

General Permit for the Discharge of Stormwater from Construction Activities

APPENDIX I

Stormwater Management for Solar Array Construction Projects

Solar development has expanded over the last several years as Connecticut and other states have invested in this important resource to further greenhouse gas emission reductions and other renewable policy objectives. However, construction of a large-scale solar array is unlike most other construction activities regulated under the General Permit for the Discharge of Stormwater from Construction Activities (“general permit”) and entails challenges not encountered in traditional development projects. If not properly managed, stormwater discharged during and after the construction of solar arrays can be a significant source of pollution resulting from increased runoff, erosion, and sedimentation, which can adversely impact wetlands or other natural resources. It is vitally important to stabilize soil, minimize soil disturbance and soil compaction, and manage the total runoff volume and velocity. Proper stormwater management practices can significantly mitigate the loss of topsoil, erosion and sediment discharges from disturbed areas and stormwater outlets, and erosion along downstream channels and streambanks. The opportunities to properly manage runoff decrease as site imperviousness increases.

Therefore, in addition to the terms and conditions of the general permit, applications for construction of a Solar Array (as that term is defined in Section 11 of the general permit) shall, at a minimum, adhere to the conditions listed below. Depending on site-specific conditions for a particular solar array construction project, additional analyses may be required.

1.0 Design and Construction Requirements

- (1) Roadways, gravel surfaces and transformer pads within the solar array are considered effective impervious cover for the purposes of calculating Water Quality Volume (WQV). In addition to these impervious surfaces, all solar panels in the array shall also be considered effective impervious cover for the purposes of calculating Water Quality Volume if the proposed post-construction slopes at a site are equal to or greater than 15% or if the postconstruction slopes at a site are less than 15% and the conditions in (a) – (d), inclusive, below have not been met:
 - (a) The vegetated area receiving runoff between rows of solar panels (see Figures 1 and 2 below) is equal to or greater than the average width of the row of solar panels draining to the vegetated area;
 - (b) Overall site conditions and solar panel configuration within the array are designed and constructed such that stormwater runoff remains as sheet flow across the entire site and flows towards the intended stormwater management controls;
 - (c) The following conditions are satisfied regarding the design of the post-construction slope of the site:
 - (i) For slopes less than or equal to 5%, appropriate vegetation shall be established that will ensure sheet flow conditions and that will provide sufficient ground cover throughout the site; and
 - (ii) For slopes greater than 5%, but less than 10%, practices including, but not limited to, level spreaders, terraces or berms as described in Figure 2, below, shall be used to ensure long term sheet flow conditions; and

