

Geothermal Design Belmont High School

Town of Belmont

March 13, 2019

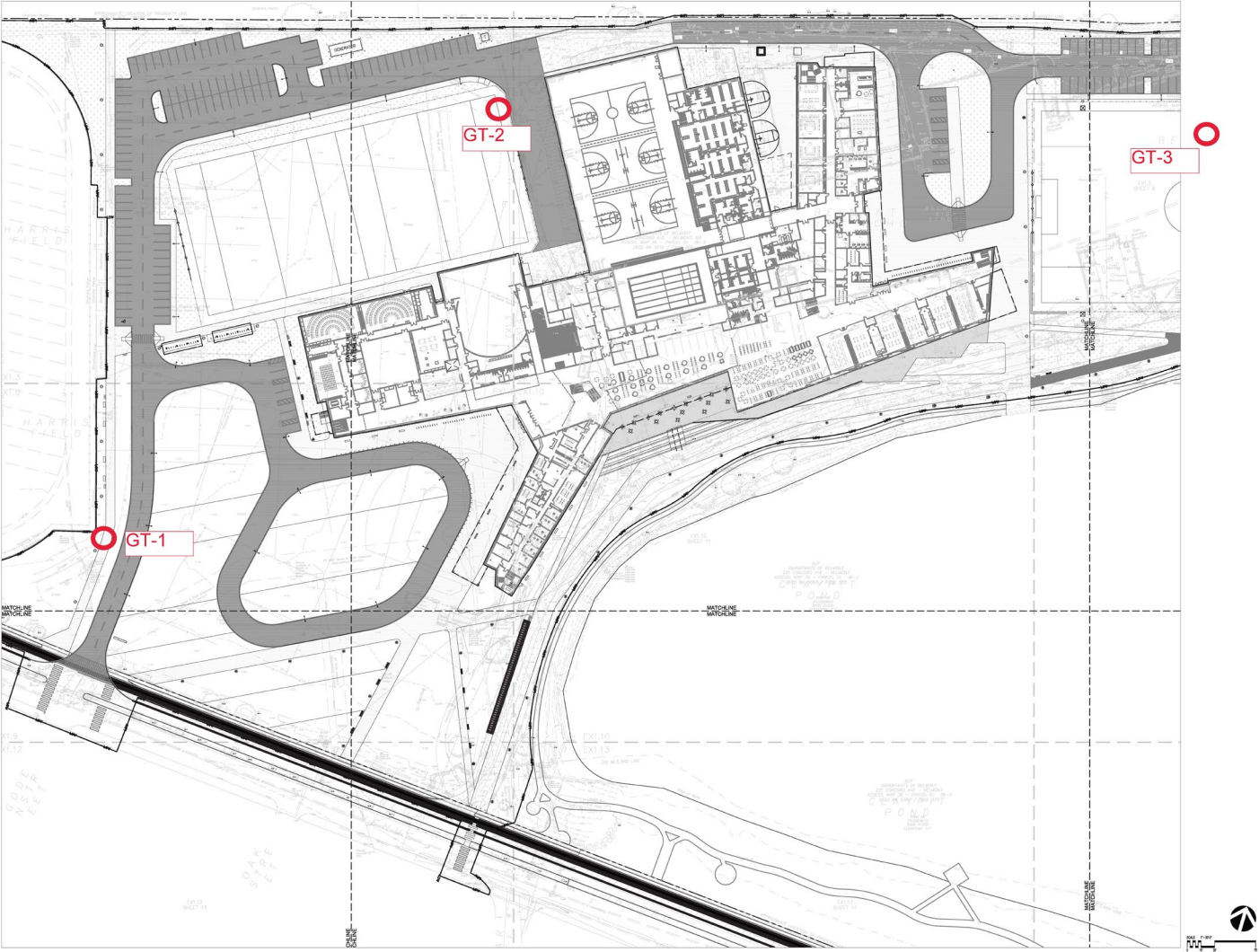


**CDM
Smith**

Geothermal Design

- Well Installation & Thermal Conductivity Testing
- HVAC Loads
- Modeling

Test Well Locations



Well Installation & Thermal Conductivity Testing





Thermal Conductivity Results

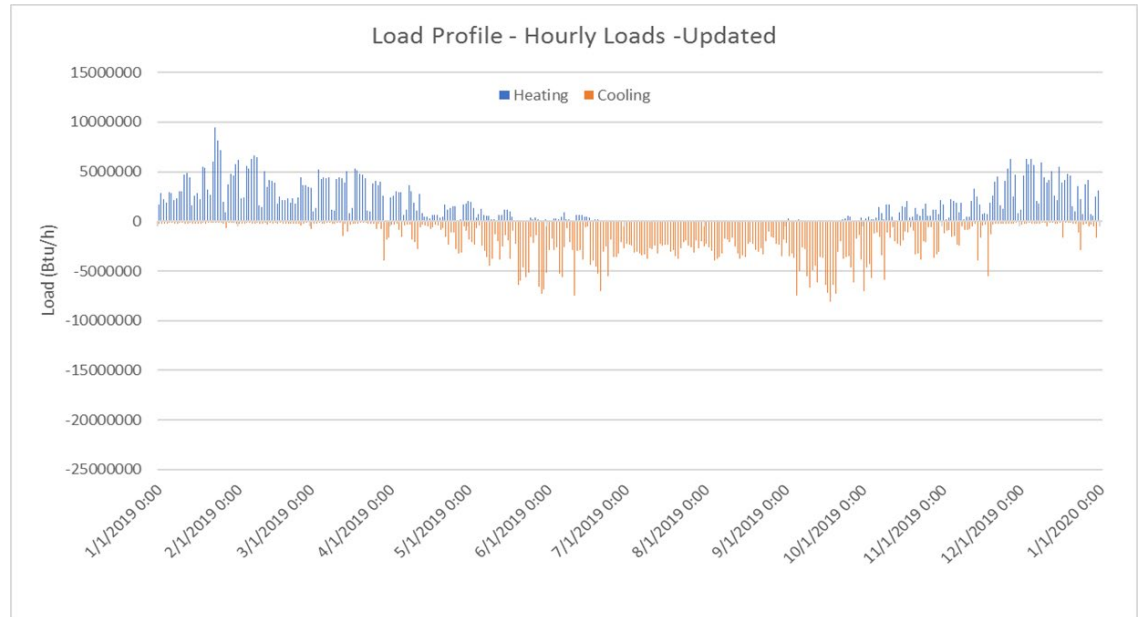
Summary of Thermal Conductivity Tests - BHS Geothermal Well Field

Parameters	Boring #			Average
	GT-01	GT-02	GT-03	
Earth Temp °F	53.0 - 54.0	53.6 - 54.2	53.8 - 55.0	53.9
Earth Diffusivity α_g ft ² /day	1.19	1.24	1.14	1.19
Volumetric heat capacity Btu/°F ft ³	35.0	34.9	35.0	35.0
Earth Conductivity k_g Btu/hr.ft. °F	1.74	1.8	1.67	1.74

Energy Loads

Monthly Total and Peak Loads - Based on hourly loads provided by In Posse - 03/05/2019

	Total Loads [1000 Btu]		Peak Loads [1000 Btu/h]	
	Heating	Cooling	Heating	Cooling
January	1,113,309	82,540	9,147	677
February	717,698	77,681	6,636	399
March	619,013	123,122	5,274	4,441
April	326,467	223,131	3,592	3,506
May	160,606	847,992	2,093	9,130
June	111,526	794,894	979	9,386
July	80,726	586,567	143	4,311
August	80,751	577,140	150	4,302
September	89,109	1,145,956	673	9,704
October	209,208	598,624	1,967	8,539
November	449,215	222,232	6,214	5,651
December	663,859	102,258	6,270	1,685
Year_Total	4,621,486	5,382,135		
Delta	(760,648)			



