

Illinois Commerce Commission – Thermal Energy Workshop #1

Customer Centered Approach

PRESENTED BY
Bill Talbert
Energy and Planning Team Leader
bill.talbert@salasobrien.com

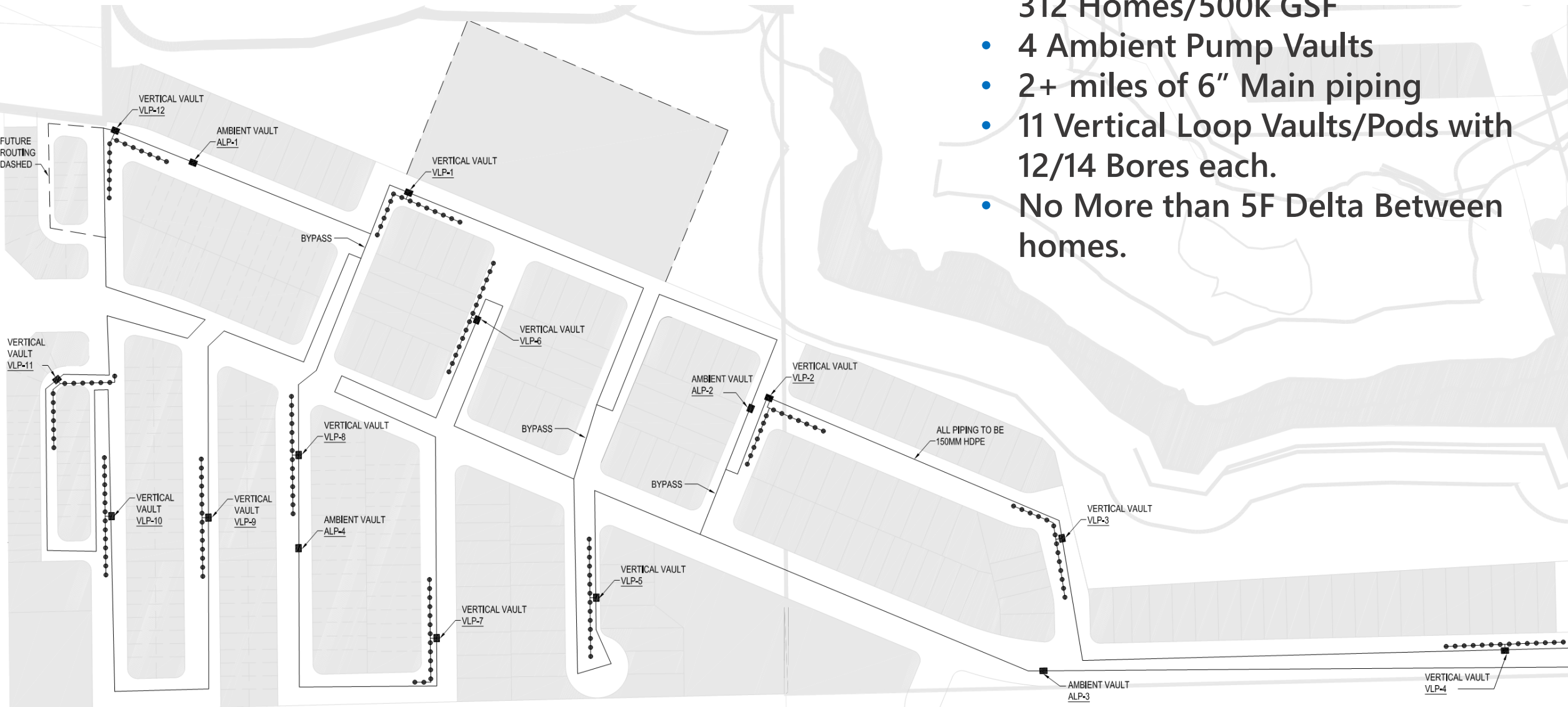


TEN – Customer Centered Approach

- Tailored and Unique Solutions
- Load Based design and technology
- Scalability
- Ownership structures
- Goal and target driven

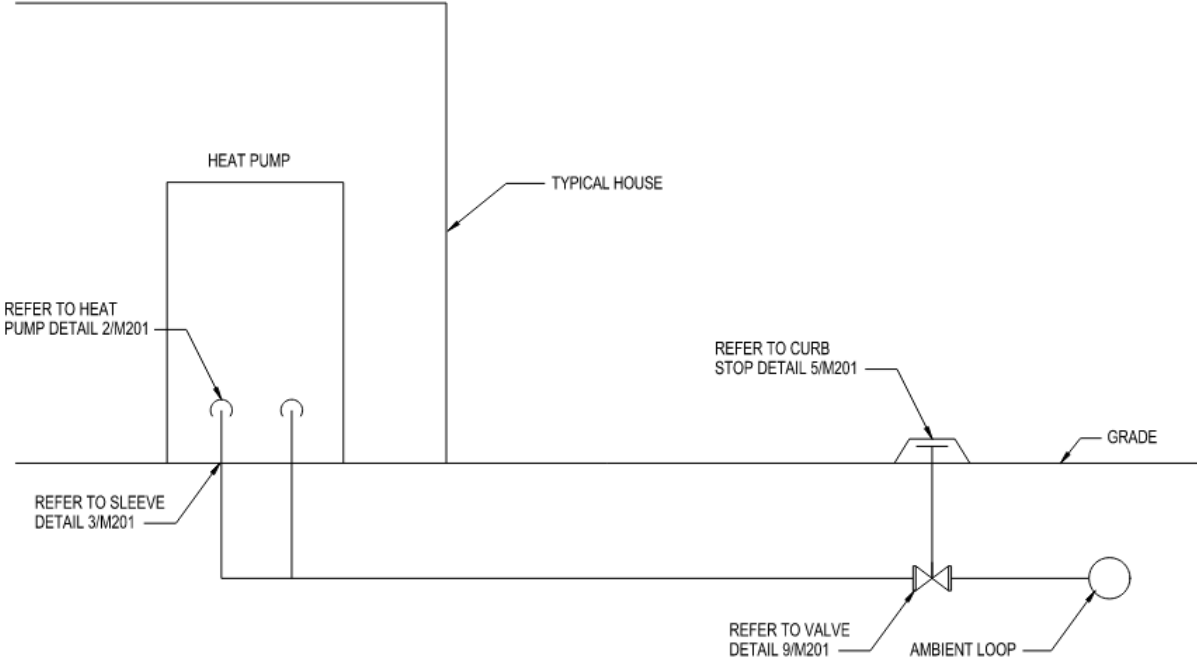
Single Family New Construction - Toronto

- Single Pipe Ambient Loop Serves 312 Homes/500k GSF
- 4 Ambient Pump Vaults
- 2+ miles of 6" Main piping
- 11 Vertical Loop Vaults/Pods with 12/14 Bores each.
- No More than 5F Delta Between homes.

