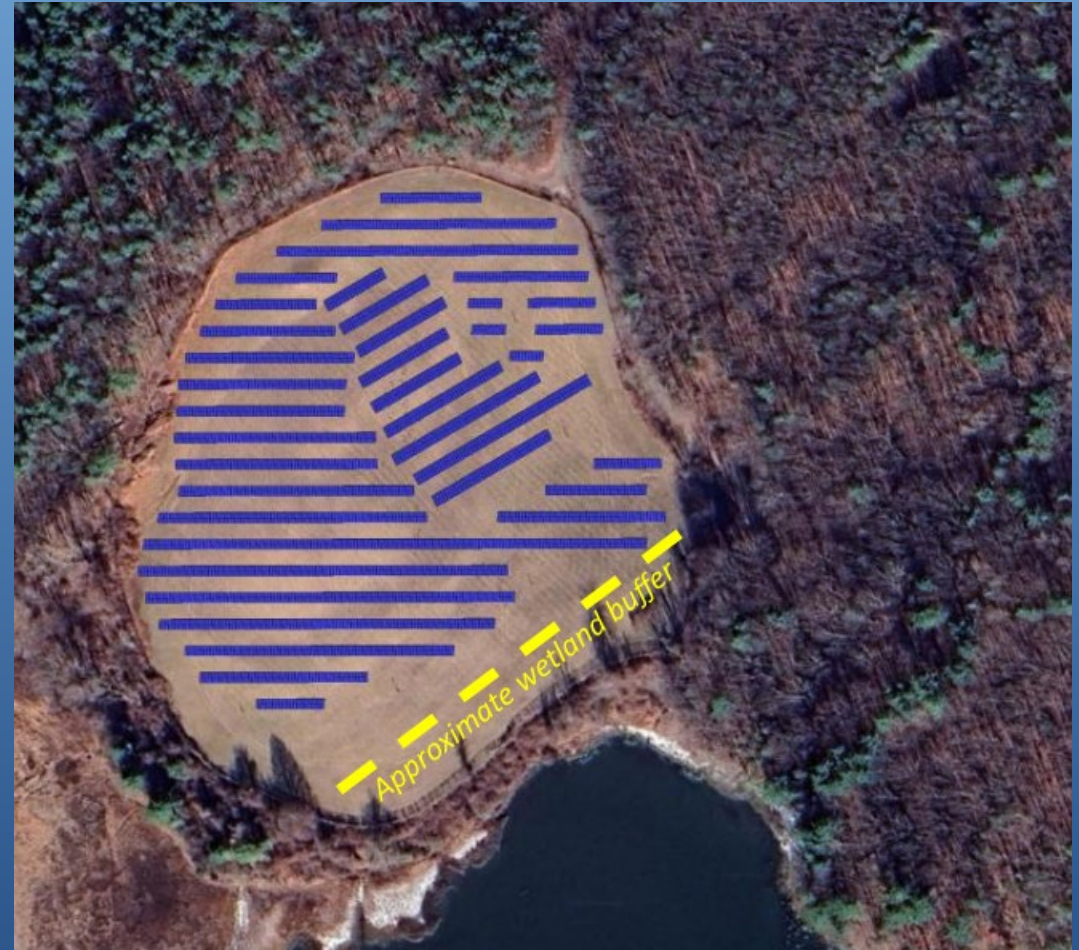


Jones Ave Solar Array - Feasibility Study

Study performed by Apex Analytics
Presented by The City of Portsmouth



City of Portsmouth, Public Works

Portsmouth Energy Advisory Committee Meeting

April 8, 2025





Utilized the Department of Energy's (DOE) System Advisor Model (SAM)

- Estimated solar production for the Jones Ave landfill site
- The tool estimates photovoltaic system sizing based on space availability and site conditions

