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ROGER'S HOUSE SCOPE OF WORK March 25, 2016

NEW ROOFTOP PV SYSTEM

The following describes the scope for work and installation details to furnish and install a new PV system on the roof of the Rogers House in Lebanon, NH.

PROJECT OBJECTIVE SUMMARY & INFORMATION:

Purchase Option: The owner of the Roger's house, the Lebanon Housing Authority, desires to have a photovoltaic system installed on the rooftop of their building, interconnected with the utility grid, net metered. The base bid option is the outright purchase of a fully operational system.

PPA or Leased Option: As an option to purchase, the own desires to solicit and review potential options to purchase, such as a lease with option to future buy or PPA.

SCOPE OF WORK SUMMARY:

- Coordinate site conditions with proposed objectives for layout and maximizing the harvest.
- Identification of the best wiring path from roof to basement electrical area with the least disruption to the occupants on the building.
- Provide design for the layout for rooftop system and electrical connections to the utility grid, integrating with the building's utility electrical feed.
- Work with utility and state incentive programs to acquire potential incentives to offset cost to the owner for the project.
- Coordination and assistance to the owner concerning historical preservation impacts on the proposed PV system to assure acceptability to Authority Having Jurisdiction in this regard.
- Permits as required for all work on site.
- Site coordination with owner, city and any other parties as required to access the roof for installation work.
- Verifications of the roof membrane life and conditions and structural support capacity for the proposed system.
- Roof cuts and patching, conduits and floor to floor cutting and fire sealing for wiring runs from roof to basement electrical area.

- ☑ Furnish and Install PV system including panels, support system, wiring, inverters, disconnects, metering and reporting as detailed herein.
- ☑ Connection to existing electrical system/utility grid; coordination with the utility for this interconnection as required.
- ☑ Provide web accessible monitoring and reporting dashboard type system with access to the owner & GWR Engineering.
- ☑ Provide Commissioning support with Engineer.
- ☑ Provide Owner training in operations, maintenance of the hardware and use & interpretation of dashboard.
- ☑ Warrantee the installation for 1 year.

