Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
Western Regional Office • 436 Dwight Street, Springfield MA 01103 • 413-784-1100

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Town of Ludlow
Board of Selectmen
Town Hall
488 Chapin St.
Ludlow, MA 01056
Attention: Ellie Villano, Town Admnistrator

Sept. 14, 2012

RE: Ludlow-DSWM-12-161-001
Ludlow Landfill
Post Closure Use – Solar Power
Permit Approval
BWPSW36
Transmittal #X252487

Dear Ms. Villano:

The Massachusetts Department of Environmental Protection (the MassDEP) is issuing this permit approval to the Town of Ludlow (the Town) for the post closure use of the Town's capped landfill (the landfill) located off Holyoke Street, as a solar power farm (Solar Farm). On August 10, 2012 the MassDEP received from the Town the BWPSW36 Major Post Closure Use permit application, under transmittal #X252487 (the application). The application was completed on behalf of the Town by Tighe & Bond, Inc. (T&B): the application form was signed by Town Administrator Ellie Villano; and was also signed and stamped by Brian S. Huntley, Massachusetts-registered Professional Engineer (P.E.) #46273. The application consists of the completed transmittal form, application form, text describing the proposed use, engineering calculations, and fifteen engineering drawings. The Civil Engineering calculations of the application were signed and stamped by either James E. Trant, Massachusetts-registered P.E. #28556 or Jacycln M. Caceci, Massachusetts-registered P.E. #46847. The Civil Engineering drawings of the application were signed and stamped by either James E. Trant, Brian Huntley or Francis J. Hoey III, Massachusetts-registered P.E. #40111; the Electrical Engineering drawings of the application were signed and stamped by David J. Colombo, Massachusetts-registered P.E. #40426 (Electrical).

Summary of Proposal

The Town completed Final Closure (capping) of the landfill in 1995, in accordance with engineering plans approved by MassDEP. The cap consists of (from bottom to top) 12 inches of sand gas vent

layer, a 40-mil textured high-density polyethylene (HDPE) geomembrane, 12 inches of sand drainage layer, and six inches of topsoil. As required, the Town performs post-closure maintenance and monitoring at the landfill, including monitoring of groundwater, surface water, and landfill gas (LFG) during the 30-year post-closure maintenance and monitoring period.

The application proposes the construction and maintenance of a 2.6 megawatt (MW) photovoltaic solar farm on approximately 10 acres of the capped landfill, as follows:

- One permanent access road will be built on the landfill cap for vehicle access for construction and maintenance activities;
- The solar array will be placed on the Town-owned portion of the landfill, on slopes not exceeding 5 degrees, with the solar panels tilted at 25 degrees from horizontal, facing south;
- A total of 1,008 pre-cast concrete foundation footings will be placed on the vegetative support layer of the cap;
- 504 photovoltaic panel racks (Sun Rack) will be installed on the foundation footings;
- 10,080 LG Electronics Solar Panels will be installed on the panel racks;
- A concrete pad will be installed on the vegetative support layer of the cap, within the center of the landfill, which will hold electrical equipment, including combiner boxes, inverters, switchboxes, transformers, and a switchgear box, where electrical power from the solar panels will be conveyed;
- The photovoltaic panel racks will be connected to the electrical equipment pad via above-ground electrical cables, strung on the panel racks and also on aluminum ladder-type racks between the panel racks;
- The switchgear box of the electrical equipment pad will convey electrical power off the landfill via an electrical cable buried in a conduit ductbank beneath the permanent access road, for transmission of electricity to the WMECO utility grid at new utility poles to be installed on the south side of Holyoke Street, at the western access road entrance.

