

NWC District Energy

Campus Energy - RFQ Supporting Documentation

April 25, 2018

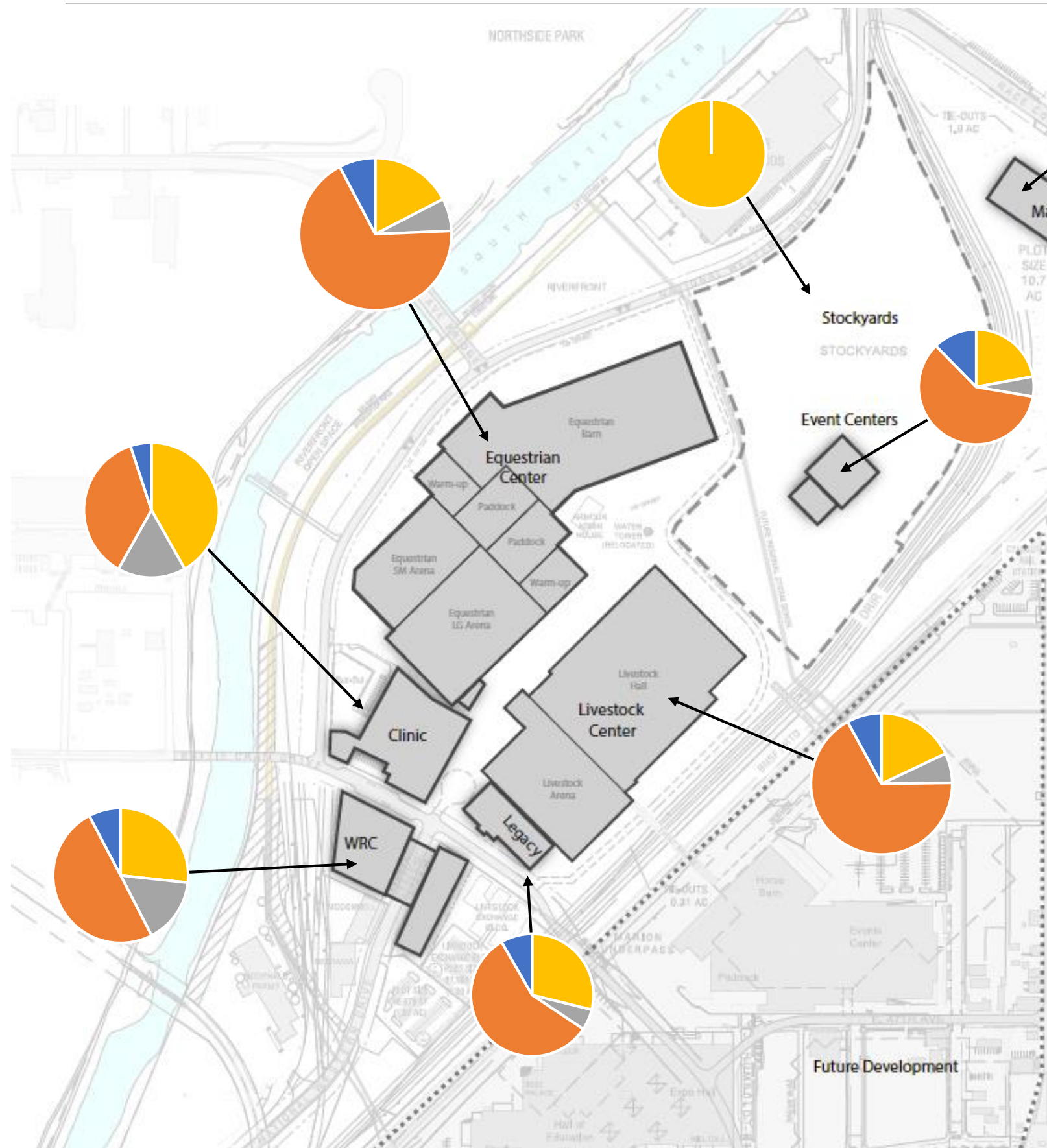


ESTIMATED ENERGY DEMAND BY BUILDING

Facility Name	Area (ft ²)	Energy Use Intensity Goal (kWh/ft ²)	Estimated Total Energy (kWh)	Total Electric (kWh)	Average Electric (kW)	Peak Electric (kW)	Design Gas Demand (kBtu/hr)	Design Cooling Demand (kBtu/hr)	Design Heating Demand (kBtu/hr)
Water Resources Center	146,500	11	1,647,932	1,389,015	159	427	127	3,369	4,542
Stockyards Event Center	39,025	11	411,123	388,036	44	159	17	1,366	1,561
CSU Animal Health Clinic	78,600	33	2,620,738	2,192,070	250	401	211	1,729	1,791
Livestock Center	387,800	9	3,445,043	3,209,888	366	1,361	176	9,307	15,900
Equestrian Center	526,440	9	4,626,072	4,306,848	492	1,845	239	12,108	21,584
NWSS Maintenance Facility	53,200	8	445,426	398,018	45	112	19	958	958
Stockyards	871,200	0.05	43,560	43,560	5	15	0	0	0
Legacy Building	113,000	11	1,227,945	1,160,428	132	360	33	2,712	3,842
Phase 1 & 2 Totals	2,215,765	11	14,467,838	13,087,863	1,494	4,412	823	31,548	50,177

- (1) Heating and cooling loads are based on a reference building model for Denver, CO climate, with 40% glazing, 0.2 cfm/sf outside air infiltration, and occupancy density based on building usage. Loads are based on preliminary information and are subject to change as design information becomes available.
- (2) Water cooled heat pump efficiencies are based on ambient piping loop seasonal operating temperatures, and all other HVAC equipment efficiencies used in DOE prototype building models.
- (3) Natural gas is only used in lab facilities and for cooking. Natural gas is not used for heating.
- (4) An estimated peak demand of approximately 4000 kW is anticipated in Livestock Facility, due to loads associated with animal blow drying during the annual Livestock show. It is expected that this additional peak load will be met by external power generators or energy storage system, rather than the campus electrical service. This load is not included in table above.
- (5) Unit Conversion - 1 kWh = 3.412 kBtu