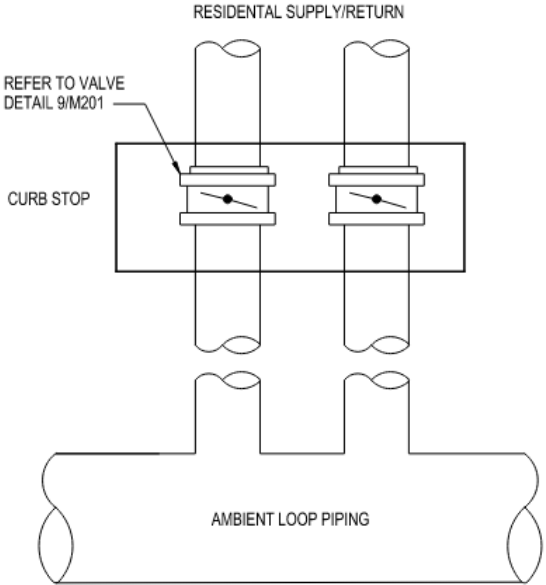


Single Family New Construction - Toronto

Ambient Loop - Interconnections



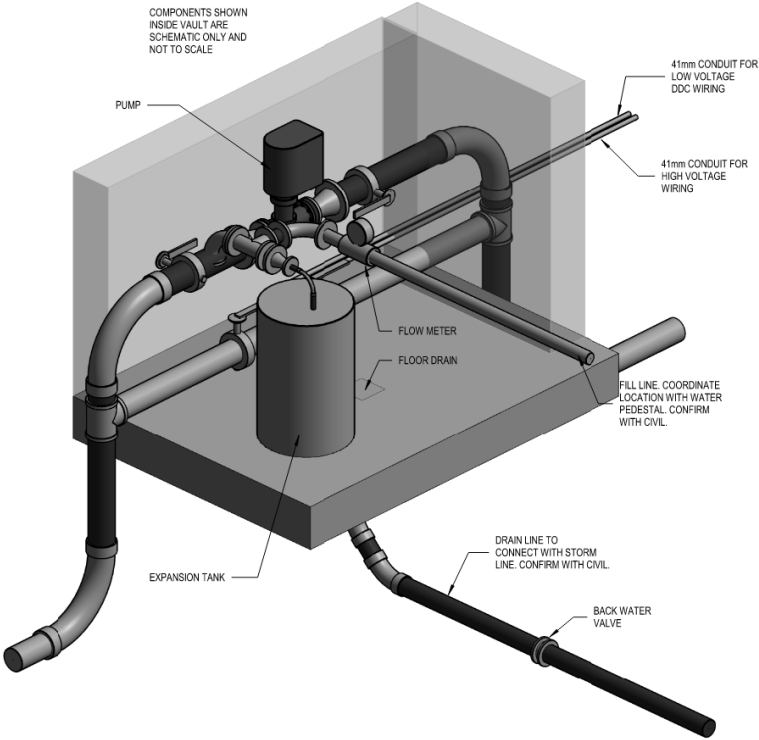
6 AMBIENT LOOP TO HOUSE PIPING DETAIL
NOT TO SCALE



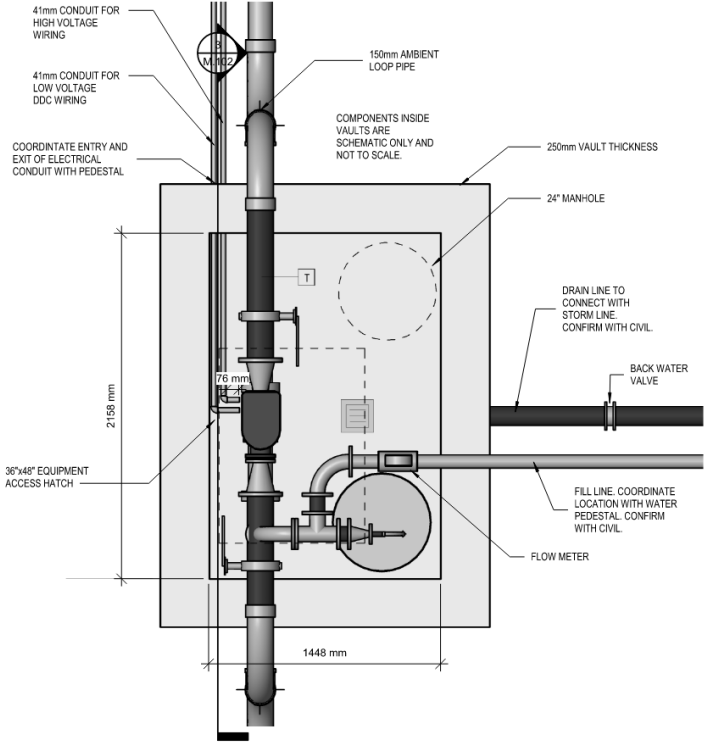
5 CURB STOP DETAIL
NOT TO SCALE

Single Family New Construction - Toronto

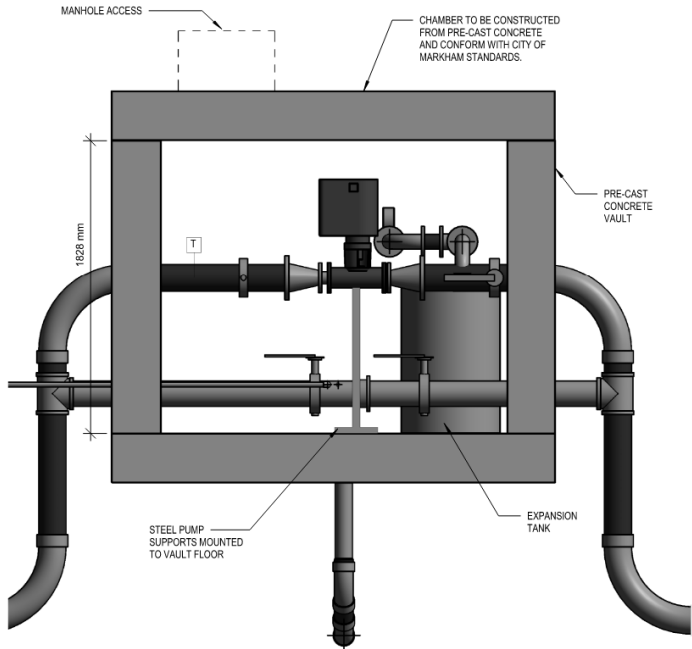
Ambient Loop – Underground Vaults



5 AMBIENT VAULT (ALP 1-4) ISOMETRIC VIEW
NOT TO SCALE

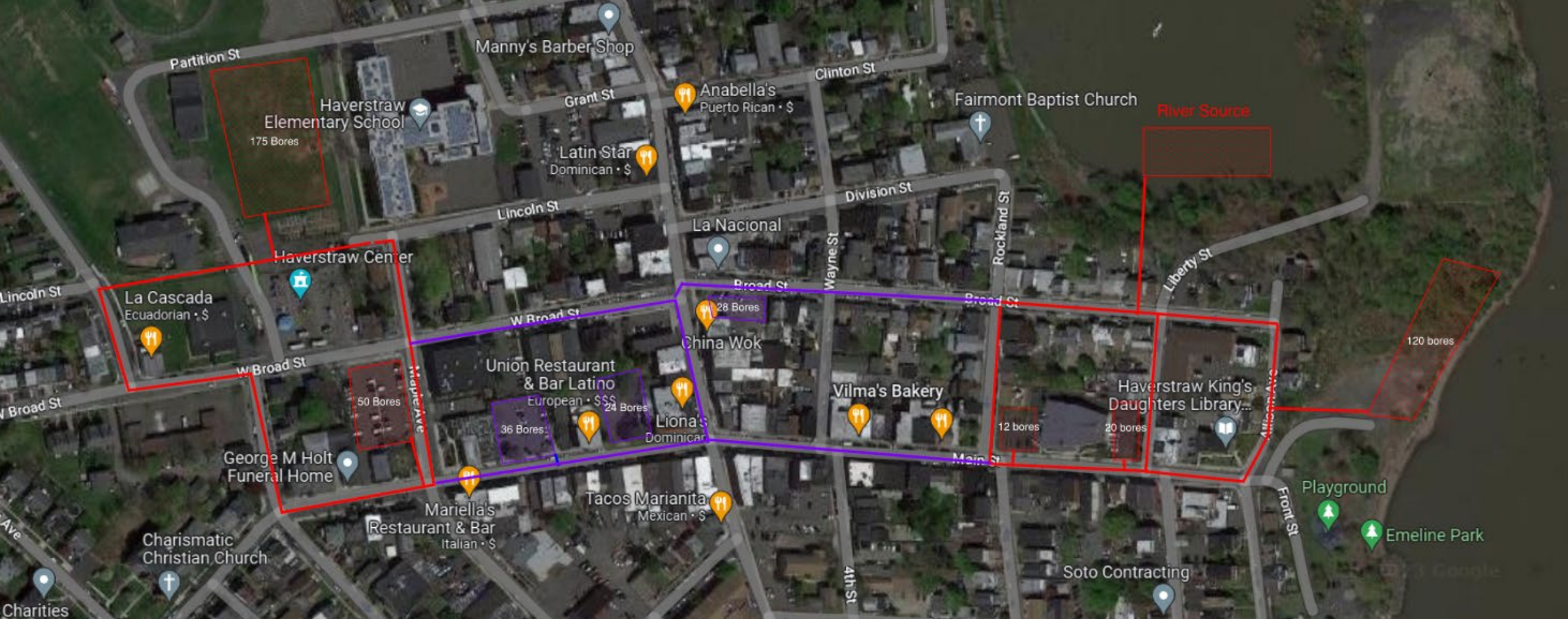


4 AMBIENT VAULT (ALP 1-4) LAYOUT
NOT TO SCALE

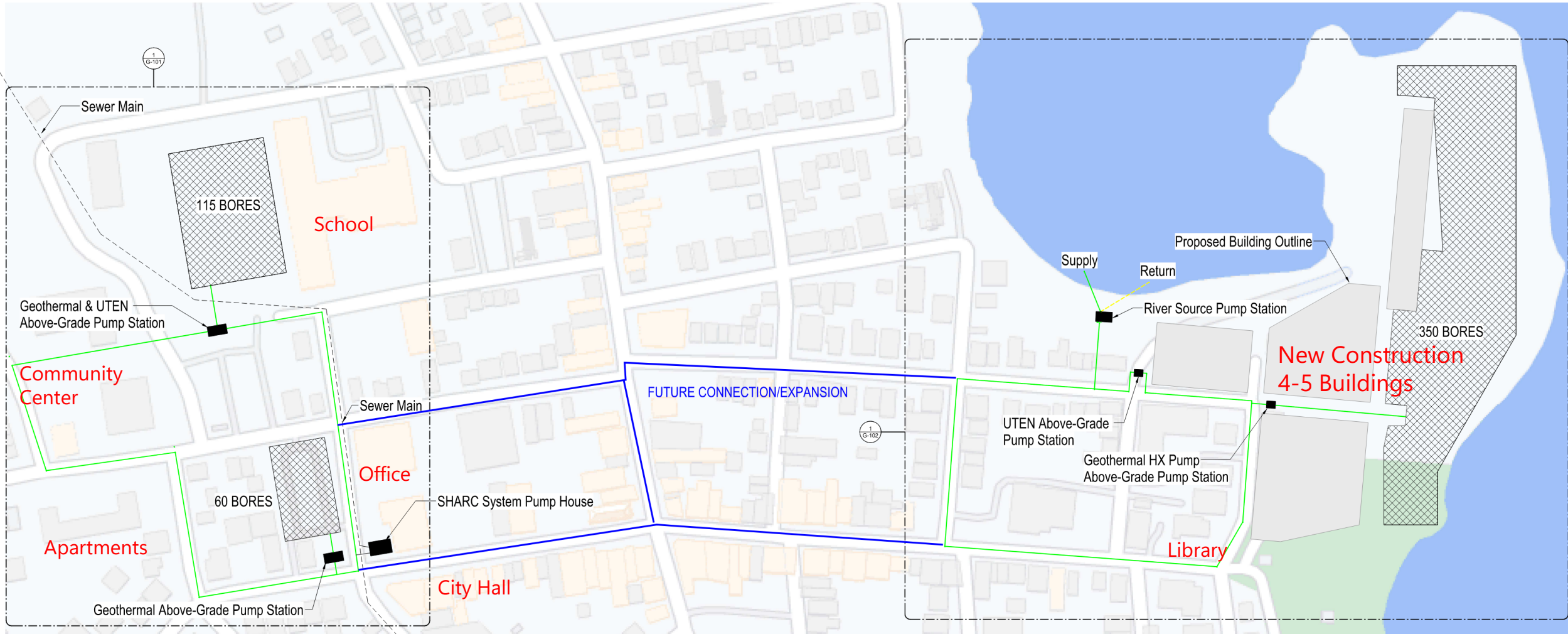


3 AMBIENT VAULT (ALP 1-4) SECTION VIEW
NOT TO SCALE

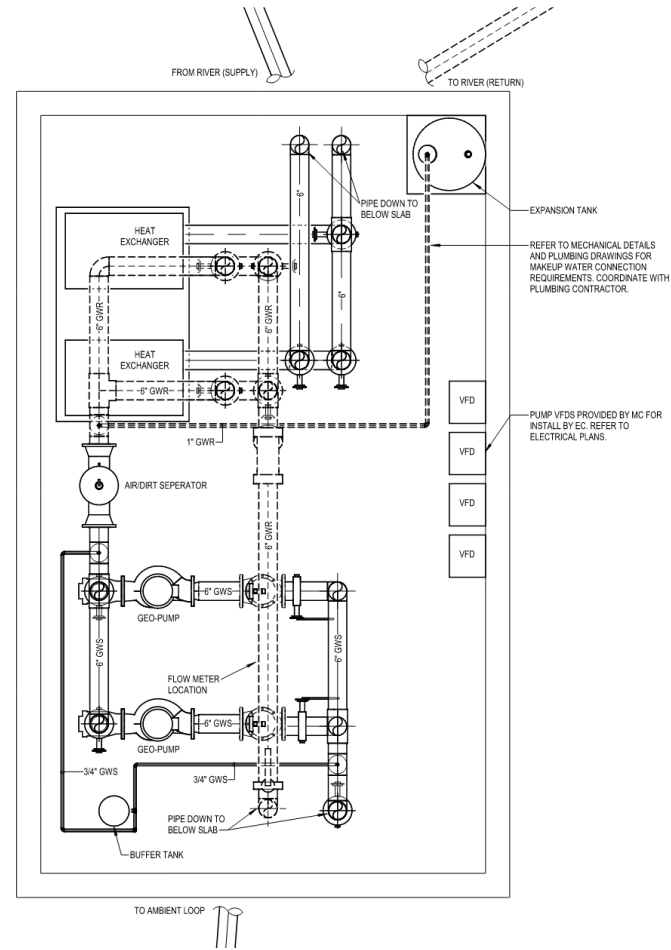
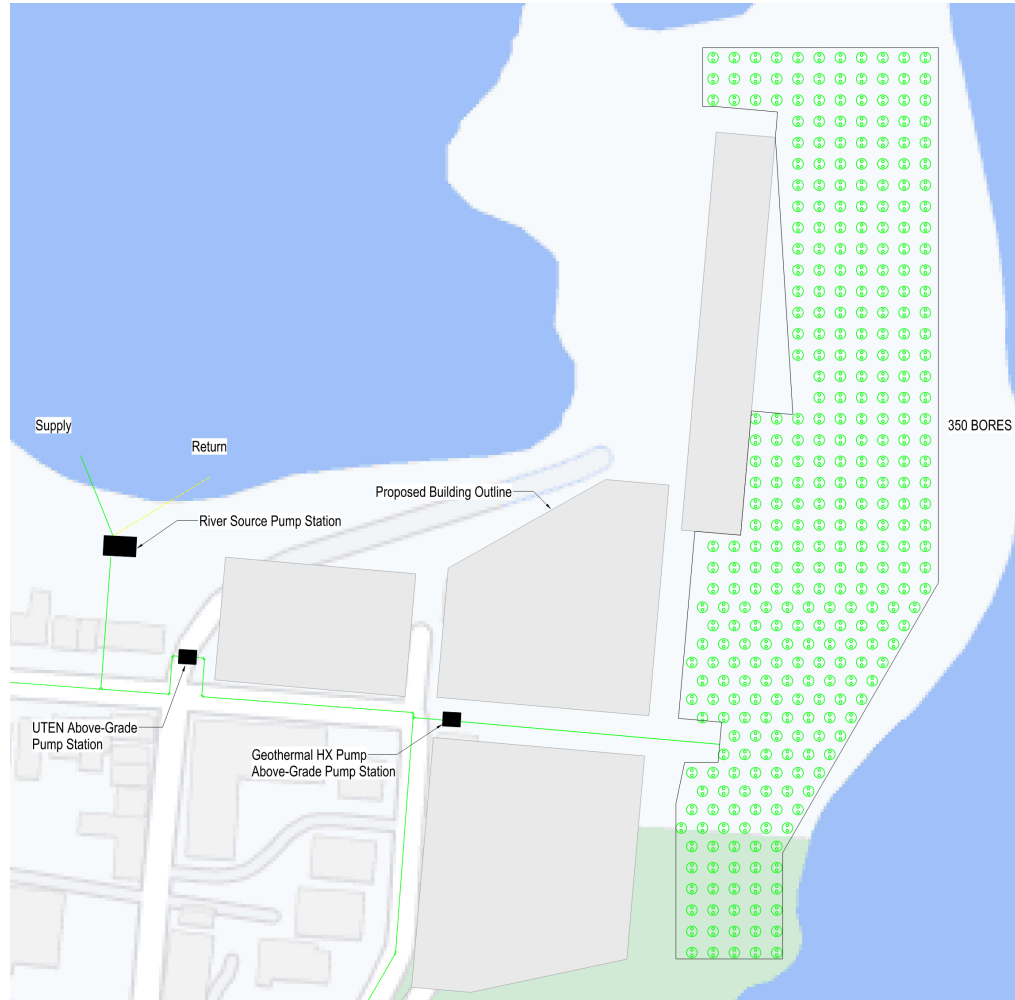
UTEN Project - NY



