

## UPDATE TO THE BOE FINANCE AND FACILITIES COMMITTEE OF SOLAR PV

### General Note on proposed changes:

The prior BOE approved ground-mounted and parking canopy solar PV systems at BMS and SHS are not feasible to permit without changes to the Town's Zoning Ordinances. Greenskies, WPS, Town, and Sustainable Westport pursued the required text changes earlier in the year but the Town withdrew the application rather than having the text change fail to pass under current conditions.

Greenskies has proposed rooftop systems as alternatives. Note: rooftop systems were not previously considered due to roof age. This approach incorporates required upcoming roof maintenance within the price of the PPA.

### Updated PPA Pricing from Greenskies:

Project Name	PPA Rate	PPA Escalator	PPA Term	Project Size (kW DC)
Staples HS Roof - Unisil (20 yr) Emerald Warranty	\$0.079	0.0%	240	336
Bedford MS Roof - Unisil (20 yr) Emerald Warranty	\$0.109	0.0%	240	302.4

### SHS Fieldhouse Solar PV

ZREC STATUS: Eversource did not award the ZREC for the SHS Fieldhouse roof installation in the first round of the current auction. The bid was designated a "Standby Bid" on Tuesday, 10/6/2020. Eversource may award a ZREC during the second round (update likely on or around 10/21/2020).

Greenskies proposed a 336 kW DC system to replace the next phase of BOE approved and planned WPS solar PV projects slated to proceed as solar covered parking.

Same:

- PV system size and production (similar)
- Ability to integrate real-time data into educational curriculum
- Works with Virtual Net Metering

Pros:

- Feasible to permit - permitting is as of right and simplified.
- Increased savings through lower costs:
  - \$0.079/kWh vs. \$0.095/kWh
  - Roughly \$122k of additional savings over the term of the PPA
- Installation is shorter and markedly less disruptive to campus activities

- Roof maintenance for the field house is no longer part of upcoming needed capital expenditures. As part of the project, the ~36,000 SF fieldhouse roof would be treated with a liquid coating and have a new 20-year warranty. (The PPA price includes this cost.)
- Proactively protects the asset from moisture incursion.
- Potentially less visible to neighbors

Cons:

- Loss of ancillary benefit of shaded/covered parking
- Less visible to the general public/potentially less impact as an awareness tool

The informal recommendation from the working group (the WPS CFO, the WPS Facilities Director, the current and former Directors of Public Works for the Town, and a representative of Sustainable Westport) is to proceed with this installation if a ZREC is awarded. To do this, the BOE would need to authorize the change. The project would then move through the change order process and permitting.

**BMS Solar PV**

At present, the original plan is not feasible, and the ZREC will expire, precluding future onsite solar at BMS without an alternative plan.

Greenskies proposed a 302.4 kW DC rooftop solar PV system to replace the next phase of BOE approved and planned WPS solar PV projects slated to proceed as a ground-mounted system.

Same:

- Ability to integrate real-time data into educational curriculum
- Works with Virtual Net Metering

Pros:

- Feasible to permit - permitting is as of right and simplified.
- Maintains the ability to procure future ZRECs and additional onsite solar at BMS
- Slightly larger system size: 302.4 kW vs. 287 kW
- Installation is shorter and less disruptive to campus activities.
- Roof maintenance for >50% of the roof at BMS is no longer part of upcoming needed capital expenditures. As part of the project (included in the PPA energy purchase price), the ~63,000 SF of the roof at BMS would be treated with a liquid coating and have a new 20-year warranty. (The PPA price includes this cost.)
- Proactively protects the asset from moisture incursion.
- The avoided cost (\$0.11/kWh) from the onsite solar system is roughly in-line with the PPA cost (\$0.109/kWh), making the project cost-neutral while removing a significant projected capital expenditure.
- Increases flexibility for future renovations and additions as needed at BMS.
- Potentially less visible to neighbors

- Does not require replacing mature plantings
- Does not require fencing off areas adjacent to the building

Cons:

- A higher PPA rate \$0.109/kWh vs. \$0.06/kWh. However, the lower-cost ground mount is no longer an option.
- Less visible to the general public/potentially less impact as an awareness tool

The informal recommendation from the working group (the WPS CFO, the WPS Facilities Director, the current and former Directors of Public Works for the Town, and a representative of Sustainable Westport) is to proceed with this installation. To do this, the BOE would need to authorize the change. The project would then move through the change order process and permitting.

