POWER ENGINEERS, LLC

Electrical Engineering, Power, Lighting, Technical Studies and Utility Consulting

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October 28, 2010

Mr. Hank Ouimet
Weston & Sampson Engineers
5 Centennial Drive
Peabody, MA 01960

Via Email

Subject: **Electrical Evaluations for Proposed PV Site**
Landfill, Sharon MA

Dear Hank,

Power Engineers, LLC has completed its review of the possible interconnection of a proposed 2MW photovoltaic (PV) system, to be located at the Town's Landfill on Mountain Street in Sharon, MA. This report details the existing electrical utility infrastructure and upgrades that would be required.

Existing Infrastructure

The existing Landfill site consists of a 15-16 acre (usable area) capped landfill and a small single building. The building has an existing 200 ampere, single-phase 120/240V electrical service, supplied from a single polemount utility transformer (rated 37.5kVA) located on a pole outside of the building. This service is fed off of the side street to the site (Whippoorwill Road) via overhead single-phase primary pole line, owned by National Grid.

The street in front of the site is Mountain Street. This roadway has a single-phase primary pole line owned by National Grid. The closets pole to the existing landfill access driveway is Pole #30 across Mountain Street. This primary overhead line is fed by a three-phase 13.8kV circuit from the north on Mountain Street. The three-phase primary terminates at Spring Street which is 0.25 miles to the north. This circuit is from the National Grid Stoughton Substation on Washington Street, which is located approximately 4 miles to the northeast of the site.

The existing infrastructure along Mountain Street being only single-phase does not have the capacity for a 2.0MW PV project. A 2.0MW (DC) PV project is likely to inject 1.6MW (AC) into the power grid due to the typical DC-AC derating of 0.80 to 0.77 from transformation through the inverters. The single-phase transformer on-site is rated only 37.5kVA and does not have the capacity for this scale of PV project either. See Figure 1 below for a photograph of the existing pole line on Mountain Street. See Figure 2 below for a photograph of the existing building on site and its electrical service pole.

Figure 1 – Existing Pole Line along Mountain Street

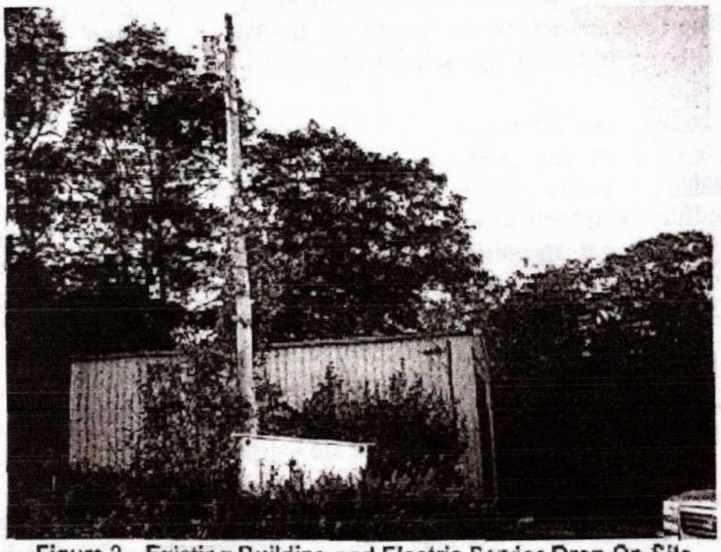


Figure 2 – Existing Building and Electric Service Drop On-Site

Possible Interconnection Points

Give the proposed size of the PV project and the remoteness of the site there is only one point of interconnection that will make technical and economic sense. This will involve the extension of the existing three-phase National Grid 13.8kV circuit along Mountain Street from where it stops at Spring Street (0.25 miles north of the site) to the site location. The wire size of this circuit appears to be 336kcmil aluminum conductor, suitable for at least 8MW of load, and appears to have had some upgrades north of the site in the vicinity of the Middle School on Mountain Street.

In order to accommodate a 2MW PV system the new primary three-phase 13.8kV overhead circuit would be extended to the site from Spring Street down Mountain Street. From the closest Pole

#30, a new tap would be made across the street to two new poles. The first pole would contain the utility company's primary metering cluster; which will meter the project as required by utility tariffs.

The second new pole would contain a three-phase group-operated switch, to be switch location to disconnect the system if necessary by the local utility. The pole would also serve as the underground conduit and cable riser to the PV system

From the pole riser underground 15kV three-phase primary cable would go to a padmounted switch cabinet and padmount metering cabinet. The metering cabinet would contain the customer's self-read meter for Renewable Energy Credits (REC's) and for third party reporting of production. The padmount switch would include a vacuum interrupter, which is a high voltage circuit breaker-like device and a high-end protective relay to trip the PV system for variations in voltage and frequency along with isolation should a fault occur. This protection is required by National Grid and dictated by the industries DG standard IEEE 1547.