- (iii) For slopes greater than or equal to 8%, erosion control blankets or stump grindings or erosion control mix mulch or hydroseed with tackifier shall be applied within 72 hours of final grading, or when a rainfall of 0.5 inches or greater is predicted within 24 hours of final grading, whichever time period is less; and
 - (iv) For slopes equal to or greater than 10% and less than 15%, the SPCP includes specific engineered stormwater control measures with detailed specifications that are designed to provide permanent stabilization and non-erosive conveyance of runoff to the property line of the site or downgradient from the site.
- (d) The solar panels shall be designed and constructed in such a manner as to allow the growth of native vegetation beneath and between the panels. Pollinator-friendly vegetation is strongly encouraged. With respect to such vegetation, the Permittee shall not use chemical fertilization, herbicides, or pesticides except as necessary to establish such vegetation.
- (2) (a) Prior to commencing construction activities, the Permittee shall ensure that the following setbacks and buffers shall be delineated and maintained on the site:
- (i) No solar panel associated with a solar array shall be located within one hundred (100) feet of any wetland or waters (“the 100-foot setback”) that, prior to or after construction, is located downgradient of any construction activity or within fifty (50) feet of any property boundary (“the 50-foot setback”) that, prior to or after construction, is located downgradient of such construction activity; and
 - (ii) Except as provided in Section 2(a)(iii) of Appendix I, there shall be an undisturbed buffer of at least fifty (50) feet between any construction activity at a site and any wetland or waters that, prior to or after construction, is located downgradient of such construction activity (“the 50-foot buffer”). Such buffer shall be comprised of existing dense herbaceous vegetative ground cover (e.g. not forested area). If the entirety of such buffer is not comprised of existing dense herbaceous vegetative ground cover, either such dense herbaceous vegetative buffer shall be established upon final stabilization or such buffer shall be at least one hundred (100) feet (“the 100-foot buffer”).
 - (iii) There shall be an undisturbed buffer of at least ten (10) feet between any construction activity at a site associated with an access road or the electrical interconnection necessary for the solar array and any wetland or waters that, prior to or after construction, is located downgradient of such construction activity (“10-foot buffer”), except if the access road or electrical interconnection passes between two wetland or waters and the undisturbed buffer cannot be achieved. Any crossing through a wetland or waters for an access road or electrical interconnection is exempt from such buffer requirement.
- (b) Notwithstanding Section 2(a)(ii), the 50-foot buffer or 100-foot buffer, as applicable, may be reduced, only where necessary, but by no more than fifty percent (50%), only if all of the following have been demonstrated to the satisfaction of the Commissioner by approval of an Application:
- (i) Stormwater control measures for managing stormwater discharges that will enter or be received by a wetland or waters shall be designed and installed in accordance with the following conditions:
 - (A) a minimum sediment load reduction of ninety percent (90%) shall be achieved before such discharges enter or are received by a wetland or waters. The required sediment load reduction shall be calculated based solely on the stormwater controls used; no sediment load reduction from conditions on the site (i.e., from any remaining buffer) shall be considered when calculating the sediment load reduction from such stormwater controls. The sediment load reduction may be calculated using a range of available models that are available to facilitate this calculation, including USDA’s RUSLE-series programs and the WEPP erosion model, SEDCAD, SEDIMOT, or other equivalent independent third party model or method acceptable to the Commissioner;

- (B) those portions of a solar array from which stormwater discharges enter or will be received by a wetland or waters shall be deemed effective impervious cover for the purposes of calculating conveyance protection in accordance with the Stormwater Quality Manual, even if those portions of such array are less than one (1) acre; and
 - (C) the buffer into which stormwater discharges shall have a slope of less than or equal to fifteen percent (15%)
- (c) A soil scientist, as that term is defined in Section 11 of the general permit, shall delineate all wetland or waters by field survey. The location of all wetland or waters and all required setbacks and buffers shall be shown on all mapping and prior to the start of construction be clearly marked on the site with flags, stakes, tape, or a similar marking device by a surveyor licensed in Connecticut.
 - (d) Delineation of the 100-foot setback and any buffer required under this Section shall be measured perpendicularly and laterally from the nearest part of the solar array or construction activity, as applicable, to:
 - (i) in the case of waters, the ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris;
 - (ii) the nearest edge of the stream or river bank, bluff, or cliff, as applicable; and
 - (iii) the nearest edge of any wetland, as determined by a soil scientist.
 - (e) The SPCP shall indicate how compliance with this Section will be achieved.
 - (f) Prior to the approval of an application, the Commissioner may determine that the 100-foot setback or any buffer required under this Section is not adequate to protect water quality or natural resources (i.e., a vernal pool, cold-water perennial streams, perennial headwater seeps or similar sensitive wetland or waters, or other sensitive habitat). In such a case, the Commissioner may reject or disapprove the application or may impose additional terms and conditions in the approval of such application, including, but not limited to, an additional setback, buffer or other control measure.
 - (g) Nothing in this Section is intended to or shall prevent improvements, as may be directed by the Commissioner in the approval of an application, to enhance the water quality benefits or the natural resource value of any buffer required under this Section.
 - (h) The terms “wetland”, “watercourse”, and “waters” shall be as defined in Section 11 of the general permit. In addition, the term “access road” shall mean a road used for the sole purpose of gaining access to the site from a public road or right-of-way or a road used solely to provide access between separate internal areas of fenced solar arrays. Access road shall *not* include any other road, including, but not limited to, a road around the perimeter of a solar array or a road used to service solar arrays.
- (3) The lowest vertical clearance of the solar panels above the ground should not be greater than ten (10) feet. The panels shall, however, be at an adequate height to support vegetative growth and maintenance beneath and between the panels. If the lowest vertical clearance of the solar panels above the ground is greater than ten (10) feet, non-vegetative control measures will be required to prevent/control erosion and scour along the drip line or otherwise provide energy dissipation from water running off the panels. This Section does not apply to solar carports that are installed over asphalt pavement.