**SHS**

System Size	240 kWh (AC)
Est. Avoided Electric Cost	\$0.110 /kWh*
PPA Cost	\$0.079 /kWh
Est. Electric Savings	\$0.031 /kWh
Est. 1st Yr Electric Savings	\$12,407 /year

Est. 20 Yr Elec Savings (high)	\$ 365,481
Est. Avoided Roofing Cost	\$ 1,347,000 **
Est. Total Savings (High)	\$ 1,712,481

Est. 20 Yr Elec Savings (low)	\$ 128,970
Est. Avoided Roof Cost (low)	\$ 124,000 ***
Est. Total Savings (High)	\$ 252,970

Roofing Costs in the Capital Forecast

2020-2021	\$ 5,858,000 **
Est. Avoided Roofing Cost	\$ 1,347,000 **
Est. Avoided Roofing Cost	\$ 124,000 ***

\* Per selected contractor proposal

\*\* Costs for full replacement as in the capital forecast

\*\*\* Costs for 20 year Unisil liquid treatment - estimate for 2025 based on 2020 costs

Note: this assumes that the roof condition is similar in 5 years and a liquid treatment remains viable

PPA Finances

Cost Escalator	0.00%	Inflation of Electric Costs	1.50%
Capacity	336 kW (DC)		

Year	Production (kWh)	PPA Rate	PPA Costs	Est. Avoided Electric Cost	Total Savings
1	400,234	\$0.079	\$31,618	\$0.110 /kWh	\$44,026 \$ 12,407
2	398,233	\$0.079	\$31,460	\$0.112 /kWh	\$44,463 \$ 13,002
3	396,242	\$0.079	\$31,303	\$0.113 /kWh	\$44,904 \$ 13,601
4	394,260	\$0.079	\$31,147	\$0.115 /kWh	\$45,350 \$ 14,203
5	392,289	\$0.079	\$30,991	\$0.117 /kWh	\$45,800 \$ 14,809
6	390,328	\$0.079	\$30,836	\$0.119 /kWh	\$46,254 \$ 15,418
7	388,376	\$0.079	\$30,682	\$0.120 /kWh	\$46,713 \$ 16,032
8	386,434	\$0.079	\$30,528	\$0.122 /kWh	\$47,177 \$ 16,649
9	384,502	\$0.079	\$30,376	\$0.124 /kWh	\$47,645 \$ 17,270
10	382,580	\$0.079	\$30,224	\$0.126 /kWh	\$48,118 \$ 17,894
11	380,667	\$0.079	\$30,073	\$0.128 /kWh	\$48,596 \$ 18,523
12	378,763	\$0.079	\$29,922	\$0.130 /kWh	\$49,078 \$ 19,156
13	376,869	\$0.079	\$29,773	\$0.132 /kWh	\$49,565 \$ 19,792
14	374,985	\$0.079	\$29,624	\$0.133 /kWh	\$50,057 \$ 20,433
15	373,110	\$0.079	\$29,476	\$0.135 /kWh	\$50,554 \$ 21,078
16	371,245	\$0.079	\$29,328	\$0.138 /kWh	\$51,056 \$ 21,727
17	369,388	\$0.079	\$29,182	\$0.140 /kWh	\$51,562 \$ 22,381
18	367,541	\$0.079	\$29,036	\$0.142 /kWh	\$52,074 \$ 23,038
19	365,704	\$0.079	\$28,891	\$0.144 /kWh	\$52,591 \$ 23,700
20	363,875	\$0.079	\$28,746	\$0.146 /kWh	\$53,113 \$ 24,367
TOTAL	7,635,626		\$603,214		\$968,696 \$ 365,481

Cost Escalator	0.00%	Inflation of Electric Costs	0.00%
Capacity	336 kW (DC)		