From the customer's metering and padmount switch new underground primary 15kV conduit and cable would be installed to each of four (4) inverter locations, each one with a 500kVA (13.8kV-120/208V) step-down transformer and 500kW inverter. The final configuration, number of inverters, panels, etc. will be determined by the selected PV vendor, but this type of configuration is typical, along with the current use of 230-270 watt PV panels.

The proposed interconnection would provide redundant utility-grade relaying to protect the National Grid system from any negative effects of the PV system, should there be a problem, along with protecting their workers from the inverters exporting power into a "dead" line during an outage; which can be a safety issue. These types of protective device would be typical for a project of this size, and would allow protection for variations in voltage, frequency, etc. caused by the inverter. A relay would be included in proposed 15kV padmount interrupter switch, with a redundant relay (for voltage & frequency protection) installed in each inverter (4 total).

National Grid has specific standards and requirements for the interconnection of distributed generation such as the proposed PV system project. The interconnection requirements address electrical system protection, revenue metering, operation, and the configuration of the primary interconnection equipment. National Grid will review the proposed design of the electrical interconnection facilities and will perform analyses to determine the impact of the proposed generation on their electrical distribution system.

The required protective relays for the selected inverter interconnection option will be specified by National Grid based on the results of their system impact study. Based on a review of the National Grid Interconnection Requirements, it is anticipated that the protective features the PV system shall be able to detect are over/under frequency and over/under voltage and overcurrent (via the inverter fuses). Upon sensing conditions that exceed allowable operating limits, the protective features shall disconnect the PV system inverter from the rest of the distribution system. Redundant utility-grade protection is proposed at the inverters and at the padmount vacuum interrupter switch

The underground primary cables to interconnect the inverter transformers would be three, single conductor, 15 kV class, #4/0 AWG, aluminum cables to carry the expected maximum 1.6MW AC

from the project, with only a minimal (1%) voltage drop. New 15kV class cables should be installed in an underground conduit for physical protection rather than being directly buried.

Recommendation

It is recommended to interconnect the proposed 2MW PV system to a new primary electrical three-phase service from Mountain Street, which will need to be extended and upgraded from the intersection of Spring Street, approximately 0.25 miles to the site. This is the simplest and most cost effective interconnection point, as no other three-phase utility feeder exists in the area for interconnection. This type of interconnection is required of multi-MW distributed generation projects and is being used in other wind and PV projects in Massachusetts.

A budgetary cost estimate has been developed for the proposed interconnection and is attached to this report. The estimated cost is $571,840, which includes the proposed new medium and low-voltage electrical work to get from the street to the 120/208V connect to each inverter (4 total), and all necessary equipment up to (but not including) the new PV inverter and PV panels. The work to reconductor by the utility company and contingencies, etc. are also estimated, bringing the total electrical work to an estimated $793,392

The proposed interconnection is illustrated on the attached One-Line (Drawing E-1) and Electrical Site Plan (Drawing E-2).

If you have any questions, or require additional information, please feel free to give me a call.