UTEN Project - NY

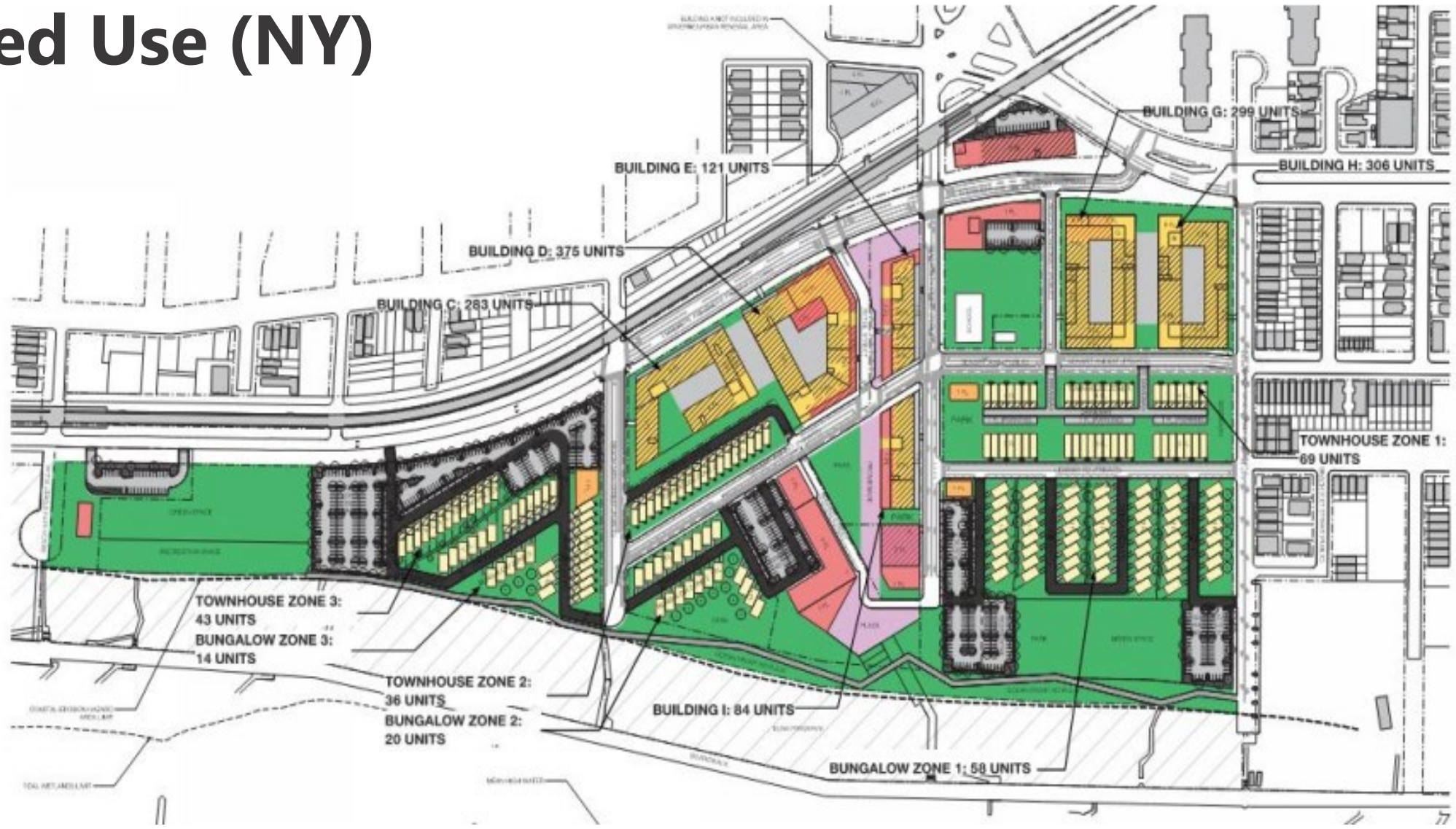


UTEN Project - NY



River Loop Vault

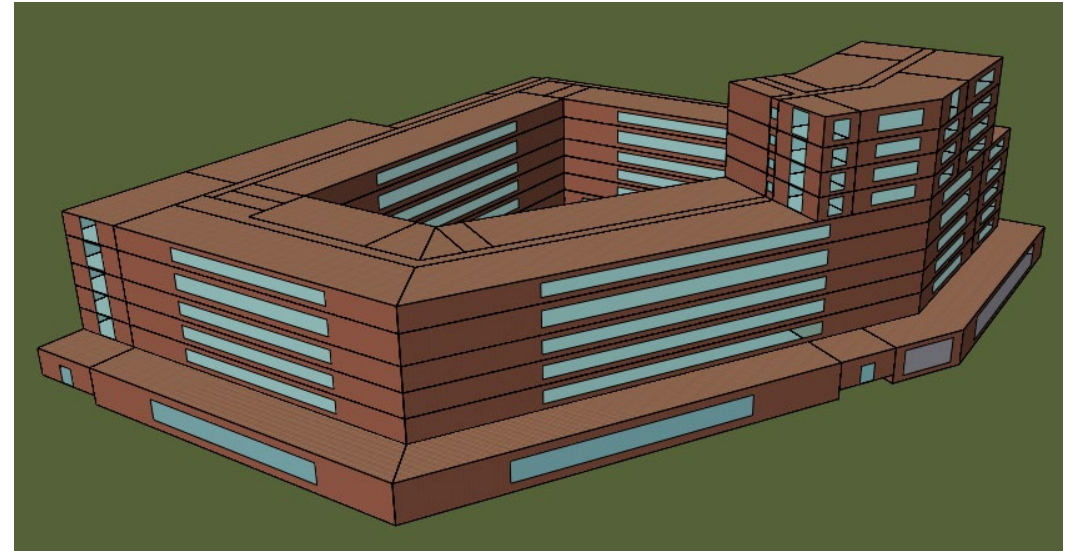
Mixed Use (NY)



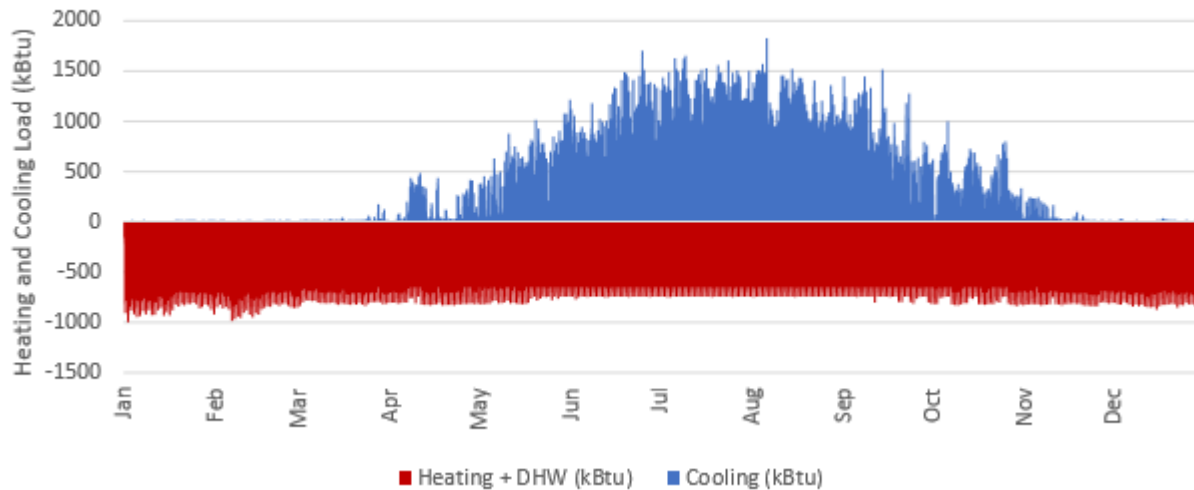
Thermal Profile Development

Multi-Family

	Annual kBtu	Peak kBtu
Domestic Hot Water	3,391,318	743
Heating	291,258	305
Cooling	2,552,620	1,828



Multi-Family Thermal Profile



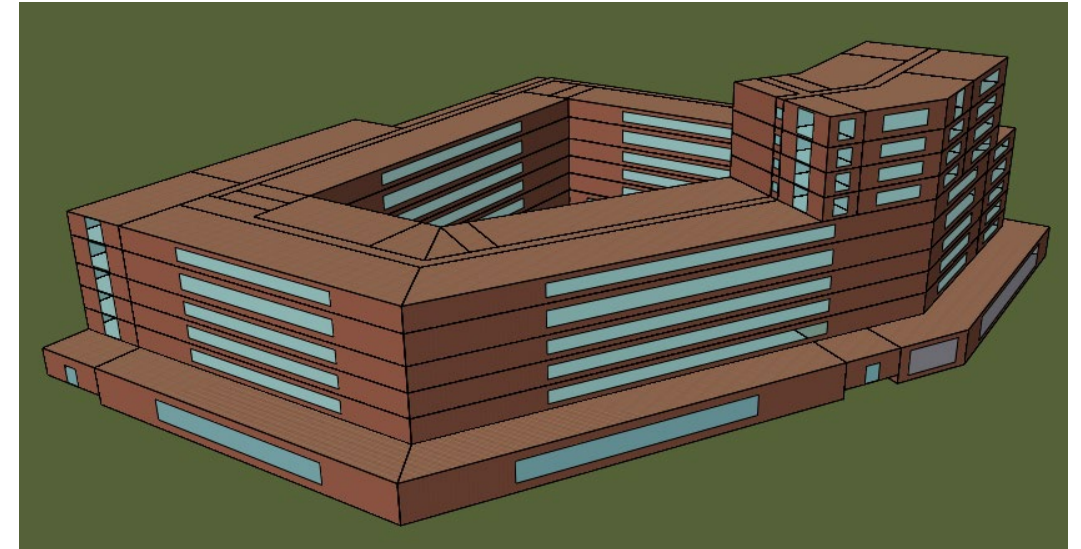
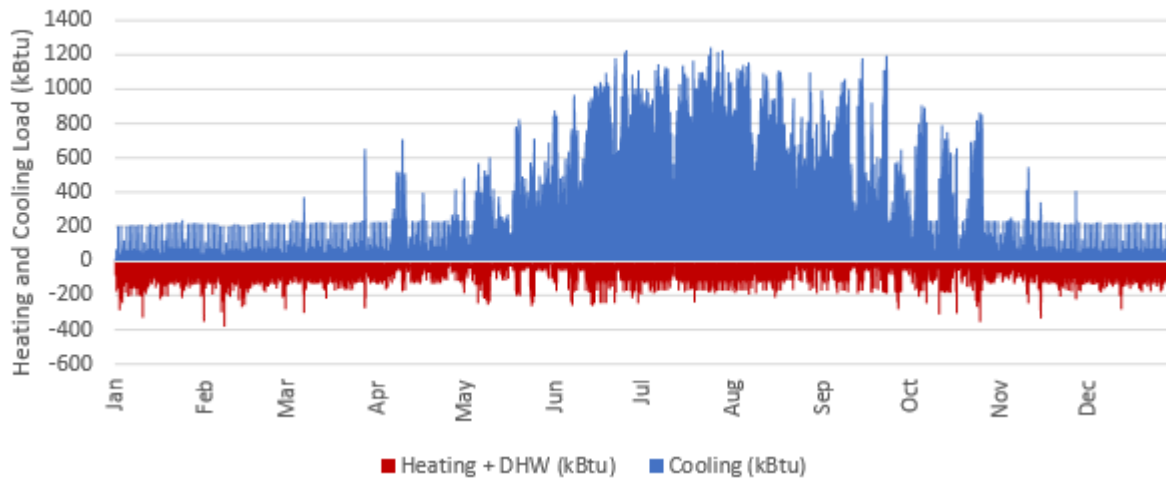
- Passive House envelope
- 317,222 ft²