Year	Production (kWh)	PPA Rate	PPA Costs	Est. Avoided Electric Cost	Total Savings
1	400,234	\$0.079	\$31,618	\$0.110 /kWh \$44,026	\$ 12,407
2	398,233	\$0.079	\$31,460	\$0.110 /kWh \$43,806	\$ 12,345
3	396,242	\$0.079	\$31,303	\$0.110 /kWh \$43,587	\$ 12,283
4	394,260	\$0.079	\$31,147	\$0.110 /kWh \$43,369	\$ 12,222
5	392,289	\$0.079	\$30,991	\$0.110 /kWh \$43,152	\$ 12,161
6	390,328	\$0.079	\$30,836	\$0.110 /kWh \$42,936	\$ 12,100
7	388,376	\$0.079	\$30,682	\$0.110 /kWh \$42,721	\$ 12,040
8	386,434	\$0.079	\$30,528	\$0.110 /kWh \$42,508	\$ 11,979
9	384,502	\$0.079	\$30,376	\$0.110 /kWh \$42,295	\$ 11,920
10	382,580	\$0.079	\$30,224	\$0.110 /kWh \$42,084	\$ 11,860
11	380,667	\$0.079	\$30,073	\$0.110 /kWh \$41,873	\$ 11,801
12	378,763	\$0.079	\$29,922	\$0.110 /kWh \$41,664	\$ 11,742
13	376,869	\$0.079	\$29,773	\$0.110 /kWh \$41,456	\$ 11,683
14	374,985	\$0.079	\$29,624	\$0.110 /kWh \$41,248	\$ 11,625
15	373,110	\$0.079	\$29,476	\$0.110 /kWh \$41,042	\$ 11,566
16	371,245	\$0.079	\$29,328	\$0.110 /kWh \$40,837	\$ 11,509
17	369,388	\$0.079	\$29,182	\$0.110 /kWh \$40,633	\$ 11,451
18	367,541	\$0.079	\$29,036	\$0.110 /kWh \$40,430	\$ 11,394
19	365,704	\$0.079	\$28,891	\$0.110 /kWh \$40,227	\$ 11,337
20	363,875	\$0.079	\$28,746	\$0.110 /kWh \$40,026	\$ 11,280
TOTAL	7,635,626		\$603,214	\$839,919	\$ 236,704

Cost Escalator	0.00%	Inflation of Electric Costs	-1.50%
Capacity	336 kW (DC)		

Year	Production (kWh)	PPA Rate	PPA Costs	Est. Avoided Electric Cost	Total Savings
1	400,234	\$0.079	\$31,618	\$0.110 /kWh \$44,026	\$ 12,407
2	398,233	\$0.079	\$31,460	\$0.108 /kWh \$43,149	\$ 11,688
3	396,242	\$0.079	\$31,303	\$0.107 /kWh \$42,289	\$ 10,986
4	394,260	\$0.079	\$31,147	\$0.105 /kWh \$41,446	\$ 10,300
5	392,289	\$0.079	\$30,991	\$0.104 /kWh \$40,620	\$ 9,630
6	390,328	\$0.079	\$30,836	\$0.102 /kWh \$39,811	\$ 8,975
7	388,376	\$0.079	\$30,682	\$0.100 /kWh \$39,018	\$ 8,336
8	386,434	\$0.079	\$30,528	\$0.099 /kWh \$38,240	\$ 7,712
9	384,502	\$0.079	\$30,376	\$0.097 /kWh \$37,478	\$ 7,103
10	382,580	\$0.079	\$30,224	\$0.096 /kWh \$36,732	\$ 6,508
11	380,667	\$0.079	\$30,073	\$0.095 /kWh \$36,000	\$ 5,927
12	378,763	\$0.079	\$29,922	\$0.093 /kWh \$35,282	\$ 5,360
13	376,869	\$0.079	\$29,773	\$0.092 /kWh \$34,579	\$ 4,807
14	374,985	\$0.079	\$29,624	\$0.090 /kWh \$33,890	\$ 4,267
15	373,110	\$0.079	\$29,476	\$0.089 /kWh \$33,215	\$ 3,740
16	371,245	\$0.079	\$29,328	\$0.088 /kWh \$32,553	\$ 3,225
17	369,388	\$0.079	\$29,182	\$0.086 /kWh \$31,905	\$ 2,723
18	367,541	\$0.079	\$29,036	\$0.085 /kWh \$31,269	\$ 2,233
19	365,704	\$0.079	\$28,891	\$0.084 /kWh \$30,646	\$ 1,755
20	363,875	\$0.079	\$28,746	\$0.083 /kWh \$30,035	\$ 1,289
TOTAL	7,635,626		\$603,214	\$732,185	\$ 128,970

