



**TECHNICAL GUIDANCE FOR UTILITY-SCALE SOLAR
INSTALLATION AND DEVELOPMENT ON AGRICULTURAL,
FORESTED, and NATURAL LANDS**

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PURPOSE AND SCOPE

In 2019 the Maine Legislature enacted solar energy legislation that resulted in significant growth in the development of utility-scale solar projects. Replacing fossil fuels with clean, alternative renewable energy sources that do not contribute to greenhouse gas emissions is a desirable objective for the state. As we work to achieve greater renewable energy generation, it is equally important to ensure that solar development does not negatively impact our state's agricultural and natural resources, including active farmland, productive timberland, rare plant populations, or rare and exemplary natural communities. The Department of Agriculture, Conservation and Forestry (DACF) has developed this technical guidance document regarding the siting of utility-scale solar projects with consideration for valuable agricultural land, forest resources, and rare or unique natural areas.

DACF also recognizes that solar energy production can provide economic benefit to landowners, and that there are ways to maximize compatibility of multiple uses on certain sites. This technical guidance document is intended to provide farmers and forest landowners with practical information to utilize when first considering solar development on their property, as well as planning important preconstruction, construction, and post-construction/ decommissioning activities. It further provides technical information for solar developers to consider when designing, installing, and removing solar projects.

As a general statement of policy, DACF strongly recommends siting of commercial scale solar projects on non-agricultural lands and within areas that do not: contain rare plant populations; provide habitat for rare or exemplary natural communities; contribute to fragmentation of large undeveloped blocks of forestland; or diminish the ability for these natural and working lands to effectively sequester carbon. If impacted by development, these natural areas, productive soils, and prime agricultural lands are finite resources that can take decades to restore, and in some cases, restoration may not even be possible.

Non-agricultural siting locations would include: on top of buildings; in parking lots; on closed landfills; on significantly disturbed sites such as brownfields, where previous development was located or significant grading has taken place; and in regenerating wooded areas that are not comprised primarily of important farmland soils (or similar areas that have little or no commercial farming potential). To determine if a project is located on important farmland soils please, refer to DACF's guide to Determining Prime Farmland Soils and Soils of Statewide Importance here: <https://www.maine.gov/dacf/ag/docs/prime-farmland-determination-guidelines.pdf>.

If agricultural lands are to be used for solar siting, DACF encourages consideration of dual-use projects. Dual-use, or agrivoltaics, is a mixed land use production system combining the agricultural use of the land with solar energy production. The integrated spacing of solar panels and elevated construction of arrays allows light to penetrate the ground at levels which support the growth of crops, forage grasses, or pollinator habitat while retaining soil moisture. The

meadow and grassland habitats provide meaningful benefits to improving soil health. Solar arrays can also be co-located with grazing for cows, sheep, and goats, apiaries for honey production, and crops. In addition to agricultural production, land leases can provide farmers additional revenue for leasing their land to Solar Developers for 20 to 35-years of the facility's lifespan. With proper planning and installation, the land could be reverted to agricultural or forest production upon decommissioning. For more information on dual-use please see our factsheet here: <http://www.maine.gov/dacf/ard/resources/docs/dual-use-factsheet.pdf>

This Technical Guidance is not intended as legal advice for solar development projects.

Table of Contents

I. Solar Basics	5
II. General Permitting Considerations	7
III. Tax, Easement and Mortgage Considerations	9
IV. DACF Solar Siting Best Management Practices	10
A. Preconstruction Planning for Landowners	10
B. During Construction – Recommendations for Solar Developers	12
C. Post Construction – Recommendations for Developers & Landowners	15
D. Monitoring, Remediation and Maintenance Considerations	16
E. Reporting Practices for Solar Developers	17
F. Decommissioning Considerations for Developers & Landowners	17

I. Solar Basics

Solar energy or photovoltaic (PV) power is produced by capturing the sun's energy and turning it into electricity. The sun releases packets of energy known as photons. When these photons hit a solar panel (also known as a module), which is made up of multiple solar cells, they knock electrons loose from their atoms. Solar cells are made of silicon, like semiconductors, with a positive and negative layer. These layers create an electric field, like a battery that allows the electrons to travel along the panel in one direction around a circuit. As such, solar modules generate direct current (DC) electricity. DC power is compatible with battery storage but needs conversion to alternating current (AC) before being sent to the electrical grid.

