

PROJECT DESCRIPTION:
 CONCEPT PROJECT PROPOSAL
 HYDRONICALLY HEATED SPRING BEDS
 HAHN HORTICULTURE GARDEN
 VIRGINIA TECH
 BLACKSBURG VA

DESIGN: ABALONEHILL DESIGN
 CONSTRUCTION FIRM: TBD
 STRUCTURAL ENGINEER: NA
 FIRE SPRINKLER ENGINEER: N/A
 SOILS ENGINEER: N/A
 GEOLOGIST: N/A
 SURVEY ENGINEER: NA
 LANDSCAPE CONTRACTOR: N/A

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Q-cm dT"	Specific Heat	Density	specific Heat	thermal conductivity	k	c
F"	Btu / lbm F"	lbm / ft ³	Btu / ft ³ F"	w / m K"	Btu in / ft ² hr F"	Btu / ft ² hr F"
water	60	1	62.34	62.34	0.6	4.160
HD polyethylene					0.45	3.120
air					0.025	0.173
granite					1.78	12.342
limestone					1.19	8.251
sandstone					1.83	12.688
sandy clay 19% water					1.61	11.163
sandy clay 26% water					2.45	16.987

<http://solarat.uoregon.edu/SunChartProgram.html>
<http://solarelectricityhandbook.com/solar-irradiance.html>
 Blacksburg SSE 22.5° Facing

Best Angle for summer	68°	22
Best Angle for winter	38°	52
Best Year Around	53°	37
38°	53°	0°
38°	53°	0°
Average Solar Insolation (kWh/m ² /day)		
Jan	3.13	2.98
Feb	3.42	3.39
Mar	4.01	4.13
Apr	4.17	4.52
May	4.16	4.7
June	4.21	4.85
July	4.23	4.84
Aug	4.23	4.68
Sep	4.39	4.6
Oct	4.5	4.47
Nov	3.43	3.3
Dec	2.97	2.81

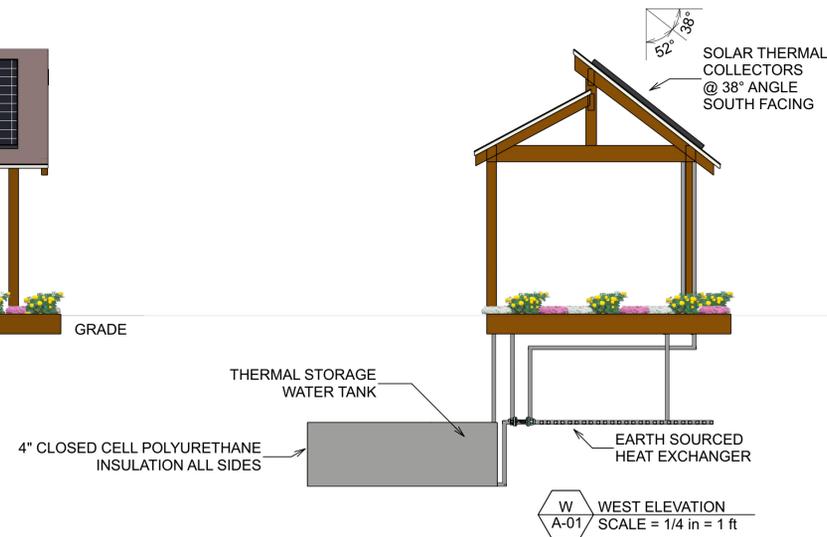
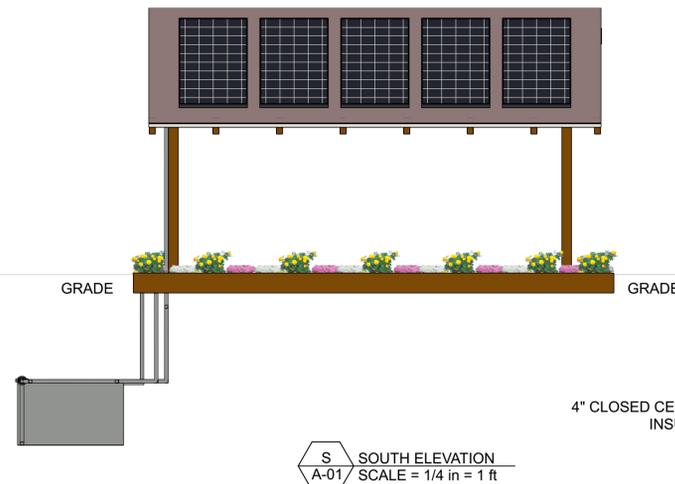
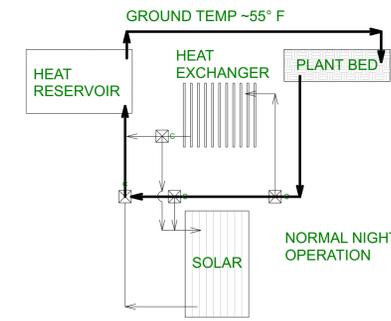
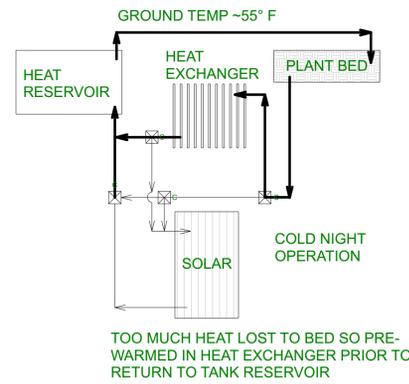
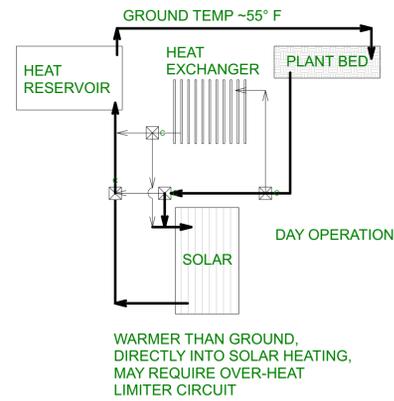
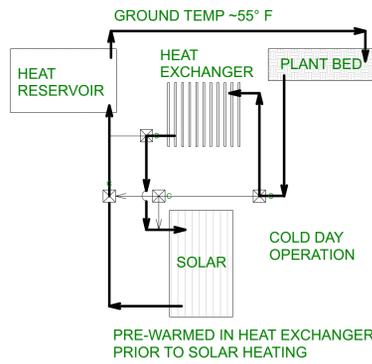
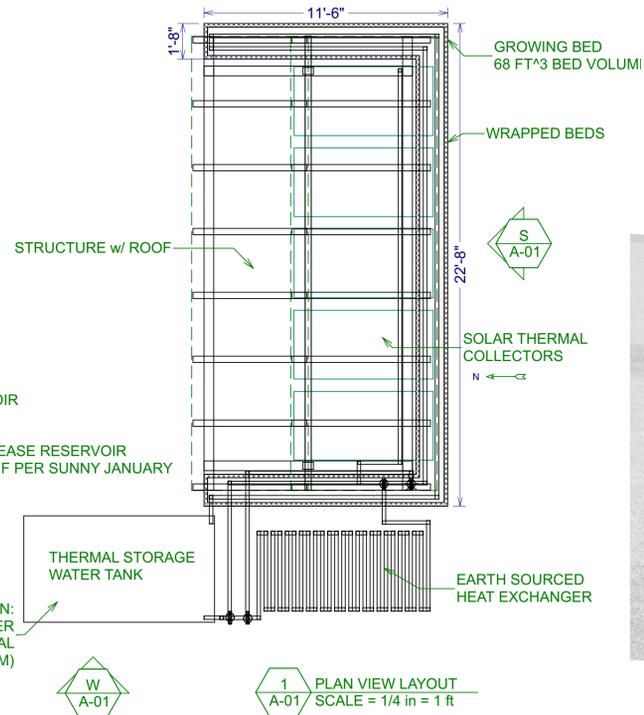
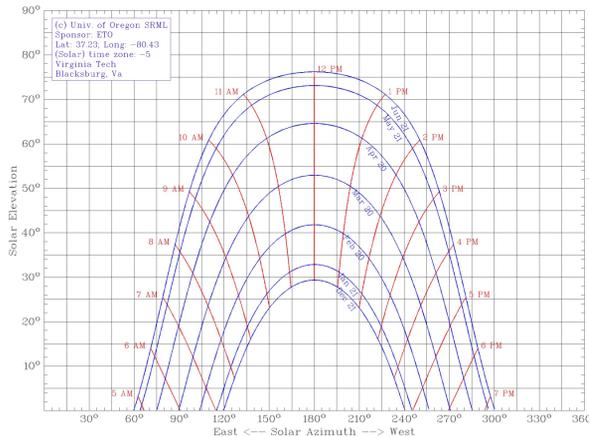
Solar Data
<http://solarelectricityhandbook.com/solar-irradiance.html>
<http://solarat.uoregon.edu/SunChartProgram.html>