SHS Roof Size (capital forecast)	154,141	sf
Treated Area	36,560	sf
% of Roof	23%	

Current Proposal Treatment Costs

Labor & Material	\$	98,400
20 yr Warranty	\$	10,968
TOTAL	\$	109,368

annual construction cost inflation	2.50%
years	5
multiplier	1.13

**BMS**

System Size	210 kWh (AC)
Est. Avoided Electric Cost	\$0.110 /kWh*
PPA Cost	\$0.109 /kWh
Est. Electric Savings	\$0.001 /kWh
Est. 1st Yr Electric Savings	\$358 /year

Est. 20 Yr Elec Savings (high)	\$ 121,984	**
Est. Avoided Roofing Cost	\$ 3,158,000	
Est. Total Savings (High)	\$ 3,279,984	

Est. 20 Yr Elec Savings (low)	\$ (89,511)	***
Est. Avoided Roof Cost (low)	\$ 216,000	
Est. Total Savings (High)	\$ 126,489	

Roofing Costs in the Capital Forecast

2024-2025	\$ 5,588,311	**
Est. Avoided Roofing Cost	\$ 3,158,000	**
Est. Avoided Roofing Cost	\$ 216,000	***

\* Per selected contractor proposal

\*\* Costs for full replacement as in the capital forecast

\*\*\* Costs for 20 year Unisil liquid treatment - estimate for 2025 based on 2020 costs

Note: this assumes that the roof condition is similar in 5 years and a liquid treatment remains viable

PPA Finances

Cost Escalator	0.00%	Inflation of Electric Costs	1.50%
Capacity	302.4 kW (DC)		

Year	Production (kWh)	PPA Rate	PPA Costs	Est. Avoided Electric Cost	Total Savings
1	357,900	\$0.109	\$39,011	\$0.110 /kWh	\$39,369 \$ 358
2	356,111	\$0.109	\$38,816	\$0.112 /kWh	\$39,760 \$ 944
3	354,330	\$0.109	\$38,622	\$0.113 /kWh	\$40,154 \$ 1,532
4	352,558	\$0.109	\$38,429	\$0.115 /kWh	\$40,553 \$ 2,124
5	350,796	\$0.109	\$38,237	\$0.117 /kWh	\$40,955 \$ 2,719
6	349,042	\$0.109	\$38,046	\$0.119 /kWh	\$41,362 \$ 3,316
7	347,296	\$0.109	\$37,855	\$0.120 /kWh	\$41,772 \$ 3,917
8	345,560	\$0.109	\$37,666	\$0.122 /kWh	\$42,187 \$ 4,521
9	343,832	\$0.109	\$37,478	\$0.124 /kWh	\$42,606 \$ 5,128
10	342,113	\$0.109	\$37,290	\$0.126 /kWh	\$43,029 \$ 5,738
11	340,402	\$0.109	\$37,104	\$0.128 /kWh	\$43,456 \$ 6,352
12	338,700	\$0.109	\$36,918	\$0.130 /kWh	\$43,887 \$ 6,969
13	337,007	\$0.109	\$36,734	\$0.132 /kWh	\$44,322 \$ 7,589
14	335,322	\$0.109	\$36,550	\$0.133 /kWh	\$44,762 \$ 8,212
15	333,645	\$0.109	\$36,367	\$0.135 /kWh	\$45,207 \$ 8,839
16	331,977	\$0.109	\$36,185	\$0.138 /kWh	\$45,655 \$ 9,470
17	330,317	\$0.109	\$36,005	\$0.140 /kWh	\$46,108 \$ 10,104
18	328,665	\$0.109	\$35,825	\$0.142 /kWh	\$46,566 \$ 10,742
19	327,022	\$0.109	\$35,645	\$0.144 /kWh	\$47,028 \$ 11,383
20	325,387	\$0.109	\$35,467	\$0.146 /kWh	\$47,495 \$ 12,028
TOTAL	6,827,982		\$744,250		\$866,234 \$ 121,984

Cost Escalator	0.00%	Inflation of Electric Costs	0.00%
Capacity	302.4 kW (DC)		