SITE PLAN WITH ESTIMATED ENERGY USE

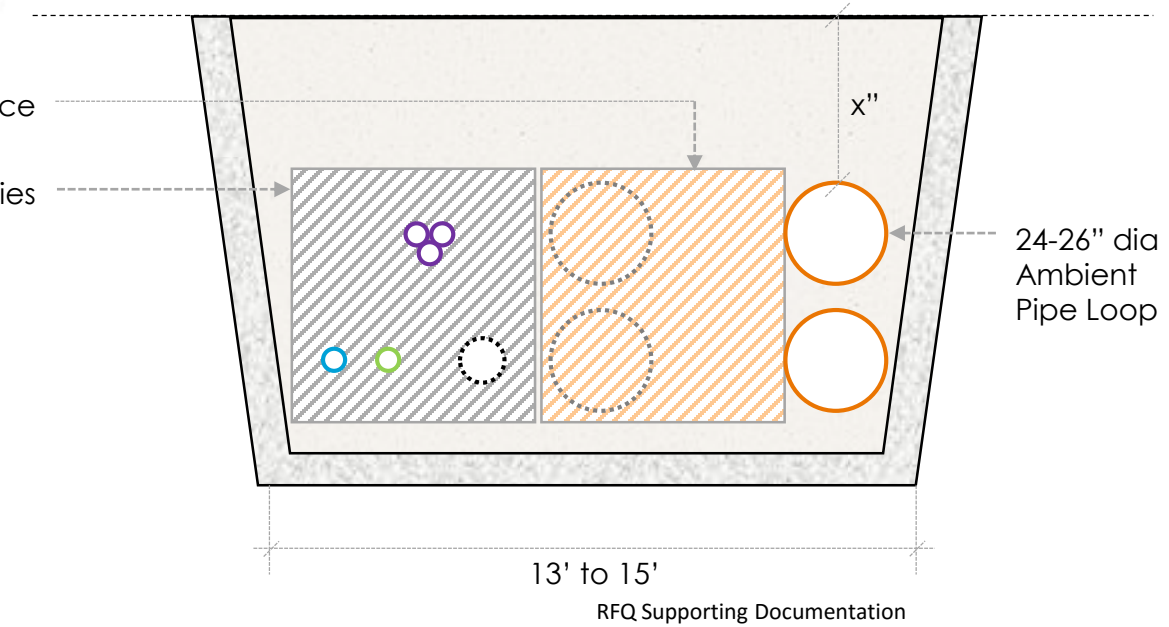
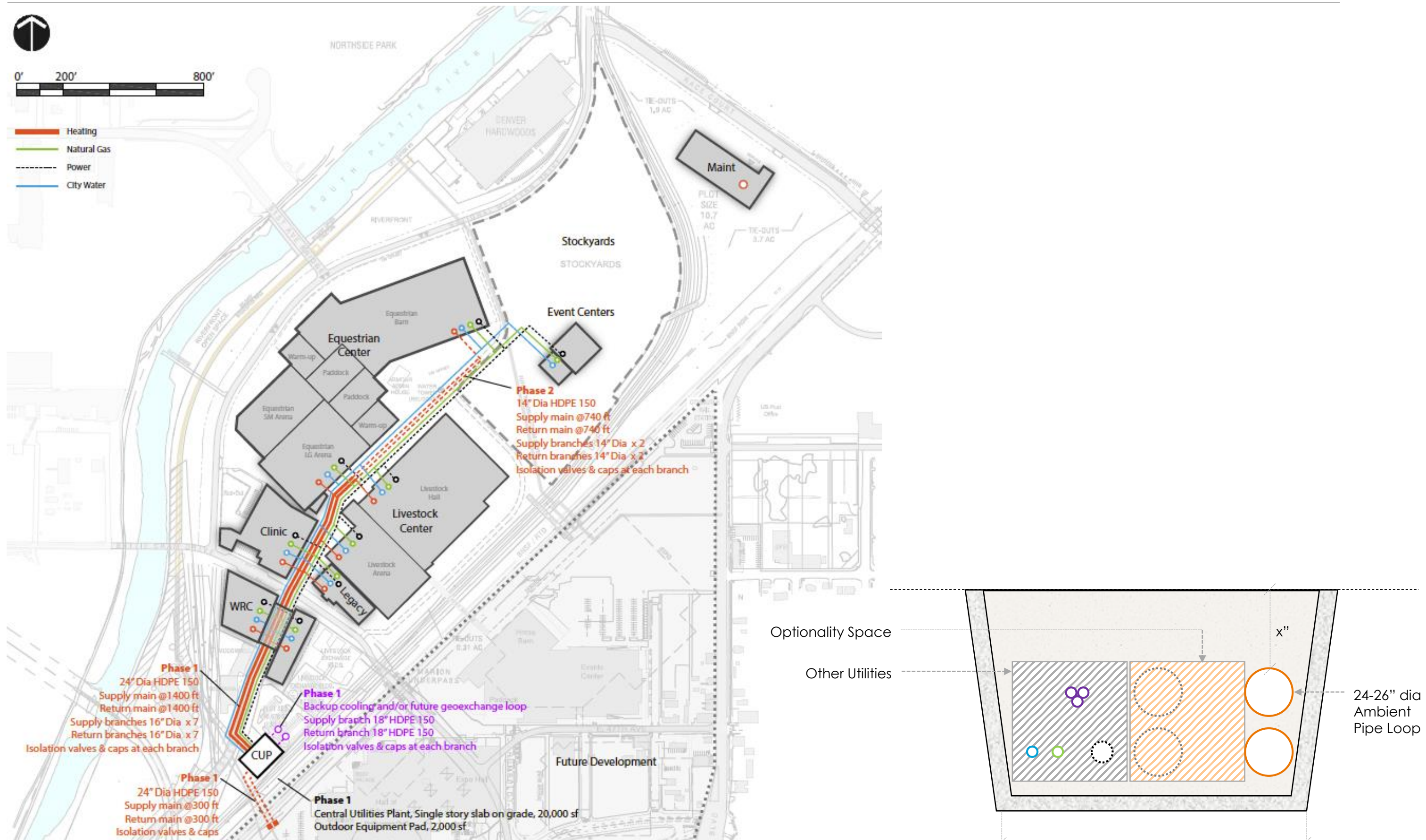


- (1) Heating and cooling annual energy use was estimated based on average Denver area heating and cooling demand rates applied to program building areas, and a hypothetical building usage schedule.
- (2) Heat pump efficiencies were based on ambient piping loop seasonal operating temperatures, and other HVAC equipment efficiencies were based on DOE prototype building models.
- (3) Other Electrical includes: lighting, fans, pumps, other electrical equipment.
- (4) Other Gas includes incidental gas equipment usage, such as cooking.
- (5) Heating includes space heating, as well as hot water.