Sincerely,

David J. Colombo, P.E.
Principal

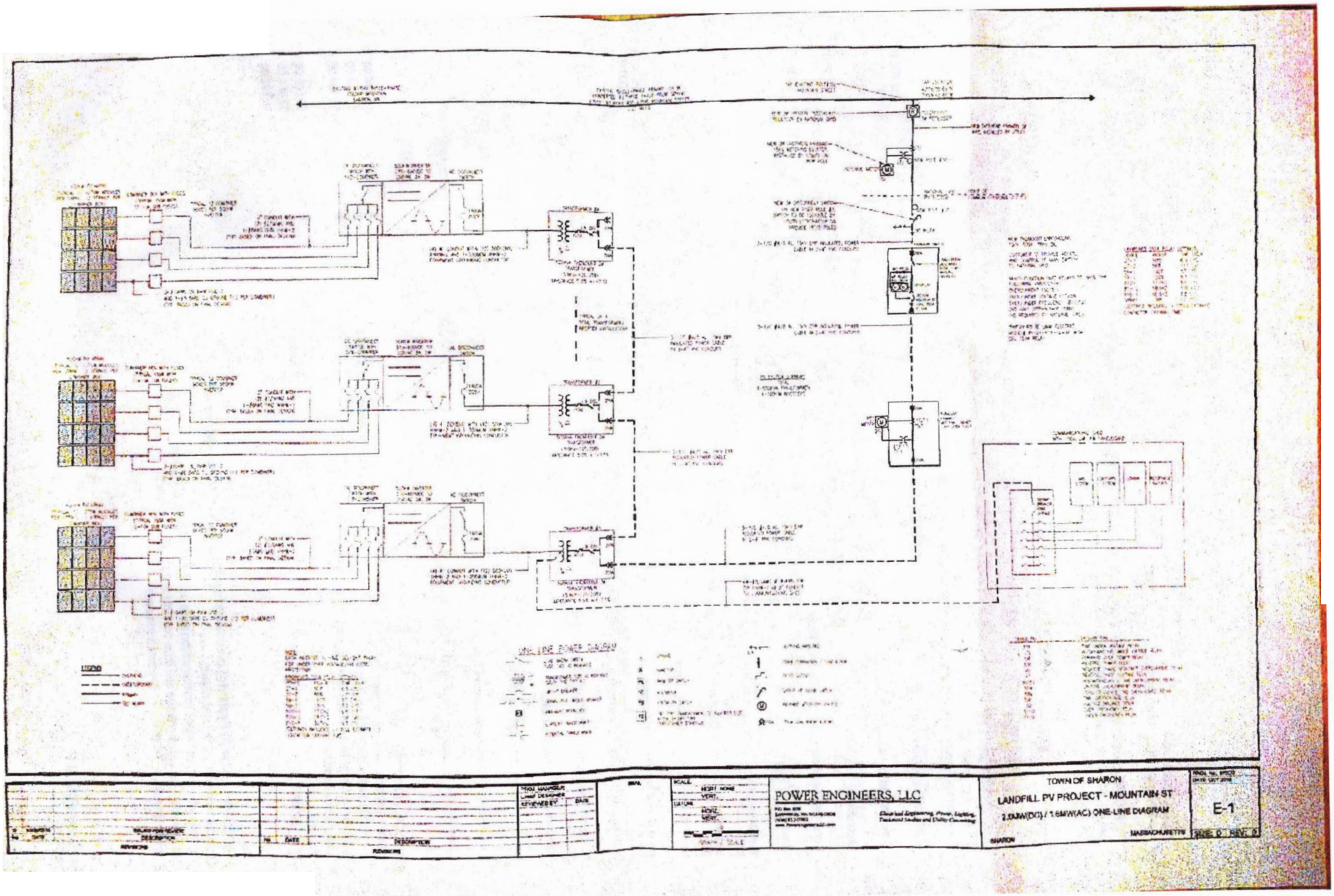
Attachments

TOWN OF SHARON
2.0 MW LANDFILL PV PROJECT

PROPOSED ELECTRICAL INTERCONNECTION
MATERIALS AND CONSTRUCTION COST ESTIMATE

Item Description	Quantity	Units	Unit Cost	Total Cost
Excavation, Backfill and Compaction for Primary Cable Ductbank (2-4")	2,970	Feet	$ 45.00	$ 133,650.00
Additional excavation & backfill for 2-2" communications conduit	2,970	Feet	$ 25.00	$ 74,250.00
Installation of Primary and Communications Conduits	5,940	Feet	$ 11.00	$ 65,340.00
Concrete Encasement of conduits	2,970	Feet	$ 20.00	$ 59,400.00
Concrete Pad for New Padmount Transformer	4	Ea	$ 2,500.00	$ 10,000.00
Grounding of Transformer	4	Ea	$ 1,000.00	$ 4,000.00
Concrete Pad for New Padmount Switch & Meter	2	Ea	$ 2,500.00	$ 5,000.00
Grounding of Switch & Meter Pads	2	Ea	$ 1,000.00	$ 2,000.00
Installation of Secondary Conduits to PV System 2-4" w/2-2" Comm	100	Feet	$ 80.00	$ 8,000.00
Installation of Secondary Cable to PV System, 4 sets 3W-600VCM	100	Feet	$ 136.00	$ 13,600.00
New Distribution Panel for Aux Equipment	1	Lot	$ 10,000.00	$ 10,000.00
Installation of New Electric Manholes	2	Ea	$ 7,000.00	$ 14,000.00
Installation of New Communication Handholes (10"x18"x20")	4	Ea	$ 900.00	$ 3,600.00
Padmount Transformers 4 x 500kVA each installed	4	Ea	$ 22,000.00	$ 88,000.00
Padmount Primary Switch installed	1	Ea	$ 45,000.00	$ 45,000.00
Padmount Primary Metering Cabinet installed	1	Ea	$ 25,000.00	$ 25,000.00
New Overhead Pole line work (2 poles w/ switch & riser)	1	Lot	$ 8,000.00	$ 8,000.00
Site Restoration - Loaming and Seeding (Manhole / Trench area only)	1	Lot	$ 3,000.00	$ 3,000.00
SUBTOTAL - CONSTRUCTION				$ **571,840.00**
Contractor Markup, Insurance, Permits, etc.	10%	of subtotal		$ 57,184.00
Additional Electrical Equipment and Testing (Control Wiring, Cable Terminations, Start-up, etc.)	10%	of subtotal		$ 57,184.00
Estimated Utility Backcharges				$ 50,000.00
Contingency	10%	of subtotal		$ 57,184.00
TOTAL ESTIMATE				$ **793,392.00**

