Nevada Contractors Field Guide for Construction Site Best Management Practices

December 2013 Update

Nevada Contractors Field Guide for Construction Site BMPs

This document has been approved by the Nevada Division of Environmental Protection (NDEP) and reflects best management practices for erosion and sediment control for construction projects.

Funding for the production and updates of the **Nevada BMP Field Guide** was provided by the Truckee Meadows Storm Water Permit Coordinating Committee (TMSWPCC) agencies, NDEP, and the Washoe County Regional Water Planning Commission. Mention of trade names or commercial products, if any, does not constitute an endorsement by any of the entities listed.

The technical review and development process involved representatives from: the TMSWPCC (City of Reno, City of Sparks, and Washoe County), NDEP, Nevada Department of Transportation (NDOT), the Las Vegas Valley Stormwater Quality Management Committee, the Associated General Contractors of America, the Builders Association of Northern Nevada and other interested members of the public.

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Preface

The regional policies and procedures presented in the Nevada BMP Field Guide are recommendations unless adopted by ordinance or code by the local entity. If the language in this field guide and the adopted ordinance differ, the ordinance language shall take precedence.

Clean runoff starts with you!

This Guide is designed to provide guidance for contractors and maintenance personnel in installing and maintaining best management practices (BMPs) to minimize water quality and quantity impacts from stormwater runoff.

The material in this Guide may have been updated after the printing. It is the responsibility of the user to verify that the project specifications and standard details are current.

Why do we need to prevent erosion and control sediment losses from construction sites?

The U.S. EPA has identified unprotected construction sites as significant contributors of sediment to waterways. Although erosion is a natural process and some sediment in waterways is necessary, excess sediment muddies up the water, kills or weakens fish and other organisms, and destroys wildlife habitat. Sediment from construction sites can also fill reservoirs, flood control structures, storm drain pipes and culverts. This can result in flooding, property damage, increased maintenance, and increased spending of private and public funds to fix problems. It is simple to reduce erosion and prevent sediment from leaving construction sites. Follow the basic approach provided in this field guide. ***Sites with steep slopes and those located near waterways need more controls than flat sites and sites located farther away from water.***

Regulatory Information

Construction projects may require one or more permits before earth disturbing activities begin. If a site ***will disturb one acre or more*** of land surface, a National Pollutant Discharge Elimination System (NPDES) storm water discharge permit is required. If the construction activities also include work in or through streams, rivers or wetlands, additional permits are required under the U.S. Clean Water Act (CWA) and by NDEP.

The NPDES permitting authority in Nevada is the NDEP and storm water permits are issued by the Bureau of Water Pollution Control (BWPC). If a project is ***smaller than one acre,*** and is ***part of a larger development*** that exceeds one acre, it also ***must be covered*** by a NPDES storm water permit. NDEP can also require a permit for projects less than 1 acre in size if they determine the project will impact receiving waters located within a 1/4-mile radius of the project. Following the erosion and sediment control recommendations in this guidebook will help you meet the NPDES permit requirements. The main goal of the entire permit program is to keep sediment and other pollutants out of lakes, rivers, streams, and wetlands.

Need information on Storm Water Permits?

Call 775-687-9418 or visit the NDEP Storm Water Permit website:

http://www.ndep.nv.gov/bwpc/storm_cont03.htm

Types of Erosion

Wind:

Water:

Pre-Construction BMPs

Planning erosion and sediment controls at your project site can help you to avoid costly mistakes. Follow the steps below before you begin clearing, grading, and excavation work. **If your project will disturb 1 acre or more (or is within a 1/4 mile of a waterway)**, you will need to obtain a storm water permit from the Nevada Division of Environmental Protection. Call NDEP at 775-687-9418 or go to the NDEP Storm Water Permit website http://ndep.nv.gov/bwpc/storm_cont03.htm. **Federal and Local permits may also apply and need to be obtained prior to construction activities.**

1. Preserve Existing Vegetation

Only dig or grade where necessary. Existing trees, bushes, and grasses help keep erosion to a minimum. Protect large trees by marking off a no-dig root protection zone along the drip line of trees and shrubs and consult a local arborist. Plan your project to limit exposure of bare soils. Do not clear vegetation or excavate areas next to streams, rivers, lakes, or wetlands without getting the required local, state and federal permits and applying the appropriate erosion and sediment control best management practices (BMPs)!

Final stabilization is revegetation showing 70% of the original vegetative cover. Any photos taken of the site before grading begins can be used to support the 70% revegetation requirement for the Notice of Termination (NOT).

Protect the roots of large trees by placing orange construction fencing around the dripline of the tree. Preserving existing vegetation at the site makes the final development more attractive and can save money by reducing clearing, excavation, and erosion control expenses.