Thermal Profile Development

Commercial

	Annual kBtu	Peak kBtu
Domestic Hot Water	198,871	60
Heating	344,354	382
Cooling	1,950,250	1,243

Commercial Thermal Profile

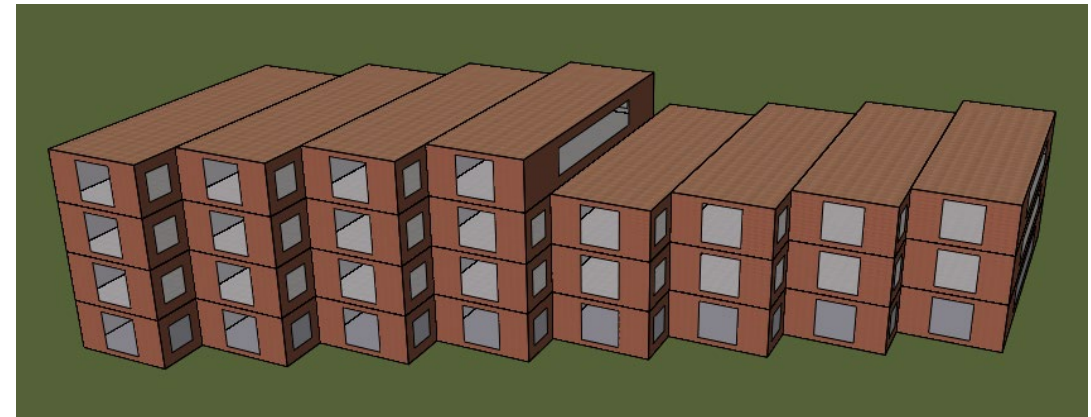
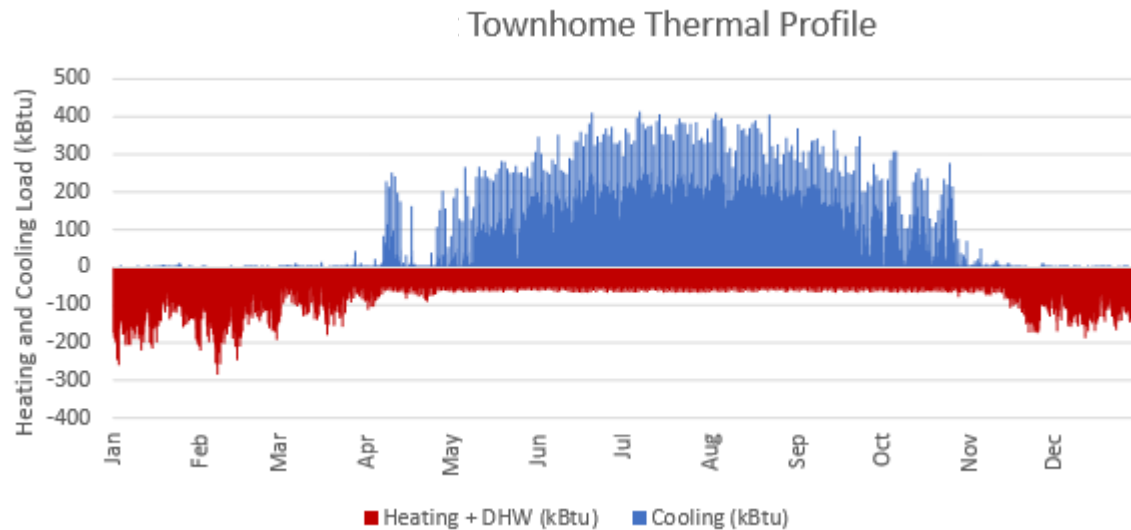


- 2020 NYC Energy Code envelope
- Office: 24,323 ft²
- Restaurant: 7,446 ft²
- Retail: 6,177 ft²

Thermal Profile Development

Town Homes

	Annual kBtu	Peak kBtu
Domestic Hot Water	275,100	60
Heating	211,051	239
Cooling	431,781	414

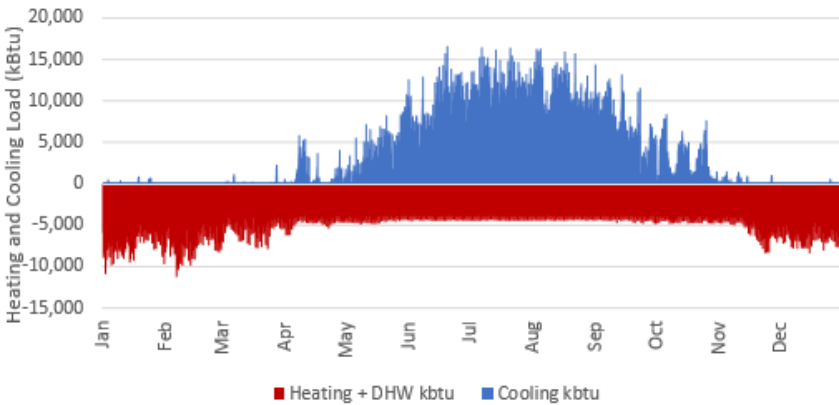


- 2020 NYC Energy Code envelope
- 33,600 ft²

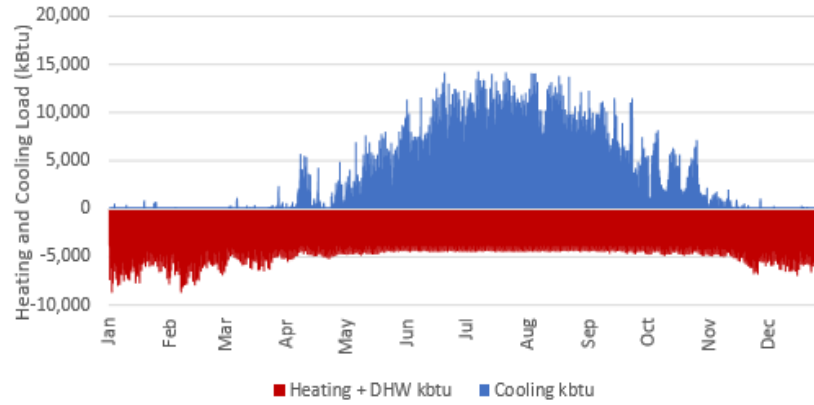
Thermal Profile Development

District Thermal Profile

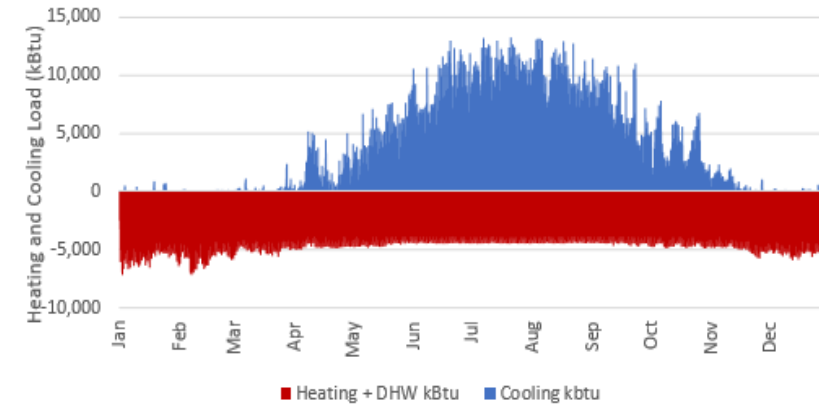
Baseline



Multi-Family Passive House



All Residential Passive House



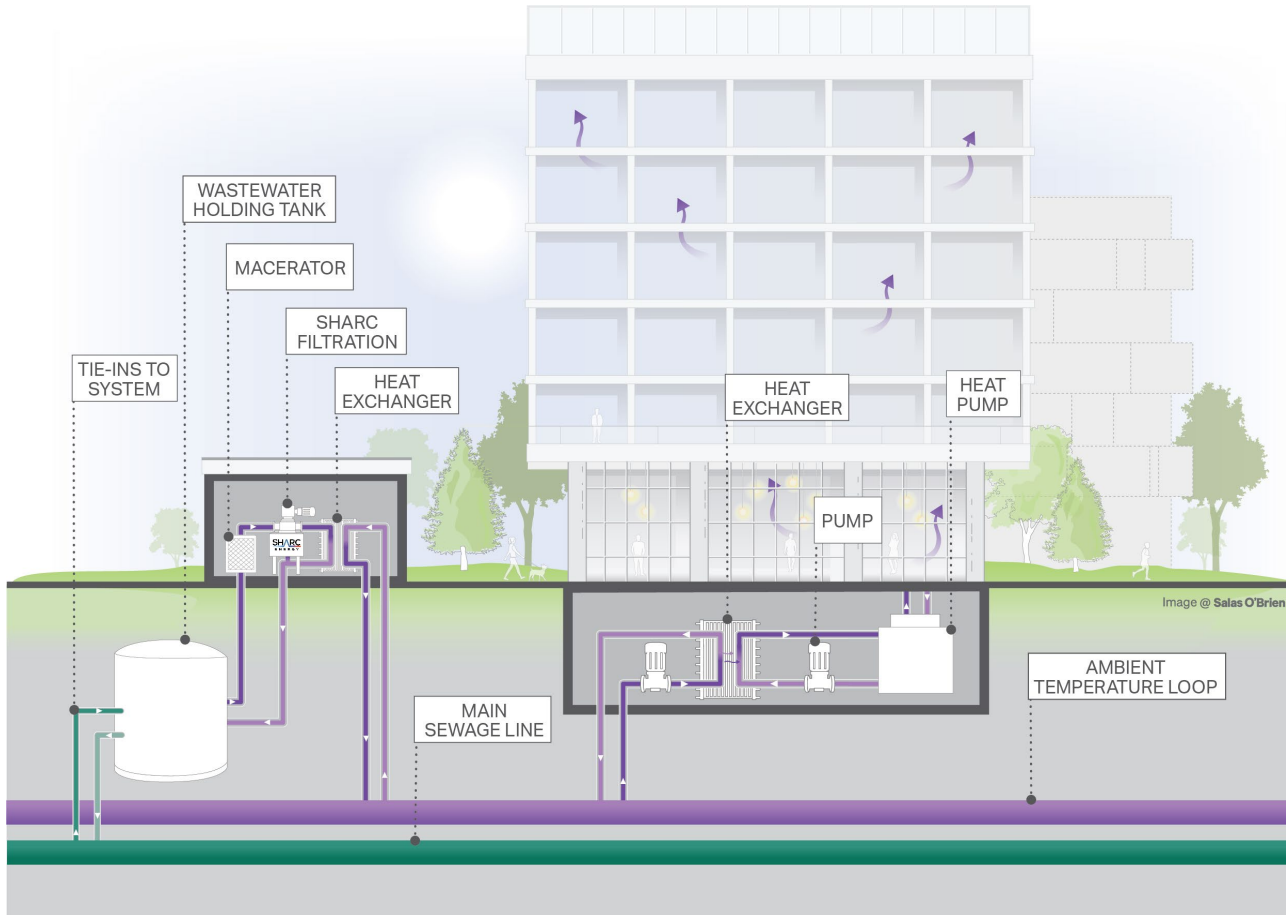
	Annual kBtu	Peak kBtu/h
Domestic Hot Water	20,455,607	4,365
Heating	8,772,480	7,818
Cooling	21,975,988	16,621 (1,385 tons)