A PV system consists of modules mounted on a racking system, wired together in series along a run. The length of the run will depend on the capacity of the inverter the modules will be connected to. For a residential scale project, an inverter would be connected to an electrical panel and potentially to a battery bank with a charge controller to regulate the battery's charge as well for off-grid or emergency back-up applications. Batteries are not required for grid-tied projects.

In utility-scale applications, electrical wire from inverters is combined and buried in underground conduits or run above ground along the racking and routed to a central equipment pad. Electricity is then fed into batteries and/or a transformer that sends electricity into the grid with above-ground cable. To minimize trenching for electrical conduit, runs can be orientated to terminate at inverters positioned on either side of a centrally located electrical conduit trench.

Solar arrays are a collection of modules mounted on metal racking systems, similar to roof racks on a car. Arrays may be fixed in their tilt and orientation (fixed mount) or may have mechanical parts that allow the array to adjust, tilt, and orient to track the sun to maximize their production (trackers). While trackers may generate more energy than fixed systems, the costs and maintenance associated with them have limited their widespread adoption. Climatic conditions such as temperature, wind and snow load have an impact on the output of the equipment. For this reason it is important to determine if the proposed equipment has a proven track record in the northeast.

Most applications are fixed roof-mounted or ground-mounted arrays. Rooftop racking systems may be clamped to standing seam metal roofs or screwed into roof rafters. The preferred orientation is due south with an angle matching actual latitude. In Maine, that is 45 degrees; however, the sun's angle changes seasonally, from being more overhead in the summer to lower in the sky during the winter, so a range of 30 to 45 works well in most cases. Steeper pitched roofs will help shed snow from the array.

Ground-mounted arrays include a metal racking structure anchored to the ground supporting modules at a determined height above the ground. Applications may include flat roofs on large commercial buildings, parking lots, landfills, agricultural fields and greenfield projects. Wind,

snow load, soil composition, array size, and row spacing are considerations for the height, anchoring, and construction of ground-mounted arrays. The racking structure may be mounted on driven piles, anchor systems, or utilize weighted ballasts. Arrays on commercial roofs have a low profile, and rows consist of single panels positioned in a landscape orientation with a minimal tilt to minimize row shading. These are typically anchored with cement blocks to avoid any roof penetrations.

In open areas, driven beams can be used to support an array. Beams made of steel are driven into the ground to a depth dependent on an impervious layer, and the racking system is affixed to the beams. This is a less costly installation method compared to other foundation methods but is dependent on favorable subterranean conditions.

Other anchoring systems, such as helical piles and ground screws, may be used. These applications can handle vertical loads at relatively shallow depths, do not require concrete, and can be removed and reused after the project has been decommissioned. These installations do not produce significant tailings, which could require grading. Ground screws can be installed with a skid steer avoiding the use of heavier equipment.

At sensitive locations such as landfills and brownfield sites, alternative ballast anchoring systems should be proposed to avoid driven piles with concrete footings and ground penetration. On landfills, precast pavers, or steel baskets filled with rock are used to weigh down the ballasts on top of the landfill cover. These can easily be moved into place with a skid steer.

A geotechnical or soil survey of the ground conditions will help determine which application may be best suited to a particular site. Typically, the most cost-effective installations will not require grading or bringing in additional materials like concrete; as a result, ground screws are becoming more widely used.

Most ground-mounted arrays are installed at the height of three feet (3') above the ground on the southern end and a height of five feet (5') or more on the northern end. For dual use systems in particular, these minimal clearances allow for ease of maintenance and livestock foraging. Where crop system integration is applied, arrays may have higher minimum clearances for hand harvesting or to accommodate mechanized harvesting equipment. They might also have gaps between panels along the racking system or utilize smaller panels with single rows in each array to increase solar penetration below the array. For more information on dual-use systems and applications, please refer to our fact sheet.

Utility-scale projects typically have a footprint greater than 40,000 square feet or one acre and is directly tied to the grid, meaning that no energy is consumed onsite but rather that the owner(s) receives a 1:1 kilowatt energy credit or financial credit on their bill. Large-scale commercial projects are between 1 and 30 acres (system size limit is 4.95MWac). They are typically created for residential community solar farms or purchase power agreements. In

contrast, utility-scale projects are greater than 20 acres and usually sell all of the power to a single entity or utility.