- (4) In addition to the Pre-Construction meeting required by Section 5.1.6.1 of the general permit, prior to each phase of any construction activity, the Permittee shall ensure that a preconstruction meeting takes place with the designing Qualified Professional, Qualified Inspector, and all site contractors and subcontractors to be involved in construction, and the appropriate District personnel. Such meeting shall include a site walk of the project site. The Permittee shall ensure that a record of the date of such meeting and a report summarizing the meeting shall be prepared and retained in the Permittee's SPCP, with a copy sent to all parties who attended the preconstruction meeting.
- (5) (a) The Permittee shall retain the designing Qualified Professional and a Qualified Inspector to conduct the Plan Implementation and Routine inspections pursuant to Section 5.2.5. It is preferable that the Qualified Inspector shall be chosen by the designing Qualified Professional. Unless otherwise approved in writing by the Commissioner, such designing Qualified Professional and Qualified Inspector shall be retained for the duration of the construction project until the Notice of Termination has been submitted to the Commissioner and determined to be acceptable, as described below in paragraph (7) below.
- (b) Plan Implementation Inspections: Notwithstanding the schedule of inspections set forth in Section 5.2.5 of the general permit, the Permittee shall ensure that the designing Qualified Professional and the Qualified Inspector conduct Plan Implementation Inspections beginning with the commencement of construction activities and through each phase of construction until all perimeter controls, initial erosion and sediment control measures, and construction stormwater traps, basins, swales, and other control measures associated with each phase have been installed and stabilized. In addition, once all of these measures have been installed and stabilized, the Permittee shall ensure that the designing Qualified Professional certifies in writing to their completion in the applicable inspection report in accordance with the SPCP. The Permittee shall ensure that the designing Qualified Professional conducts a Plan Implementation Inspection of the site at least once a month and the Qualified Inspector conducts such inspection at least once a week. (The Qualified Inspector does not need to conduct a weekly inspection during the week the qualified designing professional conducts a monthly inspection).
- (c) Routine Inspections: Following the completion of the Plan Implementation Inspections (i.e., after the designing Qualified Professional has certified that stormwater control measures have been installed and stabilized) and notwithstanding the requirements of Section 5.2.5.1 of the general permit, either the designing Qualified Professional or the Qualified Inspector shall conduct weekly Routine Inspections pursuant to Section 5.2.5.2. of the general permit, provided that the designing Qualified Professional shall inspect the site at least once a month, or more frequently if necessary, to confirm that the site is in compliance with the general permit and determine if it is necessary to install, modify, maintain, or repair such controls and/or measures to improve the quality of stormwater discharges.
- (d) In addition to any requirements of Section 5.2.5.2. of the general permit, for projects for which the designing Qualified Professional did not select the Qualified Inspector, the designing Qualified Professional shall seal and certify to the truth and accuracy of each inspection undertaken pursuant to this Section regardless of whether the inspection is performed by such designing Qualified professional or the Qualified Inspector. For projects for which the designing Qualified Professional chose the Qualified Inspector, the Qualified Inspector may submit their inspection reports without the designing Qualified Professional's certification. On or before five (5) days after the completion of each inspection, the Permittee shall ensure that certified inspection reports of all inspections undertaken pursuant to this Section are provided directly to the Permittee and shall ensure that a copy of the certified inspection report of each such inspection is provided to the appropriate District personnel and submitted electronically to the Department via email at DEEP.stormwaterstaff@ct.gov.
- (e) Unless otherwise provided for in this Section, the Permittee shall comply with Section 5.2.5. of the general permit, including, but not limited to, taking action if an inspection indicates that the site is not in compliance with the terms and conditions of the SPCP or the general permit.