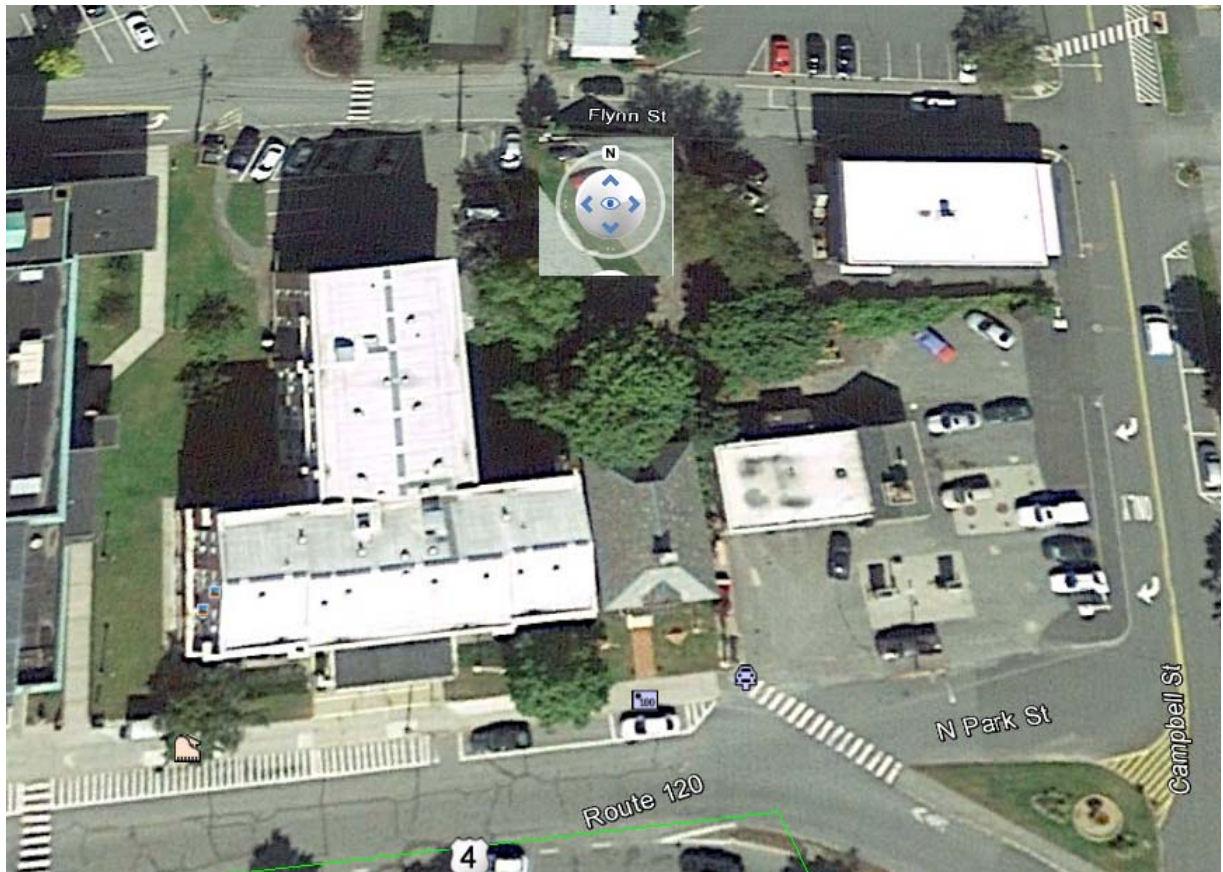


The Rogers House – Front & Rear





Existing Electrical area in basement



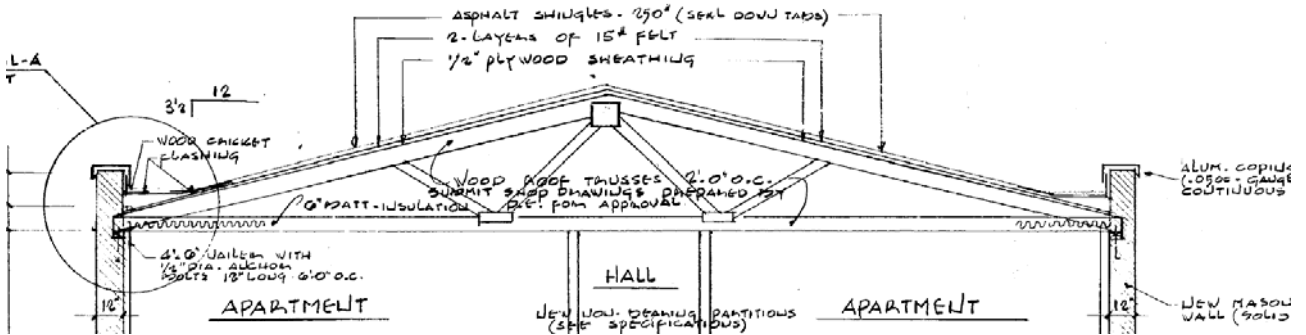
Google Earth Image



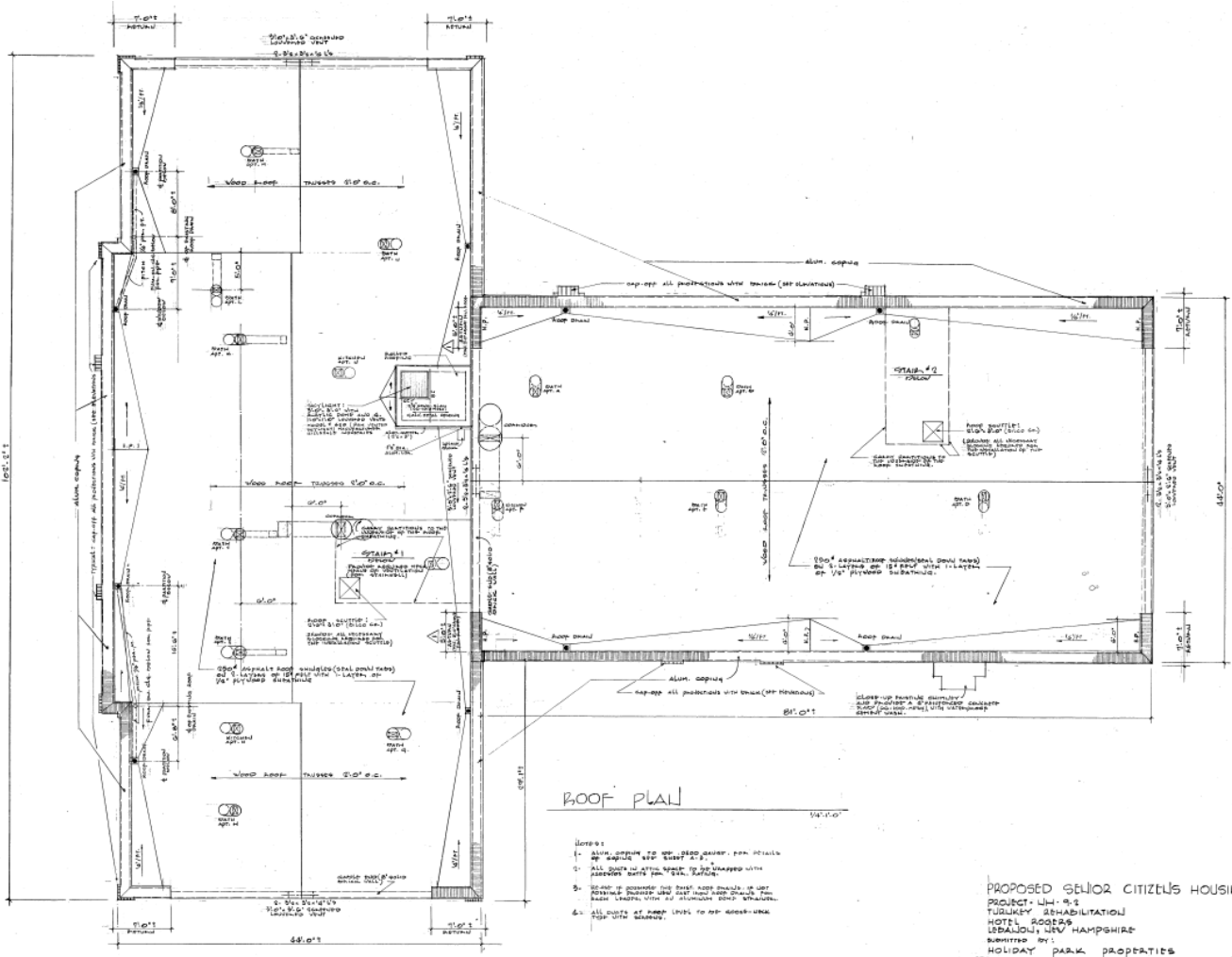
Looking North



Looking east



Typical roof truss designed



ROOF PLAN

- Notes:
1. ALUM. COPING TO TOP OF ROOF DRAIN, PER DETAILS AT "DETAIL 1" AND "DETAIL 2".
 2. ALL ROOF JOINTS SHALL BE SHIPPED WITH DISCREET CARE TO AVOID DAMAGE.
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PROPOSED SENIOR CITIZENS HOUSING
 PROJECT - 144-9-1
 TULLAH, MISSISSIPPI
 HOTEL ROGERS
 LEBAJON, NEW HAMPSHIRE
 SUBMITTED BY:
 HOLIDAY PARK PROPERTIES

ROOF PLAN

The following shows a maximized panel layout. Some of these panels land at VTR locations and would need to be eliminated.

Roof pitch is 16°

True south is about 10° off so south building azimuth used for analysis is 170°

The following assumptions were made for preliminary analysis:

South pitch: 60 panels at 280 watts = 16.8 KW: Projected annual harvest @ 21,521 KWH

North Pitch: 30 panels at 280 watts = 8.4 KW: Projected annual harvest @ 7847 KWH