A permanent access road will be constructed from the former landfill entrance on Holyoke Street (the western access entrance), through the center of the landfill, to a second (eastern) access entrance on Holyoke Street to be constructed at the eastern end of the landfill. The road will be constructed by the placement of a woven geotextile directly over the vegetative support layer of the landfill cap, and addition of 18.5 inches of processed gravel over the geotextile, with 6 inches of dense-graded, crushed stone over the gravel. One 12-inch high by 18-inch wide, concrete duct bank will be installed within the processed gravel layer of the permanent road from the western Holyoke Street entrance to the electrical equipment pad, with two 4-inch diameter PVC conduits within the duct bank; one conduit will carry the electrical transmission line from the electrical equipment pad to the utility pole on Holyoke Street, the other conduit will be a spare. Two additional two-inch PVC conduits will be installed within the processed gravel layer of the permanent access road, one to carry communications wiring (and one spare). Construction entry pads will be installed at both entrances of the access road at Holyoke Street, consisting of a 6-inch thick, crushed stone pad, 16-feet wide by 30-feet long, to avoid dirt tracking onto Holyoke Street during construction.

A temporary, construction lay-down area is proposed to be installed off the access road, within the eastern portion of the landfill, approximately 80 feet x 80 feet in area**,** consisting of a woven geotextile directly over the vegetative support layer of the landfill cap, with addition of 24.5

inches of processed gravel over the geotextile.

The concrete foundations (ballasts) for the photovoltaic racks will be pre-cast off-site, and will be 3 feet wide, 1 foot thick, and either 9.25 feet long (interior array area) or 10.25 feet (exterior array area). T&B proposes to use either crushed stone or crushed, clean asphalt, brick and concrete (ABC) material, as fill beneath each footing, to provide a planar surface for the footings, at a maximum slope of 5 degrees slope from horizontal, in the North-South direction. T&B proposes two alternative methods for placement of the crushed stone/ABC fill: (A) Placement of crushed fill only under each footing, extending out a minimum of 6 inches beyond the footing edge; or (B) Placement of a geotextile fabric strip and crushed fill (crushed stone only, not ABC) along the entire length of each panel rack line extending out a minimum of 6 inches beyond the footing edge. The photovoltaic racks will be bolted to the footings. The electrical transmission wiring from the racks to the electrical equipment pad will be run on aluminum-ladder type cable trays on the landfill surface. All photovoltaic rack assemblies and above-ground wiring will be kept at least 10 feet from any landfill gas vents.

The concrete electrical equipment pad will be constructed in the center of the landfill, just off the permanent access road, and will be 41-feet wide by 42-feet long by 1.0 to 1.5-feet thick. A minimum of 6 inches of compacted gravel and 6 inches of crushed stone will be placed beneath the pad for leveling purposes, and the concrete pad will be poured in place, from concrete trucks operating from the access road. Four inverters, two transformers, one switchgear box and ancillary equipment will be placed on the concrete pad. The electrical lines from the transformers and switchgear will run from the base of these boxes down through the concrete pad and the crushed stone/gravel below, due to electrical code requirements, however none of these electrical lines will penetrate the vegetative support layer. Specifications included in the application show that the electrical equipment, including the inverters and transformers, will be metal boxes with no opportunity for worker entry. A 6-foot chain link fence will be installed around the electrical equipment pad, by anchoring of fence posts within the concrete at the pad perimeter.

A six-foot tall, chain-link fence will be installed around the entire perimeter of the Solar Farm, consisting of a driven–post, chain link fence to be installed just outside the northern and eastern perimeter of the landfill, and a ballasted-post, chain link fence to be installed on the landfill cap, just outside the southern and western perimeter of the solar array. The fence ballasts will be pre-cast concrete blocks, 3-feet long, 1.5-feet wide, and 1-foot thick, with the fence post fitting into a sleeve in the ballast. Locking gates will be provided at the two access road entrances to the landfill.

The solar array will be grounded as required by electrical codes, including grounding to ballast blocks and the electrical equipment pad. No grounding wires or rods will extend down into the vegetative support layer of the cap.

Only low-ground pressure equipment, 7 pounds per square inch (psi) or less, will operate off the access roads, and will be operated to minimize turning during operations and to minimize repeated travel over the same areas. If use of the equipment is determined to be detrimental to the cap vegetative support layer surface, a geotextile and a 6-inch layer of crushed stone will be placed on the vegetative support layer surface in problem areas for equipment use.

