BUILDING SUSTAINABILITY/MEP

INTERFACE ENGINEERING

Heating, Ventilating, and Air Conditioning (HVAC) Systems

The HVAC systems proposed for the facility will be designed to take advantage of the existing building thermal mass, the existing building orientation, and the existing building clerestory. Pursuing a desire for comfort conditions in both extreme summer temperatures and extreme winter temperatures, both heating and cooling of the building will be provided.

Ventilation Scheme

Due to many days of temperate climate, natural ventilation is proposed for the building renovation as well as the new building addition for all unenclosed rooms. The natural ventilation scheme will be composed of:

- Operable windows located for occupant control.
- Windows with controlled actuators that will open and close based on zone carbon dioxide sensors and zone temperature sensors. These controlled windows will be located both low and high to take advantage of both cross ventilation (wind pressure) and stack effect.
- Clerestory windows with controlled actuators that will open and close based on zone carbon dioxide sensors and zone temperature sensors. The clerestory will provide natural air movement using a stack effect.

Air movement will be designed to take air from the plan West façade and release air on the plan East façade therefore minimizing odor impacts.

The enclosed Theater and Restrooms will be provided with ventilation via an air to air heat exchanger. This heat exchanger will provide ventilation to the Rooms as well as exhaust air. The air will recover the energy

created for heating/cooling of the rooms, therefore minimizing the energy use. In addition an exhaust fan will be provided for the open spaces to pull air through the building when the system is alarmed by the carbon dioxide sensors.

Heating Scheme

The existing building is very massive, providing a facility with natural thermal mass storage. This inherent quality of the existing building along with the fact that a topping slab will be required to provide a consistently flat walking environment and display environment makes a perfect match for an in-floor radiant heating system. The system will consist of:

- One new 255 MBH propane boiler with modulating controller and outdoor air temperature reset and two in-line circulating pumps.
- PEX radiant tubing embedded within a new concrete topping slab. It is expected that the topping slab consist of a 2" EPS insulation to which the tubing is adhered to and a new 3" concrete slab poured above the insulation.
- Control panels and radiant floor zoning maifolds with temperature sensors.
- Insulated heating hot water supply and return piping.

The system is meant to be maintenance friendly and minimize energy use. Solar thermal panels will be provided to augment heating capacity passively without the use of the boiler whenever adequate sunlight is available. This mates up well with the radiant slab system as very low water temperatures can be used in the slab versus an all air heating system.

In addition, the new building addition will take advantage of large window exposures on the East side of the building to provide passive heating in the cool mornings.

Cooling Scheme

Much like the heating system, the cooling system will take advantage of the thermal mass. It will also take advantage of the dry climate during hot months by using evaporative cooling technologies. Since piping will already be embedded within the slab for the heating system, the cooling system will take advantage of the infrastructure provided and reuse it for cooling. The cooling radiant slab system will consist of the following components:

- One new 20-Ton (240,000 BTUH) low silhouette fluid cooler variable frequency drive (for part load fan modulation) and in-line circulating pumps.
- Re-use of the heating system PEX tubing distribution.
- Re-use of the heating system control panels and radiant floor zoning manifolds with temperature sensors.
- Insulated tempered water cooling supply and return piping.
- Chemical treatment for the fluid cooler system.

The system is meant to be maintenance friendly and minimize energy use.

Plumbing and Fire Protection Systems

The plumbing and fire protection systems for the facility will be all new and will include the following:

- New 4" sanitary sewer main.
- New 2" domestic cold water main.
- New 6" fire riser main.

Domestic hot water will be provided via under counter instantaneous hot water heaters (one for each restroom) and integration into the building's solar hot water heating system. We anticipate approximately 8 solar hot water heating panels (4'x8' each) to provide adequate domestic hot water and heating hot water (see HVAC narrative).

Water reduction is a major goal of the systems for this facility. To reduce potable water consumption as much as possible, the following fixtures will be utilized:

- 1/8 gallon per flush urinals (saving over 85% of water use from urinals).
- 1.28 gallon per flush water closets (saving 20% of water use from water closets).
- 0.5 gallon per minute lavatories (saving 75% of water use from lavatories).

A standard dual height ADA drinking fountain will be provided. All fixtures noted above will be mounted at ADA heights where required.

Make-up water with reduced pressure backflow prevention will be provided for each of the HVAC systems (one for the heating water system and one for the cooling water system).

Floor drains and trap primers will be provided in each of the two restrooms. Restroom floors will be sloped to drain to the new floor drains.

The building will be fully sprinklered per NFPA 13 requirements. A drain will be provided from the fire sprinkler system to the exterior of the building.

Electrical Systems

The electrical system for the building will be serviced via existing power to the site. The system will incorporate the high solar income on the site through the use of photovoltaic panels as the renewable energy source. The electrical systems will consist of:

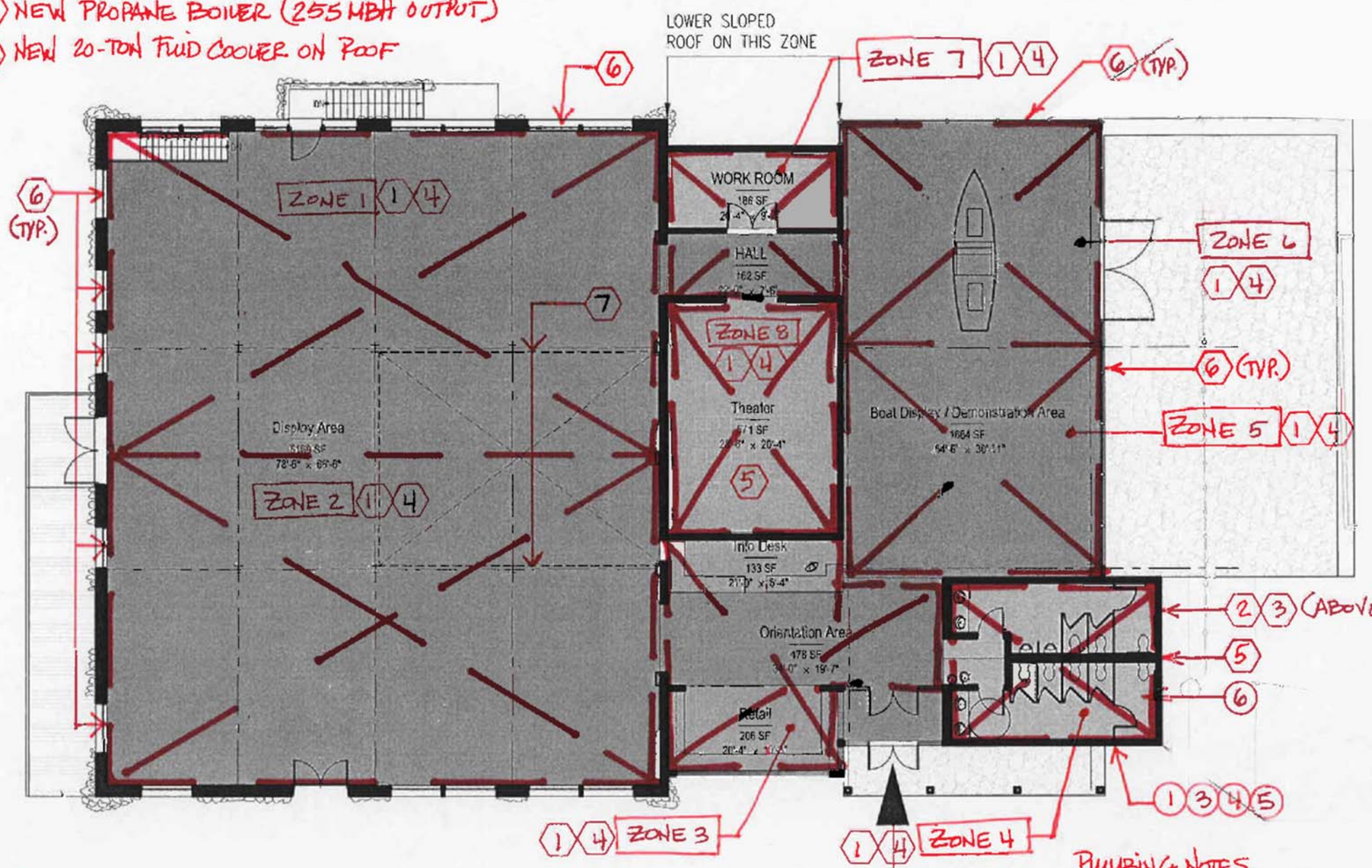
- New power lines from a pole mounted transformer on the South East side of the building.
- New electrical room in the existing basement of the building.
- New 225 amp 120/208 volt panel to support new loads to be located in the electrical room.
- Photovoltaic system inverters located in the new electrical room.
- Power distribution panels for lighting systems, receptacle/exhibit loads, and A/V loads.
- Motor starters and disconnects for HVAC (boiler, fluid cooler, pumps, heat exchanger, and fans) and Plumbing equipment (instantaneous water heaters)

A central fire alarm system is not expected for the facility. Conduit and pathways will be provided for the Security, Technology, and A/V systems within the facility.

MEP PLAN

MECHANICAL NOTES

1. INDEPENDENT RADIANT HEATING AND COOLING SLAB ZONE WITH TEMPERATURE SENSOR & CO2 SENSOR
2. NEW PROPANE BOILER (255 MBH OUTPUT)
3. NEW 20-TON FLUID COOLER ON ROOF
4. UPONOR RADIANT SLAB TUBING SYSTEM INSTALLED IN NEW TOPPING SLAB. INCLUDES UPONOR (OR SIMILAR) CONTROL SYSTEM TO CONTROL MANIFOLDS, VALVING, BOILERS, FLUID COOLERS, AND PUMPS.
5. AIR TO AIR HEAT EXCHANGER (500 CFM)
6. MOTORIZED WINDOWS FOR NATURAL VENTILATION
7. MOTORIZED RELIEF VENTS (WINDOWS) IN CLERESTORY.



ELECTRICAL NOTES

1. DEMOLISH (E) AGED ELECTRICAL EQPT.
2. EXTEND POWER LINES FROM (E) POLE MOUNTED TRANSFORMER TO (N) ELECTRICAL ROOM IN BASEMENT. PROVIDE (N) 225A 120/208 V PANEL FOR (N) LOADS.
3. INVERTERS IN ELECTRICAL ROOM FOR P.V. SYSTEMS.

PLUMBING NOTES

1. (N) PLUMBING FIXTURES:
   - * 1/8 GPF URINALS
   - * 1.28 GPF WATER CLOSETS
   - * 0.5 GPM LAVATORIES
   - * DUAL HT DRINKING FOUNTAINS
2. MAKE-UP WATER FOR BOILERS AND FLUID COOLER
3. FLOOR DRAINS AND TRAP PRIMERS
4. (N) 4" SANITARY

   (N) 2" DCW
   (2) NEW UNDERCOUNTER WATER HEATERS
5. (N) 6" FIRE WATER SERVICE
6. SOLAR THERMAL PANEL AND TANK FOR RADIANT HEATING SYSTEM.