	Annual kBtu	Peak kBtu/h
Domestic Hot Water	20,455,607	4,365
Heating	5,640,964	4,939
Cooling	20,913,824	14,282 (1,190 tons)

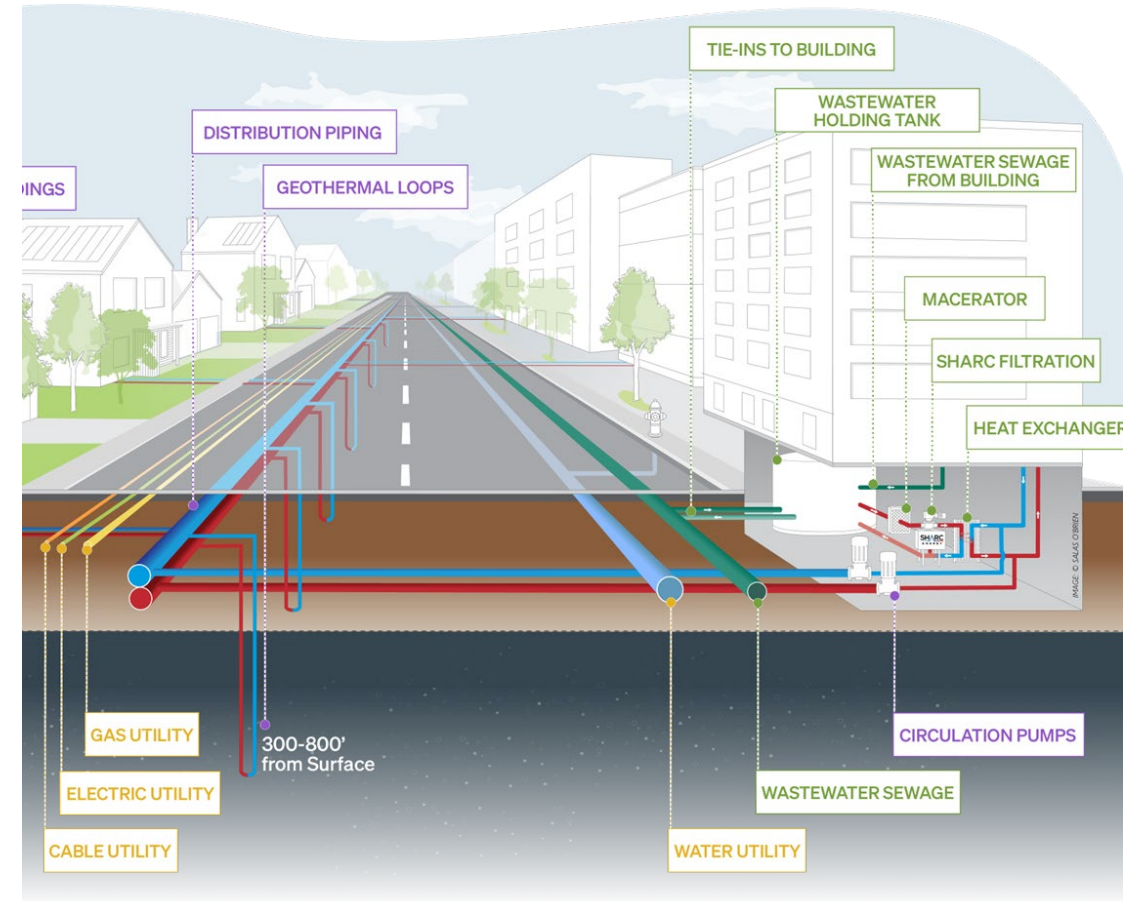
	Annual kBtu	Peak kBtu/h
Domestic Hot Water	20,455,607	4,365
Heating	3,706,275	3,857
Cooling	20,172,766	13,274 (1,106 tons)

Thermal Energy Systems (Multi-Source)

WET system serving the ATL



WET system serving the Building

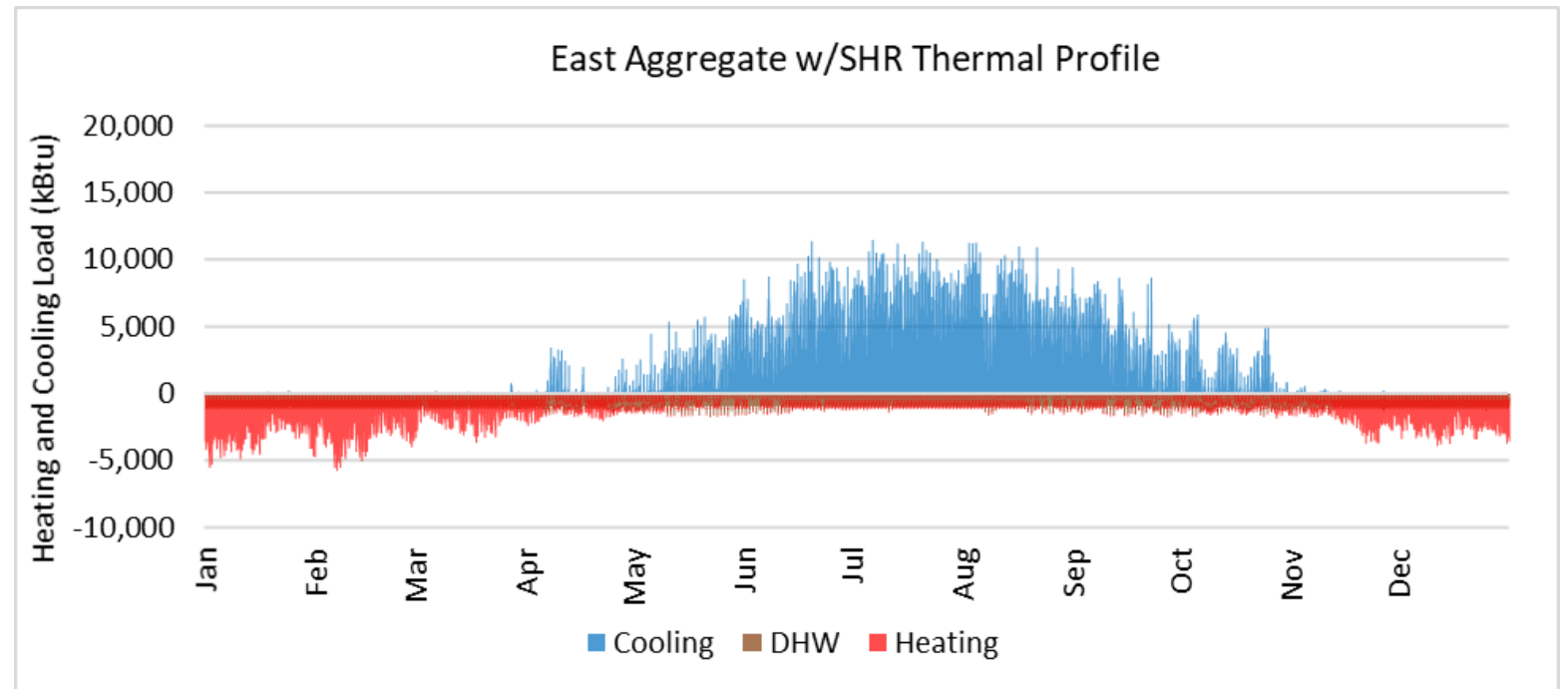


Thermal Profile Development

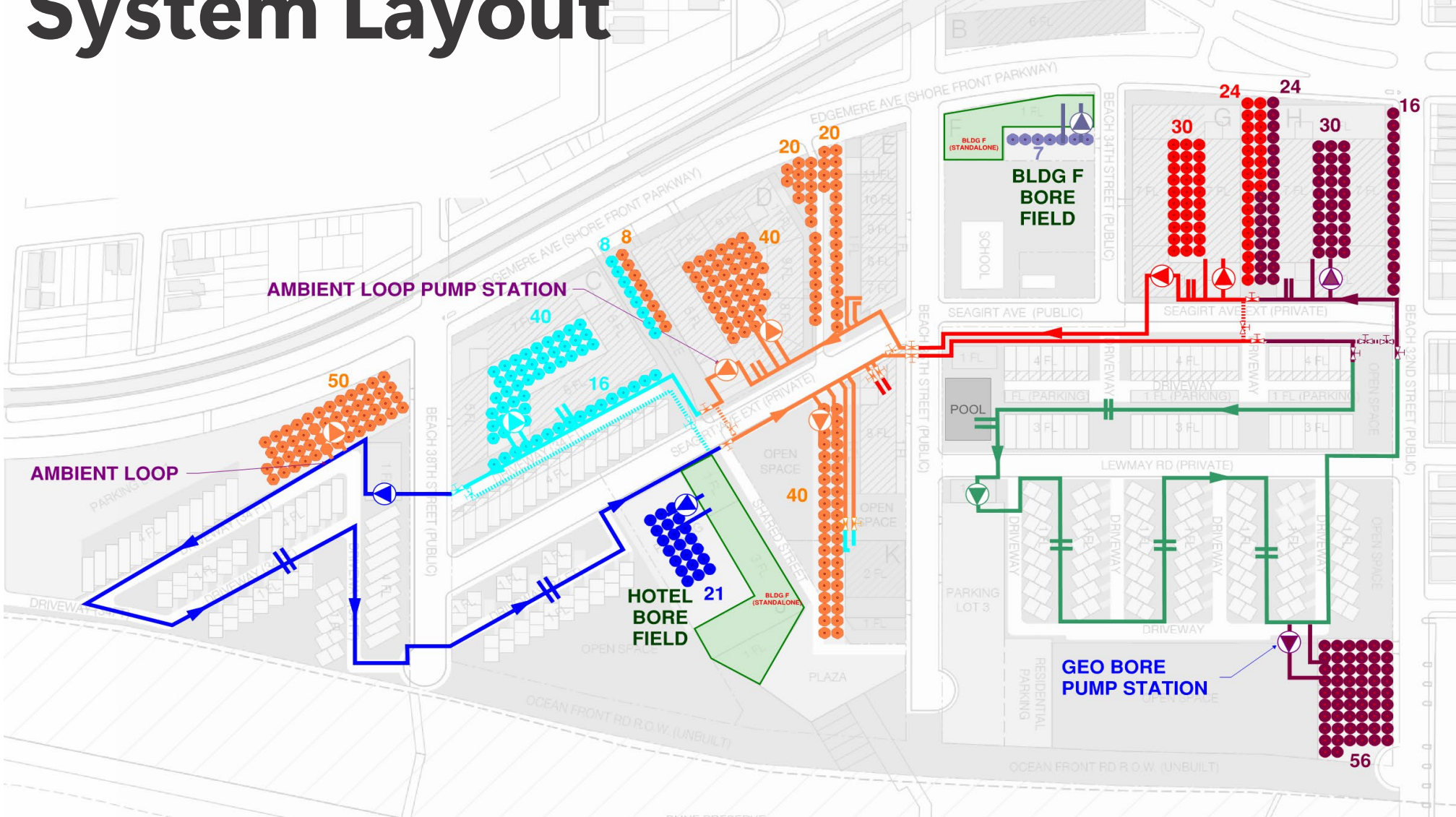
District Thermal Profile w/ Waste-Water Heat Recovery