2. Phase Construction - Minimize Disturbance

Minimize clearing and grading to preserve mature vegetation and protect adjacent water bodies. Also, identify natural landscape features you want to keep, such as natural drainages and groundwater recharge areas that can be utilized for drainage and infiltration of storm water. Protect large trees, wildflower areas, grasslands, streams, and wetlands by marking off these areas with orange construction fencing and warning equipment operators of their location. Plan your project around these features, so they remain in place after construction is completed.

Excavate and/or place fill material at the site in stages, to avoid exposing large areas of bare soil to wind and water erosion. Establish final grade quickly, then seed, mulch, or cover bare soil. Require utilities and subcontractors to grade their work sites and seed, mulch, or cover excavated areas promptly. You should require contractors and subcontractors to sign the "Contractor's Certification Statement" section of your Storm Water Pollution Prevention Plan (SWPPP) if their work might generate pollutants that could be transported in storm water. They are responsible for implementing the pollution control measures (aka BMPs) required under the SWPPP and the State's General Construction Permit. If work will proceed over several weeks or months, apply temporary soil stabilization measures until final grade work is completed. **NDEP's General Construction Permit (see Section 4) requires establishment of temporary vegetation, permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, or other appropriate soil stabilization measures as soon as practicable and within no more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.**

Minimize Disturbance on all construction sites.

Excavation and grading work should be done during dry weather if possible. Plan for rainy weather by making sure erosion and sediment controls are in place and that soil stabilization measures are on bare soil areas.

3. Salvage and Stockpile

Salvage the top six inches of native material including gravel, soil, and vegetation. Stabilize or revegetate disturbed areas until the project is ready for permanent revegetation. If soil is infested with noxious weed seeds, remove contaminated soil and replace with clean, uninfested soil for revegetation.

4. Identify Temporary vs. Permanent BMP Methods (14-day rule)

It is important to understand the difference between temporary and permanent construction site BMPs. Often, temporary BMPs are left on-site for years after a project is finished, which leads to littering from residual, non-biodegradable products. Temporary BMPs are only meant to be in place temporarily - no longer that 14 days without maintenance.

Fiber rolls are one of the main concerns, as many of the fiber rolls that are used in the construction industry for temporary or permanent erosion control are held together with plastic netting. Several years after construction is completed, the fibers decompose, leaving the plastic netting as a pollutant.

Limiting the amount of bare soil exposed to the weather at any given time by constructing projects in phases reduces erosion and sediment control expenses. It also limits the liability of maintaining unfinished construction sites for extended periods of time.

a. Diversion ditches and berms- temporary and permanent

- Limit the use of temporary improvements to reduce soil disturbance. Develop a comprehensive, long-term plan that reduces the need for temporary diversion ditches and unneccessary soil disturbance.
- Develop permanent berms and diversion ditches with aesthetic considerations such as revegetation and landscaping.

b. Fiber rolls - temporary and permanent

- Key in and stake every 4 ft. and trench in at least 30% of the depth of the roll.
- Inspect often and maintain at least every 14 days. Remove at completion if not biodegradable.
- Replace when full of sediment from upslope (ie - when water is pooled behind the roll).
- Permanent only if biodegradable - these need not be removed.
- See Section 2 - Installing Fiber Rolls,

c. Silt fence - temporary

- Limit the amount of use on site.
- Maintain when 1/3 full or at 14 days.
- See Section 2 - Silt Fence Installation.

d. Mulch and binders - temporary and permanent - can be used for dust control

- Short-term solution - should be applied during active construction and for permanent erosion control, but is NOT a substitution for vegetation.
- Paper, wood fiber, cotton, flax.
- Plant-derived binder.

e. Rock and gravel - temporary and permanent

- Sediment and erosion control.
- Can screen and use as a berm in lieu of silt fence for temporary sediment control.
- Re-spread and stabilize for permanent application.

f. Sediment traps and basins - temporary

- Catching sediment from active construction sites versus post construction.
- On-site construction site runoff treatment.

Active Construction Operations

Divide your construction site into natural drainage areas, so you can deal with each one individually. Control erosion on bare soil areas by applying mulch, seed or other soil stabilizers, and minimizing the time bare soil is exposed to the weather (both rain and wind). Control points for sediment runoff will be in the ditches and channels where concentrated flows occur, and/or in the sediment traps/basins installed at the site. The last line of defense should be the sediment controls installed around the storm drain inlets that collect runoff leaving the site.

Install up-gradient berms and diversions, install and stabilize drainage channels and sediment traps/basins before excavation, fill, or grading work begins (see Sections 3, 8 and 9). Install fiber rolls, silt fences and other sediment barriers downhill from bare soil areas before clearing or excavation work begins (see Section 5).

1. BMP Maintenance

Inspect all construction site BMPs weekly and within 24 hours of rain events of ½ inch or more. Inspections must be made by qualified personnel (someone with stormwater training, understanding of erosion control, understanding of the NDEP General Permit) familiar with BMPs. Keep records of inspection observations and actions taken, and file with the other paperwork in the project Storm Water Pollution Prevention Plan (SWPPP).

