Stormwater Best Management Practice

Land Grading

Minimum Measure: Construction Site Stormwater Runoff Control
Subcategory: Erosion Control

Description

This land grading fact sheet includes information related to land grading, gradient terraces, permanent slope diversions and temporary diversion dikes. Land grading involves reshaping the ground surface to planned elevations, as approved construction drawings from a civil engineer or other qualified professional show. Land grading provides more suitable topography for buildings, facilities and other land uses and helps control stormwater, soil erosion and sedimentation during and after construction.

Applicability

Land grading applies to all sites that require earthwork—particularly those with uneven topography or easily erodible soils—because it can stabilize slopes and decrease stormwater velocity.

Siting and Design Considerations

When preparing grading plans or other construction drawings that specify grading, a civil engineer or other qualified professional should account for:

- Existing soil types
- Existing slopes
- Existing drainage patterns
- Environmentally sensitive areas
- Proposed land use
- Proposed stormwater control measures

Grading plans should specify limits of disturbance, land elevations, slopes, drainage patterns and construction schedules. A grading plan should also describe erosion and sediment controls, including locations, dimensions, quantities and standard details.

Construction staff should perform land grading in ways that limit the extent and duration of soil-disturbing activities. When developing grading plans, design engineers should minimize the limits of disturbance and

Land grading involves reshaping the ground surface to planned elevations.
Credit: Anthony D'Angelo for USEPA, 2012

only include areas necessary for construction, utility installation and equipment traffic. Construction sequencing, the practice of minimizing unstabilized soils at any given time during construction, should be a consideration when scheduling and conducting land grading activities. Clearing and grading should never occur beyond the limits of disturbance that approved construction drawings specify.

When developing grading plans, preserving natural, existing or established vegetation in temporary or permanent buffer zones is a low-cost way to reduce stormwater discharge and off-site sedimentation. In addition, design engineers should take care to ensure that land grading does not disturb steep slopes, wetlands, streams, stream valley buffers, forested areas or endangered species habitats.

To minimize off-site sediment transport, construction staff should divert stormwater from undisturbed areas away from areas that will be disturbed. Temporary diversion structures—such as check dams or temporary slope drains—should interrupt disturbed areas with long slopes to reduce stormwater velocities and divert stormwater from exposed areas.

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If construction staff uses blasting agents or explosives, they should take care to limit their emissions into the surrounding environment. These products may contain perchlorates, which are water-soluble chemicals. If construction staff must use explosives containing perchlorate, they should employ good housekeeping practices to ensure they properly dispose of any debris (MassDEP, 2006).

Limitations

Design engineers should develop grading plans to preserve existing drainage patterns as much as possible. Land grading that disrupts natural stormwater flow patterns might lead to poor drainage, high stormwater velocities or increased peak flows during storm events. Clearing and grading an entire site without maintaining a vegetated buffer or implementing adequate erosion and sediment control measures can promote off-site transport of sediments and other pollutants. If construction staff cannot use excavated material or store it on-site, they should make accommodations for off-site transport and disposal. Disposal costs increase if hazardous substances have contaminated the excavated material.

Maintenance Considerations

Construction staff should implement all land grading and erosion and sediment control practices per approved construction drawings and inspect them at frequencies in accordance with applicable permits and consistent with the site's stormwater pollution prevention plan. Construction staff should also inspect unstabilized areas and associated erosion and sediment controls after rainfall events. Necessary maintenance may include backfilling or stabilizing washouts and eroded areas or removing accumulated sediment from erosion and sediment controls.

Construction staff should stabilize areas where grading activities are complete and where they do not anticipate disturbance for 2 or more weeks, including any stockpiles that they will not actively use for 2 or more weeks (40 CFR 450.21[b]; U.S. EPA, 2019). Construction staff should also apply dust control measures in accordance with the permit and consistent with the site-specific stormwater pollution prevention plan.

Effectiveness

When sites properly implement land grading with appropriate stormwater management and erosion and sediment control practices, land grading can mitigate stormwater flow from steep slopes and stabilize highly erodible soils. Land grading can increase erosion and off-site sediment transport when it alters drainage patterns or when it leads construction staff to clear vegetated areas on the perimeter of the site (U.S. EPA, 2004).

Cost Considerations

Land grading incurs costs in both the design and construction phases. Even for small sites, a certified engineer or landscape architect may spend several hours establishing final grades and incorporating stormwater management and erosion and sediment controls into the development plan. These costs increase as sites become larger and more complex.

During construction, in addition to performing labor associated with grading activities, construction staff may need additional time to construct diversions and berms. The site may require off-site fill for low-lying areas or depressions. Where excavation is necessary, sites may need to remove and dispose of excess soil if on-site use or storage is not possible.

Costs of common land grading activities are as follows (RSMeans, 2019):

- Fine grading, soil treatment and stabilization costs are approximately $4 to $6 per square yard.
- Shallow excavation (1 to 4 feet deep) with a backhoe where dewatering is not necessary costs $6 to $10 per cubic yard of removed material.
- Larger-scale grading requires a site-specific assessment and a detailed earthworks analysis to retain as much soil on-site as possible and limit disposal costs.

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

U.S. Environmental Protection Agency (U.S. EPA). (2015). *Model post-construction stormwater runoff control ordinance.* Washington, DC: U.S. Environmental Protection Agency.

Massachusetts Department of Environmental Protection (MassDEP). (2006). *The occurrence and sources of perchlorate in Massachusetts*.

RSMeans. (2019). Earthwork data from RSMeans [Online data file]. RSMeans data from Gordian.

U.S. Environmental Protection Agency (U.S. EPA). (2019). *National Pollutant Discharge Elimination System general permit for discharges from construction activities* (as modified).

U.S. Environmental Protection Agency (U.S. EPA). (2004). *Development document for final action for effluent guidelines and standards for the construction and development category* (EPA-821-B-04-001).

Disclaimer

This fact sheet is intended to be used for informational purposes only. These examples and references are not intended to be comprehensive and do not preclude the use of other technically sound practices. State or local requirements may apply.