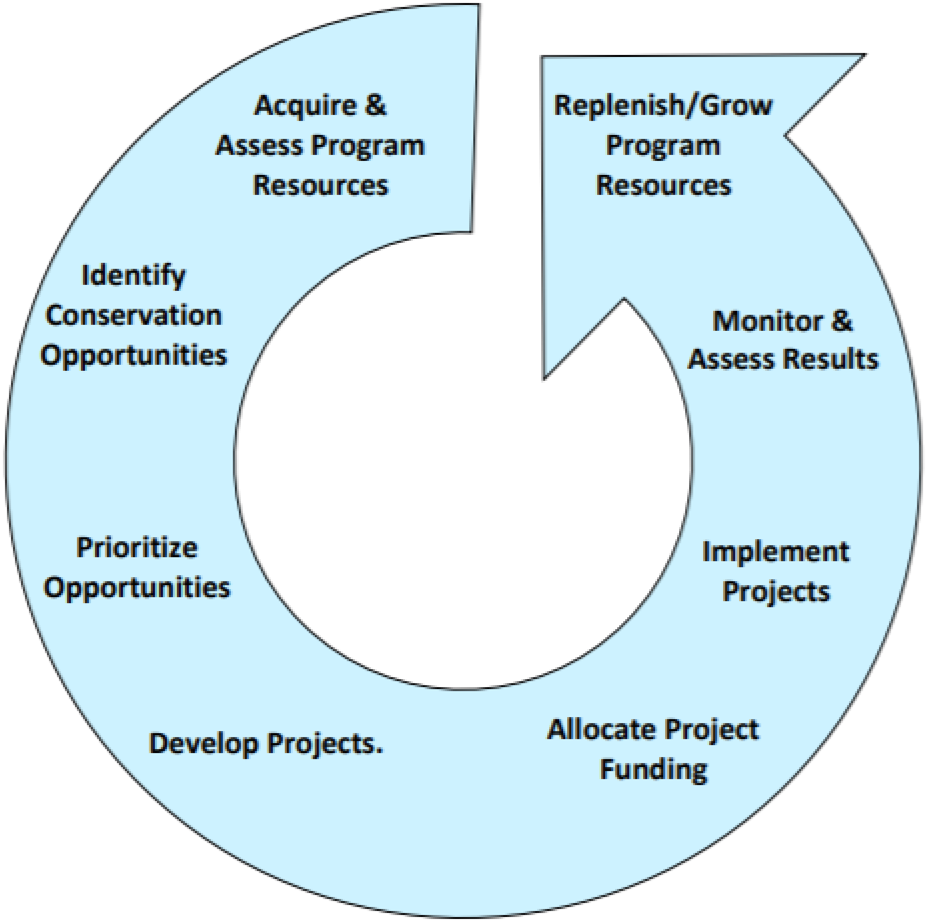
UNIVERSITY OF OREGON OVERVIEW

- 295-acre campus located in Eugene, Oregon with 80+ buildings
- Tier 1 Public Research University and #1 in Oregon
- Over 22,000 students enrolled in 2021-2022
- 10MW Combined Heat and Power (CHP) plant
- 6.5MW Emergency Power Generation
- Two (2) Natural Gas Fired Boilers (60/65 kpph)
- 7,500-ton Chilled Water Plant
- Nearly four miles of Distribution Tunnels



UTILITY AND ENERGY INITIATIVES

- EWEB study and potential rebates
- Delta-T improvements
- Equipment Staging and Pump Control
- Building-side improvements
- Hydraulic modeling
- Strategic Energy Management Plan