T&B performed geotechnical analyses for the solar array as follows:

- Loadings (increased ground pressure) from the foundations, racks and panels were calculated at the top of the sand drainage layer of the cap (including wind and snow loads), and the calculated ground pressures were compared to a standard of 5 psi. T&B's calculations showed that ground pressures from the solar arrays at the ballast blocks ranged from 1.9 psi to 2.3 psi, and the ground pressure from the electrical equipment pad would be 3.6 psi.
- Settlement of the ballast blocks was calculated to be in the range of 0.036 inches to 0.037 inches.
- Seismic stability was calculated to be acceptable for the solar array;
- T&B states that the loading and settlement on the access roads on the cap, including potential vehicle tire loading on the access roads, would be equivalent to values calculated for the Oliver Street Landfill in Easthampton, which were previously deemed acceptable and approved by MassDEP;
- T&B concluded that all analyses, for the foundations and the roads, showed minimal loading and settlement, and no stresses or settlement which would damage the impermeable layer of the landfill cap.

T&B performed updated stormwater analyses for changes to stormwater runoff from the proposed work using the Drainage2 Stormwater Model; T&B concluded that there will only be small changes in stormwater runoff, and the existing stormwater control system can handle the flows. The only proposed change to stormwater management at the landfill is the proposed installation of two, 18-inch culverts at the western access road location, where it crosses the perimeter stormwater swale.

T&B states that the proposed construction and operation of the Solar Farm will not alter the conclusions of the previous Qualitative Risk Assessment for the landfill (completed as part of the Comprehensive Site Assessment); i.e. that there are no significant risks to human health and the environment posed by the landfill, or by the presence of the Solar Farm on the landfill.

There are no proposed changes to the existing, long-term monitoring program for the landfill. The landfill will continue to be inspected and mowed semi-annually. If erosion is observed, the surface will be stabilized.

The Town signed a 20-year Power Purchase Agreement (PPA) with Borrego. If, at the end of that 20-year period, the option to renew is not exercised, Borrego will be responsible for decommissioning of the Solar Farm, which would consist of removal of all structures, including foundations and associated crushed stone, and restoration of the landfill cap to its original condition. The access roads would remain to provide future landfill access for the Town.

T&B states that construction of the Solar Farm will begin in November of 2012, and will be completed by July of 2013.

MassDEP Determinations

Personnel of MassDEP have reviewed the Post-Closure Use permit application for the Ludlow Landfill in accordance with MGL c. 111 s. 150A, MGL c. 30A, 310 CMR 19.000, and MassDEP's publication Landfill Technical Guidance Manual (the LAC), revised in May, 1997. MassDEP has determined that the application is approved in accordance with MGL c. 111, s. 150A and MGL c. 30A, subject to the conditions outlined below.

1. The Town of Ludlow (the Town) is the owner of the landfill and the permittee for the Solar Farm construction and operation.

2. A third-party, independent Massachusetts-registered professional engineer knowledgeable in landfill design and construction (the "Engineer") shall supervise the overall construction of the Solar Farm. The Engineer and/or a qualified QA/QC officer shall be present at the site at all times during road building, fence installation, ballast delivery and placement, installation of the electrical equipment pad, and rack/panel construction, when construction equipment is operating on the landfill. The QA/QC officer shall work under the direct supervision of the Engineer.

3. The Engineer's duties shall include, but not be limited to: oversee installation and construction of the components of the Solar Farm as outlined above; oversee quality assurance/quality control (QA/QC) testing and verify all data generated through the testing program; document all construction and QA/QC activities; and submit monthly construction progress reports to the MassDEP and the Town, which shall summarize the work performed during the month.

4. The Engineer's monthly construction report shall include at a minimum the following:

   (A) Any deviation from compliance with requirements approved or set forth in this Permit;
   (B) Any actions taken to correct such deviations, as required by MassDEP or recommended by the Engineer;
   (C) Schedules to correct identified problems;
   (D) Review of quality assurance/quality control (QA/QC) testing data generated, and documentation for construction and QA/QC activities;
   (E) The inspection report shall be signed and dated by the Engineer certifying that to the best of his/her knowledge all information is accurate and complete; and
   (F) The Engineer shall submit one copy of the monthly report to the MassDEP and one copy to the Town no later than seven (7) days following the end of the previous month.

5. Upon completion of the Solar Farm installation, the Engineer shall submit to MassDEP a completion report, signed and sealed by a Massachusetts-registered P.E., certifying that the work was completed in accordance with the application and the conditions of this permit.