II. General Permitting Considerations

Solar developments in Maine will require environmental site permitting, whether through the Maine Department of Environmental Protection (DEP), Land Use Planning Commission (LUPC), Department of Inland Fisheries and Wildlife (IFW), the US Army Corps of Engineers, municipalities, or some combination thereof. Below is a high-level listing of potential permitting that may apply to solar development projects and resources for further information. This overview is not to be interpreted as legal advice. Readers are encouraged to further research permit requirements by consulting relevant agency staff and by obtaining independent legal counsel.

- A. >1 acre of disturbance within an organized area of the state:
 - 1. Subject to Stormwater Management Law (38 M.R.S. 420-D)
 - 2. Requires a DEP Stormwater Management Law Permit Application found here: <https://www.maine.gov/dep/land/stormwater/swapp1.pdf>
 - 3. May be eligible for a Stormwater Permit By Rule
- B. > 20 acres of land (total area includes everything inside the fence, an area outside the fence needed for maintenance, roads, collector lines to the point of interconnection, and shade management areas):
 - 1. Subject to Site Location of Development Act (38 M.R.S. 481)
 - 2. Requires a DEP Site Law Application found here: <https://www.maine.gov/dep/land/sitelaw/application-text-2015.pdf>
- C. Activities in, on, over, or adjacent to protected natural resources (including rivers, streams, brooks, and wetlands):
 - 1. Must comply with the Natural Resources Protection Act (38 M.R.S. 480)
 - 2. Requires a Natural Resources Protection Act (NRPA) permit under its subsequent jurisdiction. For more information please visit:
 - a. DEP: <https://www.maine.gov/dep/land/nrpa/>
 - b. LUPC: https://www.maine.gov/dacf/lupc/application_forms/index.shtml
 - c. May be eligible for NRPA Permit By Rule
- D. DEP Resources:
 - 1. Site Law Location of Development Act: <https://www.maine.gov/dep/land/sitelaw/index.html>
 - 2. Natural Resources Protection Act: <https://www.maine.gov/dep/land/nrpa/index.html#form>
 - 3. Stormwater Management Law: <https://www.maine.gov/dep/land/stormwater/index.html>
 - 4. Permit By Rule: <https://www.maine.gov/dep/land/nrpa/ip-pbr.html>
 - 5. For more information contact: Jim Beyer, Bureau of Land Resources at: jim.r.beyer@maine.gov or 207-446-9026
- E. IFW Resources:

1. IFW's Solar Project Guidance:
<http://maine.gov/dacf/ard/docs/ifw-solar-project-guidance-03052020.pdf>
 2. For more information contact: Robert Stratton, Wildlife Biologist at Robert.D.Stratton@maine.gov or 207-287-5659 or John Perry, Environmental Review Coordinator at John.Perry@maine.gov or 207-287-5254
- F. Municipal Zoning:
1. There are no statewide zoning laws that address solar development. However, some towns have adopted specific solar zoning ordinances. These range from allowing energy generating facilities in commercial and industrial zones, to more nuanced approval in rural and residential areas. On the opposite end of the spectrum, some towns have no zoning requirements allowing for development in any zone. Consult town offices for more information.
- G. Municipal Building Permits and Approvals:
1. Many municipal ordinances require solar development plans to be reviewed and approved by the local fire chief, planning board, municipal engineer, and/or code enforcement officials, among others. These requirements may be based on the type of installation (ground-mounted vs. rooftop), if the energy produced will be consumed onsite or sold onto the grid, and the nameplate capacity or the footprint of the system. Consult town offices for more information.
- H. Development in areas served by the LUPC, including townships, most plantations, and certain towns (see <https://www.maine.gov/dacf/lupc/about/offices/index.shtml> for descriptions, maps of service area, and contacts):
1. Grid-scale solar energy generation facilities are defined in the LUPC's rules as facilities that occupy one or more acres, have a nameplate capacity of more than 250 Kilowatts, and are solely intended to generate electricity for commercial sale offsite. These facilities will likely require rezoning to a Commercial Industrial Subdistrict or Resource Dependent Subdistrict and require a development permit. Zoning Petition Application forms and Non-residential Development Permit Application forms can be found here:
https://www.maine.gov/dacf/lupc/application_forms/index.shtml
 2. Non-grid-scale solar energy generation facilities are generally allowed with a permit or in accordance with standards in most subdistricts. Contact the appropriate regional LUPC office for information on a specific development site.
 3. For reference:
 - a. LUPC Rules, Chapter 10:
https://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Ch10_ver2019_06_17.pdf
 - b. LUPC Statute, 12 M.R.S.:
https://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Statute_2017.pdf
- I. Forestry considerations
1. See Section IV - A - 3 below.
- J. Rare and exemplary botanical features considerations
1. See Section IV - A - 4 below.