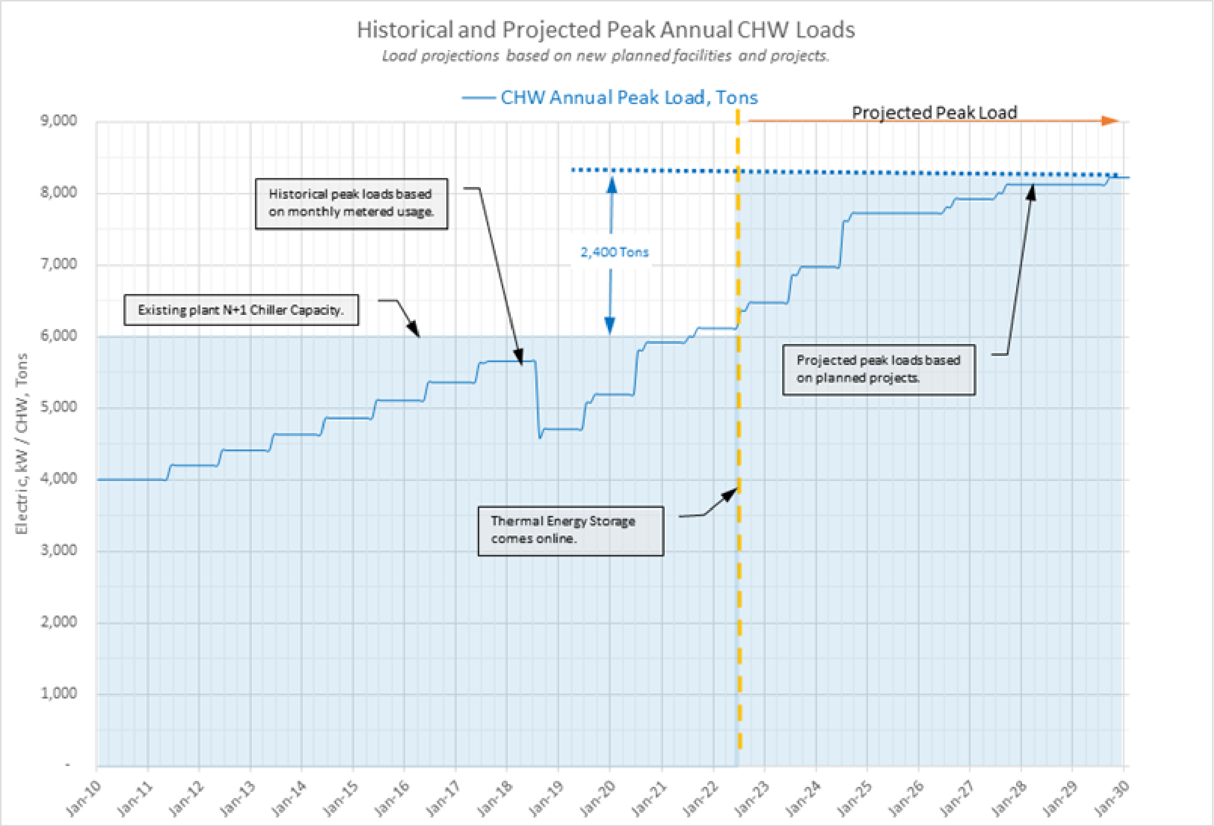


DRIVERS FOR UPGRADES

- Campus is growing!
- Chilled water load is projected to grow from 6,000 tons to 13,500 tons by 2050
- Need to expand existing chilled water plant capacity to maintain N+1 redundancy
- Potential for rebates and future financial advantages with TOD electrical rate structure
- Desire for increased resiliency

OUR PROCESS

- Developed load projections
- Focus was on 2030 with consideration though 2050
- Load Assumptions
- Current Day CHW load profile
  - Load Growth (2019 peak – 4,600 tons)
    - 6,000 Ton Peak - +30%
    - 8,400 Ton Peak - +80%