Maintain all BMPs in good working order until project completion. Remove sediment and other debris from culverts and storm drain inlets, and from sediment traps and basins as needed. Sediment and debris accumulating behind silt fences or other sediment filters should be removed regularly. Do not allow sediment to accumulate behind silt fences to depths more than 1/3 the height of the fence. Keep rock pads at construction site entrances/exits clean by raking or adding new rock as needed when sediment begins to fill spaces between the rocks. Place the sediment removed from sediment control BMPs where it won't wash back in the storm drain system or waterways. Repair all BMPs that have become dislodged or damaged (such as silt fences, fiber rolls, rock check dams, etc.) as soon as possible and note repair actions in the SWPPP.

2. Signage

Mark each construction site clearly with several signs associated with the construction that is taking place. Post public notices, dust control violation reporting procedures,

erosion control areas, hazards, and Stormwater Pollution Prevention Plan information at the site entrance on the sign boards. Contact persons, phone numbers, and other emergency information should be easily located on these sign boards. Concrete washout areas must have signage.

A Storm Water Pollution Prevention Plan (SWPPP), which describes the erosion and sediment control BMPs that will or are being used at the site, is required for construction sites that will disturb 1 or more acres of land per federal, state, and local regulations. A SWPPP must be written up at least 2 days before construction activities begin and prior to obtaining a Notice of Intent (NOI) from NDEP. The SWPPP must be kept on site, updated regularly, and be available for review by local, state, and federal inspectors.

3. Perimeter Control & Construction Site Entrance

Perimeter control should be a temporary construction site BMP put in place prior to active construction, serving as a boundary for each active construction site.

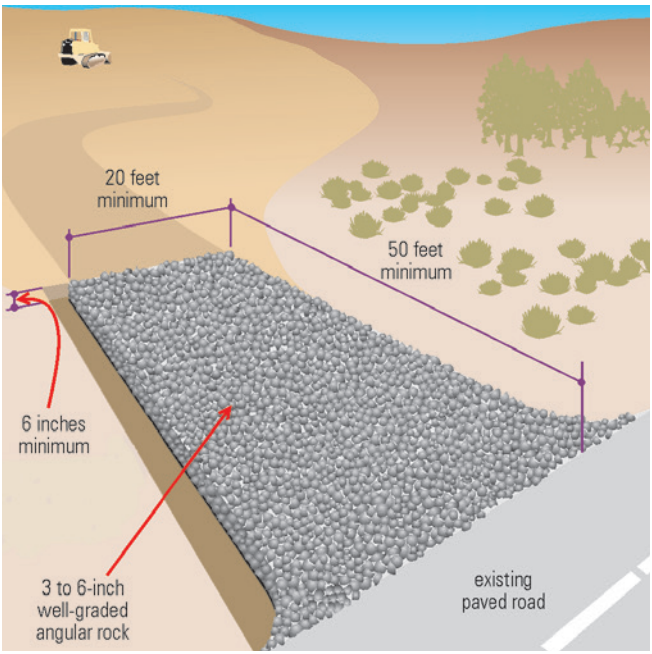
Use an orange fence (as in the photo above) to secure the perimeter of a construction site. It is not appropriate to secure the perimeter of a construction site with silt fence. Silt fence is a temporary sediment control BMP. The photo above also shows a great example of a construction track out pad, used for sediment and dust control.

Silt fence should be used for sediment control only. This sediment is not controlled by the silt fence shown, and a berm of soil would be a more appropriate measure for sediment control. It has not been maintained properly. Also, pay attention to where the soil is going, is there a waterway near by that it is affecting? Can it get off-site?

Mud tracked onto paved roads is the number one complaint from citizens regarding construction site operations. Use 3 to 6-inch well graded, washed, angular rock at entrance/exit pads leading to paved roads. Rock pads should be a minimum of 20’ wide, 50’ long, and 6" thick. Install wider and longer rock pads to accommodate larger vehicles and higher traffic loads. Install a filter fabric liner under the rock to keep it from sinking into the soil below. Rake rock or add new rock if the pad fills with sediment. Discourage alternate routes that avoid pads.

A rib or corrugated steel plate can be added to a stabilized construction entrance/exit for additional mud removal ability. However, traffic should be confined to pass over the rib plate and not be allowed to drive around it (e.g. the gate in the photo above should be secured on each side of the rib plate).

Good installation of a stabilized construction entrance/exit. The rock pad, consisting of 3 to 6-inch well-graded, washed, angular rock installed on top of a filter fabric liner, effectively keeps sediment from the construction site from being tracked onto the roadway. However, dirt areas need to be stabilized and the gutters protected from loose sediment.



Above is a diagram for the proper design and installation of a track out pad. Track out pads are used to capture sediment from vehicles leaving a construction site.

Mud and sediment tracked onto roadways from construction sites leads to public complaints, air pollution, sediment washing into storm drains and pollutants discharging into waterways.