NOTES:
1. Cost Estimate is budgetary for planning purposes and does not include permitting, legal, financing and other costs beyond those listed above.
2. Cost Estimate does not include communication cable, as type is unknown at this time.
3. Cost Estimate is for interconnection and does not include PV inverter or Panels
4. An interconnection to 4- 500kW PV inverters is assumed.



POWER ENGINEERS, LLC

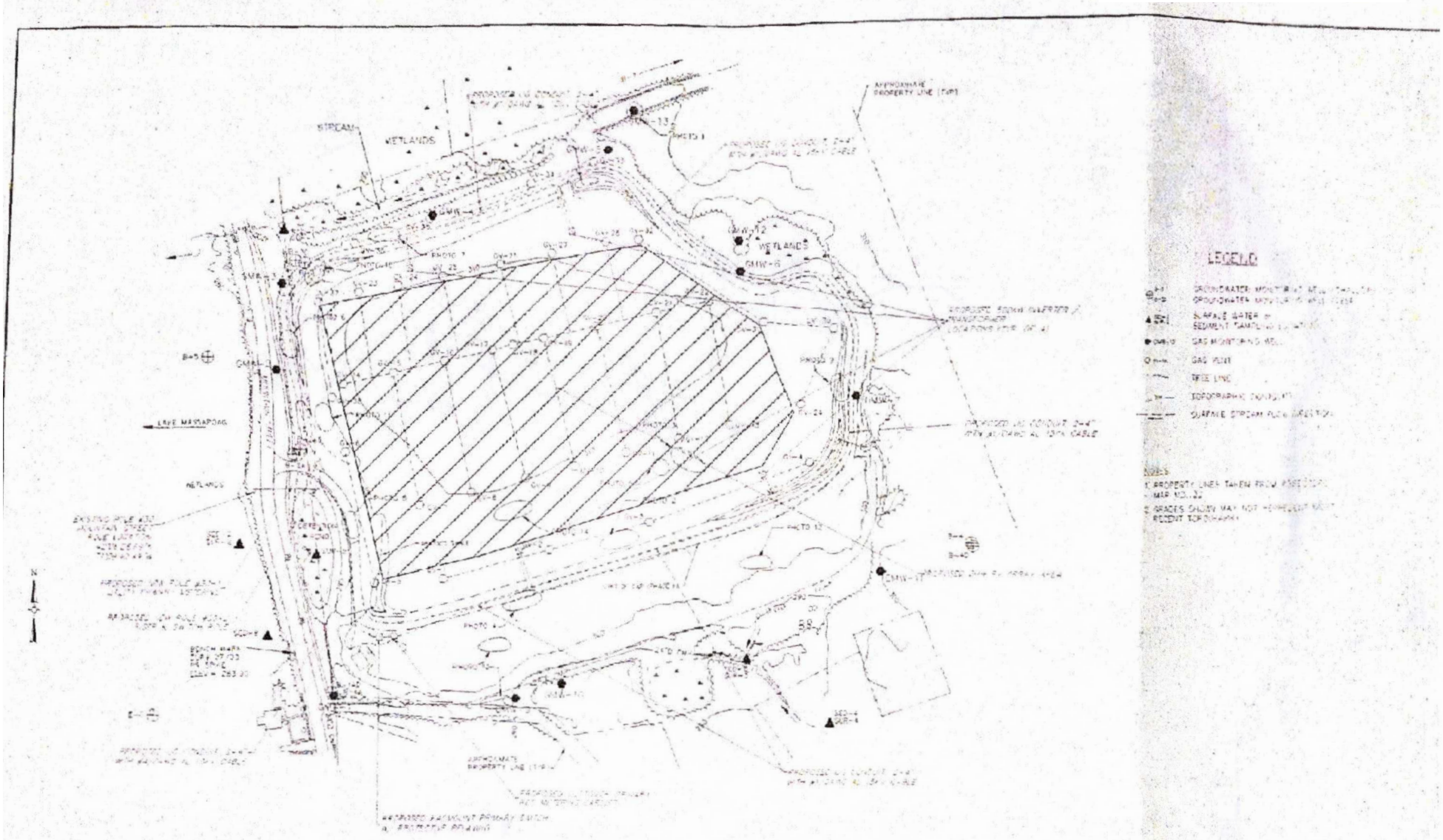
TOWN OF SHARON

LANDFILL PV PROJECT - MOUNTAIN ST

2.0MW(DC) / 1.6MW(AC) ONE-LINE DIAGRAM

SHARON MASSACHUSETTS

E-1



0 10/15/2010 ISSUED FOR REVIEW NO. DATE DESCRIPTION REVISIONS	NO. DATE DESCRIPTION REVISIONS	PROJ MANAGER: CHIEF DESIGNER: REVIEWED BY: DATE	SEAL	SCALE: HORZ. 1"=40'-0" VERT. DATUM: HORZ. VERT. 0 20 40 80 GRAPHIC SCALE	POWER ENGINEERS, LLC P.O. Box 1066 Greenville, SC 29602-1066 (864) 848-2040 www.PowerEngineersLLC.com Electrical Engineering, Power, Lighting, Transmission Studies and Utility Consulting	TOWN OF SHARON LANDFILL PV PROJECT - MOUNTAIN ST 2.0MW(DC) / 1.6MW(AC) ELEC SITE PLAN SHARON MASSACHUSETTS	PROJ. No. 94000 DATE: OCT 2010 E-2 SIZE: D REV: 0

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Town of Sharon, Massachusetts
Weston & Sampson Project No. 2100581

December 3, 2010

Mr. Eric Hooper
DPW Director
Town of Sharon
217R South Main Street, Box 517
Sharon, Massachusetts 02067

Re: Sharon, Massachusetts – Mountain Street Sanitary Landfill
Solar Facility Project (Draft)

Dear Mr. Hooper:

Weston & Sampson has completed the first two tasks of our contract on the above referenced project. The first task was to look into what would be required to provide an interconnection point between the proposed solar facility at the landfill and the existing electrical services in that area. The second task was to inspect the landfill and based on that inspection provide a cost estimate to perform the work needed to bring the landfill into compliance, if necessary, with the Solid Waste Regulations so that the solar facility could be constructed. A more detailed description of the work provided for each task is covered below.

Task 1 was to evaluate the interconnection potential for a 2 MW photovoltaic solar power facility at the Mountain Street Landfill. The evaluation indicates that there is only single-phase electrical service on Mountain Street in the vicinity of the landfill and that three-phase power will need to be run approximately 0.25 miles from Spring Street located north of the proposed facility. National Grid is the local electrical provider for this area. The interconnection evaluation was performed by Power Engineering, LLC and a copy of the interconnection electrical evaluation is attached as Attachment A.