OUR PROCESS

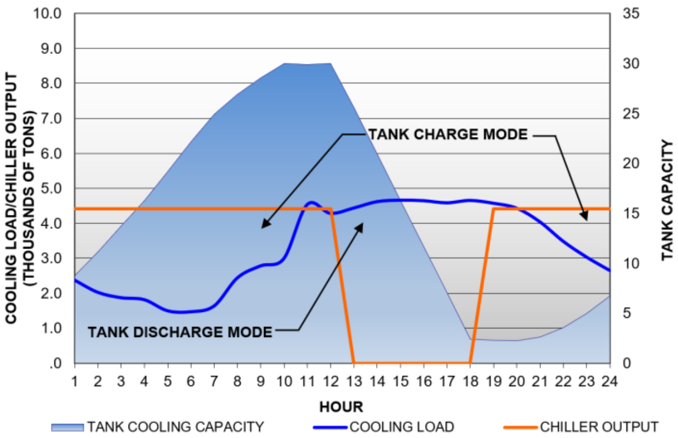
- Identified new chiller capacity/capital costs needed for future loads
  - Chiller plant design based on 1500 ton “blocks” of capacity
  - Determined that 2 chillers could be avoided through 2037
  - Preserves future plant floorspace, reduced maintenance costs

OUR PROCESS

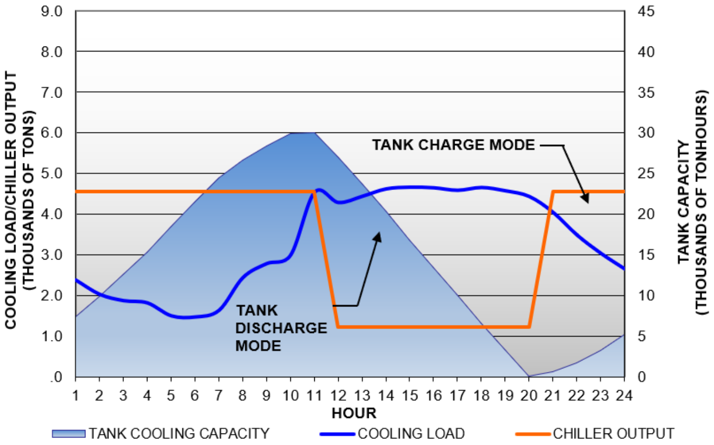
- Evaluated tank sizes, materials, and operating scenarios
  - 2, 3, and 4 MMGal tank capacities evaluated
  - Concrete and Steel tanks were both considered
  - Load Levelling, Partial Storage, and Full Storage analyzed
  - Load Levelling maximized capital offset with minimum tank size
    - Likely different results with a time-of-day rate structure

OUR PROCESS

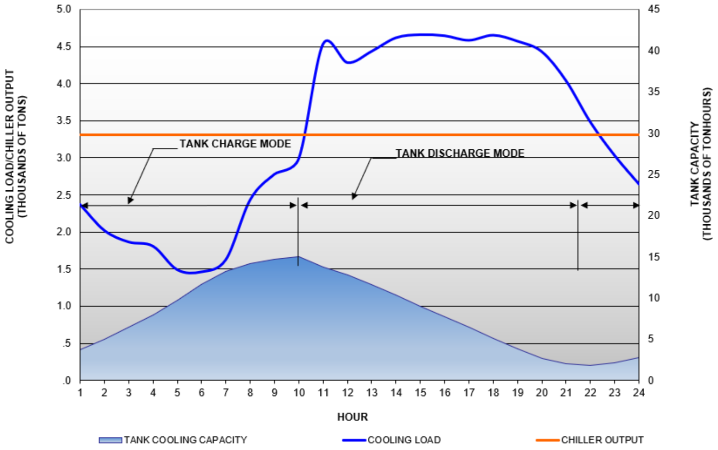
FULL LOAD SHED (FLS)



PARTIAL LOAD SHED (PLS)



LOAD LEVELLING (LL)