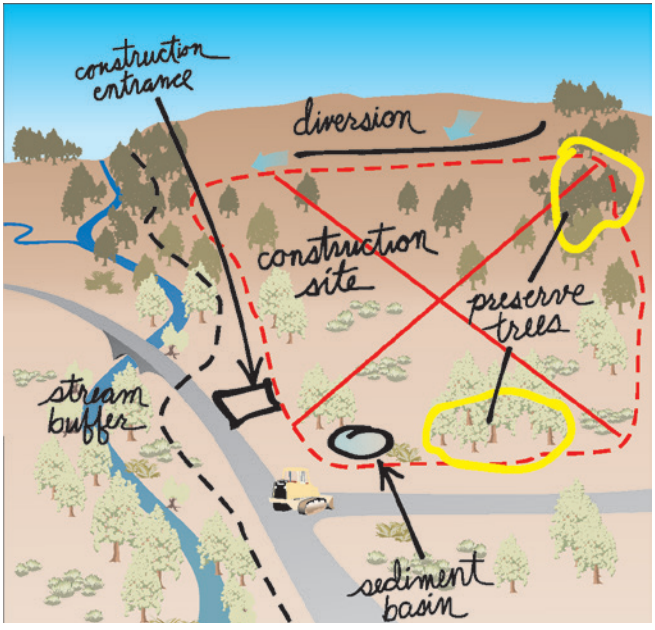
Inappropriate construction site entrance/exit. No rock pad has been installed and sediment is being tracked onto nearby paved roads. Stockpiles must be stabilized to prevent runoff in a storm event.

Vegetated buffers are excellent BMPs and may prevent the need for a silt fence on site, which can equal cost savings.

4. Storm Water Management

Divide your construction site into natural drainage areas, so you can deal with each one individually. Control erosion on bare soil areas by applying mulch, seed or other soil stabilizers, and minimizing the time bare soil is exposed to the weather (both rain and wind). Control points for sediment in runoff will be in the ditches and channels where concentrated flows occur, and/or in the sediment traps/basins installed at the site. **The last line of defense should be the sediment controls installed around the storm drain inlets that collect runoff leaving the site.**

Install up-gradient berms and diversions, install and stabilize drainage channels and sediment traps/basins before excavation, fill, or grading work begins. Install fiber rolls, silt fences and other sediment barriers downhill from bare soil areas before clearing or excavation work begins.



Identify drainage areas, natural drainage swales and man made drainage ditches and channels. Install diversions, grassed channels, sediment traps/basins, downslope sediment barriers, and rock construction entrance before beginning work.

a. Runoff Controls

One of the most important elements of the SWPPP is the site map. It should provide details such as site topography and drainage patterns and the locations of the following:

- The erosion and sediment control BMPs that will be used on the site (mulching, fiber rolls, silt fencing, etc.).

- Stabilized construction entrances/exits to prevent tracking of sediment onto adjacent paved roadways.
- Vehicle and equipment maintenance, fueling, cleaning and storage areas.
- Storage areas for construction materials, supplies and waste.
- Designated concrete washout areas.
- Areas where storm water runoff will discharge off the site into either the storm drain system or nearby surface waters.
- Areas to be revegetated or stabilized with other methods.

As with the SWPPP, the site map is a living document that must be revised and updated when project designs change, different BMPs are used, and/or BMPs are moved or removed.

Keep upland runoff from flowing through your construction site by diverting it around the site or routing it through stable ditches so it won't create erosion. Below are some simple approaches for dealing with uphill sources of runoff.

Proper placement of BMPs is essential. Never locate fiber rolls or silt fences in active channels. The fiber roll in the photo has caused flooding of nearby raw lands by forcing water out of the channel, causing avoidable non point source pollution.

Diversion Berms and Dikes

A diversion berm or dike is a long, mounded "collar" of compacted soil located uphill from an excavated area. The berm is designed to intercept overland runoff from up gradient areas and direct it around the construction site. This prevents upland water from becoming muddied with sediment from the construction site. Berms can be temporary BMPs or a permanent landscape feature of the site.

Locate berms so that storm water flowing along their uphill face follows a gently sloping path (i.e., less than 5% slope). Rock protection or rolled erosion control products such as turf reinforcement mats or erosion control blankets might be needed for berms that channel water at a slope of 5% or more (see Sections 4 and 6). Berm side slopes should be 2H:1V or flatter, at least 18" high, have a minimum top width of 24", and be stabilized immediately after construction (preferably with mulch and vegetation) to maximize stability and effectiveness.

Extend the downhill end of the berm so it directs overland flow to areas of dense vegetation or flat surfaces to promote dispersal and infiltration.

Diversion Ditches and Swales

Ditches should be at least 8 – 12" deep. Stabilize immediately after construction. Ditch side slopes should be 2H:1V or flatter.