Year	Production (kWh)	PPA Rate	PPA Costs	Est. Avoided Electric Cost	Total Savings
1	357,900	\$0.109	\$39,011	\$0.110 /kWh	\$39,369 \$ 358
2	356,111	\$0.109	\$38,816	\$0.110 /kWh	\$39,172 \$ 356
3	354,330	\$0.109	\$38,622	\$0.110 /kWh	\$38,976 \$ 354
4	352,558	\$0.109	\$38,429	\$0.110 /kWh	\$38,781 \$ 353
5	350,796	\$0.109	\$38,237	\$0.110 /kWh	\$38,588 \$ 351
6	349,042	\$0.109	\$38,046	\$0.110 /kWh	\$38,395 \$ 349
7	347,296	\$0.109	\$37,855	\$0.110 /kWh	\$38,203 \$ 347
8	345,560	\$0.109	\$37,666	\$0.110 /kWh	\$38,012 \$ 346
9	343,832	\$0.109	\$37,478	\$0.110 /kWh	\$37,822 \$ 344
10	342,113	\$0.109	\$37,290	\$0.110 /kWh	\$37,632 \$ 342
11	340,402	\$0.109	\$37,104	\$0.110 /kWh	\$37,444 \$ 340
12	338,700	\$0.109	\$36,918	\$0.110 /kWh	\$37,257 \$ 339
13	337,007	\$0.109	\$36,734	\$0.110 /kWh	\$37,071 \$ 337
14	335,322	\$0.109	\$36,550	\$0.110 /kWh	\$36,885 \$ 335
15	333,645	\$0.109	\$36,367	\$0.110 /kWh	\$36,701 \$ 334
16	331,977	\$0.109	\$36,185	\$0.110 /kWh	\$36,517 \$ 332
17	330,317	\$0.109	\$36,005	\$0.110 /kWh	\$36,335 \$ 330
18	328,665	\$0.109	\$35,825	\$0.110 /kWh	\$36,153 \$ 329
19	327,022	\$0.109	\$35,645	\$0.110 /kWh	\$35,972 \$ 327
20	325,387	\$0.109	\$35,467	\$0.110 /kWh	\$35,793 \$ 325
TOTAL	6,827,982		\$744,250		\$751,078 \$ 6,828

Cost Escalator	0.00%	Inflation of Electric Costs	-1.50%
Capacity	302.4 kW (DC)		

Year	Production (kWh)	PPA Rate	PPA Costs	Est. Avoided Electric Cost	Total Savings
1	357,900	\$0.109	\$39,011	\$0.110 /kWh	\$39,369 \$ 358
2	356,111	\$0.109	\$38,816	\$0.108 /kWh	\$38,585 \$ (231)
3	354,330	\$0.109	\$38,622	\$0.107 /kWh	\$37,816 \$ (806)
4	352,558	\$0.109	\$38,429	\$0.105 /kWh	\$37,062 \$ (1,367)
5	350,796	\$0.109	\$38,237	\$0.104 /kWh	\$36,324 \$ (1,913)
6	349,042	\$0.109	\$38,046	\$0.102 /kWh	\$35,600 \$ (2,445)
7	347,296	\$0.109	\$37,855	\$0.100 /kWh	\$34,891 \$ (2,965)
8	345,560	\$0.109	\$37,666	\$0.099 /kWh	\$34,196 \$ (3,470)
9	343,832	\$0.109	\$37,478	\$0.097 /kWh	\$33,514 \$ (3,963)
10	342,113	\$0.109	\$37,290	\$0.096 /kWh	\$32,846 \$ (4,444)
11	340,402	\$0.109	\$37,104	\$0.095 /kWh	\$32,192 \$ (4,912)
12	338,700	\$0.109	\$36,918	\$0.093 /kWh	\$31,551 \$ (5,368)
13	337,007	\$0.109	\$36,734	\$0.092 /kWh	\$30,922 \$ (5,812)
14	335,322	\$0.109	\$36,550	\$0.090 /kWh	\$30,306 \$ (6,244)
15	333,645	\$0.109	\$36,367	\$0.089 /kWh	\$29,702 \$ (6,665)
16	331,977	\$0.109	\$36,185	\$0.088 /kWh	\$29,110 \$ (7,075)
17	330,317	\$0.109	\$36,005	\$0.086 /kWh	\$28,530 \$ (7,474)
18	328,665	\$0.109	\$35,825	\$0.085 /kWh	\$27,962 \$ (7,863)
19	327,022	\$0.109	\$35,645	\$0.084 /kWh	\$27,405 \$ (8,241)
20	325,387	\$0.109	\$35,467	\$0.083 /kWh	\$26,858 \$ (8,609)
TOTAL	6,827,982		\$744,250		\$654,739 \$ (89,511)