Cost data from DOE and other Northeastern state solar programs

- Validated with the APEX's bottom-up site estimate

APEX modeled three scenarios

- Option 1 – City-owned single 1.7MW-ac system
- Option 2 – City-owned two systems sized at 950kW-ac and 750kW-ac with one Behind the Meter (BTM) at the High School
- Option 3- Modeled option 2 using a credit purchase agreement with a private developer assuming a 15% discount on market rates



Options Evaluated

Option 1: A single 1.7 MW City-owned solar array

Front-of-the-meter (FTM) system connection to the electrical grid at Jones Ave

PROS	CONS
<ul style="list-style-type: none">• Lowest total cost to construct• Medium Net Benefit (if 2 system qualified for ITC)• No time pressure for Investment Tax Credit (ITC)• No behind-the-meter (BTM) complications at High School• Minimal (if any) disturbance to woodlands and wetlands	<ul style="list-style-type: none">• No ITC refund to the city• Larger new bond issuance by City• Longer and more complicated study by the utility/transmission company (Eversource)

Option 2: Two City-owned systems totaling 1.7 MW

One 950 kW FTM system connecting to the electrical grid at Jones Ave and one 750 kW behind-the-meter (BTM) system connecting directly to the high school

PROS	CONS
<ul style="list-style-type: none">• Medium total cost to construct• Smaller system can be connected BTM at HS to lower demand charges from utility• Highest Net Benefit if qualified for ITC• Both systems should have shorter, less costly study by Eversource• Potential for project phasing and financing	<ul style="list-style-type: none">• Time pressure to approve and start to qualify for ITC• Additional new electric line through woodlands and wetlands to HS (recommend underground conduit)• Consider additional development costs such as ledge removal and time• Disturbance to HS during construction• Higher total cost overall



Options Evaluated Cont.



Option 3: Power Purchase Agreement for Option 2

Credit purchase agreement with a private developer. This option was determined to provide a lower overall benefit to the City compared to City Ownership

PROS	CONS
<ul style="list-style-type: none">• Low upfront Cost to the City• Developer performs all design and construction activities	<ul style="list-style-type: none">• Lower City benefit (assumed 15% of savings power rate)• Private entity operating power generation on City property• Risk of not realizing power savings rates