Lined ditches can be used to divert clean upland runoff around construction sites, which reduces erosion and sedimentation problems. Ditches require temporary or permanent stabilization.

Discharge to areas with dense vegetation, rock protection, or to flat surfaces to promote dispersal and infiltration. If the diversion is permanent, for slopes that are 2% grade or less, revegetate and stabilize with biodegradable erosion control blankets, fiber rolls or mulch and binders.

As noted previously, straw bales, fiber rolls and silt fences should never be installed across channels, diversion berms or ditches (e.g. perpendicular to the direction of concentrated flows) because this typically forces runoff to flow around these features and create additional erosion.

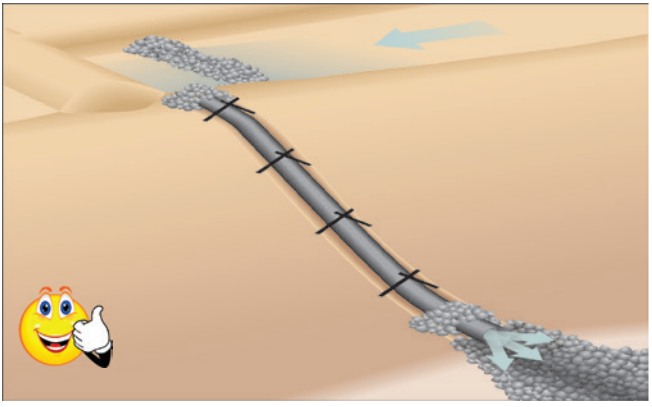
When runoff concentrates above slopes, additional measures, such as temporary slope drains or permanent rock-lined downdrains are needed to safely convey runoff across the slope to stabilize discharge points without allowing erosion to occur.

Stabilize with vegetation on relatively gentle slopes (2% or less). Where slopes exceed 2%, additional measures may be necessary, such as installing fiber rolls and track walking, and if extreme, installing erosion control blankets and armoring with riprap.

Temporary slope drains that use plastic pipe must be staked down securely, installed perpendicular to the slope, and have rip rap installed at the outlet to dissipate the energy of the discharge and prevent erosion. Temporary slope drains are used where concentrated flows need to be transported down highly erodible slopes.

Temporary slope drains must be sized at a minimum to convey the peak flow produced by the 2-year, 24-hour storm event. The maximum drainage area should be 5 acres. Do not use on slopes steeper than 2H:1V.

Compact the inlet/outlet and protect with a filter fabric liner. Securely entrench the inlet to prevent water from leaking under the inlet. Stabilize the outlet with riprap or other materials to dissipate the energy of the discharge and to prevent erosion. Pipes should be perpendicular to the slope, secure with stakes or brackets, and use watertight, gasketed fittings.



Securely stake temporary slope drains that use plastic pipe. Install perpendicular to the slope, install riprap at the outlet to dissipate the energy of the discharge and prevent erosion. Use temporary slope drains where flows are concentrated. Note the rock check dam in front of inlet used to filter sediment and protect the inlet from erosion.

Vegetated water bar with rock cobble outfall

Active Construction Drainage Control

Drainage control on site can be achieved by using sand bags, gravel bags, k-rail, etc. for temporary protection during active construction.

The use of silt fences and other sediment barriers involves simple observation and common sense (e.g. water flows downhill). The following summary provides details on how to install sediment barriers.

Sediment Barrier Placement

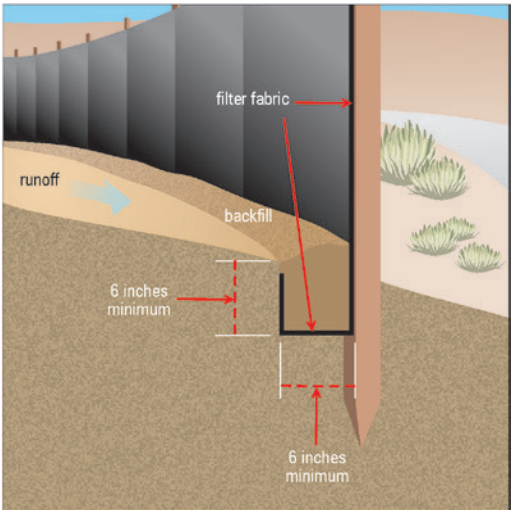
Sediment barriers, such as silt fences, gravel filter berms, sandbag barriers and brush and rock filters are required below (downhill from) areas of bare soil to trap sediment and keep it from washing into waterways. Straw bales must not be used as sediment filters. There are several factors to consider when placing silt fences, rock sediment filters, or other commercial sediment barriers:

- The goal is to pond runoff, filter and settle it out.
- Place sediment barriers on the downhill edge of bare soil areas (e.g. at the toe of slopes and around soil stockpiles).
- Install multiple sediment filters across long slopes.
- Spacing on long slopes is every 100 - 200 feet.
- Put filters across slopes, on the contour (level).