Based on Power Engineering's evaluation, it is recommended that a new primary electrical three-phase service be extended from Spring Street to the site. This would be the simplest and most cost effective interconnection point and this type of interconnection point is required for multi-MW distributed generation projects. The evaluation has determined that it will cost approximately $793,392 to provide an interconnection point for the proposed 2 MW facility at the landfill.

Task 2 was to provide a cost estimate for repairs at the landfill in order to bring the landfill into compliance with the 310 CMR 19.000, Solid Waste regulations, which would allow the site to be used for the solar facility. Weston & Sampson performed a semi-annual inspection of the landfill capping system during October 2010. This inspection was part of the requirements of the landfill's Post-Closure Monitoring and Maintenance Plan. That inspection report has been submitted to the DEP and the Town. A copy of the landfill inspection report is attached as Attachment B. The inspection indicates that the landfill needs to be mowed in order to remove woody vegetation from the landfill surface. In addition, all woody vegetation needs to be removed from drainage swales and detention basins. The perimeter drainage swales around the landfill need to be surveyed to verify areas of negative drainage. Storm water was noted standing in many locations. In addition, there are other minor items that should be addressed as noted in the inspection report. Weston & Sampson, based on the results of that inspection, developed a cost estimate to perform the work necessary to bring the landfill into regulatory compliance. The cost estimate to repair the landfill is approximately $35,400 (see Attachment B).

Please review the attached information and call us if you have questions or provide us with comments. Once we have discussed any issues with this information, we will issue a final letter documenting the interconnection and the landfill repairs. Upon the acceptance of this information, we can then move forward with the development of solar facility RFP.

Please call if you have any questions or require additional information.

Very truly yours,

WESTON & SAMPSON

Duane C. Himes

Duane C. Himes, P.E., P.L.S.
Team Leader

Attachments

cc: File

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