Timelines of 1-system and 2-system Options

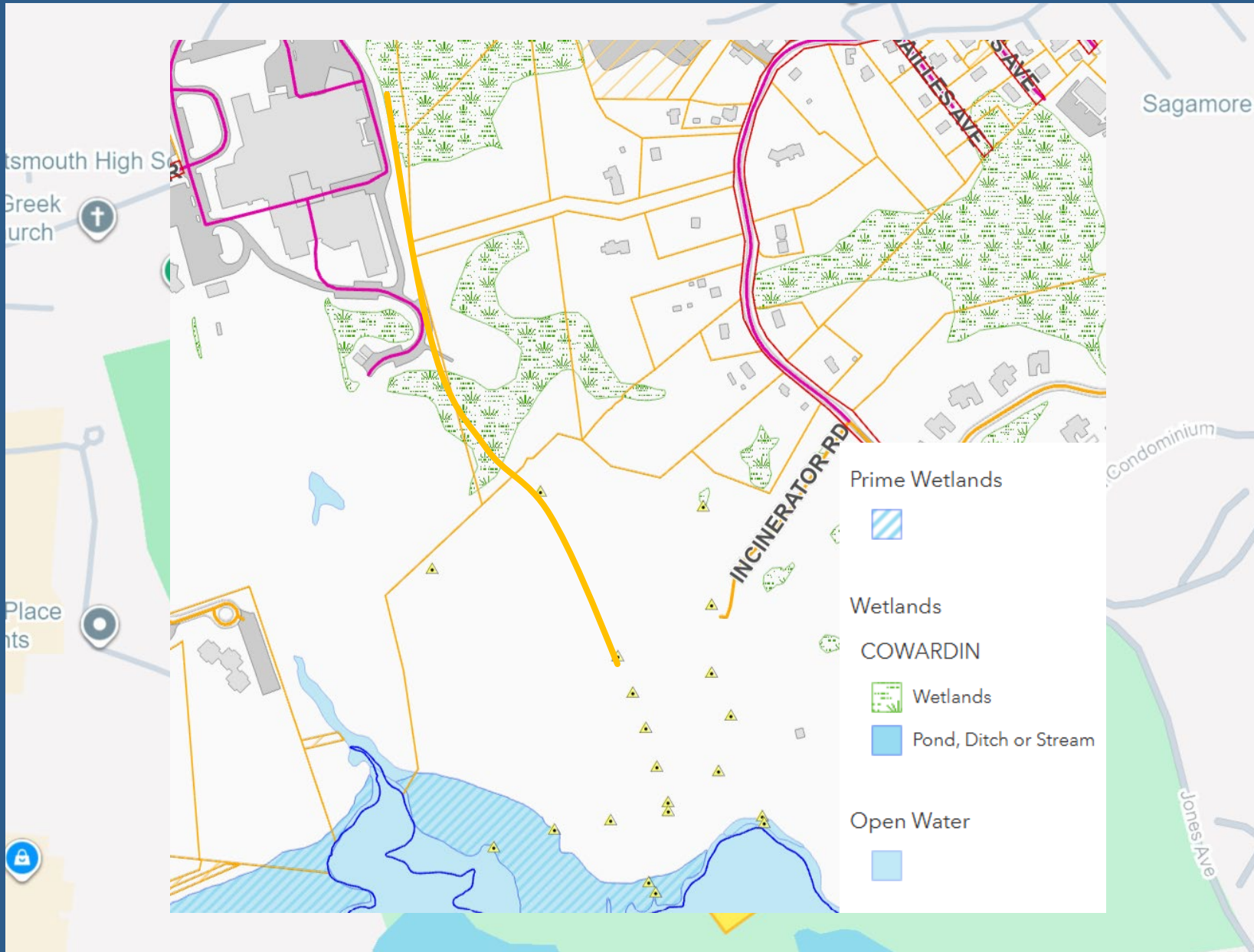


- **By phasing the two-system project, the City can potentially capture 35%-40% of eligible costs**
 - Project must be online by 12/31/2027 to qualify for ITC
 - Analysis by the City, including anticipated DES permitting time-frames, indicate that it's unlikely to meet the schedule identified below for the 2-system option
- **Option 1 timeline considerations:** The requirement for systems >1 MW to undergo a complex transmission level study would add 9-11 months to the schedule, and exceed the 12/31/2027 deadline for systems to be "in service" to qualify for the ITC
- **Scenario 2 timeline considerations:** A two-system approach will potentially not trigger transmission study, and would likely be less impactful to each feeder they would connect to, reducing needed upgrades from Eversource
 - If the two-system approach takes too long to start/contract, or ends up requiring the transmission study, the City could decide to change the design back to a one-system 1.7 MW-ac design and reapply to Eversource
 - There are still significant long-term benefits from this 1-system approach

	Apr-26	May-26	Jun-26	Jul-26	Aug-26	Sep-26	Oct-26	Nov-26	Dec-26	Jan-27	Feb-27	Mar-27	Apr-27	May-27	Jun-27	Jul-27	Aug-27	Sep-27	Oct-27	Nov-27	Dec-27	Jan-28	Feb-28	Mar-28	Apr-28	May-28	Jun-28	Jul-28	Aug-28	Sep-28								
Two Systems 750 & 950 KW ac	Hire EPCand Design						Appl. Accept.		ASO Determ.		Dist. Impact Study			ISA	Construction			Comm & PTO																				
	Environmental Permitting																																					
One System 1.7 MW ac	Hire EPCand Design						Appl. Accept.		ASO Determ.		ASO/Cluster Study Process										Dist. Impact Study		ISA	Construction			Comm & PTO			Cutoff for ITC								