6. Borrego Solar Systems, Inc. (Borrego) and the Engineer shall be considered operators

with respect to the construction of the Solar Farm and compliance with plans and specifications. Borrego shall also be considered an operator during the operational life and decommissioning of the Solar Farm. As such, the Department may take enforcement action against Borrego or the Engineer, consistent with its authority under applicable Massachusetts law and regulation, for any failure to construct the Solar Farm in accordance with approved plans and specifications of which Borrego or the Engineer were, or should have been, aware.

7. The owner, operators and their contractor(s) are responsible to ensure that all necessary precautions are taken to protect the health and safety of workers and the general public during both construction and maintenance of the solar farm. A copy of the site-specific Health & Safety Plan for the construction and maintenance of the Solar Farm shall be submitted to the MassDEP prior to the beginning of any construction work, which shall include protocols for monitoring of landfill gas as needed, and protocols for modifying work practices if landfill gas is detected at levels deemed unsuitable.

8. All disturbance of the landfill cap shall be limited to the proposed installations on top of the vegetative support layer of the cap, i.e. - no excavations or other penetrations shall be performed into the vegetative support layer or sand drainage layer of the cap without separate written approval from the MassDEP. All concrete footings on the cap shall be placed on top of, or above, the vegetative support layer of the cap, unless otherwise approved by the MassDEP. There shall be no penetrations (utility, conduit or other) at the base of any rack ballasts. <u>There shall be no penetrations of any kind of the impermeable layer of the cap.</u>

9. The owner, operators and their contractor(s) are responsible to ensure that the inverter and transformer boxes on the landfill cap area will not accumulate landfill gas within the boxes during the construction and operation of the solar farm. Any landfill gas levels exceeding 10% of the Lower Explosive Limit (% LEL) within any electrical equipment box shall trigger the requirements of 310 CMR 19.132(4)(g), for notification and action. The additional requirements for the electrical equipment pad include the following:

   A. The maximum areal size of the electrical equipment concrete pad shall not exceed 41 feet long by 42 feet wide;
   B. Each inverter/transformer box shall be ventilated as proposed, and the floor of each box shall be solid, with no openings for landfill gas to enter at the floor level, except for the box penetrations as proposed;
   C. There shall be no utility, conduit or any other penetrations through the base of the boxes or the base of the concrete pad, except for the box penetrations as proposed, i.e. – all other utility penetrations shall enter only through the side of the boxes, not the bottom, and these penetrations shall be fully sealed (both outside and within each conduit). The transformer and switchgear box penetrations shall be fully sealed against landfill gas entry, and the conduit/wiring from these boxes shall not extend down into the vegetative support layer of the cap;
   D. The inverter/transformer boxes shall not include a heater;
   E. The eastern portion of the chain-link fence surrounding the electrical equipment pad

shall be equipped with solid, plastic slats within the matrix of the chain-link fence. If MassDEP determines that nuisance noise conditions are being created by the electrical equipment, MassDEP reserves the right to require noise studies and/or the installation of additional noise mitigation measures; and

F. As part of the site-specific H&S Plan, a written protocol shall be prepared and submitted for the maintenance of the inverters/transformers, and for regular calibration and maintenance of landfill gas monitors used by workers on the site.

10. All necessary precautions shall be taken to ensure that the proposed construction and maintenance work associated with the Solar Farm shall not in any way damage the impermeable layer of the landfill cap, leachate collection/conveyance pipes, landfill stormwater control structures, landfill monitoring wells, or landfill gas venting wells. If any damage occurs to any of the above-listed landfill components, the Town or Borrego shall notify MassDEP immediately (within 24 hours maximum), a written plan for repair of the components shall be submitted to MassDEP within 48 hours, and any repair work shall be completed on the schedule determined by MassDEP.

11. Prior to the commencement of construction activities, all landfill gas vents, landfill gas monitoring wells, groundwater monitoring wells, and other existing, above-ground structures of the landfill cap and appurtenances shall be flagged for visibility, and protective barriers shall be placed around such structures as needed to prevent damage by vehicles accessing the cap area, including the landfill gas monitoring wells located north of the landfill.