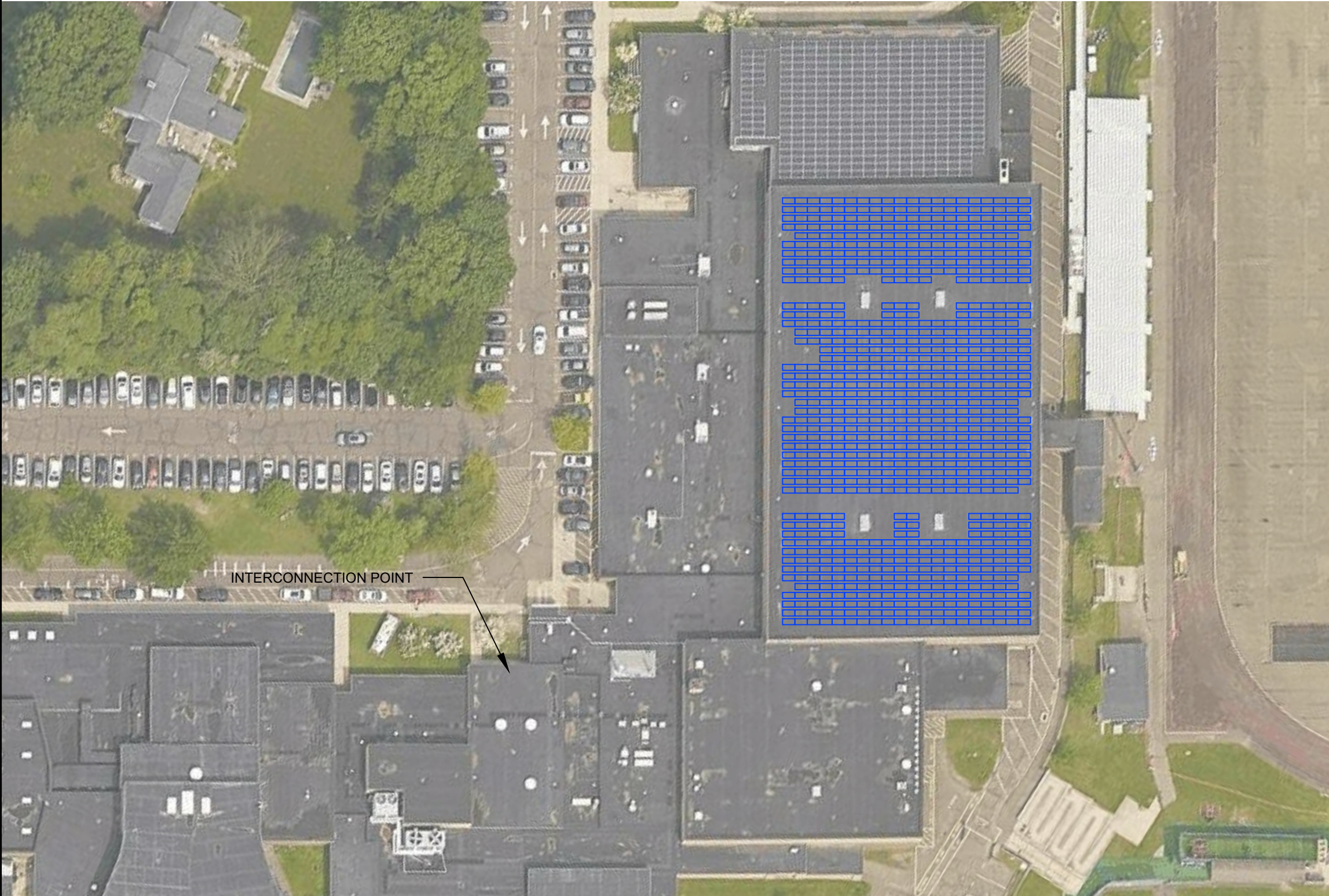
BMS Roof Size	111,510	sf
Treated Area	63,000	sf
% of Roof	56.50%	