Modeling

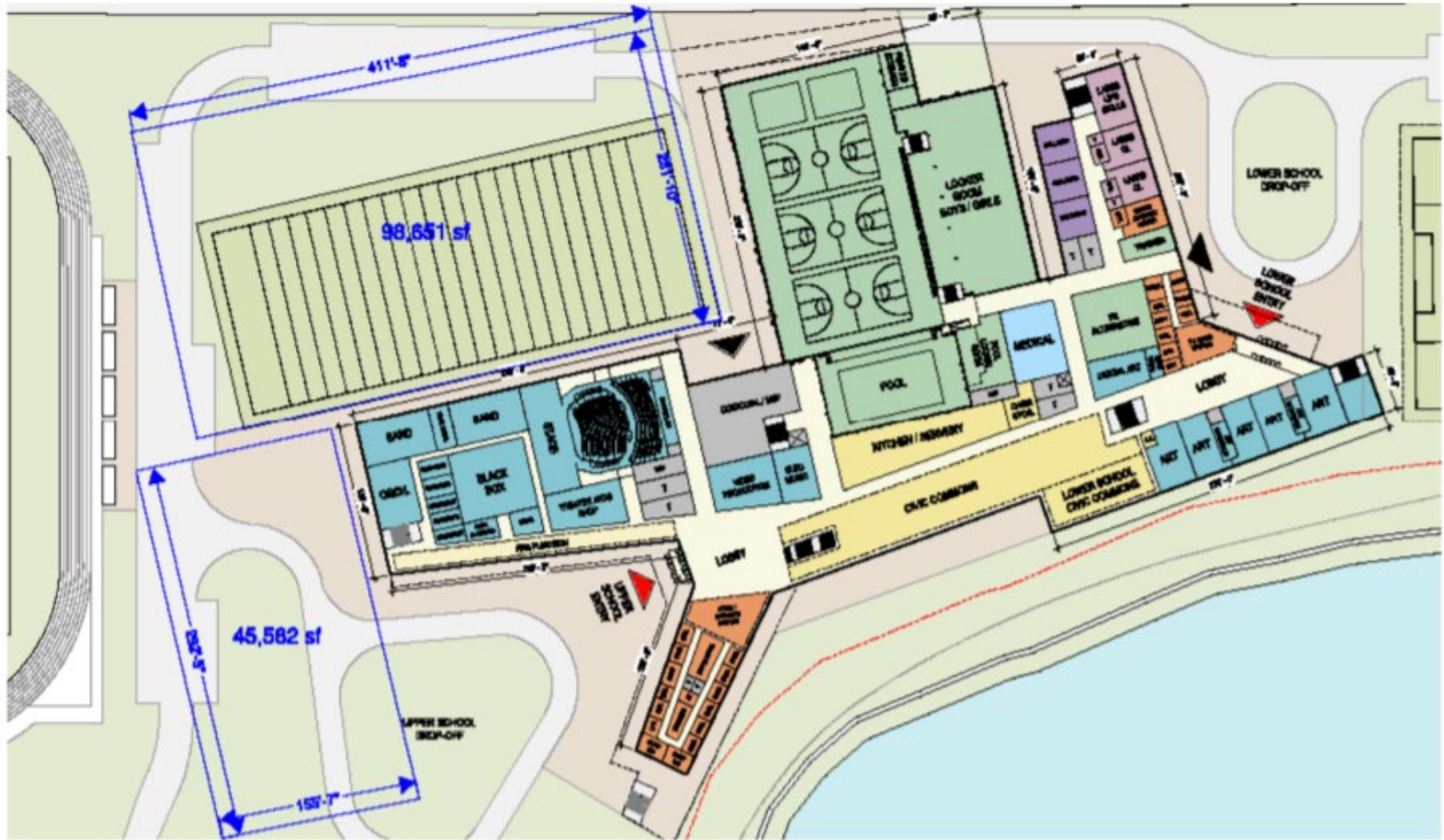
Design Input Parameters

Soil Inputs_ Average		Borehole Inputs		Vertical Piping Inputs	
Earth Temp °F	53.9	Borehole diameter in	6.0	Diameter in	1.5
Earth Diffusivity α ft ² /day	1.19	Grout Conductivity Btu/hr.ft.°F	1.4	Pipe DR	9
Volumetric heat capacity Btu/°F ft ³	35	Borehole spacing ft	20.0	Pipe Material	PE4710
Earth Conductivity k_g Btu/hr.ft.°F	1.74	Borehole depth ft	500.0	Fluid Factor	1.25

Simulation @ 50-yrs Period

Design Case (# of Wells)	Maximum EWT constraint (°F)	Minimum EWT constraint (°F)	Peak EWT				Average EWT			
			Max. Peak EWT (°F)	@ Month	Min. Peak EWT (°F)	@ Month	Max. Ave EWT (°F)	@ Month	Min. Ave EWT (°F)	@ Month
320	85	40	85.0	597	46.6	1	74.0	597	51.2	1.0

Proposed Well Field





Proposed Vault Locations