- (f) For sites that have ceased all construction activities for the winter, the Permittee shall confirm that the site is stabilized prior to ceasing construction activities. Upon such confirmation, the Permittee may, with the approval of the appropriate District, suspend site inspections until construction resumes, except that a Qualified Inspector shall inspect the site after any rain event of one-half inch or greater.
 - (g) The Permittee shall also ensure that the proposed inspection checklist prepared by the designing Qualified Professional is submitted for the review and approval of the Commissioner and is included with the application for the general permit. No other professionals may serve as the designing Qualified Professional or Qualified Inspector without the prior submittal of relevant credentials and inspection checklist for the Commissioner's review and written approval.
- (6) In addition to the requirements of this general permit regarding inspection checklists, the Permittee shall ensure that a copy of all such checklists is submitted electronically to the Department email (DEEP.stormwaterstaff@ct.gov) and the appropriate District within five (5) days from the date an inspection of the site was performed.
- (7) The Permittee shall ensure, after completion of a construction project, that a Notice of Termination is filed in compliance with Section 4 of this general permit. The Notice of Termination shall be signed by a District representative certifying that such District representative has personally conducted a Post Construction Inspection, Final Stabilization Inspection, and Termination Inspection in accordance with Section 5.2.5. of this general permit and verified compliance with the requirements of those Sections. The Notice of Termination shall not be submitted until the site has achieved and maintained final stabilization (as defined in Section 11) for all phases of construction for at least two (2) years, following the confirmation of final stabilization. For sites, including, but not limited to landfills, where existing vegetation was never disturbed and panels were mounted on ballast blocks, the Notice of Termination shall not be submitted until at least one (1) year following the confirmation of final stabilization. Monthly post-construction inspections shall be conducted by the Qualified Inspector following final stabilization until the Notice of Termination is submitted.
- (8) (a) Prior to undertaking any construction activity, the Permittee shall secure and maintain a Letter(s) of Credit in accordance with the requirements of this Section.
- (b) For sites with a total disturbance of twenty (20) acres or more, the total amount of the Letter(s) of Credit shall be \$15,000.00 per acre of disturbance. For sites with a total disturbance of less than twenty (20) acres, the total amount of the Letter(s) of Credit shall be \$7,500.00 per acre of disturbance. Should a project developer locate more than one project with a total disturbance of less than twenty (20) acres in the same vicinity, for purposes of this Section, the Commissioner reserves the right to combine such projects and consider them as being a site with a total disturbance of twenty (20) acres or more.
- (c) The wording of such Letter(s) of Credit must be identical to the wording specified in Appendix J of the general permit. The Permittee shall maintain such Letter(s) of Credit in effect until the Commissioner notifies the permittee that the Notice of Termination, filed pursuant to the conditions of subsection (d)(i) or (d)(ii), below, has been accepted by the Commissioner.
- (d) At the option of the Permittee, the amount of the Letter(s) of Credit required under Section 8(b) of Appendix I shall be submitted under one of the following conditions:
- (i) If a single Letter of Credit is submitted for the total amount determined in Section (b), above, the Letter of Credit shall be released once a Notice of Termination has been filed in compliance with Section 4 of the general permit and accepted by the Commissioner.

(ii) The permittee has the option of submitting three (3) separate Letters of Credit in the amounts of fifty percent (50%), forty percent (40%), and ten percent (10%) of the total amount determined in Section (b), above.

- The first fifty percent (50%) Letter of Credit may be released upon the written determination by the inspecting District that all perimeter controls, initial erosion and sediment control measures, and construction stormwater traps, basins, swales, and other control measures have been installed, functioning, and stabilized in accordance with the general permit and the SPCP.
- The second forty percent (40%) Letter of Credit may be released upon a determination by the inspecting District that all post-construction stormwater management measures specified in the SWPCP have been installed, functioning and stabilized in accordance with the general permit and the SPCP; and
- The final ten percent (10%) Letter of Credit shall be released once a Notice of Termination has been filed in compliance with Section 4 of the general permit and accepted by the Commissioner.