Proposed wSHR Load Summary		
Load	Annual (kBtu)	Peak (kBtu/h)
DHW	5,227,571	1,678
Heating	5,250,259	4,939
Cooling	14,344,443	11,453

Proposed Load Summary		
Load	Annual (kBtu)	Peak (kBtu/h)
DHW	20,455,607	4,365
Heating	5,640,964	4,939
Cooling	20,913,824	14,282

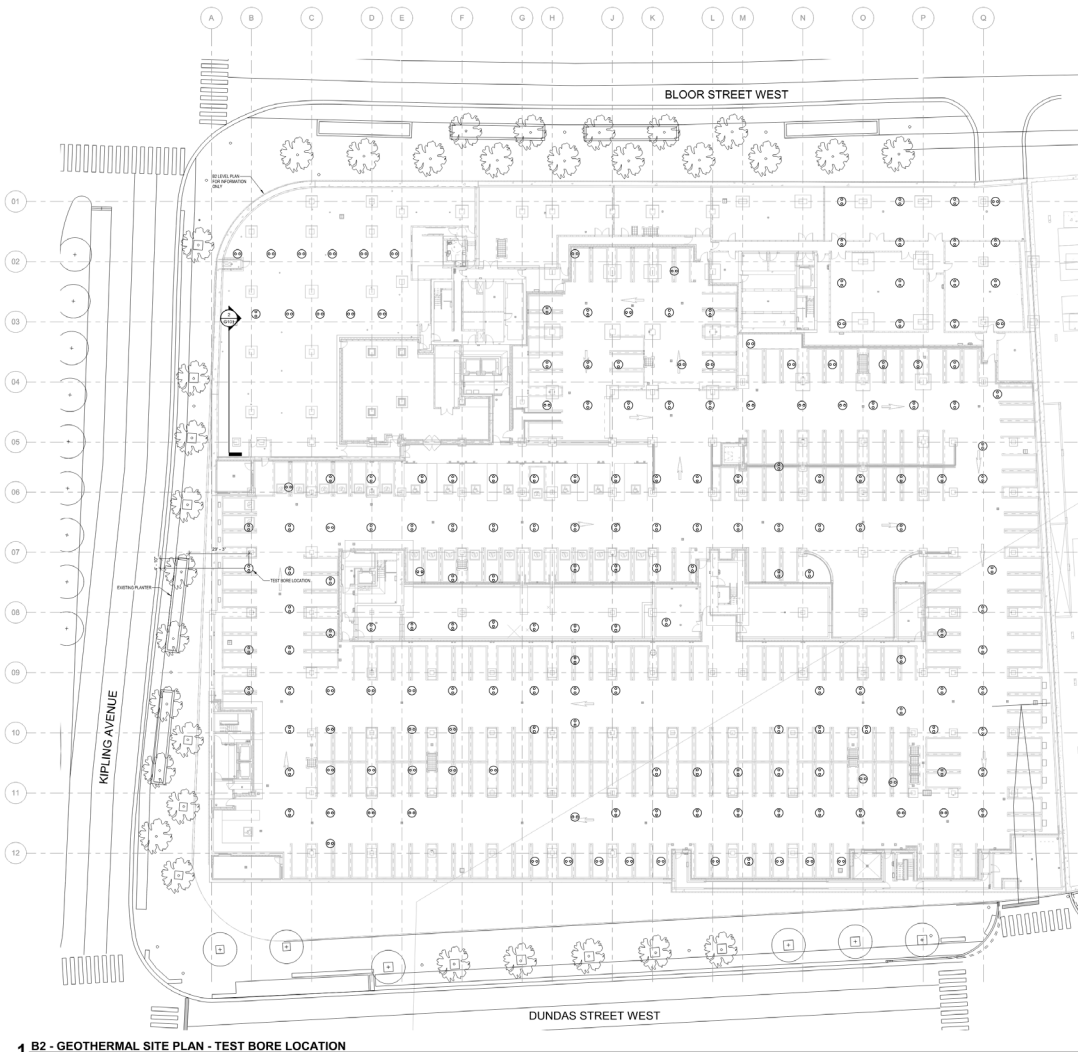


TEN System Layout

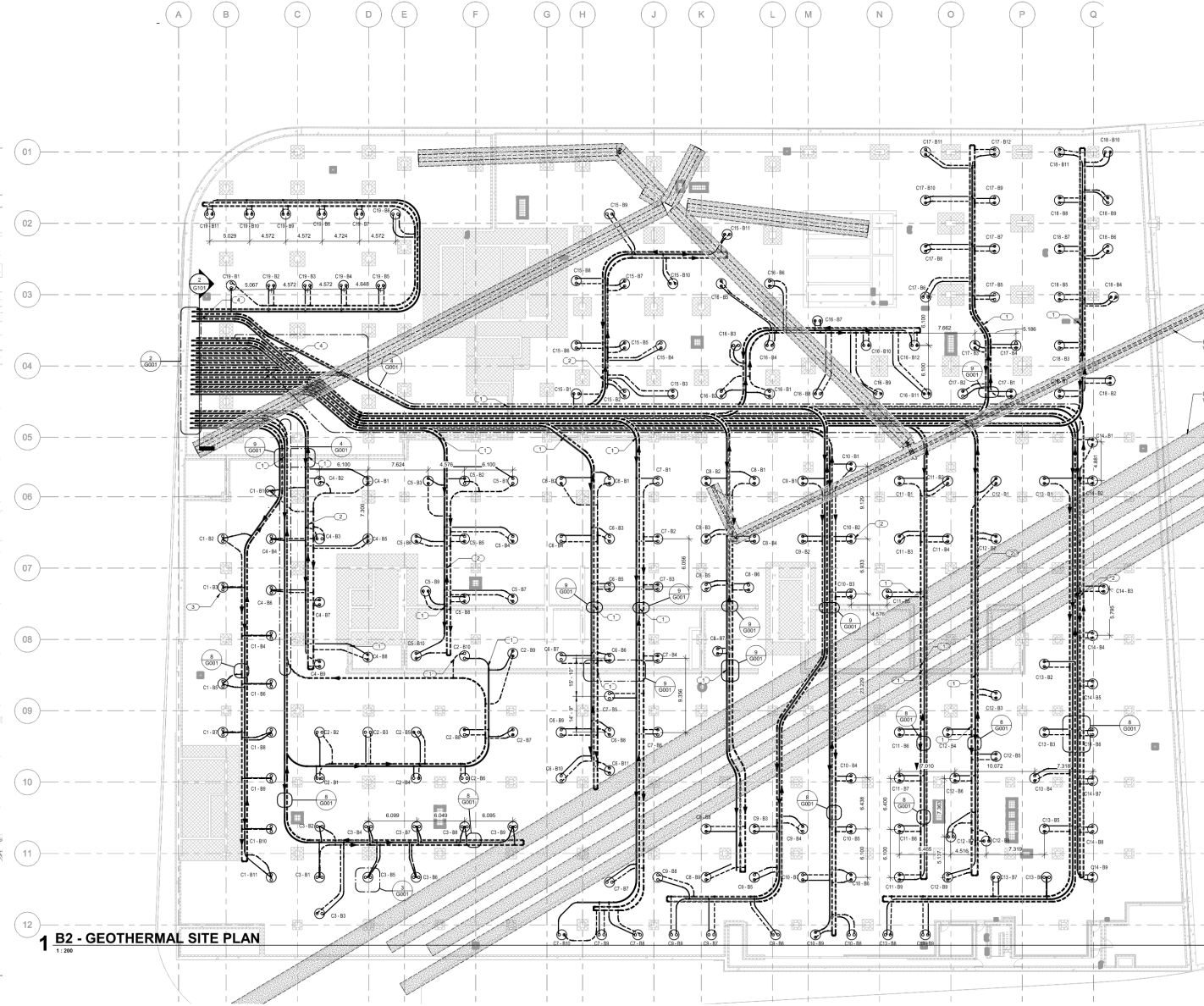


Phased Construction and Expansion

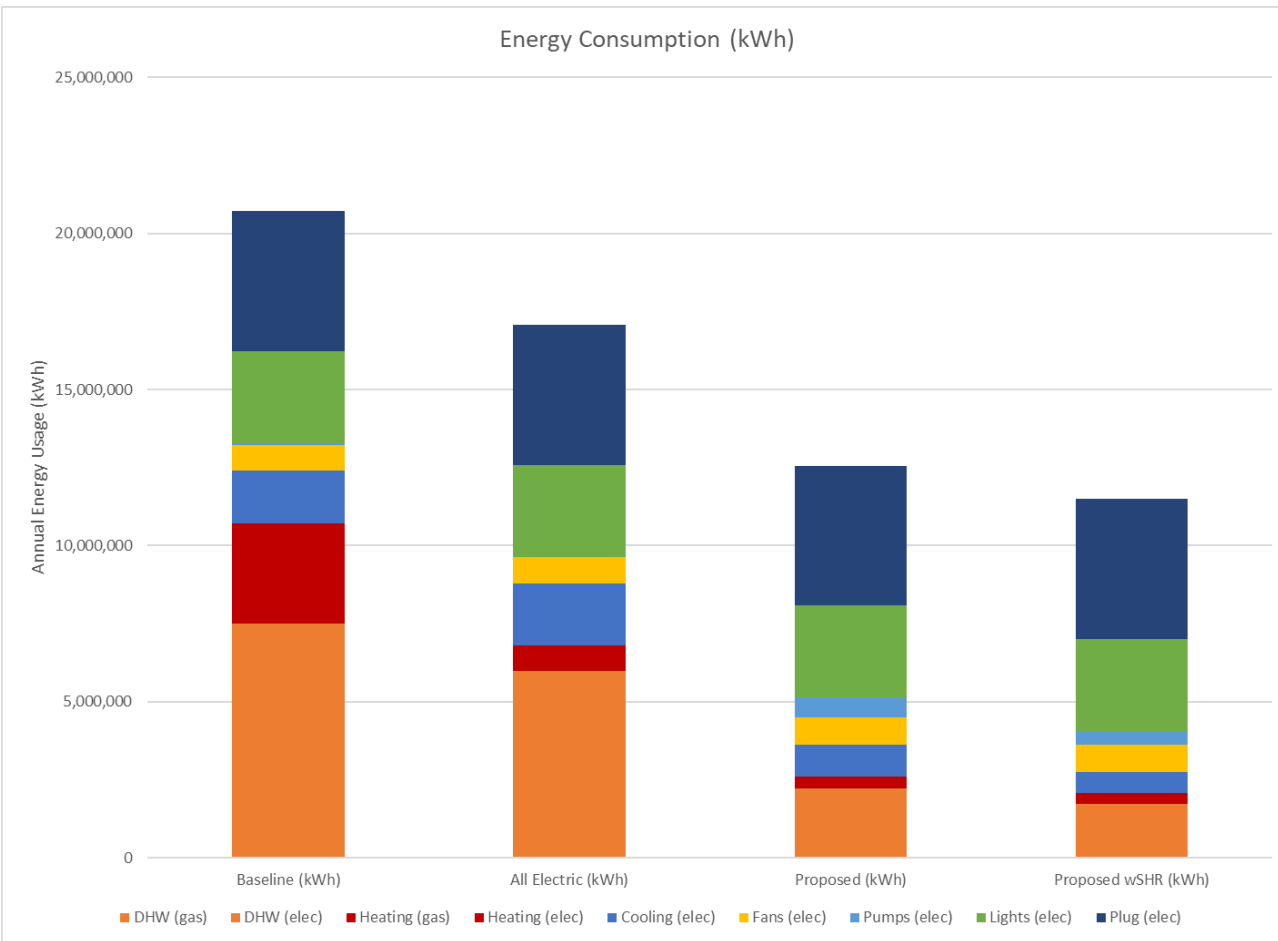
BORE FIELD DESIGN



1 B2 - GEOTHERMAL SITE PLAN - TEST BORE LOCATION



Energy Consumption

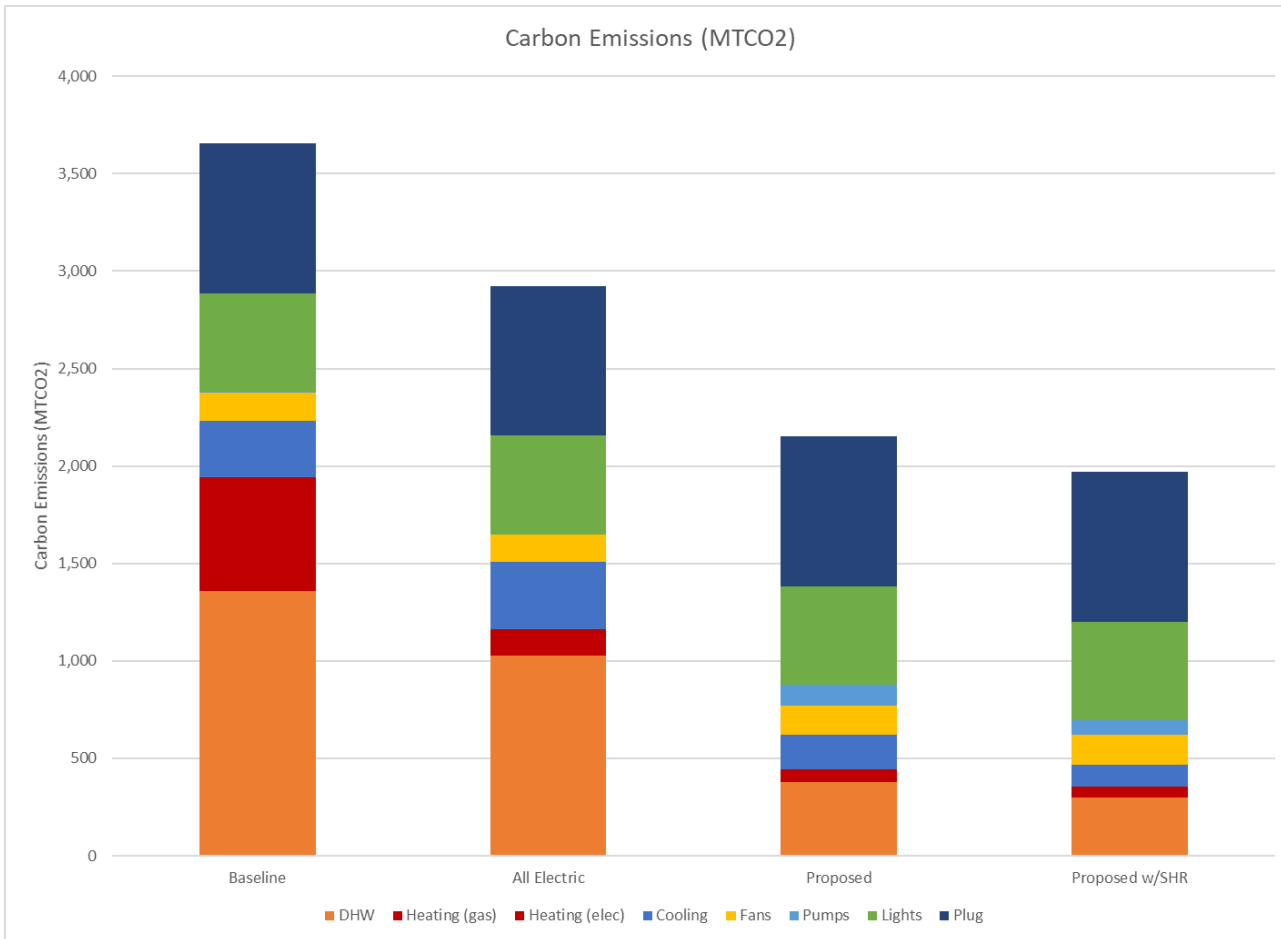


	Energy (kWh)			
	Baseline	All Elec	Proposed	Proposed wSHR
DHW*	7,493,687	5,994,950	2,210,237	1,736,028
Heating*	3,213,702	803,425	382,305	338,268
Cooling	1,690,461	1,997,817	1,024,450	664,942
Fans	833,304	833,304	888,934	888,934
Pumps	37,760	7,598	616,133	434,412