III. Tax, Easement and Mortgage Considerations

A. Tax Considerations

Much of Maine's farmland is enrolled in the state's Farmland Current Use Program, which establishes the valuation of property on its current use, instead of market value. A similar program exists for Tree Growth properties. The enrolled property must meet specific criteria and, as currently designed, any change in the use of the land can disqualify it, resulting in a significant penalty to the property owner.

Before entering into any agreements or leases with a Solar Developer, farmers and forest landowners should contact their municipal assessor to determine the property tax consequences of developing the property into a solar energy generation facility. If the property is enrolled in the Farmland, Open Space, and/or Tree Growth Tax current use taxation programs, a change in use will result in the assessment of withdrawal penalties, landowners may want to contractually pass the payment of any withdrawal penalties onto the Solar Developers.

For more information on the penalties, please consult the following Maine Revenue Services Property Tax Bulletins:

- Maine Tree Growth:
<https://www.maine.gov/revenue/forms/property/pubs/bull19.pdf>
- Maine Farmland:
<https://www.maine.gov/revenue/forms/property/pubs/bull20.pdf>

B. Easement Considerations

If a property is currently or has the potential to be enrolled in conservation or non-development easements, landowners should contact the easement holder (the entity which issued the easement) to discuss the implications of developing solar on the parcel. Based on the terms of the easement, it may not be possible to develop solar installations. Or, conversely, solar development may limit one's ability to enter into such easements in the future.

C. Mortgage Considerations

If landowners have an outstanding mortgage, some solar companies will not entertain a project on the property. This is because the bank would have the first position on the asset. Landowners should discuss this issue with the Solar Developer and contact their lender to determine if solar development would be an option. There is the chance that the mortgagee would be required to pay off the mortgage immediately if they had not consulted with their mortgage lender before entering into a contract.

IV. DACF Solar Siting Best Management Practices

A. Preconstruction Planning for Landowners

1. Soil Sampling

- a. Documenting the soil profile and health will be useful in land restoration after the lifespan of the project, if decommissioning is desirable at that time, especially if heavy soil disturbance is planned. Maintaining this documentation is a good practice, as landowner needs and interest could change over time or shift if there is a change in ownership.
- b. For measuring organic matter and nutrient content, soil test kits may be obtained through the University of Maine Cooperative Extension here: <https://umaine.edu/soiltestinglab/home/kit-request/maine-soil-request/>
- c. For documenting the soil texture, compaction, structure, consistency, and drainage contact a licensed soil scientist here: <https://www.maine.gov/pfr/professionallicensing/professions/geologists/index.html>

2. Preconstruction Considerations

- a. Consider the timing of construction and how it may interfere with current activities on the land. Will it impact crop production and harvest activities on adjacent land? Would it create limitations on access to other land or equipment?
- b. Consider the needs of future operations on the site. Plan roads that are appropriate to the immediate and long-term objectives and needs of the solar energy generation facility and adjacent lands. Keep in mind weight limitations, road maintenance, safety considerations, and fire suppression access.
- c. Discuss opportunities to limit subsurface anchoring structures or foundations where possible. Refer to the Department's Fact Sheet on Foundation and Installation Types for more information: <http://www.maine.gov/dacf/ard/resources/docs/solar-installation-applications-factsheet.pdf>
- d. Prior to beginning work, determine boundary lines, harvest objectives, and post-construction conditions with the Solar Developer and any subcontractors.
- e. Walk the property with the Solar Developer, their subcontractors, and other pertinent professionals (such as foresters, wetland scientists, engineers, municipal and state officials) to identify important features of the site, such as seasonally wet areas, steep slopes, invasive plants, poorly drained soils. Determine what Best Management Practices (BMPs) are needed for stream crossings, roads, landings, and for protecting water bodies during construction and closeout. For the development of solar installations, follow Maine DEP BMPs for Erosion & Sedimentation Control, found here: <https://www.maine.gov/dep/land/erosion/escbmps/index.html>. For more information on BMPs for forestry, please consult: Maine Forest Service Best Management Practices for Forestry: Protecting Maine's Water Quality – Third Edition (MFS BMP Manual) here: https://digitalmaine.com/cgi/viewcontent.cgi?article=1052&context=for_docs