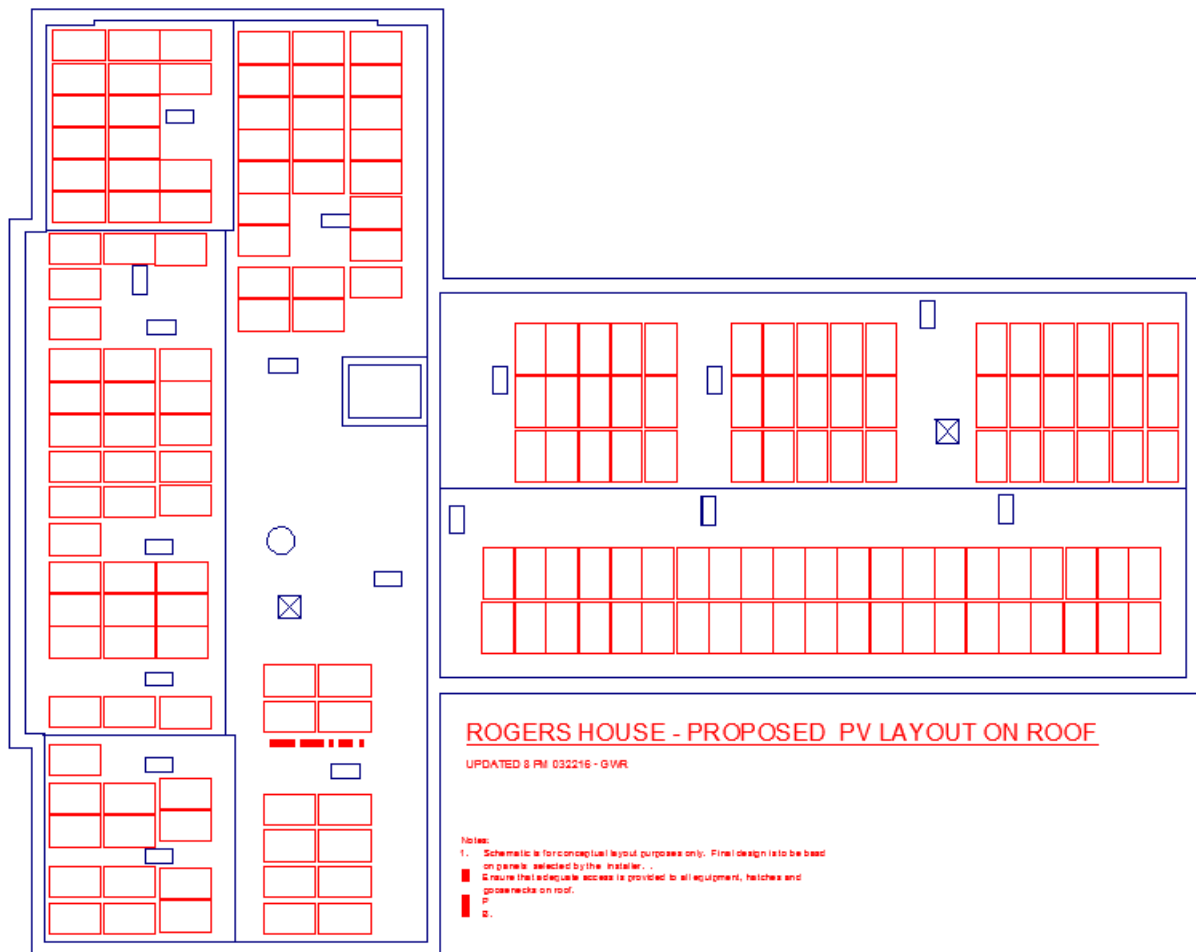
East Pitch: 46 panels at 280 watts = 12.9 KW: Projected annual harvest @ 12,171 KWH

West Pitch: 40 panels at 280 watts = 11.2 KW: Projected annual harvest @ 14,795 KWH

Totals: 176 panels = 49 KW: Projected annual harvest @ 56,334 KWH

This assumes no shading and no snow cover reductions. There does not appear to be any shading issues, however the snow cover is hit or miss, depending on weather; just look at the differences between last year and this year! It will be acceptable to provide projections based on no shading or snow cover.

POTENTIAL PANEL LAYOUT (Based on SolarWorld Sunmodule Plus # SW 280 mono - 40"x 66" panels)



In running PV watts software for this location for the same KW system at 16° pitch: the west pitch shows to have 10% less harvest than south orientation. West only 15% less. North 27% less, but that number can be reduced to 10% if panels are installed flat, which may be an option for bidders to consider. This analysis favors the installation of panels on both the east and west pitches as shown. The north is favored at 0%, IF this can be accomplished by the installer. The question here concerns the viability of harvest versus cost. The reduction in the harvest for the east/west orientation as compared to a south is considered acceptable for this site and it is desired to install panels on both the east and west pitches. The north area is optional and should be considered as an add alternate to the total PV system. Bidders should render opinions as to the viability of the added 8KW alternate.

Based on this it is the goal of the owner to maximize the roof installation to achieve a 49 KW system with the potential of annual harvest at 56,000 KWH.

It is understood that there may be factors not considered that make achieving this goal impossible. All bidders are requested to attempt to maximize their layouts based on their best practices and space available.

Proposed layout, sizing and harvest shall be provided by the bidders. Identify limiting factors, site experience, or other possible reason for reduction (or increase!) in site KW load and harvest.