Lights	2,947,364	2,947,364	2,947,364	2,947,364
Plug	4,491,528	4,491,528	4,491,528	4,491,528
Total	20,707,806	17,075,986	12,560,951	11,501,477
HVAC Savings*	-	27%	61%	69%
Total Savings	-	3,631,820	8,146,854	9,206,329
Total Savings	-	18%	39%	44%

* Baseline DHW and Townhome/Bungalow heating are natural gas, but were converted to kWh for comparison purposes

**HVAC savings include heating, cooling, and DHW energy usage

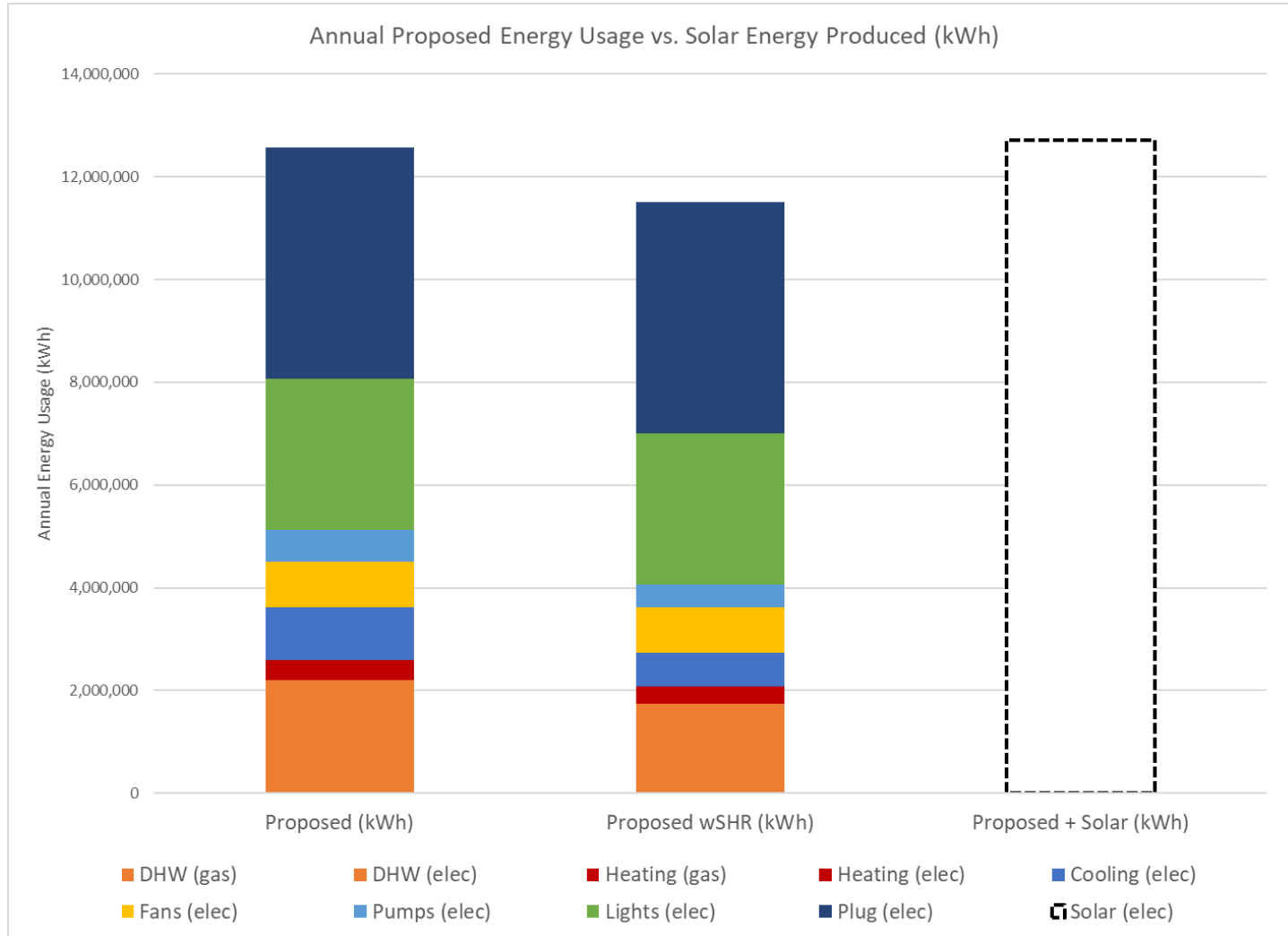
Carbon Emissions



Carbon Emissions (MTCO ₂)				
	Baseline	All Elec	Proposed	Proposed wSHR
DHW	1,360	1,027	378	297
Heating	583	138	65	58
Cooling	289	342	175	114
Fans	143	143	152	152
Pumps	6	1	106	74
Lights	505	505	505	505
Plug	769	769	769	769
Total	3,655	2,924	2,151	1,970
Total Savings	-	731	1,504	1,686
	-	20%	41%	46%
GHG/SF	0.00185	0.00148	0.00109	0.00100