- f. If the area is heavily infested with long-lived invasive plants, merely removing the above-ground vegetation is unlikely to kill the invasive plants as they can re-grow from their roots. It is advisable to take steps to address any significant infestations of invasive plants before construction or harvesting. Invasive plants are diverse, and there is no “one size fits all” removal plan; effective approaches vary by plant species, infestation size, and whether seeds are present. Use the principles of Integrated Pest Management (IPM) to determine the best treatment, or combination of treatment methods, to address the infestation. If the landowner is Certified Organic, additional consultation with the certifying agent is strongly advised if any herbicide use is contemplated. Disposal of invasive plant material should be done with care so as not to spread seeds or viable plant fragments.
 - g. Review the operations and maintenance agreement with the solar developer to understand who is responsible for what activities during and after construction.
3. Clearing Forested Land
- a. Under Maine Forest Service rules, clearing land which produces forest products (i.e., the trees, or products made from the trees, are sold) for a non-forested use (such as a solar project) requires landowners to submit a Forest Operations Notification (FON) (Chapter 26 Rules). The FON must accurately identify the intended Change of Use. Please refer to Chapter 26 Rules found here: https://www.maine.gov/dacf/mfs/publications/rules_and_regs/chap_26_rules.pdf
 - b. The change of use must be completed by the end of the second full calendar year following the year of the timber harvest. If the change of use is not completed within two calendar years, timber harvesting must have complied with Maine Forest Service Forest Regeneration and Clearcutting Standards (Chapter 20 Rules): https://www.maine.gov/dacf/mfs/publications/rules_and_regs/chap_20_rules_05012014.pdf. If there is any uncertainty about whether the solar project will come to fruition on time, err on the side of caution and abide by Chapter 20 Rules.
 - c. Other Maine Forest Service rules which may apply to timber harvesting include Statewide Standards for Timber Harvesting and Related Activities in Shoreland Areas (Chapter 21 Rules), https://www.maine.gov/dacf/mfs/publications/rules_and_regs/chap_21_rules_effective_01012016.pdf and Standards for Timber Harvesting and Timber Harvesting Related Activities within Unorganized and Deorganized Areas of the State (Chapter 27 Rules): https://www.maine.gov/dacf/mfs/publications/rules_and_regs/chap_27_rules.pdf
 - d. All timber harvesting activities must comply with all other applicable federal, state, or municipal legal requirements. For more information on state timber

harvesting rules, please consult: The Forestry Rules of Maine 2017: A Practical Guide for Foresters, Loggers and Woodlot Owners, found here:

https://digitalmaine.com/for_docs/52/

- e. Before conducting any timber harvest, contact the Maine Forest Service for assistance at www.maineforestservice.gov, forestinfo@maine.gov, or 207-287-2791. The Maine Forest Service recommends that woodland owners work with a licensed forester when making decisions or undertaking management activities in their woods. For more information:

https://www.maine.gov/dacf/mfs/policy_management/working_w_a_forester.html

If the harvest is located in a Development Subdistrict in an area served by the LUPC, contact the regional LUPC Office for information on permitting requirements. LUPC Regional Offices can be found at:

<https://www.maine.gov/dacf/lupc/about/offices/index.shtml>

- f. In summary, developing solar on forested land is a change of land use, which must comply with change of use standards. This means that the solar facility must be developed within two (2) years of clearing the trees. Otherwise, the landowner may be in violation of clearcutting standards. A scoping or option agreement does not guarantee the land will be developed. See section IV- A-3-C above.

4. Considerations for Rare Plants and Rare or Exemplary Natural Communities and Ecosystems

- a. During the project design or pre-application phase of a solar project, the Solar Developer (or consultant working on their behalf) is strongly encouraged to contact the Maine Natural Areas Program (MNAP) to inquire whether any rare plants or rare/exemplary natural communities or ecosystems have been documented on the property. Inquiries may be sent to maine.nap@maine.gov.
- b. Under some circumstances, several MNAP-defined natural communities and rare plant populations are protected when projects trigger a Natural Resources Protection Act (NRPA) or Site Law permit as defined by DEP. In those cases, avoidance and set back measures apply. Pre-identification of these natural features through MNAP and/or field surveys will significantly help with project planning.