Annual Energy Use for Campus Energy Concept

Building	Area (sq. ft)	Estimated Total Energy, MWh/yr	Electrical (Other), MWh/yr	Gas (Other), MWh-Th/yr	Heating, MWh/yr	Cooling, MWh/yr
Water Resources Center	146,500	1,648	440	259	822	127
Stockyard Events Center	39,025	411	91	23	246	51
CSU Animal Health Clinic	78,600	2,621	1,095	429	965	132
Livestock Center	387,800	3,445	619	235	2,316	275
Equestrian Center	526,440	4,626	806	319	3,143	358
NWSS Maintenance Facility	53,200	445	134	47	207	57
Stockyards	871,200	44	44	0	0	0
Legacy Building	113,000	1,228	354	68	704	102
Phase 1 &2 Annual Energy Consumption, MWh/yr:		14,468				

SITE PIPING PLAN



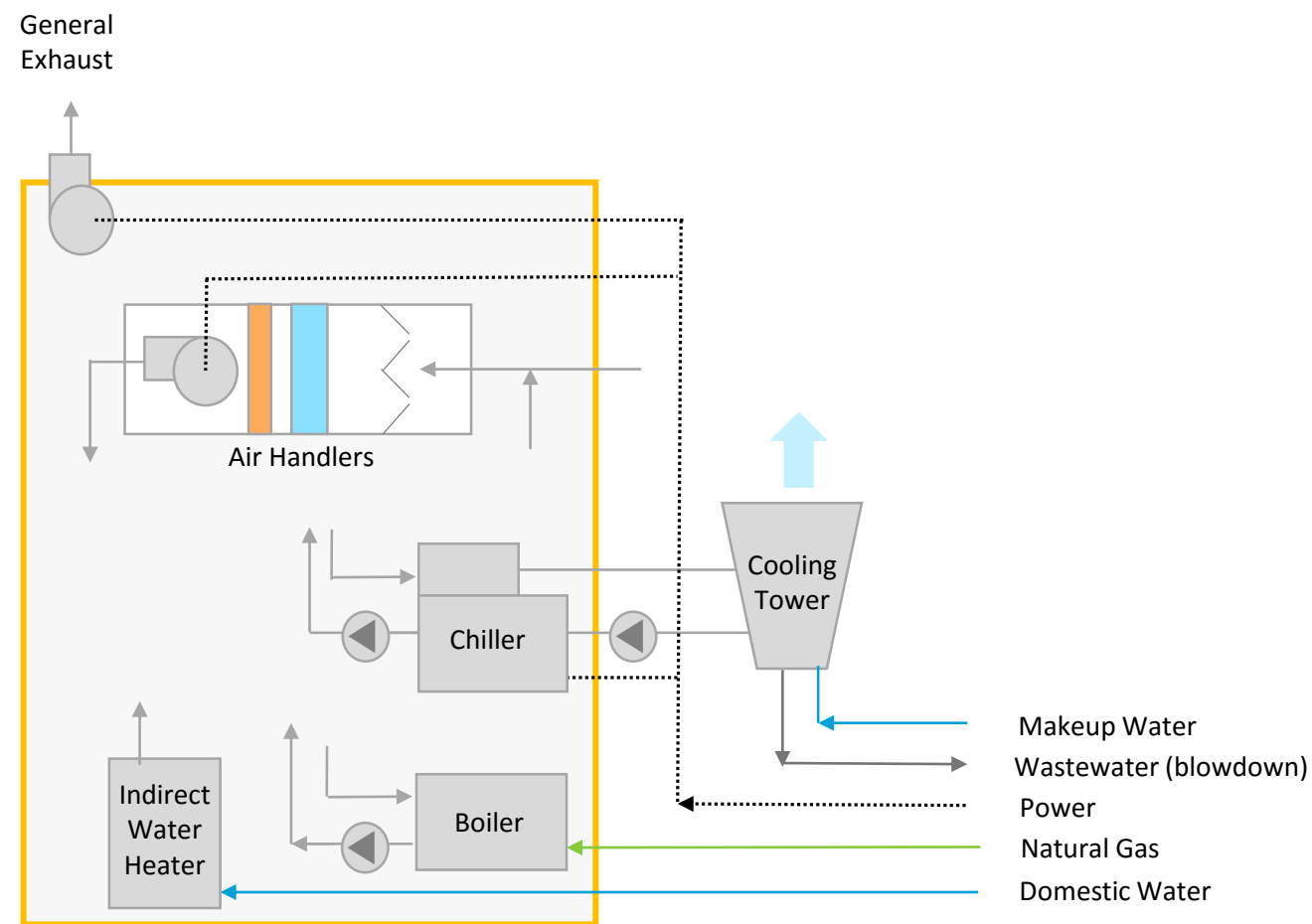
HVAC SYSTEMS SCHEMATIC – BUSINESS AS USUAL VS CAMPUS ENERGY CONCEPT

Business As Usual

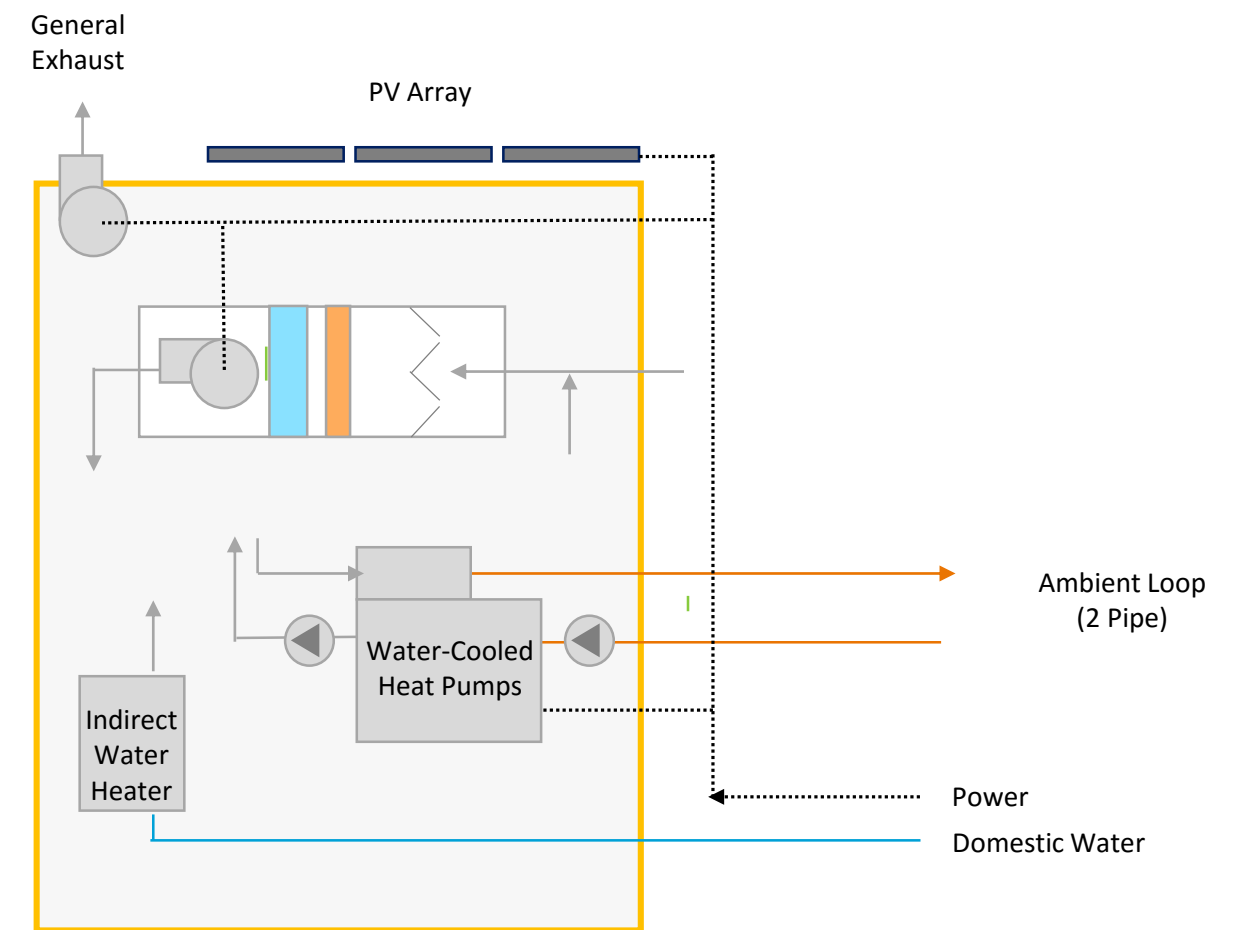
Cooling	Chiller/Cooling Tower	6.1	Electricity
Heating	Boiler	79%	Gas
Hot Water	Indirect Water Heater	79%	Gas