(9) For solar arrays that are located on top of a closed landfill, authorization under this permit is not required if the following conditions are all met:

- (a) There is no grading, excavation, or other disturbance of the existing vegetated landfill cap.
- (b) Solar panels are mounted on concrete blocks (“ballast blocks”) resting on the surface of the landfill cap.
- (c) All equipment used for panel and infrastructure installation is designated for low ground impact.
- (d) No panels are placed on the landfill side slopes or any slope exceeding ten percent (10%).
- (e) The total area of any grading, excavation, or other disturbance throughout the project is less than one (1) acre.

2.0 Design Requirements for Post-Construction Stormwater Management Measures.

- (1) Post-construction stormwater control measures shall be designed and constructed to provide permanent stabilization and non-erosive conveyance of runoff on the site, to the property line of the site, or downgradient from the site to ensure protection of on- and off-site wetland, wetlands, and waters (as those terms are defined in Section 11 of the general permit) or other natural resources.
- (2) Orientation of panels shall be considered with respect to drainage pattern, flow concentration, drainage area and velocity.
- (3) The permittee shall conduct a hydrologic analysis that:
 - (a) evaluates and controls the 2, 25, 50 and 100-year 24-hour rainfall event post-development peak discharge to the corresponding pre-development peak discharge rates in accordance with the Stormwater Quality Manual, with the following exceptions: that sheet flow is maintained for a maximum length of 100 feet; shallow concentrated flow is calculated using velocity factors per NRCS Part 630 National Engineering Handbook Chapter 15 (the use of TR-55 paved or unpaved velocity factors are not acceptable); if swales are used to convey or control stormwater, such swales shall convey and control stormwater from a 100-year, 24-hour rainfall event; and
 - (b) is based on site specific soil mapping to confirm soil types; and

- (c) is able to determine and confirm the infiltrative capacity of any stormwater management measures. In addition, in areas where grading exceeds a two (2) foot difference between existing and proposed grades, the runoff curve number shall increase by one full HSG (e.g. runoff curve number for soils of HSG B shall be considered HSB C). For sites where grading does not exceed a two (2) foot difference between existing and proposed grades, the runoff curve number associated with the Hydrologic Soil Group present on-site shall increase by one half (1/2) the difference between the Hydrologic Soil Group present on-site and the next higher Hydrologic Soil Group (e.g. half the difference between the runoff curve number for HSG B versus HSG C) to account for the compaction of soils that results from extensive machinery traffic over the course of the construction of the array. For sites where there is no grading and existing vegetation is maintained, no increase in curve number is required; and
- (d) is based on slope gradient, surveyed soil type (adjusted per subparagraph (c), above), infiltration rate, length of slope, occurrence of bedrock, and change in drainage patterns. Pre- and post-development drainage area maps shall be provided showing this information; and
- (e) for an engineered stormwater management system, demonstrates no net increase in peak flows, erosive velocities or volumes, or adverse impacts to downstream properties in accordance with the general permit and the Stormwater Quality Manual.