B. During Construction – Recommendations for Solar Developers

Construction activities that may result in soil disturbance, including excavation, grading, cutting, or clearing of trees, stumping, and use of heavy mechanized equipment, should be limited to the extent practicable. Because all solar farm construction projects result in some degree of soil disturbance, consider the following before and during construction:

1. Anticipating Site Conditions

- a. Minimize rutting and compaction of wet or saturated soil during timber harvesting. Harvest during the winter on the frozen and snow-covered ground, in the driest summer months, or with the use of slash to provide support for harvesting equipment.
 - b. Timber harvesting in spring and fall when streams are high, and soils are saturated is strongly discouraged. If the installation of a permanent stream crossing is to occur between October 2nd through July 14th, an applicant must contact IFW to obtain and submit a Request for Approval of Activity form. Using this form, IFW will conduct a site visit to approve or deny the request. Find your regional office here: <https://www.maine.gov/ifw/about/contact/department-directory.html>
 - c. Monitor and adjust BMPs as needed under seasonal or weather-related changes.
2. Site Compaction
- a. Use tracked vehicles when possible in order to reduce the pounds per square inch of pressure on soils.
 - b. The use of timber mats or similar measures can provide bearing strength when soils are soft.
 - c. When possible, limit vehicles or equipment axle loads over 12,000 pounds when soils experience higher than average rainfall for a trailing 30-day period, based on local rainfall data.
3. Clearing Forested Land
- a. See Clearing Forested Lands and Considerations for Rare Plants and Rare or Exemplary Natural Communities and Ecosystems in the Preconstruction in section (A3, A4) above.
4. Regrading
- a. When possible, avoid stumping, grubbing, and removal of sod. Leaving stumps and sod in place will provide soil stability, bearing strength, and prevent erosion.
 - b. Excess stripped topsoil shall not be utilized for onsite fill. Where excess topsoil has been removed from permanently impacted areas (e.g., roads), it should be stockpiled to reclaim the area from which it came or spread on other areas of the project site with insufficient topsoil.
 - c. Stockpile excess subsoil for reuse in excavated areas to recreate soil conditions before alteration.
 - d. Remove rock excavated during construction from areas intended to return to agricultural use.
 - e. Divert runoff from roads into undisturbed vegetation using effective conveyance structures such as water bars, turnouts, or other best management practices.
 - f. Minimize impacts to wetlands by using slash, corduroy, or other effective BMPs to increase bearing capacity and allow for the natural movement of water.
5. Road Creation and Water Diversion
- a. Follow Maine BMPs for erosion, sedimentation control, and road construction as outlined in the DEP BMP Manual: <https://www.maine.gov/dep/land/erosion/escbmps/index.html>

- b. Follow Stream Smart Design practices for any new stream crossings. For more information, see https://www.maine.gov/dacf/mfs/policy_management/water_resources/stream_smart_crossings.html
 - c. In addition:
 - i. Ensure road design is appropriate for its intended use.
 - ii. On agricultural land, ensure access roads are constructed so they do not shed water onto active agricultural fields, and that the finished grade does not interfere with normal drainage patterns. This may require the installation of waterbars or culverts.
 - iii. On forested land, divert runoff from access roads to stable, vegetated areas using appropriate diversion structures. Culverts or other water conveyance structures should be used to allow for normal drainage patterns of wetlands.
 - iv. Determine appropriate weed control strategies for the access road.
 - v. Temporary access roads may be constructed of erosion control mulch, the thickness depending on how wet the soils are (6 inches for dry soils and 12 inches for wet soil areas).
6. Erosion Controls
- a. Stormwater from the drip edge of solar panels can cause soil erosion, particularly when the soil below it has been disturbed and is bare. To prevent soil erosion under the drip edge of solar panels, install controls such as erosion control blankets, hay mulch, or other appropriate measures to prevent erosion until ground cover conditions are permanently stabilized.
 - b. Employ measures to maintain runoff as sheet flow from the solar panels onto and across vegetated areas. If concentrated flows are necessary, proper design, construction, and maintenance techniques of swales, berms, level spreaders, etc. may be needed.
7. Trenching Considerations
- a. Construction techniques that eliminate or minimize soil disturbance, such as directional drilling, are preferred over excavating and trenching.
 - b. If excavation activities occur, stockpile the soil in like horizon types and placed back in the order in which they were removed to restore the soil to as closet to its original conditions.
8. Utility Connection
- a. For overhead powerlines and utility power pole installation, ensure that pole placement and the height of the wire will not interfere with the ability to access the land with harvest equipment.
9. Buried Utilities
- a. The National Electrical Code sets the standards for buried electrical lines, which are dependent on the voltage and length of the run. Code allows for direct buried lines, although they are typically installed in PVC conduits for solar projects to avoid damage. The Code requires anywhere from 18 to 30 inches of

minimum coverage, whereas a minimum of 30 inches is typical for solar installations.