Campus Energy Concept

Cooling	Heat Pump w/ SHR	2.58	Electricity
Heating	Heat Pump w/ SHR	3.58	Electricity
Hot Water	Indirect Water Heater	3.58	None

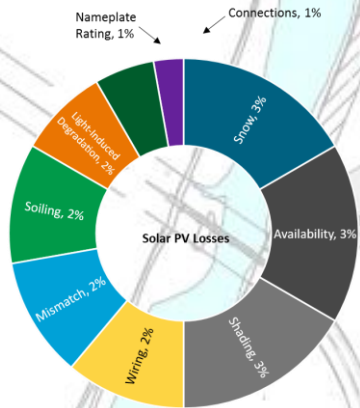
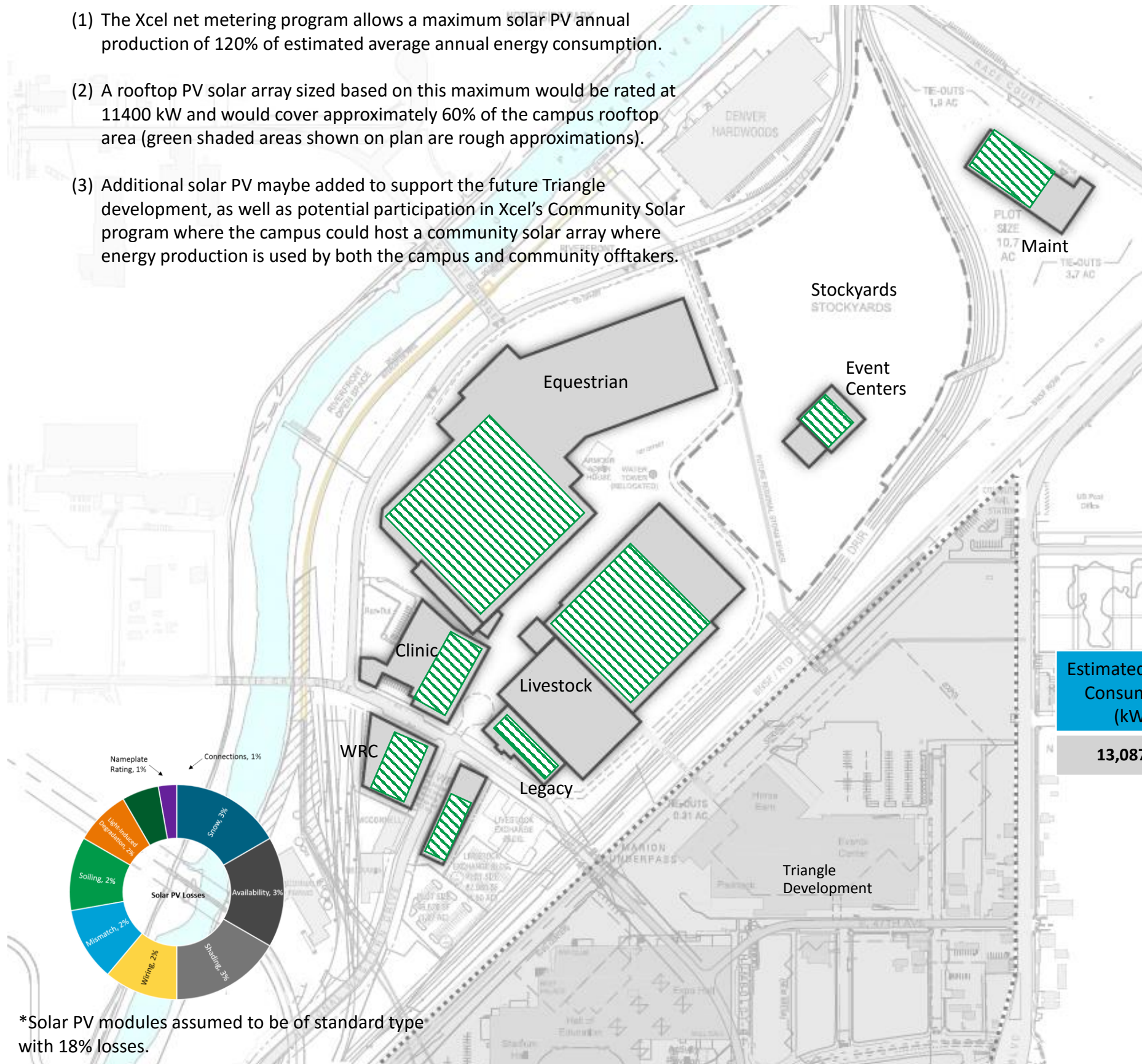