Silt Fence Installation

Each 100-foot section of silt fence can filter runoff from about ¼ acre (about 110 feet uphill). To install a silt fence correctly across moderate to gently sloped bare soil areas (4H:1V to 10H:1V), follow these steps:

- Measure the extent of the bare soil area.
- Mark silt fence locations across contours and space multiple rows based on slope angle and soil type.
- Dig trench 6” deep X 6” wide.
- Unroll silt fence along trench and place about 12 inches of the fence over the trench.
- Drive stakes in against downhill side of trench.
- Drive stakes at least 12 inches into the ground.
- Push fabric into trench; spread along bottom.
- Fill trench with soil and compact.



Remember: stakes go on the downhill side. Dig trench first, install fence in downhill side of trench, tuck fabric into trench, then backfill on the uphill side (the side toward the bare soil area).

Silt fence spacing on sloping sites

	Soil Type		
Slope Angle	**Silty**	**Clays**	**Sandy**
Moderate (4H:1V)	100 ft.	125 ft.	150 ft.
Slight (10H:1V)	125 ft.	150 ft.	200 ft.

The stakes to be used as fence posts should be free from decay, splits, or cracks, have a minimum thickness of 2" X 2", a minimum length of 4 feet, and should have a maximum spacing of 8 feet. Steel fence posts (t-posts) may also be used. Areas prone to high winds may require closer spacing of fence posts. Silt fencing can also be reinforced with wire fencing installed on the downhill side of the filter fabric and between the posts and the filter fabric. This method is highly recommended.

Silt fencing should not be installed:

1. Where fiber rolls can be used.
2. Where native materials (soil, gravel, rock, vegetation) are available.
3. Up and down slopes.
4. Above (uphill from) areas of bare soil.
5. Across ditches, channels, or streams.
6. Across slopes steeper than 4H:1V (25%).

Install J-hooks In Silt Fences

If muddy runoff flows along the uphill side of a silt fence, install "J-hooks" every 40 – 80 feet. These are curved sections of silt fence that act as small dams to stop, pond up, and filter or settle out sediment in runoff (see illustrations). *Use J-hooks to trap and pond muddy runoff flowing along uphill side of silt fence. Turn ends of silt fence toward the uphill side to prevent bypassing. Double up and use multiple J-hooks every 50 to 150 feet for heavier flows.*

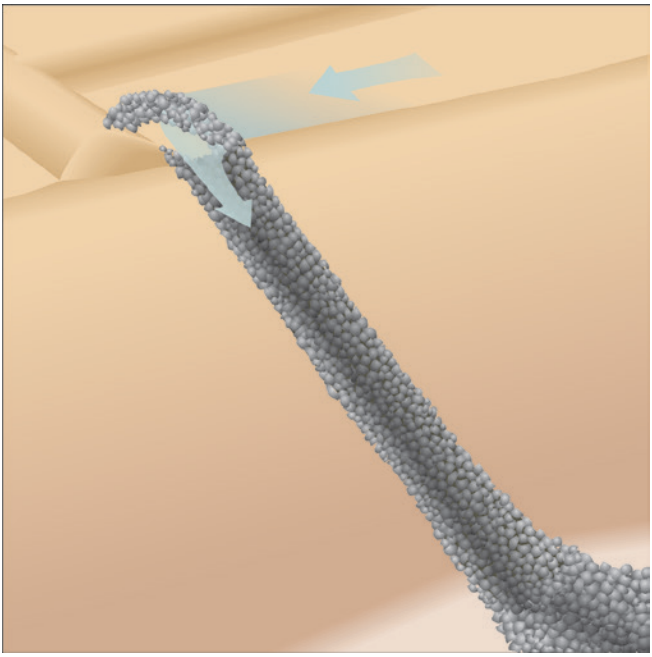
Good use of J-hook in silt fence to trap sediment in water running along fence. Sediment must be removed if it reaches 1/3 of the way up the fence.

Good use of a temporary slope drain to convey concentrated runoff from a construction project safely across a highly erodible slope. A gravel filter pad around the drain inlet is being used to remove sediment prior to discharge to the creek below the slope.

Very good application of a rock lined downdrain channel to carry concentrated runoff down a slope face. Consider use of coir erosion control blankets under rock. Install multiple drains at appropriate spacing where necessary. Always install flow dissipaters at the bottom of the downdrain to absorb energy of the discharge.

Good installation of a permanent, rock-lined diversion channel on a construction site to divert upland runoff around the site.

Good rock lined channel installation with filter fabric being installed under the rock rip rap.



Temporary or permanent *rock-lined downdrains can be used to safely convey concentrated runoff across slopes. A geotextile liner or coir blanket may be installed under the riprap to keep water from undermining the riprap. All slope drains must have flow dissipaters at the outlet to absorb high energy discharges. They should also have rock check dams or filter pads at the inlet to protect the inlet from erosion and to filter sediment.*

Very poor erosion control below the storm drain outlet. Culvert should have been extended to the active channel bottom to provide stable discharge.

