Erosion and Sedimentation Control (Urban): Best Management Practices for Design and Construction of Driveways in Mountainous Areas

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"Driveways in mountainous areas can be a significant source of sediment and erosion products that reaches streams and other waterbodies. The availability of a driveway BMP manual, designed to reduce nonpoint source loading to waterbodies, is a valuable watershed management tool."

– Jane Clary, Wright Water Engineers

In 1995 the Colorado Nonpoint Source Council, an advisory group to the Water Quality Control Division of the Colorado Department of Public Health and Environment, reviewed and updated the urban and construction portion of the Colorado Nonpoint Management Program. A guidance report identified the need for creating project-specific construction and maintenance best management practices (BMPs).

Driveway construction in mountainous terrain was identified specifically as an area where gains could be made in reducing erosion and pollution potential.

In the mountainous areas of Colorado, driveway construction can be a significant source of sediment, erosion products, oil, grease, household chemicals, de-icers and lawn fertilizers — all of which can find their way into streams, rivers and lakes.

While BMPs for road and highway design and construction are available, they generally are out of scale relative to driveways. Driveways usually are designed and built to less stringent standards than highways, creating the potential for nonpoint source pollution.

The construction of driveways in mountainous areas often requires special planning as compared to flatland areas to prevent pollution transport to waterways. Mountainous areas generally have a shorter growing season, steep slopes, limited topsoil and sensitive streams. These factors may pose special challenges when revegetating a site or implementing erosion control measures.

In the spring of 1999, Wright Water Engineers and the Denver Regional Council of Governments began work to create a project-specific set of BMPs for driveway construction in mountainous areas. They formed an advisory committee of stakeholders including county, state and federal officials, environmental coalitions, professional societies, consultants, and landscape architects.

With the input from the committee, a draft of 25 key BMPs and 15 key erosion and sediment control principles were created for review and circulated for comment.

In 1999, a final version of the BMP manual, a brochure, a news release and an evaluation form were distributed for use by government agencies, homeowners, developers and consultants. The manual includes a brief description, installation guidelines, special considerations, maintenance considerations and illustrations for each BMP.

The manual now is referenced in the Larimer County code, and has been presented by Wright Water Engineers at the meetings of various professional organizations including forestry organizations and the Rocky Mountain Chapter of the International Erosion Control Association.

Best Management Practices for Design and Construction of Mountain Driveways

- Minimize disturbance of vegetation and wetlands, particularly riparian areas along streams, wetlands and steep slopes.
- Divert stormwater during construction to minimize contact with disturbed areas.
- Vehicle tracking pads stabilize construction entrances. The controls typically consist of either a rock bed or depressed asphalt at least 50 feet long separating construction areas from public roads.

- Straw bales can serve as a temporary sediment barrier to intercept and detain sediment, and decrease flow velocities from small drainage areas. Some local governments encourage use of silt fences instead.
- Sand bags can be used to stabilize roadside ditches or other areas.
- Silt fences are temporary barriers constructed of woven, synthetic material attached to posts. This BMP pools water from an eroding area, allowing the sediment to settle.
- Sediment traps are temporary basins or embankments which allow water to pool long enough for sediment to settle. Sediment traps capture sediment from limited runoff areas.
- Sediment basins are used to detain runoff from an area and allow settling of sediment. Sediment basins include an outlet (usually a pipe) to control the outflow rate. For mountain driveways, sediment basins are appropriate as part of the BMPs for overall site development.
- Brush barriers are temporary sediment barriers composed of limbs, weeds, vines, root matter, soil, rock and other cleared material to form a berm to intercept and detain sediment and decrease flow velocities.
- Check dams are small dams constructed across a drainage ditch or swale to reduce the velocity of concentrated flows. Reduced runoff velocity reduces erosion and gullying in the channel and allows sediment to settle.
- Buffer strips are graded uniformly in densely vegetated areas of native grass. They require sheet flow to promote filtration, infiltration and settling to reduce runoff pollutants.
- Grass-lined swales are densely vegetated small drainageways with low-pitched side slopes that collect and slowly convey runoff. Properly designed swales reduce the force of water flow and make it shallow, reducing sedimentation and erosion.
- Revegetation is the establishment of vegetative cover on soil left bare by the construction process. Revegetation limits erosion and sedimentation on areas adjacent to the driveway by preventing raindrop and sheet flow erosion and weed infestation of exposed earth.
- Mulching is the application of plant residue or other suitable biodegradable material to the soil surface. The goal of this BMP is to protect the soil surface. Mulch also facilitates the growth of vegetation and reduces wind erosion.
- Erosion control blankets are strong, man-made mattings used to stabilize channels, swales and newly-planted slopes. The type and weight differs depending on slope and soil. Erosion control blankets can be used in place of mulch on areas of high velocity runoff and/or steep grade.
- Some slopes require vegetative and/or mechanical measures to ensure stable slopes, depending on factors such as slope angle, soil type, aspect and climate. Mechanical measures may include surface roughening, wattling, erosion mats/nets, terraces, side drains, riprapping, mulch, tackifiers, soil seals, soil cement and retaining walls.
- Slope drains, flexible or rigid conduits that extend from the top to the bottom of a cut or fill slope, carry stormwater runoff to a stabilized outlet to avoid erosion.
- Road drainage control is one of the most important BMPs for minimizing erosion and sedimentation in mountainous areas. A variety of approaches can be used including controlling road slopes, providing drainage dips, wing ditches, culverts, cross drainage and other measures.
- Outlet protection involves reducing flow velocities and sediment scour at stormwater outlets or otherwise protecting receiving channels. Measures include riprapping or paving channel sections or installing stilling basins.
- Infiltration practices include measures to percolate runoff into soils. Typical practices include rock-filled trenches or basins. Infiltration is highly dependent on subsoil permeability – use of this BMP will have limited application in mountain areas.
- Stream crossings associated with mountain driveways are typically either culverts or bridges. Proper stream crossing design is important to minimize impacts to the stream and man-made structures.
- Source controls include construction staging, good housekeeping, and proper storage of chemicals, oil, lubricants, paints, solvents, concrete-curing compounds and other liquid chemicals such as fertilizers, herbicides and pesticides. Source controls should be applied to overall site development including both the building site and the driveway.
- Winter road maintenance, including snow removal and sanding, is necessary for safe and efficient use of driveways. Since plowed snow can contain residual amounts of petroleum products, salt and sediment which can adversely impact water quality, minimize the use of sand and salt.