ELECTRICAL CONNECTION PATHS OF OPTIONS 1 & 2





LANDFILL CLOSURE PERMIT WILL REQUIRE MODIFICATION



Cap Stability Evaluation

- Assessment by a New Hampshire-licensed Professional Engineer
- Minimum analysis includes:
 - Cap bearing capacity (solar foundations and construction equipment)
 - Settlement tolerance and anticipated settlement
 - Impacts to subsurface piping and conduits
 - Global and veneer stability under static and seismic conditions
- Calculations must consider wind and snow loads
- Low-ground-pressure equipment is typically required



Stormwater & Landfill Gas Controls

- PE evaluation of stormwater changes caused by increased impervious coverage
- Explosion-proof electrical equipment required where feasible
- Non-panel equipment located off the landfill cap



Operations, Access & Maintenance

- Maintain access to vents, wells, probes, markers, and monitoring features
- Post-closure inspection, monitoring, and maintenance continue during construction and operation
- Construction damage must be repaired promptly and reported to NHDES



End-of-Life & Financial Assurance

- Solar arrays must be removed and the landfill restored to pre-project conditions
- Closure plans must be updated to reflect the post-closure solar use
- Financial assurance cost estimates must include solar removal and site restoration

Solar array development on a closed solid waste landfill is a post-closure use that would require a Type I-B permit modification from NHDES.



■ **Nominal Total Savings & Cash (Gross)**

- **All project cash inflows over a 25-year analysis period.**
 - Includes Utility bill savings, net metering credits, REC sales, and any direct cash the systems generate.
 - Excludes Construction/installation costs, borrowing costs, and O&M costs.

■ **Nominal Total Net Savings**

- **Nominal Total Savings & Cash (Gross) minus all project costs.**
 - Project costs include financing, construction, installation, interconnection, and all associated system equipment.

■ **Net Benefit (Net Present Value of Nominal Total Net Savings)**

- **True value of the project in today's dollars after accounting for costs, financing and when the savings occur.**
 - Includes all construction and financing costs, all project savings and revenues, the timing of cash flows, and the City's cost of borrowing (3.75%).



FINANCIAL SUMMARY OF OPTIONS



- With ITC, Option 2: Two System has largest Net Benefit (breakeven 16 years)
- Without ITC, Option 1: Single System has largest Net Benefit (breakeven 20 years)
- If the ITC refund is not received, break even point is significantly extended by 3-4 years for Option 2
- The private option has lower overall benefits.
 - Assumption of 15% savings on electrical costs may not be realized
 - Existing PPA solar array currently ~30% over market rate

Single System - Without ITC			
Nominal Total Savings & Cash		\$	12,734,324
Nominal Total Net Savings		\$	7,057,343
Net Benefit (NPV)		\$	4,146,253
Two Systems - with Tax Equity Refund			
Nominal Total Savings & Cash		\$	13,045,175
Nominal Total Net Savings		\$	8,707,889
Net Benefit (NPV)		\$	5,274,818
Private Owned - Private Tax Equity Flip (5yr)			
Nominal Total Savings & Cash		\$	7,039,575
Nominal Total Net Savings		\$	5,701,410
Net Benefit - All Parties		\$	2,961,840
Net Benefit for City, 15% savings		\$	1,211,380



SUMMARY AND CONCLUSIONS



- The Single City-owned 1.7 MW system
 - Provides the highest long term cost benefit (without ITC for option 2)
 - Lowest construction cost for City-owned system
 - Simple interconnection infrastructure
 - Greater construction schedule certainty
- The Two City-owned systems totaling 1.7 MW
 - Provides the highest long term cost benefit (with ITC)
 - Higher Construction Cost than single system (without ITC)
 - Complicated interconnected infrastructure (to HS & Jones Ave)
 - Higher value behind the meter electricity generation
- Power Purchase Agreement for Option 2
 - Provides the lowest long-term cost benefit (risk of no financial benefit to City)
 - Low Upfront Costs for the City
- The City should explore alternative BHM options throughout the City that would require less environmental impact and lower construction and O&M costs