A - BUILDING CONTINUOUSLY IN USE - CONTRACTOR RESPONSIBILITIES

Because this work involves cutting and patching from the roof to the existing basement in an occupied building, consideration is given to minimize potential roof leaks, the interruption of power and usable corridors and exits. All building exits shall be maintained throughout this project. Proper advanced (1 week minimum) notice of all work and potential power interruptions shall be provided to the owner. A complete plan shall be provided to the owner as to the project's work sequencing, areas impacted and scheduling of specific work for this project. This plan shall include, at a minimum, all line items in the scope of work as listed above.

Provisions shall be made to protect all interior finishes from any work within the building.

Work that will generate noise that could be disruptive to the occupants must be clearly identified so that the owner can coordinate with the tenants so they are clearly aware of such. It is assumed the roof work will be insulated from the spaces below due to attic and insulation; however, notification of this work should still be provided and clarified as to the areas it will occur and when, just in case elderly housing tenants find disturbance to be intrusive. A well informed tenant is a happy tenant, we hope.

Site storage space is at a premium. There is another contract underway in the mechanical space that will not allow for use of that space for storage. Bidder should assume all materials must be stored off site. Coordinate daily material delivery needs with the owner for space on site. Owner will make available space for daily operations, but the bidders must be clear in what those needs are. Use of adjacent parking lots and grounds for access to the roof with lifts must be coordinated with the owner.

Restricted entrance to the building is employed at this site. On a daily basis the contractor must coordinate with the owner what access is needed for the work to be performed that day.

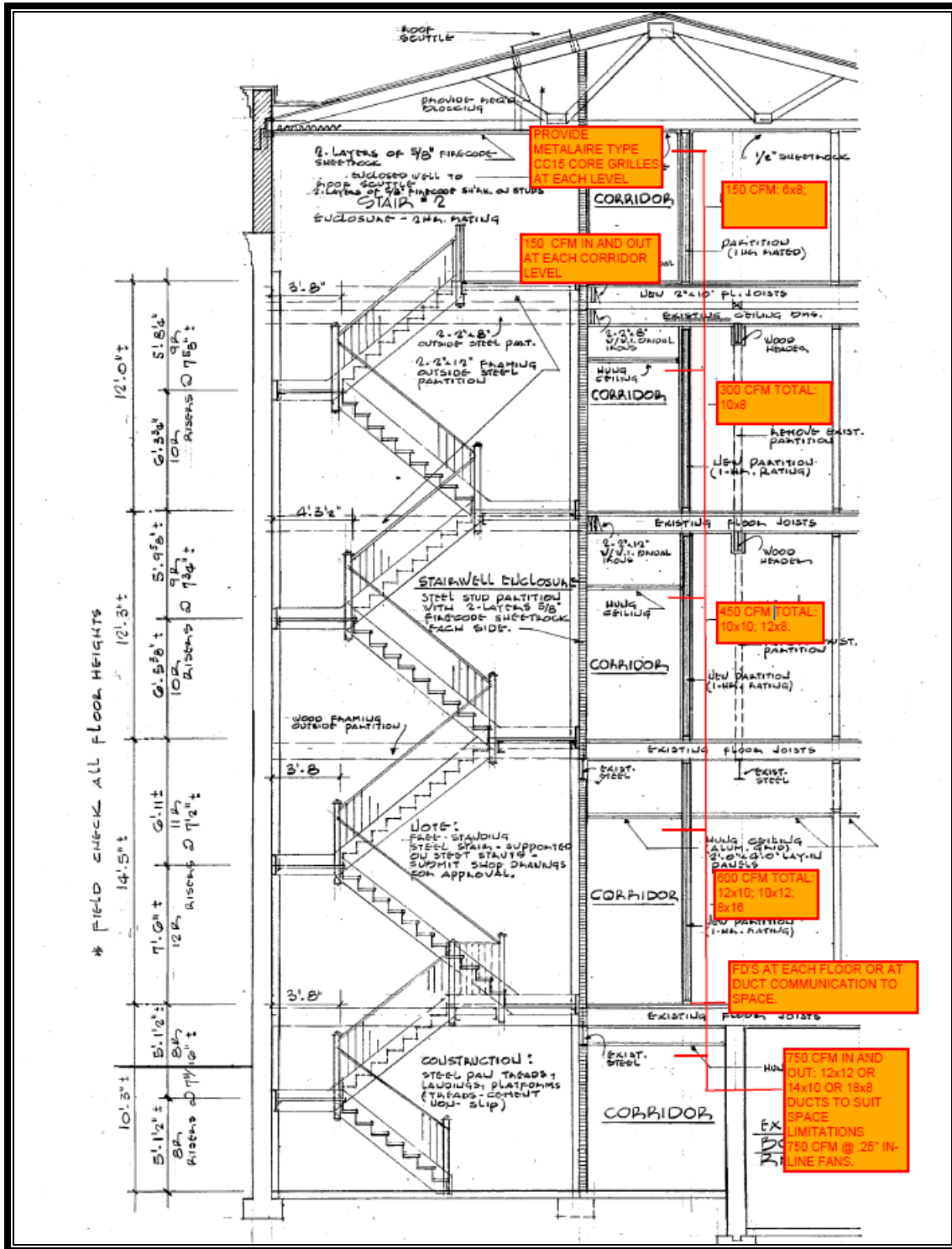
Bidders must clarify how they intend to perform their work in regards to building access.