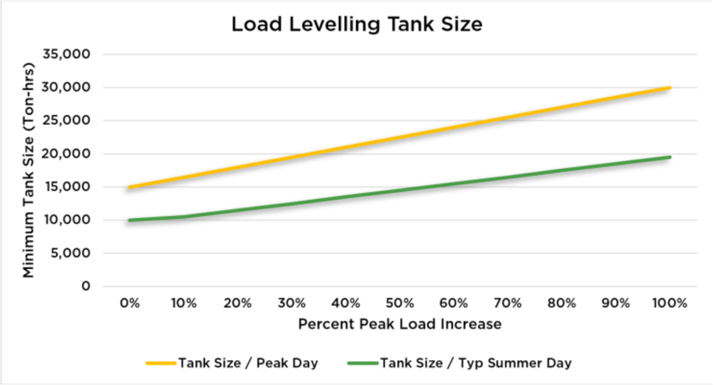


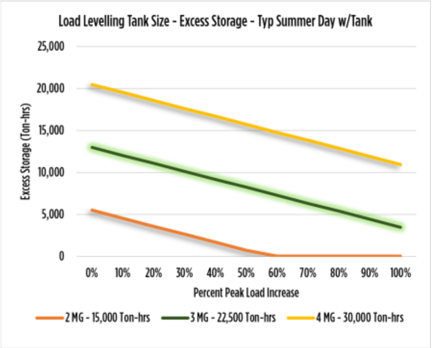
OUR PROCESS

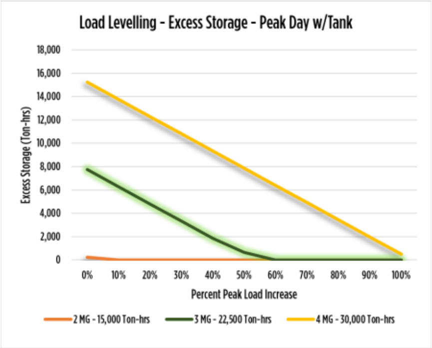
- Financial analysis and LCC-based tank size selection
- Concrete Tank (tank only)
  - 2MMGal/15,000 ton-hours (95’ x 55’)
  - 4MMGal/30,000 ton-hours (130’ x 55’)
- Steel Tank (tank only)
  - 2MMGal/15,000 ton-hours (81’x 56’)
  - 4MMGal/30,000 ton-hours (112’ x 58’)
- Costs are roughly equal at budgetary pricing level – steel vs. concrete
- Steel tank requires less diameter for similar overall height

OUR PROCESS

- ▶ Under current loads:
  - Max $ Savings = Load Levelling (LL)
  - $ saved for 2MG = 3MG = 4MG
- ▶ ANY Future Load Growth limits operation of 2MG Tank
- ▶ 3MG Tank Size Recommended
  - LL on 99% of days thru 100% peak growth
  - LL even on peak day thru 50% peak growth