Appendix with Detailed Slides

Jones Ave Solar Array Feasibility Study



DETAILS ON FINDINGS



- The combination of ISO-NE/transmission company study requirements and the phase out of the Section 48E ITC for solar at 12/31/2027 shifted the analysis to focus on the potential for two <1 MW systems
- By remaining below 1 MW, the ISO-NE rules allow for a proposed DG system to avoid participating in an Affected System Operator Study* if it is deemed "electrically irrelevant" shortening the interconnection timeframe by about 9-11 months
- Doing so would enable the City to qualify for the ITC using the "direct-pay" or "refund" method, receiving a grant for 30-40% of eligible cost directly from the IRS (30% plus the 10% bonus for domestic content if the equipment qualifies)
- This structure, with or without the ITC, would be more beneficial to Portsmouth than entering a long-term PPA led by a private developer
- All savings and capex estimates are subject to variance in practice, and can be bounded with some sensitivity analyses

*[ISO-NE Section 1.3.9](#), governs the process and requirements for impact assessment of new generation on the transmission system, which is not required but currently in practice done for all projects >1 MW; [ISO-NE Planning Procedure No. 5-1](#) at section 2.1 explicitly states <1 MW projects are exempt from this review, but two projects in the same area adding up to >1 MW may be reviewed as a single project by the transmission company.



- The consulting team used both a bottoms-up and top-down approach for estimating the Cap Ex costs of the systems, with historical data from other states further validating the estimate
- Bottoms-up included unit-specific component costs based on conversations with active solar developers, and best-estimate additions for project-specific differences, such as the conductor to the H.S.
- Vendor estimates are general, private market assumptions, but could be higher for the City due to public contracting requirements
- Savings are based on current NH Net Metering law, which allows for the Supply rate only for systems > 100 kW, including public systems of > 1 MW, and does NOT currently include demand rate savings for a BTM connection of one of the two smaller systems
- Supply rates are increased 2.5% per year average, system degradation is 0.5% a year, public discount rate is 3.75% and private discount rate is 8%
- Private system PPA is assumed to provide 15% savings to City vs. Eversource supply rate; this could be negotiated higher or lower, or be fixed with an escalator-style contract
- The City's borrowing cost was estimated at 3.75%, a recent (Fall 2025) value for a AAA municipal bond; private borrowing was estimated at 6.75%



CAP EX COMPARISON



- The separate systems will require more privately owned conductor, more site work, more vendor costs, and slightly higher install costs
- Utility costs are assumed higher for the combined system due to the cost of ASO study, and likelihood of higher system upgrade costs (3V0, voltage management, etc.)

CAPEX	System 1	System 2	1+2	Combined	Differences
Predevelopment Costs	\$ 17,500	\$ 17,500	\$ 35,000	\$ 35,000	\$ -
Utility Costs (apps, studies, CIAC)	\$ 516,000	\$ 56,000	\$ 572,000	\$ 726,000	\$ (154,000)
Other Costs (Site Etc)	\$ 215,000	\$ 290,000	\$ 505,000	\$ 215,000	\$ 290,000
System and EPC Cost (no profit)	\$ 1,463,000	\$ 1,404,750	\$ 2,867,750	\$ 2,575,500	\$ 292,250
EPC Profit %	\$ 246,300	\$ 240,475	\$ 486,775	\$ 357,550	\$ 129,225
Total System and EPC Cost	\$ 1,709,300	\$ 1,645,225	\$ 3,354,525	\$ 2,933,050	\$ 421,475
Total Project Cost	\$ 2,457,800	\$ 2,008,725	\$ 4,466,525	\$ 3,909,050	\$ 557,475

Thank you!

Questions?