- b. The amount of buried conduit will be minimal because much of the electrical wire is connected above-ground along the underside of the modules. For buried conduit, 30 inches or more of soil cover is recommended to allow for adequate root growth for desired agricultural use or ground cover.

10. Concrete

- a. Do not bury excess concrete or leave on site.

11. Stockpiling Soil

- a. Avoid stockpiling soil on slopes greater than 15%.
- b. Create stockpiles by soil horizons: topsoil in one pile, horizons above the "C" horizon in another, and the "C" (unweathered parent material) horizon soils in a third. When used to restore a farm field after decommissioning, the piles should be placed back in the ground in the order in which they were removed.
- c. Seed agricultural stockpiled soils with a conservation or perennial mix and mulch with straw for long term storage.
- d. Utilize silt fencing, hay bales, or erosion control mulch to prevent sediment from leaving the stockpile site until stabilized with vegetation.

C. Post Construction – Recommendations for Developers & Landowners

1. Site Cleanup

- a. Take all best efforts to remove all construction debris (wire, bolts, metals, plastics) to avoid mixing with soil or being consumed by grazing livestock.
- b. Remove all excess concrete from the site.

2. Drainage Structure Repair

- a. Any surface or subsurface drainage structures to be left in place should be in good working order and should maintain or improve pre-existing conditions.

3. Any surface or subsurface drainage structures to be left in place should be in good working order and should maintain or improve pre-existing conditions.

4. Revegetation

- a. Select a seed mix that meets the maintenance agreement, which may include pollinator habitat, livestock grazing pasture, cover crops, row crops, or grass.
- b. Prepare the seedbed by removing debris, regrading the topsoil, and scarifying the soil surface.
- c. Amend the soil as recommended, based on soil tests, crops needs, and recommendations of the seed supplier.
- d. Apply the seed mix immediately after preparing the bed at the supplier's recommended rate. If the site cannot be seeded shortly after the seedbed has been prepared, use temporary erosion control measures until seeding takes place. On areas subject to erosion, use erosion control blankets, hydro-seed, or tack the mulch down.
- e. If restoration efforts take place during the summer, mulch with enough straw to completely cover the soil to prevent erosion, keep the seed moist, and prevent

weed establishment. Typically, 90 lbs. of mulch will cover 1,000 sq. ft. (or two square bales for a 30 foot x 30 foot area). Hydro-seeding is another option.

- f. If restoration efforts take place after October 1st, use winter seeding rates and re-seed any bare areas in the spring. Use temporary measures to divert surface water runoff away from the newly seeded area(s) until they are permanently stabilized.

D. Monitoring, Remediation and Maintenance Considerations

Solar Developers should provide landowners entering a solar contract with an operations and maintenance plan. They should ensure that all monitoring, remediation, and maintenance work be listed as the sole responsibility of the Solar Developer unless there are site conditions and/or potential damage attributable to any agricultural land use practices undertaken by the landowner. At a minimum, the plan should address the following:

1. Revegetation Monitoring

- a. In the two years following project completion, revegetation efforts should be monitored three times during the growing season (Spring, Summer, and Fall). They should also be monitored whenever new soil is brought in and applied to the site.
 - i. Observations should include but are not limited to: erosion, bare soil, soil compaction, tree growth, and invasive plants.

2. Rehabilitation of Disturbed Soils

- a. Avoid using areas affected by livestock compaction until vegetation is re-established. Where fill is required use native excess topsoil from the property or imported topsoil free of invasive species consistent with the quality of the existing site conditions.
- b. Reseed disturbed areas lacking desired vegetation with non-invasive plants.
- c. Rehabilitation efforts should restore the natural soils and hydrology to the extent practicable.

