Stormwater Best Management Practice

Straw or Hay Bales

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

Description

Construction sites have historically used straw or hay bales for erosion and sediment control as check dams, inlet protection, outlet protection and perimeter control. Many applications of straw bales for erosion and sediment control are ineffective due to the composition of straw bales, inappropriate placement, inadequate installation, lack of maintenance or a combination of all these factors (Fifeld, 1999). In addition, straw bales are maintenance-intensive and can be expensive. Because many applications of straw and hay bales have been ineffective, EPA recommends carefully considering other stormwater control measures first. This fact sheet provides more information and alternatives to straw and hay bales.

Limitations

Limitations to straw and hay bales include the following:

- ***Channel flow***: Straw bales cannot reduce erosion in channel conveyances. Installing a straw bale structure across a channel may actually increase stormwater velocities by reducing the channel's cross-sectional area. This can result in increased erosion around the bales and widening of the channel's cross section (City of Portland, 2008).
- ***Heavy rain***: Straw bales do not work well in areas with heavy rain or on sites with large drainage areas or steep slopes. Straw bales can be impermeable and cannot withstand high flows. Construction staff should take care during placement and installation to avoid failure from undercutting, overtopping and end-running. Construction staff should not install straw bale structures across ditches or concentrated-flow areas because the structures can exacerbate erosion and flooding.
- ***Deployment and use***: Construction staff should not use straw bales on streets or sidewalks because they cannot properly stake the bales into concrete or asphalt, and the straw bales will wash away in higher flows. Straw bales are also difficult to transport and to carry around onsite, particularly when attempting to dispose of waterlogged straw bales. Often, the bindings break and the straw can wash into and clog storm drains (City of Portland, 2008).
- ***Resilience***: Straw bales will rot and fall apart over time (approximately 3 months), particularly in areas of high rainfall; therefore, they require intensive maintenance. Straw bales will float, and construction staff should properly stake them even in low-flow conditions. As previously stated, in high-flow conditions, water will flow around a straw bale barrier or undercut spaces between the bales.

Alternatives

The following is a list of typical applications for straw and hay bales and some alternative practices that are more effective.

Common Uses of Straw or Hay Bales	Alternatives to Straw or Hay Bales
Perimeter controls	■ Silt fence ■ Brush barrier
Check dams	■ Rock check dams ■ Fiber rolls ■ Compost filter berm ■ Filter berm
Slope protection	■ Geotextiles ■ Compost blankets ■ Erosion control blanket
Storm drain inlet protection	■ Filter fabric, gravel bags and other designs ■ Compost filter socks ■ Fiber rolls
Concrete washout structures	■ Prefabricated concrete washout containers

Considerations

If using straw bales (considering the limitations listed above), each bale should be at least 14 inches wide, 18 inches high and 30 inches long, with a minimum mass of 50 pounds (Broz et al., 2017). The straw bale should consist entirely of vegetation except for the binding material. Steel wire, nylon or polypropylene string should bind the bales. Bales should not have jute or cotton binding. Baling wire should be at least 14 gauges in diameter, while nylon or polypropylene string should

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have an approximately 12-gauge diameter with a breaking strength of 80 pounds of force.

Proper installation of straw bales is critical, as improper installation can make them ineffective. Construction staff should intrench straw bales approximately 4 to 6 inches into a pervious ground surface. They should use wood stakes to hold the bales in place. The stake material should be commercial-quality lumber that is free from decay, splits or cracks longer than the thickness of the stake or other defects that would render it structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. Any exposed bar reinforcement should have end protection. Upstream slopes should be shallow, with an upstream flow path of less than 100 feet from the bale, as steep slopes will cause flow to overtop the straw bales.

Maintenance Considerations

Straw bales degrade making the replacement of rotting bales a regular maintenance activity. Replacement intervals are typically every 3 months, depending on local conditions. Maintenance will include repairing any erosion from washouts around the bales. Construction staff may also have to clean out sediment that settles in ponded areas around correctly installed bales when the sediment accumulation reaches one-third of the bale height. Construction staff will also have to remove straw bales when they burst open or are no longer necessary.

Effectiveness

Straw bale barriers are generally not as effective as similar alternative practices due to the limitations discussed above. These barriers often fill to capacity after small storms and can wash away if staked incorrectly. Straw bale structures cannot accommodate large storms and tend to fail during large storm events.

Cost Considerations

Staked hay bales cost around $5 to $10 per linear foot to install depending on location, site layout and material availability. By comparison, silt fences cost around $2 to $3 per linear foot to install, last longer, and are often a more effective means of erosion and sediment control (RSMeans, 2019). Similarly, brush barriers can be a low-cost alternative to site perimeter control when material comes from the clearing of the site.

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

Broz, B., Pfost, D., & Thompson, A. (2017). *Controlling runoff and erosion at urban construction sites: Straw bale barriers*. University of Missouri Extension.

City of Portland, Oregon. (2008). Erosion and sediment control manual.

Fifield, J. S. (1999). When best management practices become "bad management practices." In *International erosion control association proceedings of conference 30* (pp. 189–203).

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