B – INVERTERS & ELECTRICAL PATHWAYS

It is desired to have, at a minimum, an inverter (group) for each pitched section for reporting output on the dashboard. Bidders will need to survey the site to determine inverter locations. Rooftop or basement electrical room appear to be the only locations available in this building. The owner has no space to offer, however bidders can ask the owner about potential space re-purposing if they see spaces that they deem potentially viable.

The pathway for the electrical from the roof to the basement must be coordinated with the owner. Site surveys are required to determine the best path. Bidders should be aware that there is another project on the site that desires to run ductwork from the basement mechanical space to the upper level corridor. Under that bid contractors are being asked to survey the site and put their thinking caps on to determine the best possible path for the ductwork. The coordination of the electrical wiring with

the duct path seems to be a logical progression for this project. We expect we will figure out the duct path during the site walkthrough for that project's bid process on April 13.



C – SUBMITTALS & APPROVALS:

Successful bidder is required to provide a shop drawing submission for approval by owner & engineer on the panel layout, inverter locations, wiring pathway, all materials to be provided, assembly/anchor methods, dashboard, projected performance with supporting documentation and a schedule of work.

Work shall not be mobilized until this submittal has been approved.

USGBC LEED Accredited & ASHRAE High-Performance Building Design Certified Professional

C – STARTUP & COMMISSIONING:

GWR Engineering proposes to oversee the implementation of this work and commission the system to verify their operation to the intent of this scope of work. Prepare the systems for startup and perform and document the startup following the installation noted as follows:

- Prefunctional checks - Installation verification: When the unit installation is completed and the contractor is ready to perform startup, contact the owner & engineer for verification of installation. DO NOT PERFORM STARTUP without this verification.
- Once installation review has been made, any non-conformances or deficiencies identified shall be corrected. Notify the engineer and owner of their corrections for final verification of installation and authorization to perform startup.
- Once authorization for startup has been given, startup domestic hot water heaters and controls in coordination with engineer & owner on site following the installation/startup manual procedures.
- The contractor shall complete (and provide the owner with a copy) a startup report that shall document the systems checks and pressure verification, power performance, and safety device operation verifications.
- The contractor shall review with the owner all specific startup procedures and operations that involve the installed systems that may be of importance in operation or maintenance.
- The owner shall sign off on an acceptance of installation form provide by the contractor indicating the date this review was performed and who the attending parties were on site for this procedure.
- DASHBOARD review and verification of navigation, reporting, trending and access.

D – CLOSEOUT REQUIREMENTS:

Contractor to provide the following:

- Documentation on the startup and owner acceptance of an operational demonstration.
- Provide a complete set of Operations & Maintenance Manuals for all installed systems.
- Contractor shall review the maintenance procedures on all equipment, devices and systems installed.
- The contractor shall warrantee the work for a period of 1 year from the date of the acceptance document noted above. Panels to have 25 year minimum and inverters 10 year minimum warrantee. The contractor shall provide the owner with these warrantee documents.

E – BIDDING:

The LHA will oversee all bidding and bidding requirements including additional documentation and bid forms.

IF the contractor wishes to provide additional work outside this scope all of these items must be listed separately for independent evaluation by the engineer and owner.

F – QUESTIONS:

The Owner, LHA, shall be the primary point of contact for all questions.

G – SITE VISIT: LHA will issue site visit invitations

Respectfully submitted,

Bill

Gordon (Bill) W. Root, Jr., P.E., HBDP, LEED AP, President

ASHRAE High-Performance Building Design Certified Professional



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