Figure 1
Solar Panel Installation with Slopes $\leq 5\%$

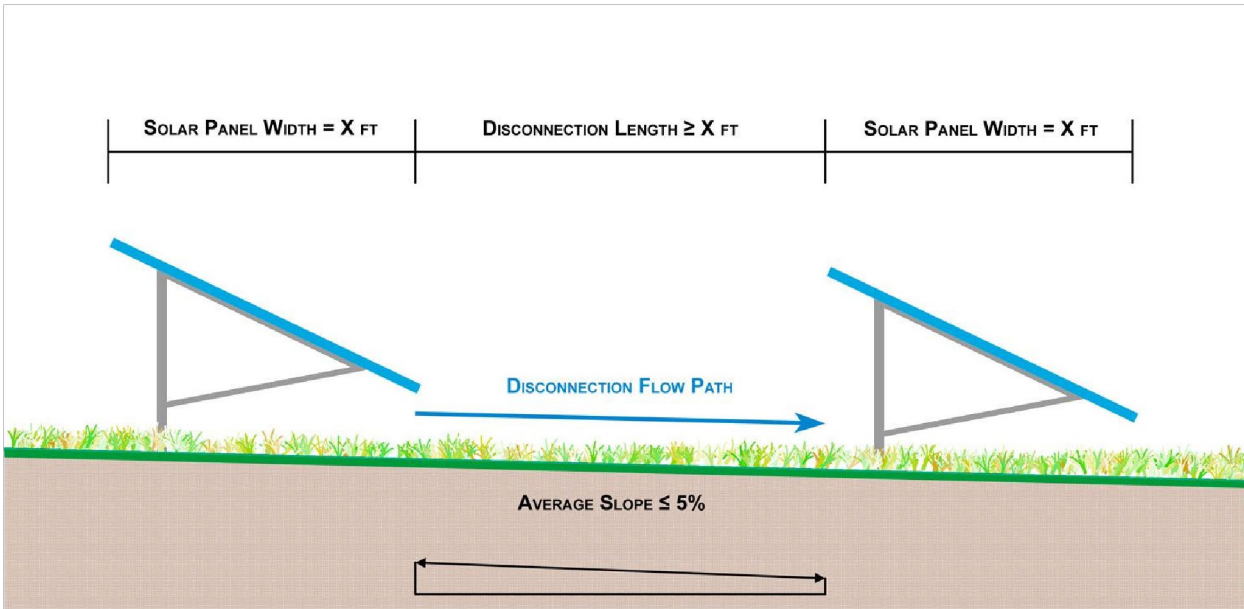
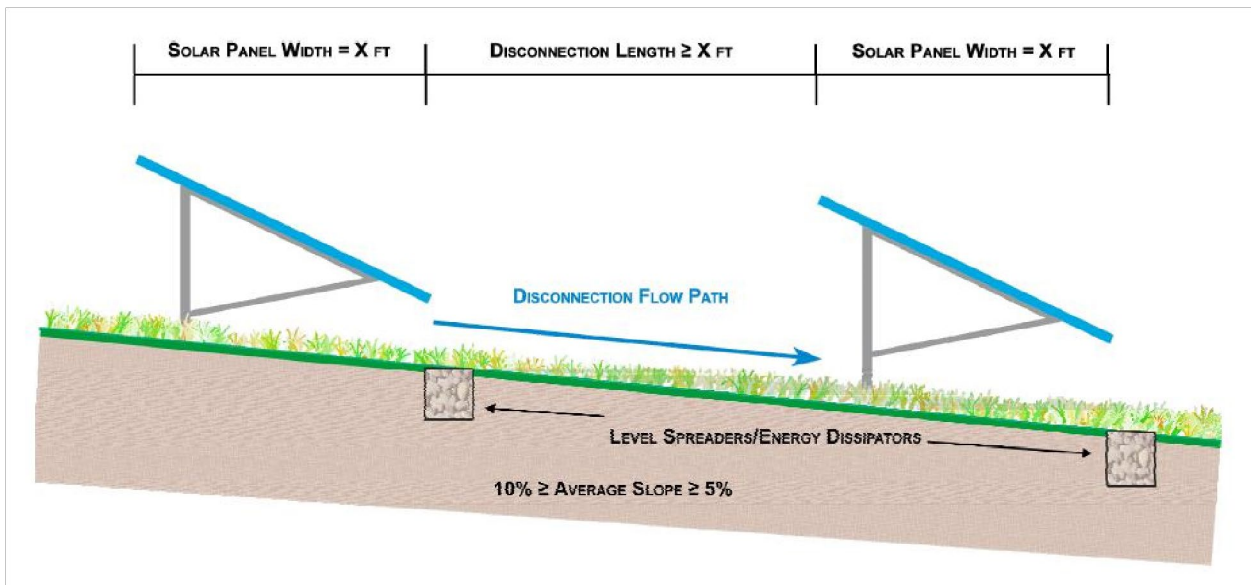


Figure 2
Solar Panel Installation with Slopes $> 5\%$ and $\leq 10\%$



Source: Maryland Department of the Environment: Stormwater Design Guidance – Solar Panel Installations