RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
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Freshwater Wetlands Program and Stormwater Construction Permitting Ground-Mounted Solar Array Guidance

This document serves as guidance for the preparation of freshwater wetland and stormwater construction permit applications for the installation of ground-mounted solar arrays. This guidance is intended to help design professionals prepare applications in a manner that allows for timely and efficient review by the Rhode Island Department of Environmental Management Office of Water Resources (RIDEM OWR).

This document addresses some of the requirements of the Rhode Island Stormwater Management Design and Installation Rules (Stormwater Rules) (250-RICR-150-10-8) and the Rhode Island Stormwater Design and Installation Manual (RISDISM) as well as the Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act (Wetland Rules) (250-RICR-150-15-3) that are especially relevant and applicable to new Solar Array development. It is not intended to be a substitute for those or any other applicable rules or regulations. Applicants are encouraged to review the Stormwater Rules, the RISDISM, the Wetland Rules and all applicable rules and regulations (i.e. RIPDES General Permit for Stormwater Discharge Associated with Construction Activity (CGP), Groundwater Discharge (GWD)/Underground Injection Control (UIC) Program (Groundwater Discharge Rules; 250-RICR-150-05-3), etc.) to ensure that all requirements are met.

Tips for Smart Siting of Ground-Mounted Solar Arrays

- RIDEM OWR aims to balance conservation of natural resources with promotion of renewable energy opportunities, including ground-mounted solar. The clearing of forests and other green spaces (including farmland) for the siting for ground-mounted solar arrays is strongly discouraged. **Avoiding forested sites and existing open space may alleviate environmental concerns and accelerate the permitting process.**
- The siting of ground-mounted solar arrays on sites that are already cleared or disturbed or otherwise cannot be developed is encouraged (i.e., brownfields; closed landfills; gravel pits; commercial/industrial developed lots).
- For the installation of solar panel systems on landfills, applications should be filed directly with the Office of Land Revitalization and Sustainable Materials Management (OLRSMM), Solid Waste Section. These projects go through an expedited review process as per Solid Waste Regulations No. 2 (250-RICR-140-05-2.1.9(J) - Installation of Solar Panels on Landfills).
- Consider alternatives to ground-mounted solar on areas that do not require clearing of land, such as placing solar panels/arrays on existing commercial/industrial rooftops, parking garages, parking lots, or carports.
- RIDEM OWR discourages the blasting of large areas of ledge, particularly on forested areas that are proposed to be cleared, as this can have unanticipated impacts on groundwater-fed surface waters.

- Avoid the placement of solar arrays in the vicinity of public and private wells and their associated protective radii. Applicants should consult with the Rhode Island Department of Health to determine minimum required setbacks from public and private wells.
- It is advised that Applicants ensure that any requirements of local municipality ordinances are met in addition to satisfying other environmental requirements.
- **Considerations for siting Solar Arrays near Freshwater Wetlands**
    - Avoid and minimize alterations and associated impacts to freshwater wetlands. Clearing within freshwater wetlands or their associated buffers for placement of ground-mounted solar panels is considered an avoidable activity and will likely not be permitted. Solar arrays that are proposed adjacent to freshwater wetlands may require a Freshwater Wetlands Permit, which will likely lengthen the review process.
    - When proposing solar arrays adjacent to Freshwater Wetlands, **panels should be designed so they will not be shaded (now or in the future) by trees located in freshwater wetlands or buffers, especially on the south side of the project area.**
    - Security fences located within or adjacent to freshwater wetlands or buffers should be designed to have a minimum 6-inch opening between the ground surface and the bottom of the fencing to prevent significant impacts to wildlife movement.
    - Other land disturbance activities associated with construction and operation of a solar array, such as access roads and utility interconnections, should also be designed to avoid and minimize disturbance to natural areas, including freshwater wetlands and their associated buffers.

Permitting Application Guidance

Site Plans

(1) Plans must have a signed and dated Rhode Island Professional Engineer's stamp.

(2) Site plans should depict the following (in addition to standard site plan requirements):

- At least 2' topography on pre- and post-construction plans.
- The complete limits of work, **including any off-site work required for utility connections of the solar array to the grid network.**
- The spacing between the rows of solar panels. Spacing between rows should be equal to or greater than the plan-view width of the panels to ensure that adequate light and water reaches the vegetated areas beneath the panels in order to maintain a good vegetative cover.
- Any wells that are located within 400' of the proposed solar array and the protective radius associated with the wells.
- All areas of moderate (8-15%) and steep slopes (>15%). Be sure to include erosion control measures for moderate and steep slopes.
- All areas of proposed clearing of vegetation, including trees and brush/shrub cover. Consider any areas that may need to be cleared in the future to minimize shading of the solar panels**.**

(3) Provide details and specifications for all areas of proposed vegetative cover. A seed mix that includes both shade-tolerant and sun-loving vegetation should be utilized to ensure that survival occurs in the areas beneath and between panel rows. Provide the application requirements for limestone, fertilizer, pesticides, and/or herbicides that may be necessary to establish the vegetative cover.