12. Construction work along the northern landfill perimeter shall not interfere with, or damage in anyway, the landfill gas (LFG) venting trench located between the landfill cap and the road in that area. As part of this construction project, the missing, damaged or broken riser pipes associated with the LFG venting trench shall be repaired.

13. Vehicles operating on the landfill cap shall only operate on the designated access roads, except for low-pressure construction equipment (with ground pressures of 7 psi or less) which may operate off the access roads, in accordance with the remaining conditions of this permit. All operators of vehicles entering the cap area shall be clearly instructed by the on-site engineer and/or the contractor of the requirements of this permit prior to arrival, to avoid damage to the landfill cap components. Low-pressure construction equipment operating off the access roads shall limit turning by tracks on the vegetative support layer as much as possible. In no case shall rutting or other disturbance extend more than 6 inches down into the vegetative support layer (i.e. to the sand drain age layer). If MassDEP determines that the use of excavation equipment is creating the potential for damage to the sand drainage layer or the impermeable layer, the usage of such equipment shall cease immediately upon notification by MassDEP, and alternative work practices for operation of equipment of the cap (i.e. placement of geotextile and crushed stone, as proposed) in the affected area(s) shall be instituted.

14. MassDEP specifically reserves the right to restrict or prohibit heavy vehicular loads from the access road on the landfill cap, either as a weight restriction or a usage restriction, should inspections or other information reveal the potential for damage to the cap beneath the road

from heavy vehicle loads. MassDEP also specifically reserves the right to impose, at any time deemed necessary by MassDEP, additional requirements for construction of the access road on the cap, including the addition of a geogrid to the base of the access road.

15. Prior to the start of construction, the Town or Borrego shall submit to MassDEP a written protocol for the use of concrete pumpers or concrete delivery trucks on the cap, including restriction of use only to the access road, and a restriction on the use of outriggers or stabilizers unless specifically approved by MassDEP. The protocol shall also include procedures for the use of outriggers or stabilizers by tracked excavators working anywhere on the cap (i.e. either no use of outriggers/stabilizers for concrete pumpers or excavators on the cap, or sufficiently large pads placed beneath outriggers/stabilizers to avoid damage to the cap).

16. If Borrego intends to use different solar panels, panel racks, ladder racks, or electrical equipment other than that detailed in the application, Borrego shall notify MassDEP and provide documentation that the alternative equipment does not increase calculated ground pressures or decrease calculated Factors of Safety for solar array stability.

17. Clean, crushed asphalt, brick and concrete (ABC rubble), crushed to 3" diameter or less, may be substituted for crushed stone beneath ballast blocks, as proposed. Coated (painted or stained) ABC rubble shall **not** be used in the Solar Farm construction. Compaction of the crushed stone or clean ABC must not damage the geomembrane of the cap, and crushed stone or ABC shall not be compacted more than 6 inches into the vegetative support layer.

18. The Town, Borrego and their contractor(s) are responsible to ensure that the proposed work complies with all applicable local, state and federal electrical codes and permits, including the National Electrical Code (NEC), 2011 Edition, Article 690 –"Solar Photovoltaic (PV) Systems". The Town, Borrego and their contractor(s) are also responsible to ensure that the proposed work complies with all other applicable local, state and federal regulations.

19. The owner and operators are responsible to ensure that the access entrances from the landfill onto Holyoke Street comply with applicable local and state regulations for traffic safety, and that any applicable permits for these entrances are gained prior to construction. Prior to construction, representatives of the Town's DPW and Police Department shall meet with Borrego and the Engineer to discuss whether or not the Holyoke Street curve in the vicinity of the proposed Eastern access road entrance warrants a flagman or other traffic control during construction. The Town shall notify the MassDEP of its determination prior to the commencement of construction. The owner and operators are also responsible to ensure that the solar farm work complies with applicable Town zoning regulations.

20. Following completion of installation, inspections of the Solar Farm shall be performed on a quarterly basis by a qualified, third-party inspector, and quarterly inspection reports shall be submitted to MassDEP. After one year of quarterly inspections, the Town may petition MassDEP in writing to reduce the frequency of inspections. Environmental monitoring shall continue to be performed at the landfill by the owner or operator as outlined in existing correspondence to the Town from MassDEP. The entire landfill shall

continue to be maintained (inspected and mowed) semi-annually. Any erosion problems, settlement problems, or other issues observed on the landfill cap (inside or outside of the fenced Solar Farm) shall be reported to MassDEP and repaired immediately.