US climate data
<http://www.usclimatedata.com/climate/blacksburg/virginia/united-states/usva0068/2016/1>
http://www.greengaragedetroit.com/index.php/Mass_Thermal_Storage
http://www.chrc.org/docs/reports/thermal_storage.pdf
<http://www.nrel.gov/reed/>
<https://www.builditsolar.com/Projects/Cooling/EarthTemperatures.htm>

Phase-Change Material
https://en.wikipedia.org/wiki/Phase-change_material
 Glauber's salt (sodium sulfate decahydrate) is being sold commercially. Glauber's salt changes phases at 90°F and has a 108-BTU-per-pound "latent heat"
https://www.researchgate.net/publication/316893824_Preparation_and_thermal_properties_of_Glauber%27s_salt-based_phase-change_materials_for_Qinghai
https://www.researchgate.net/publication/303169868_Preparation_and_properties_of_glauber%27s_salt-based_composites_phase_change_materials_by_physical_method
http://www.pcmproducts.net/Encapsulated_PCMs.htm
http://allanstime.com/SolarHome/Eutectic_Salt/index.html

Materials
<http://www.archplastics.com/wp-content/uploads/polygal-technical-guide.pdf>
<http://greenhousegab.com/consider-the-r-value/>

Solar Greenhouses
<https://attra.ncat.org/attra-pub/viewhtml.php?id=59>
<http://www.greenhousegarden.com/thermal-mass-heat-storage>



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COVER SHEET / PROJECT DESCRIPTION

General Notes:

It is intended that these drawings shall be used in support of Engineering and Design plans, calculation sheets, and specifications.

No.	Revisions/Issue	Date
1	Concept Proposal Project	02/08/18

Hahn Horticulture Garden
 Virginia Tech
 Blacksburg, Va 24061

Concept Project Proposal
 Hydronically Heated Spring Beds
 7472 Darel Drive
 Cook, Mn 55723



20180208
 Date
 2/11/2018
 Scale

A-01