(4) Provide a typical cross-section of the proposed solar panel footing system and ground cover that includes the following:

- The type of footing (post, piling, concrete ballasts; if concrete ballasts are proposed, provide details);
- Dimensions of the solar panels;
- Height of the lower lip above the ground surface and;
- A minimum coverage of 6" of loam if proposing grass or meadow as ground cover.

(5) Provide details and notes regarding potential areas of scour immediately below the solar panel drip edges on steep slopes. Provide options for scour control if instances of erosion/scour develop beneath panel drip edges at any point after construction.

Stormwater Site Planning, Analysis and Design

(1) Provide treatment of the minimum Water Quality Volume (WQv) according to Minimum Standard 3 (Water Quality) of the Stormwater Rules (0.2" over the entire proposed disturbed area). Where panels are not oriented generally parallel with the slope and/or where slopes are moderate or steep (>8%), runoff needs to be either intercepted by stone trenches for infiltration and/or directed non-erosively to an infiltration practice. This requirement may be waived if the site is considered "ideal" by meeting the following criteria for greater than 80% of the site:

- Flat to gentle well-vegetated slopes are present (<8 %);
- Solar panel drip edges align with elevation contour lines (i.e. drip edges are not perpendicular (± 15 degrees) with the elevation contour lines);
- There is adequate spacing between panels that is approximately equal to panel width and;
- There is no proposed use of fertilizer, pesticides, or herbicides, apart from a specified limited amount of fertilizer to establish the initial vegetative cover.

(2) Treat the required WQv for all impervious areas (including equipment pads and access roads) according to Minimum Standard 3 (Water Quality) of the Stormwater Rules with appropriate water quality Best Management Practices (BMPs). Access roads that are pervious and considered low traffic (i.e., only used for infrequent inspection and maintenance activity) may qualify for a written technical justification, provided that the design includes a minimum of 6" depth of washed crush stone graded flush with the adjacent ground. Provide protection of this stone surface from sediments during the construction phase.

(3) The required WQv from the impervious solar panels may be adequately treated by the pervious ground below if runoff is converted to and maintained as dispersed sheet flow onto vegetated areas having a "good" hydrologic condition. When rows of panels run perpendicular to the elevation contours, runoff may not be adequately dispersed into sheet flow and may also create the potential for erosion. **The design should include adequate measures to achieve and maintain sheet flow from the drip edges of the panels, such as level spreaders, terraces, and/or berms.** If adequate sheet flow cannot be achieved, propose a stable conveyance of runoff directed into a BMP such as an infiltration basin, sand filter, or bioretention practice.

(4) If a stone surface is proposed between and/or beneath the solar panels, demonstrate that the required WQv associated with the impervious areas of the solar panels will be infiltrated within this area.

(5) In order for modeled ground cover to be considered in "good" hydrologic condition, at least 6" of loam cover must be provided. The existing condition depths of A-horizon soils should be preserved (there should be no export of topsoil from the site). If only a 4" to 6" cover of loam can be provided, then modeling using a "fair" hydrologic condition is appropriate.

(6) Site plans and SESC plans need to include project-specific design and construction notes to ensure that construction methods and procedures minimize soil compaction. The use of heavy equipment should be minimized. If some compaction cannot be avoided, specify proposed remedial measures such as tilling or aeration.

(7) Demonstrate that adequate light and water will be available to sustain the vegetative cover. The site's ability to sustain good vegetative cover will be limited in situations where the solar panel drip edges run generally perpendicular (± 15 degrees) with the slope contour lines, and/or in situations where the spacing between panels is less than the horizontal width of the panels.

(8) Address the following in the existing vs. proposed condition hydrologic analysis:

- Model the pre- and post-project 1, 10, and 100-year Type III 24-hour rainfall events and the post-project 1.2" Type III 24-hour water quality rainfall event.
- If concrete ballasts are to be used as footings, include the gross coverage area of the ballasts as part of the overall post-project hydrologic analysis.
- Provide analyses for all proposed culverts associated with the project. For culverts involving regulated wetlands, address any increases in peak water levels up-gradient of the culvert. Include the peak water levels up-gradient of each proposed culvert in the 1, 10, and 100-year 24-hour Type III storm events.

(9) The design must address Minimum Standard 4 (Conveyance and Natural Channel Protection) of the Stormwater Rules for flow which is released in a concentrated source (i.e., pipe, swale or basin outlet) for each waterbody ID number by providing extended detention of the total runoff volume from the 1-year 24-hour Type III storm event. Drainage areas that collectively have concentrated discharges from an area that totals less than 5 acres can be excluded from this requirement.