Note: Some facilities in Business As Usual case use direct expansion air handler units with electric resistance heating.

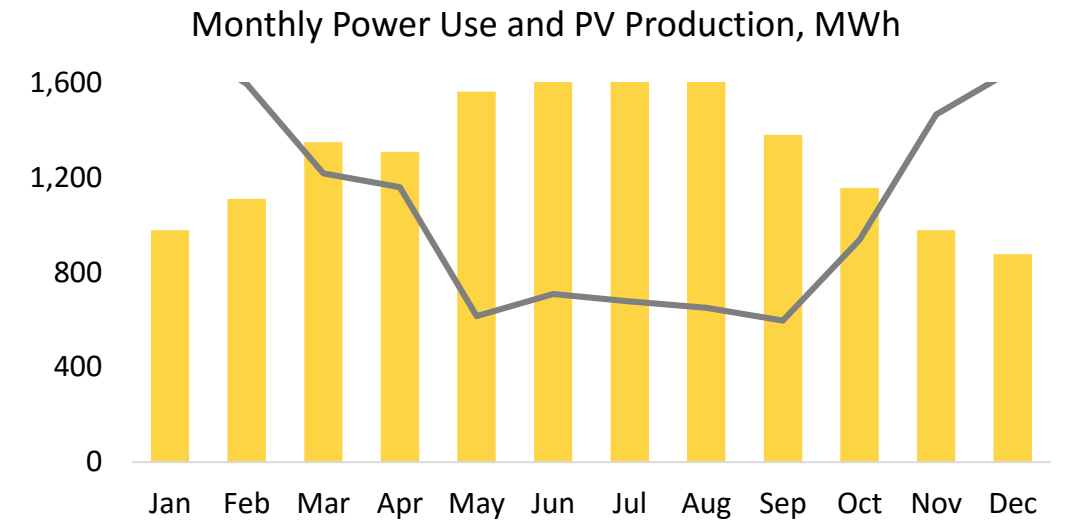


CAMPUS RENEWABLE ENERGY – PV SOLAR PRODUCTION BASED ON NET METERING

- (1) The Xcel net metering program allows a maximum solar PV annual production of 120% of estimated average annual energy consumption.
- (2) A rooftop PV solar array sized based on this maximum would be rated at 11400 kW and would cover approximately 60% of the campus rooftop area (green shaded areas shown on plan are rough approximations).
- (3) Additional solar PV maybe added to support the future Triangle development, as well as potential participation in Xcel’s Community Solar program where the campus could host a community solar array where energy production is used by both the campus and community offtakers.



*Solar PV modules assumed to be of standard type with 18% losses.



— - Phase 1 & 2 estimated electrical power consumption
 ■ - PV solar production based on Net Metering Rules

Estimated Electric Consumption (kWh)	Annual Avg Electric (kW)	PV Module Area (ft ²)	Solar Array Size (kW-DC)	Annual Solar Production (kWh-AC)	% of Phase 1 & 2 Consumption
13,087,863	1,552	193,963	11,400	15,705,435	120%