Current Proposal Treatment Costs

Labor & Material	\$ 171,950
20 yr Warranty	\$ 18,900
TOTAL	\$ 190,850

annual construction cost inflation	2.50%
years	5
multiplier	1.13





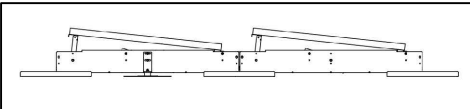
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PROPOSED PV SOLAR ARRAY LAYOUT

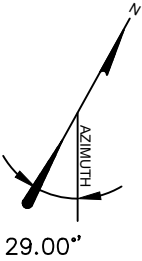
1"=60'

SYSTEM INFORMATION	
SYSTEM SIZE (DC)	336 kW
SYSTEM SIZE (AC)	240 kW
PANEL SIZE	HANWHA 400 W Q.PEAK DUO L-G5.2*
PANEL QUANTITY	840
PANEL TILT	10°
PANEL AZIMUTH	29°
ROW SPACING	18"
INVERTER SIZE	(4) SOLECTRIA 60TL*
ESTIMATED ANNUAL PRODUCTION	400 MWh

\*Preliminary equipment selection, equivalent alternative may be used in actual installation



RACKING CROSS-SECTION  
(NOT TO SCALE)



PROGRESS SET  
NOT FOR CONSTRUCTION

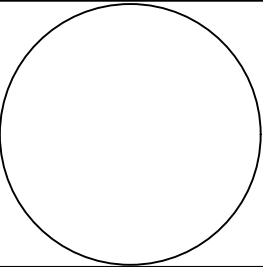
**Greenskies**

127 Washington Street  
North Haven, CT 06473  
PH - 860.398.5408  
FAX - 860.398.5423

REVISIONS:		
NO.	DATE	DESCRIPTION

**PROPOSED SITE PLAN**

**STAPLES HIGH SCHOOL**  
**PV SOLAR ARRAY**  
**70 NORTH AVENUE**  
**WESTPORT, CT 06880**



BATCH NO.:	PROPOSAL
DRAWN BY:	AF
SCALE:	AS NOTED
DATE:	27 JULY 2020

**PV.01**





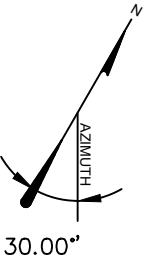
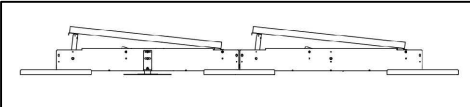
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PROPOSED PV SOLAR ARRAY LAYOUT

1"=50'

SYSTEM INFORMATION	
SYSTEM SIZE (DC)	302.4 kW
SYSTEM SIZE (AC)	210 kW
PANEL SIZE	HANWHA 400 W Q.PEAK DUO L-G5.2*
PANEL QUANTITY	756
PANEL TILT	10°
PANEL AZIMUTH	30° / 28°
ROW SPACING	18"
INVERTER SIZE	(1) SOLECTRIA 60TL* (3) SOLECTRIA 50TL*
ESTIMATED ANNUAL PRODUCTION	357.9 MWh

\*Preliminary equipment selection, equivalent alternative may be used in actual installation



PROGRESS SET  
NOT FOR CONSTRUCTION

**Greenskies**

127 Washington Street  
North Haven, CT 06473  
PH - 860.398.5408  
FAX - 860.398.5423

REVISIONS:		
NO.	DATE	DESCRIPTION

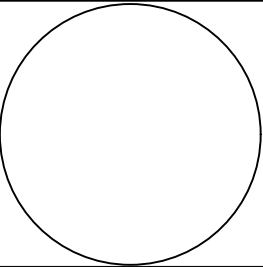
**PROPOSED SITE PLAN**

**BEDFORD MIDDLE SCHOOL**

**PV SOLAR ARRAY**

**88 NORTH AVENUE**

**WESTPORT, CT 06880**



BATCH NO.:	PROPOSAL
DRAWN BY:	AF
SCALE:	AS NOTED
DATE:	28 JULY 2020

**PV.01**