(10) Provide peak runoff discharge rate control of 10- and 100-year Type III storm events in accordance with Minimum Standard 5 (Overbank Flood Protection, Qp) of the Stormwater Rules.

(11) If the amount of proposed disturbance exceeds 50 acres, a downstream analysis is required for each design/analysis point.

(12) It is recommended to avoid any new concentrated discharges from stormwater BMPs to adjacent and/or down-gradient properties.

(13) For any proposed panels that will be located either within a 100-year floodplain or within proposed stormwater basins, address whether any impacts to the panels or their electrical systems will occur.

(14) Proposed stormwater infiltration basins that will have a vegetated bottom need to utilize a sandy loam soil cover so as to facilitate infiltration.

(15) RIDEM OWR considers the Pocasset River to be a flood prone area and has a management goal of no increase in contributing total runoff volume to the river. **Sites that are located within the watershed of the Pocasset River should include the following:**

- Evaluation of impacts associated with any increases in total runoff volume and/or peak runoff discharge rates in the 10 and 100-year 24-hour Type III storm events.
- Infiltration practices in the proposed design as may be necessary to avoid an increase in total runoff volume discharged from the site in the 10- and 100-year 24-hour Type III rainfall events.

Soil Erosion and Sediment Control Plan (SESC) Requirements

(1) Provide a separately-bound SESC Plan document that uses the latest template found on the RIDEM Stormwater Construction Permitting website.

(2) Refer to the Rhode Island Soil Erosion and Sediment Control (RISESC) Handbook for design and operation guidance.

(3) Provide SESC plan sheet(s) and associated detail sheet(s) as part of the overall plan submission. Be sure that the SESC plans depict the locations of the following items:

- Construction staging;
- Equipment and materials storage;
- Worker parking;
- Stockpiling of soil material with appropriate erosion control and;
- Stone construction entrance(s) of appropriate size.

(4) In accordance with the Stormwater Rules, preserve topsoil on the site to the maximum extent feasible. Indicate on site plans the location(s) where topsoil is to be stockpiled for later use.

(5) In accordance with the Rhode Island Soil Erosion and Sediment Control (RISESC) Handbook, structural control measures must be used to limit stormwater flow from coming onto the project area, and to divert stormwater flow from exposed soils to limit erosion, runoff, and the discharge of pollutants from the site.

(6) Include sediment traps and/or basins as appropriate, unless the site will be immediately vegetated (such as with hydroseeding within 72 hours) and will be developed in phases of no greater than 5 acres at a time. Include typical cross-sections and outlet details for sediment traps/basins.

(7) Utilize temporary measures to protect sites of proposed permanent or long-term stormwater control practices. Avoid the siting of temporary sediment traps/basins on areas intended as the site of infiltration practices. If this is not feasible, include methods to restore the infiltration capacity of the soils.

(8) If temporary sediment traps/basins are used to control sediment and turbidity discharges in areas that discharge to **cold water streams,** additional measures must be included to mitigate thermal impacts, such as discharge of the first inch of runoff through a stone channel, for any concentrated discharge 2

(9) 00-feet or less from the designated cold-water stream.

(10) Loose mulch (including wood chips and shredded bark) should be used only for temporary stabilization, and only on flat to gently rolling slopes. Mulches with nettings or anchoring may be used as temporary stabilization on steeper slopes. Permanent stabilization methods should consist of loam and seed.

Post-Construction Operation and Maintenance Plan

(1) Provide a separately bound Post-Construction Operation and Maintenance Plan (O & M Plan) that meets the requirements of the Stormwater Rules, RISDISM, and CGP, as applicable.

(2) Be sure that the O&M Plan includes and/or addresses the following:

- A requirement that all vegetated areas beneath, between and downslope of the solar panels be maintained in a “good” hydrologic condition, with at least 85% coverage.
- A schedule of mowing operations for vegetative cover beneath and between the solar panels that requires mowing at least annually and maintains vegetation at a height that will maximize sheet flow. It is advised that vegetation be maintained to a height no shorter than 4” and no taller than 12” (grass) or 18” (meadow).

- A requirement for occasional inspection and maintenance of all areas of proposed washed crushed stone access roadways. Appropriate maintenance includes periodic rejuvenation of the stone surface by removal of any surface sediments, replenishment of washed crushed stone, and surface scarification.
- A requirement for the inspection and maintenance of all proposed infiltration practices. Include requirements for periodic rejuvenation of the infiltration practices, including the re-establishment of vegetative cover, as necessary.
- A requirement that the site be inspected on a specified regular basis for any erosion. Include requirements to immediately restore eroded areas to originally approved grades and re-stabilize these areas with vegetation as soon as seasonal limitations allow.
- A statement that the use of fertilizer, pesticides, or herbicides will be minimized or eliminated on the site, apart from a specified limited amount of fertilizer to establish the initial vegetative cover.
- A schedule for routine and non-routine maintenance tasks for each stormwater management practice.