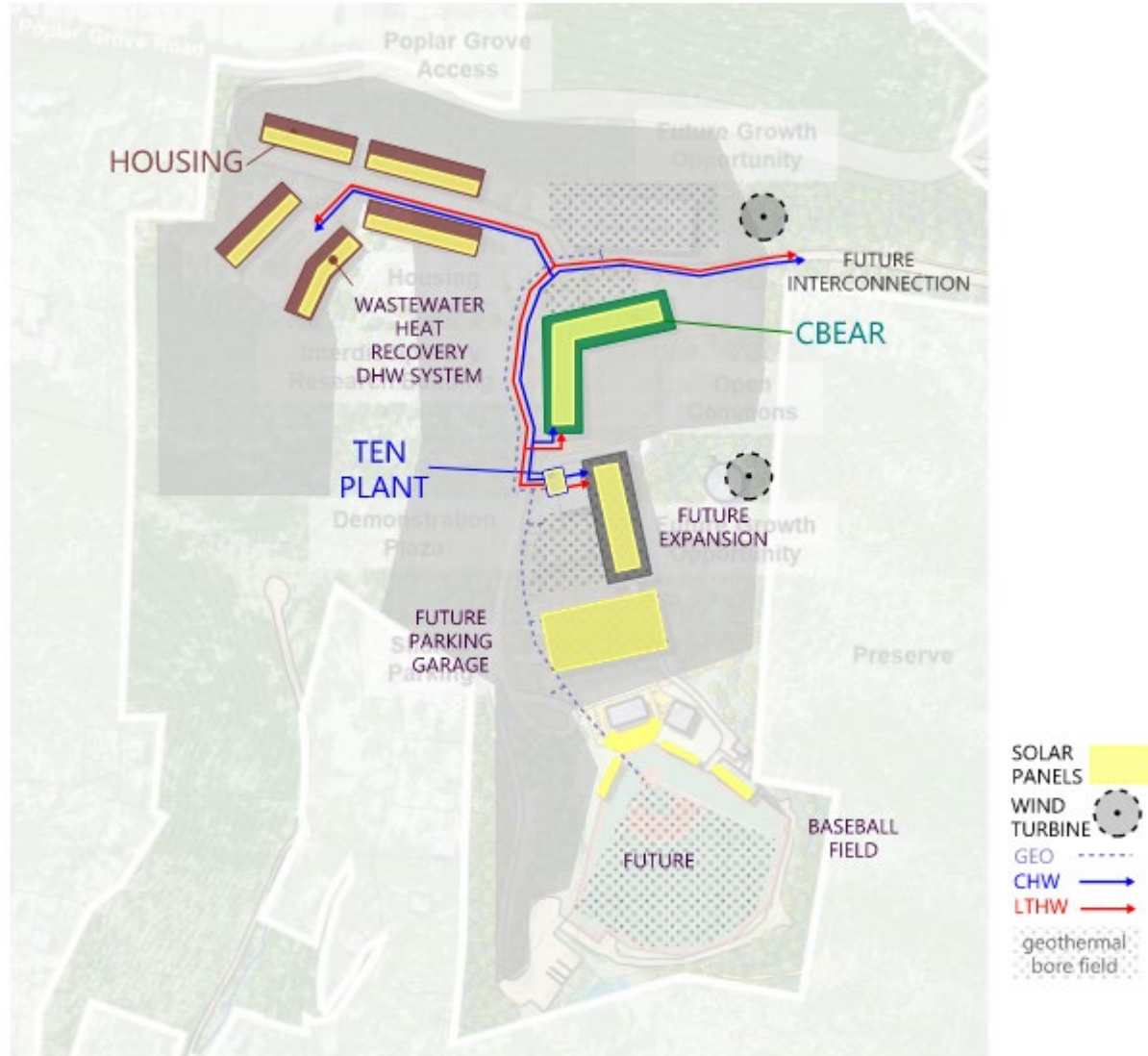
LL97 Emission Limits	
Year	MTCO ₂ /SF
2024-2029	0.00675
2030-2034	0.00407
2050	0.0014

Carbon Emissions



	Energy (kWh)	
	Proposed	Proposed wSHR
DHW	2,210,237	1,736,028
Heating	382,305	338,268
Cooling	1,024,450	664,942
Fans	888,934	888,934
Pumps	616,133	434,412
Lights	2,947,364	2,947,364
Plug	4,491,528	4,491,528
Total	12,560,951	11,501,477
Max Solar Generation:		12,719,970
Total Savings (Net	-159,019	-1,218,493
kW Installed	10,497	9,492
Potential kW Reduction		1,005
Reduced Area		Parking Lot 3

Net Zero Campus – Public Private Partnership (P3)



INNOVATION DISTRICT - DISTRICT ENERGY SYSTEM

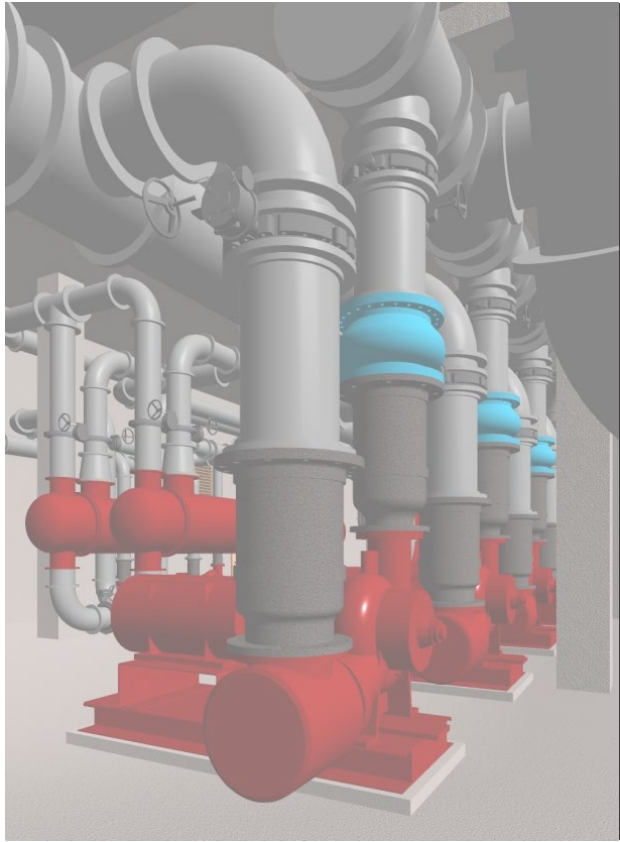
Central Thermal Plant & Distribution System

- Distributed vertical closed loop geothermal
- 4-pipe low temp hot water and chilled water system
- Decentralized wastewater heat recovery DHW

Renewable Power Generation

- Wind Turbines
- Distributed roof mounted PV

University Operated Public Utility

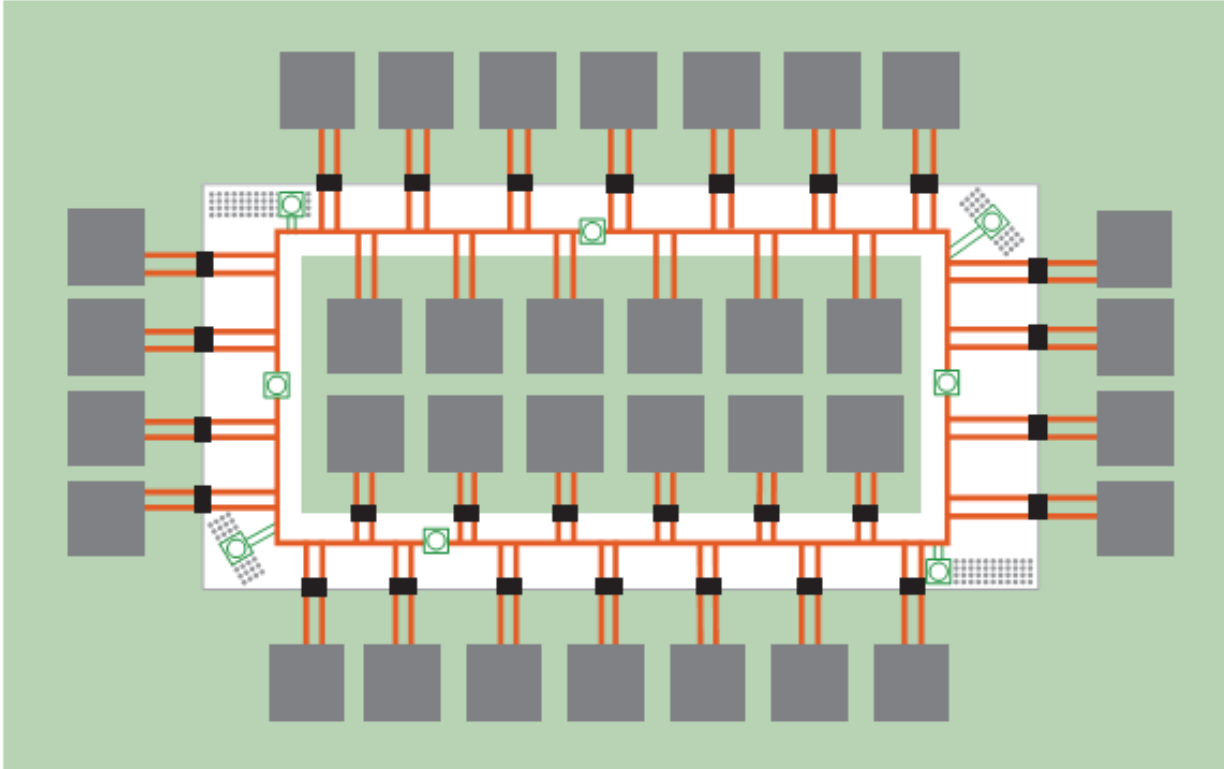


Q & A?

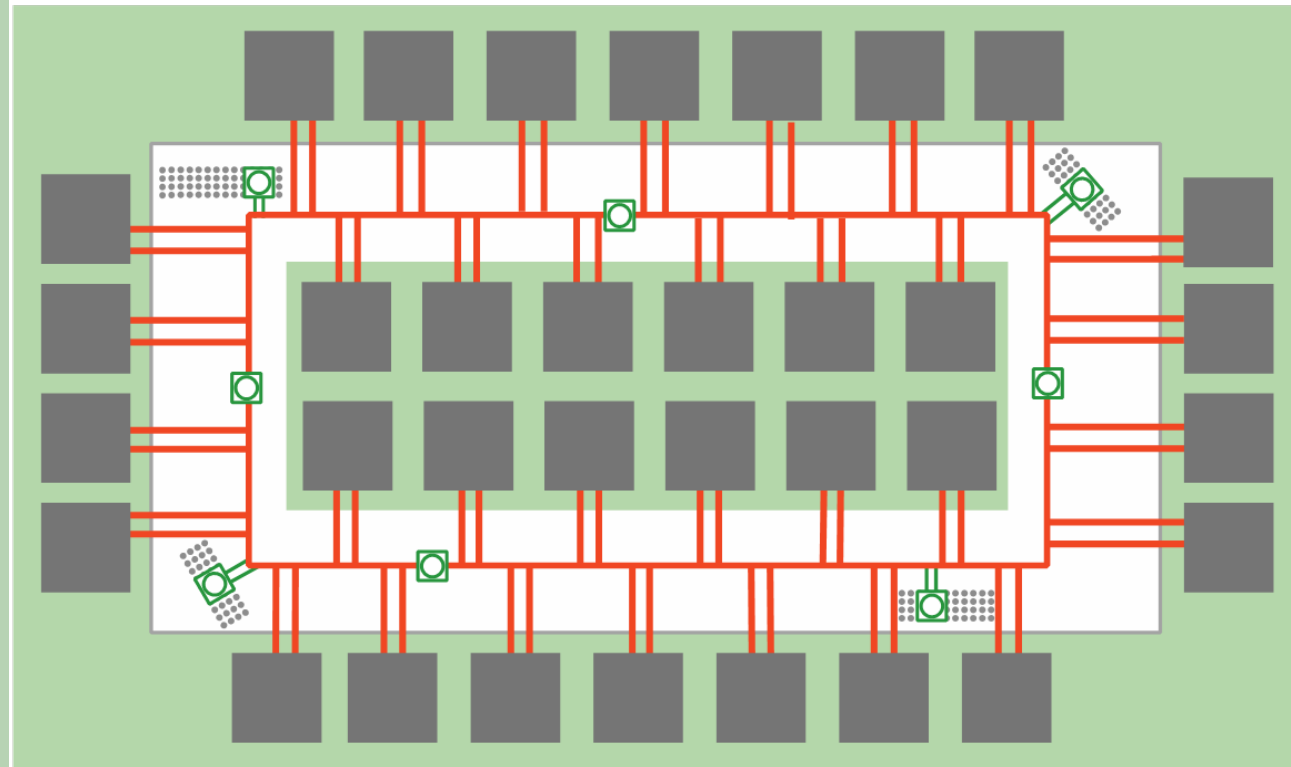
Thank You!

- Contact Information | bill.talbert@salasobrien.com

Utility Scale Models



Distributed HX w/ interconnection w/ ETS



Distributed HX w/ interconnection w/o ETS

TEN with SHR/WET System