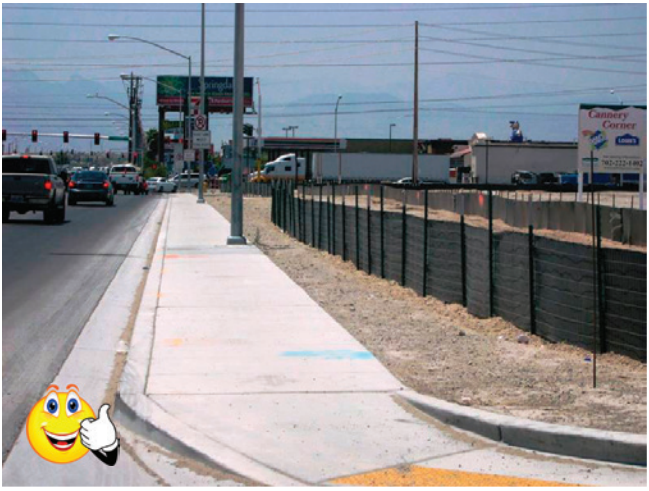
Silt Fence Slicing Devices

New tractor-mounted equipment that “slices” silt fence into the ground can provide a better installation than the open trench hand installation method. The equipment uses a chisel-point or vibratory plow to create a narrow slit in the ground. Rolled silt fencing is pushed into the slit, creating

a very tight seal that prevents water from blowing out the bottom of the fence. Posts are driven and attached to the fence after the fencing is installed.

Besides better performance, the slicing method is also faster. For slicing and all other silt fence applications, posts should be spaced at least 8 feet apart.

Silt fences should not be installed across ditches, channels, streams or at any location where concentrated flows might occur.



Silt fencing can be reinforced with wire fencing on the downhill side of the filter fabric to provide extra strength, important in wind prone areas.

Other Sediment Barriers

Brush, gravel, and rocks cleared from construction sites can often make an excellent sediment filter if properly placed (e.g. along the border of disturbed soil areas, at the toe of slopes, and along ditches, channels and streams). Brush and rock filters should be installed along level contours, be a minimum

of 18 inches high, have a minimum top width of 2 feet, and be at least 5 feet wide at the base. They should be compacted slightly with a loader or dozer to compress the material into a consolidated barrier. These BMPs may be prone to damage in high winds and should be monitored - they may require additional monitoring and maintenance.

Correct installation method for silt fence. Key in and backfill.

Fiber rolls and other commercial products made from coconut fiber, straw, aspen shavings, or other materials can also be used as sediment barriers on slopes. Follow the manufacturers' installation instructions and ensure that sediment filter spacing on slopes is correct. Make sure runoff does not bypass barriers underneath or around ends.

Installing Fiber Rolls

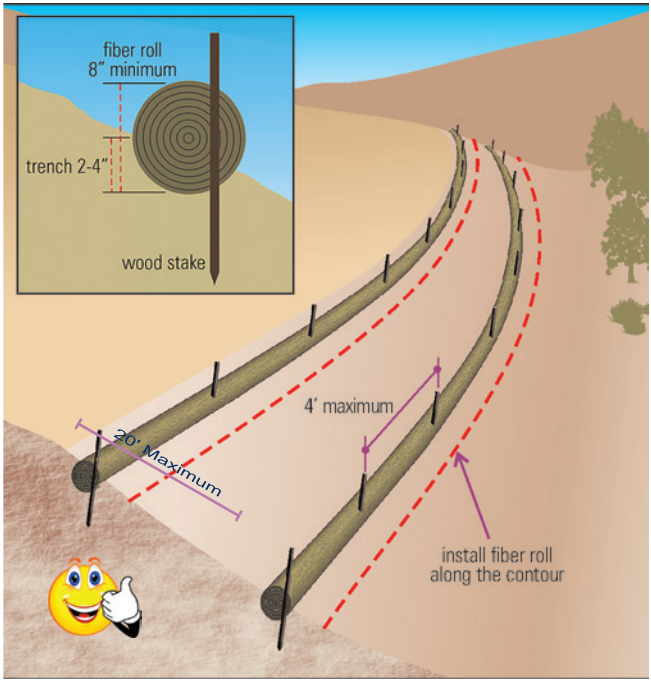
Fiber rolls, also known as straw wattles or sediment logs, allow water to pass through while decreasing runoff velocity, allowing sediment to settle. They are used for sediment control and can provide permanent erosion control, and they are much less prone to damage by wind, a problem with silt fences. They are preferred to silt fences in many areas because they can be left in place permanently, if biodegradable.

Use biodegradable fiber rolls for all specified temporary applications; they can be left in place, saving valuable time and expenses associated with labor including off-hauling, and they are effective in reducing runoff.

