



# The Four Phases of Stormwater Management



## BACKGROUND

The number and size of utility scale solar projects being deployed across the US is increasing rapidly. Stormwater management is often challenging, and requires a unique approach due to the size, scale of land disturbance, location, and re-stabilization process required for a utility-scale solar project. This poster discusses key stormwater elements that should be considered during four phases of the project life cycle: development, engineering, construction, and operation.

## OBJECTIVE

- Understand the four distinct phases where stormwater management should be considered: development, engineering, construction, and operation.
- Understand how the decisions made and actions taken during these four phases can contribute to the success of the stormwater management plan.

## RESULTS

**Development:** Stormwater management and erosion control should be a consideration during site selection and development.

- Seek to understand the potential effect of stormwater erosion on your site selection by analyzing soil type & depth, vegetation type & density, drainage patterns, modeling runoff, and considering terrain.
- Conduct field surveys in accordance with EPA's Integrated Vegetation Management approach.
- Conduct preliminary evaluation of grading, racking and pile design to reduce site disturbance to extent feasible. Ensure temporary and permanent erosion control BMP placement and cost is considered early in the project.

**Engineering Design:** Stormwater management and erosion control design of a project should be guided by stormwater analysis and 2-Dimensional hydrologic modeling.

- Many permitting authorities' review standards were not created for utility scale solar sites. Thus, exceeding "code minimum" should be the norm: the owner, engineer and contractor should discuss erosion control design early in the engineering lifecycle.
- Wider spacing of single-axis trackers, and attention to slopes under trackers will encourage higher infiltration of stormwater.
- Stormwater velocities internal to the site should be modeled and minimized to the extent possible using internal BMPs, and sediment laden flows should not be allowed to leave the site.
- Sensitive receptors like wetlands, public roadways, and residences should receive extra consideration and protection.
- Design vegetation plans focused on low-growing native plants and/or cultivars adapted to pre-construction soil types.

**Construction:** During construction, areas of disturbance should be limited to the maximum extent possible and BMPs should be well maintained.

- Contractor bids to include appropriate amount of budget for BMP placement and maintenance.
- Minimize disturbance and compaction of the ground from driving by use of proposed access roads for construction traffic.
- Preserve topsoil during earthwork exercises. In a cut and fill operation, the first earthwork operation should be scraping and stockpiling of topsoil and the last operation should be replacement of the topsoil in the graded area.
- Develop a communication plan between owner/operator, engineer of record, vegetation specialist, and contractor regarding seed mix and amendment selection. Plan planting timelines within construction schedule accordingly.
- Based on the observation and monitoring of a SWP3 specialist, temporary measures shall not be removed until the site is fully restored and permanent measures are installed.

**Operation:** Vegetation must be maintained and established, and permanent stormwater controls must be maintained.

- Ensure that the vegetation grown on site is as desired in SWP3 and Vegetation Management Plan - most permits require that vegetation be restored 70% of the existing vegetation. Undesired species, noxious weeds and pests should be controlled regularly through IVM.
- Additional BMPs may be required, and identification of adaptive management approach to additional topsoil or seeding being required should be identified. Mitigate erosion and scour when it does happen in accordance with the project Operations and Maintenance Plan.

## CONCLUSIONS

1. **Adequate modeling** to determine effects of stormwater on erosion.
2. **Prioritize vegetation** in all 4 phases, vegetation – from existing to restored – needs to be thought through and communicated clearly.
3. **Appropriate costing** BMP budgeting needs to be emphasized.
4. **Adherence to plan** There can't just be a good plan and design, it actually needs to be carried out.

## REFERENCES

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4. [ASCE-Hydrologic Response of Solar Farms](#)

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