21. This post-closure use permit shall be valid for a period of 30 years from the date of this permit, provided that MassDEP may amend the term of the permit in accordance with an approved modification pursuant to either 310 CMR 19.039 or 19.040. This permit is issued to the Town for the Solar Farm construction and operation. If the Town intends to transfer this permit to any other entity for operation of the Solar Farm, the requirements at 310 CMR 19.044, Transfer of Permits, shall be satisfactorily completed. If the permittee or operator discontinues operation of the Solar Farm, the permittee or operator is responsible to perform decommissioning activities as outlined in the permit application, including removal of the solar array equipment, ballasts, and associated crushed stone. If the Town intends to operate the Solar Farm after the expiration of this permit, the Town is required to submit a request for a renewal of the permit at least 90 days prior to the expiration of the permit.

22. MassDEP and its agents and employees shall have the right to enter upon the landfill at all reasonable times, to inspect the landfill and any equipment, structure or land located thereon, take samples, recover materials or discharges, have access to and photocopy records, to perform tests and to otherwise monitor compliance with this Permit and all environmental laws and regulations. This right of entry and inspection shall be in addition to MassDEP's access authorities and rights under applicable federal and states laws and regulations, as well as any permits or other agreements between the Permittee and MassDEP.

23. MasDEP reserves the right to require additional or increased monitoring or maintenance activities in the event that the post-closure use is or may be having a detrimental effect on the landfill cap or appurtenances. MassDEP reserves all rights to suspend, modify or rescind this permit, should the conditions of this permit not be met, should the Solar Farm create nuisance conditions or threats to public health, safety or the environment, or should MassDEP otherwise determine that continued post-closure use is negatively impacting the landfill cap or appurtenances.

Pursuant to 310 CMR 19.037(5), any person aggrieved by the issuance or denial of this permit decision, except as provided for under 310 CMR 19.037(4)(b), may file an appeal for judicial review of said decision in accordance with the provisions of M.G.L. c. 111, s. 150A and c. 30A not later than thirty [30] days following the receipt of the final permit. The standing of a person to file an appeal and the procedures for filing such appeal shall be governed by the provisions of M.G.L. c. 30 A. Unless the person requesting an appeal requests and is granted a stay of the terms and conditions of the permit by a court of competent jurisdiction, the permit decision shall remain effective or become effective at the conclusion of the 30 day period.

Any aggrieved person intending to appeal the decision to the superior court shall provide notice to MassDEP of said intention to commence such action. Said Notice of Intention shall include the MassDEP File Number (12-161-001) and shall identify with particularity the issues and reason(s)

why it is believed the approval decision was not proper. Such notice shall be provided to the Office of General Counsel of MassDEP and the Regional Director for the regional office which made the decision. The appropriate addresses to which to send such notices are:

General Counsel
Department of Environmental Protection
One Winter Street-Third floor
Boston, 02108

Regional Director
Department of Environmental Protection
436 Dwight Street - Fifth Floor
Springfield, MA 01103

No allegation shall be made in any judicial appeal of this decision unless the matter complained of was raised at the appropriate point in the administrative review procedures established in those regulations, provided that matter may be raised upon a showing that it is material and that it was not reasonably possible with due diligence to have been raised during such procedures or that matter sought to be raised is of critical importance to the public health or environmental impact of the permitted activity. This approval pertains only to the Solid Waste Management aspects of the proposal and does not negate the responsibilities of the owners or operators to comply with any other local, state or federal laws and regulations now or in the future.

If you have any questions about this matter, please contact Larry Hanson of this office at 413-755-2287.

Sincerely,

Daniel Hall
Section Chief, Solid Waste Management

cc: Ludlow Board of Health
Ludlow Planning Dept.
Ludlow DPW – Paul Dzubek
Ludlow Police Dept.
Borrego Power – Scott Sargeant
Tighe & Bond – Brian Huntley, P.E.