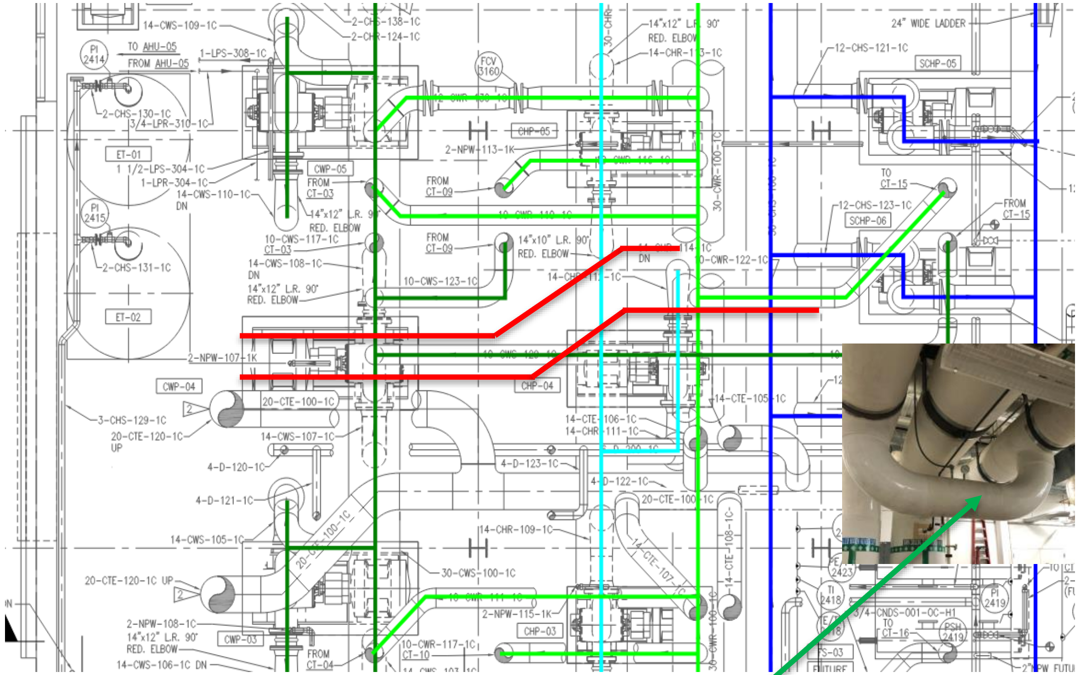


Note: Excess Storage must be >0 to Load Level

OUR PROCESS

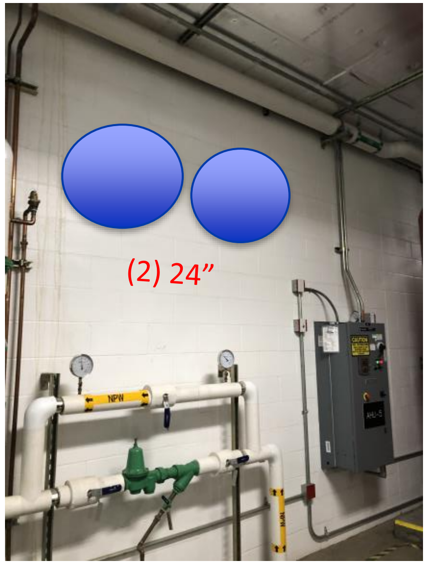
- Design

Piping Plan View

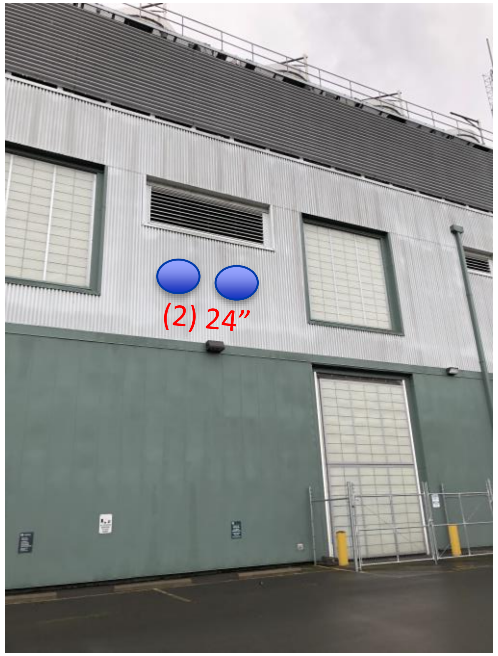


Decoupler – New Valve

Interior

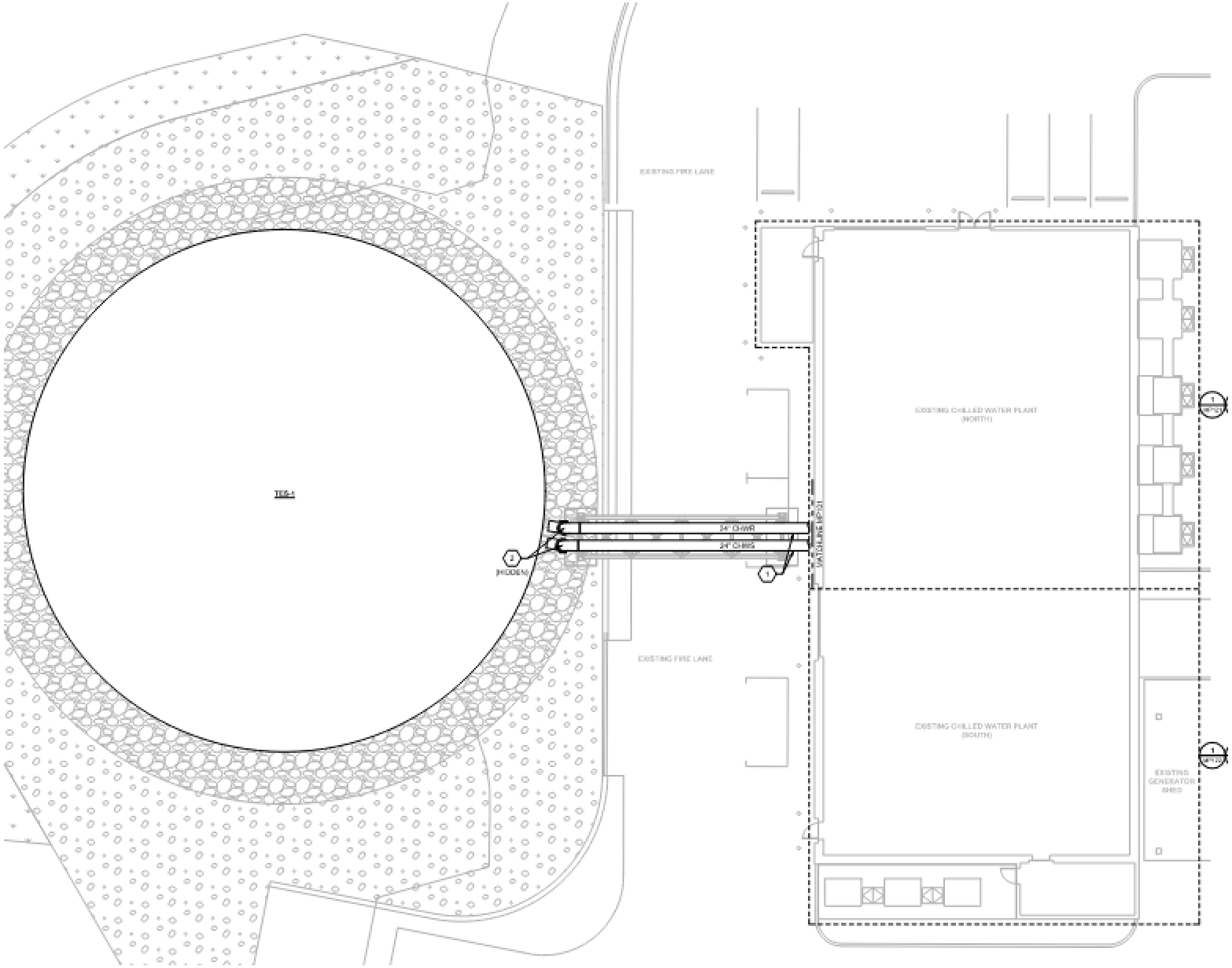


Exterior



OUR PROCESS

- Design



OUR PROCESS

- Bidding
  - Solicitation allowed for concrete or steel
  - Multiple bids received
  - Generally similar bid $ and duration
    - One outlier with major exclusions

EFFORTS TO DATE/CURRENT STATUS

- Tank has been awarded
- Permitting completed
- Site work has begun
- Temporary chilled water shutdown for tie-ins completed

NEXT STEPS

- Complete additional balance of plant work
  - New Cooling Tower
  - CHW Pump VFDs
  - Upgrades to Free Cooling Heat Exchanger
  - Control System upgrades
  - Miscellaneous structural upgrades

LESSONS LEARNED

- Low cost, low carbon electricity is challenging for ECMs
- Load levelling will likely prevail with no time-of-day rate impact
- Benefits to selecting a vendor that can provide a full “turnkey” tank installation
- Water treatment costs can be significant

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