3. Removal of Invasive Plants

- a. Remove those invasive plants that are detected within the project area during the monitoring phase. Monitor the area for invasive plant regrowth for at least one full growing season after removal/treatment.
- b. Invasive plants are diverse, and there is no “one size fits all” removal plan; effective approaches vary by plant species, infestation size, and whether seeds are present. The Solar Developer should use the principles of Integrated Pest Management (IPM) and follow all applicable rules and regulations when considering manual, mechanical, and herbicide treatments. If the landowner is certified organic, additional consultation with the certifying agent is strongly advised if any herbicide use is contemplated.
- c. Dispose of invasive plant material with care so as not to spread seeds or viable plant fragments.
- d. If the area treated is extensive and bare soil is present, reseed with non-invasive plant species.

4. Maintenance
 - a. Maintain vegetative growth within the project area throughout the growing season.
 - b. Mechanical methods
 - i. To avoid rutting and compaction, do not undertake maintenance of groundcover using mechanical methods such as lawnmowing, bush hogging, and weed whacking when soils are saturated.
 - ii. Clippings may be left in place as mulch or removed from the site.
5. Infrastructure Checks
 - a. Inspect project area fencing and gates on a seasonal basis and repair as needed.
 - b. Secure any exposed electrical wires to the solar equipment and protect against damage from grazing animals and other wildlife with meshing or other pest guards. This equipment must be repaired as necessary.

E. Reporting Practices for Solar Developers

1. Ongoing Reporting
 - a. Upon seasonal inspections, the Solar Developer should immediately report to the landowner the need for any remediation work identified and determine with the landowner what remediation actions to undertake prior to work commencing, unless otherwise agreed.
2. Annual Report
 - a. The Solar Developer should consolidate their annual observations about the project area into an annual report for the landowner.
 - b. The report should include images of any adverse impacts to the land and document the remediation process and results.
 - c. The report should also identify any long-term projects or changes in maintenance going forward and what additional permits or approvals may be needed.

F. Decommissioning Considerations for Developers & Landowners

Decommissioning plans are required currently as part of DEP's Site Location of Development permitted solar projects (larger than 20 acres). However, regardless of size, the Solar Developer should provide for all projects a decommissioning plan that includes restoration measures to restore the property to its original status as part of the solar contract. The plan should identify when a project is considered abandoned and a timeframe for completion of decommissioning activities, which is typically 120 days. Examples include decommissioning after a specified amount of time construction has not been undertaken, or the system has not been operational, a land lease has expired, or with prior written notification. The decommissioning plan should also identify who is responsible for the costs of decommissioning and how this work will be funded (e.g., trusts, escrow accounts, surety bonds, or letters of credit). Decommissioning and restoration work should be the sole responsibility of the Solar Developer. The Solar Developer should notify the landowner prior to undertaking any decommissioning steps or of any need to update the decommissioning plan.

At a minimum, the decommissioning plan should address the following:

1. Above-ground Structure Removal and Disposal
 - a. Including, but not limited to, removal and appropriate offsite disposal of panels, racking system, signage, fencing, equipment pads, and storage buildings.
2. Below-grade Equipment
 - a. Remove any equipment buried less than 48 inches deep and dispose of offsite. This includes but is not limited to underground utilities, concrete piers, footers, and electrical conduit.
 - b. Any equipment buried deeper than 48 inches may be left in place. Any abandoned conduit should be sealed or capped to avoid the potential of unwanted drainage onto adjacent property.
3. Access Roads
 - a. Unless otherwise specified by the landowner, remove access roads and restore this land back to its predeveloped grade and soil conditions.
4. Regrading
 - a. Establish contours that support the natural hydrology of the area and its next intended use. Where fill is required, use native excess topsoil stockpiled from the property or imported topsoil free of invasive species consistent with the quality of the existing site conditions.
5. Drainage Structure Repair
 - a. Repair or replace any surface or subsurface drainage structures to remain.
6. Restorative Work on Adjacent Lands
 - a. Where land outside of the project area has been disturbed by project activities (e.g., access road creation, culvert work, etc.), restorative practices should occur under favorable conditions when the land is workable and relatively dry using BMPs.
7. Revegetation
 - a. See Revegetation in Post Construction section above.
8. Property Owner Notification
 - a. Verify whether or not a decommissioning plan can be recorded with the Registry of Deeds.
 - b. Before the final electrical inspection, the Solar Developer should provide the landowner evidence that the decommissioning plan was recorded with the Register of Deeds.