Use fiber rolls to break up runoff flows on long slopes. Critical: install along level contours and trenched or keyed into a concave trench at least 30% of roll diameter, so runoff does not flow under them. Remove rocks and debris from the trench prior to installation. Press firmly into trenches and stake down securely with stakes spaced no more than 4

feet apart. Use wooden stakes a minimum of ¾ inch thick X ¾ inch wide and drive into the soil a minimum of 12 inches deep. Overlap the ends of rolls by 6-inches to 1-foot. Gaps between fiber rolls provide a preferred pathway for runoff to concentrate, which accelerates erosion. Fiber rolls placed in consecutive rows should have a vertical spacing of no more than 20 feet (as measured along the face of the slope). On steep slopes, tighter spacing is recommended. Consult manufacturer's instructions for expected lifespan of product, slope limits, etc. Stabilize soils on long slopes as soon as possible.

Apply seed and mulch during the seeding window (Fall and Winter months); otherwise use other temporary erosion control measures such as approved soil binders until seed can be applied.



Proper fiber roll installation is essential. Install along level contours and trenched into the soil about 30% of roll diameter. They should be securely staked into the ground with stakes spaced no more than 4' apart. Overlap ends with no gaps.

Good slope erosion protection with overlapped ends of fiber rolls.

Good fiber roll installation Great overlap of fiber rolls - gaps between sections of fiber rolls often allow runoff to concentrate, which can result in accelerated erosion.

Maintenance of Sediment Barriers and Removal

- Sediment collecting behind silt fences must be removed before it is 1/3 of the way up the fence. When the sediment accumulation reaches three quarters (¾) of the height of fiber roll barriers, it should also be removed or replaced if clogged.
- Remove collected sediment to a vegetated area or other place where it will not wash into storm drains, ditches, channels, or streams. Re-trench and re-install fencing and fiber rolls that are undercut by rills or gullies. Repair silt fencing that is damaged by wind and make sure the base in securely anchored into the soil. Regular inspections are necessary for wind damage.
- Repair gully formation by re-grading, reseeding, and mulching, applying soil binders, and/or filling eroded areas with rock, soil, brush, or other materials. Use

erosion control blankets to control large areas of uphill erosion. Replace broken or bent-over stakes. Inspect places where silt fences and fiber rolls are joined to make sure the joint is solid and there are no gaps. Install J-hooks in silt fencing and fiber rolls where water flows along silt fence or fiber rolls if necessary.

- All silt fencing should be removed once final stabilization is obtained and before the project is completed. Remove all silt fence at once. Stabilize the former anchor trench with seed, mulch, or other suitable material Leave biodegradable fiber rolls in place. Remove non biodegradable fiber rolls for temporary erosion control applications. Remove synthetic fiber rolls once the uphill area is stabilized. If fiber rolls are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground. Seed, mulch, or stabilize the re-graded area following removal.

Very poor silt fence maintenance. Fences and other sediment control BMPs must be inspected and repaired weekly.

Incorrect installation. The base of silt fences must be trenched into the soil. Incorrect BMP installations cost developers money, are ineffective, and can lead to permit violations and jobsite closures.

Poor maintenance of silt fencing. Only locate silt fences at the top of a hill or across slopes steeper than 4H:1V to prevent run on. Locate silt fencing at the base or toe of slopes and/or at the perimeter of construction sites to prevent run off. This slope is also badly eroded with gullies and should be regraded, reseeded and mulched or have effective soil binders or other erosion control measures applied.

Excellent sediment perimeter control with fiber rolls temporarily weighted down with sand bags. Biodegradable fiber rolls can be left in place. Spacing should be a MINIMUM of 4 ft. between sandbags, anchors or stakes.

Sediment barrier installed backwards. Silt fence fabric should face bare soil area. Stakes go on downhill side. Straw bales can be used to back up fence on downhill side, but not uphill.

b. Inlet and Outlet Protection

When installing storm drain protection, contractors must ensure it does not flood or damage other areas. Culverts and storm drain pipes are designed to carry moderate and large flows of storm water. Their size is based on the amount of area they drain and the local jurisdiction's design standards. Storm drain inlets located near construction sites are prone to receiving sediment and other pollutants if unprotected. Once in a storm drain, sediments and other pollutants drain directly to creeks, lakes, wetlands or rivers. Excess sediment in storm drain pipes can also reduce their capacity and cause flooding problems. When culvert and storm drain outlets are not properly protected from high velocity flows, they can become severely eroded.

Good mix of sod, seed, and mulch at this site. However, sediment has been tracked on the street and the storm drain inlet needs protection. A BMP such as gravel bags surrounding the inlet should be installed to prevent sediment from entering the storm drain system. Straw requires anchoring.

Culvert and Storm Drain Inlet Protection

Drain inlet protection should be the last line of defense at construction sites. First, control erosion and reduce sediment production with erosion control BMPs such as seed, mulch and soil binders (see Section 4). Apply to all bare soil areas as soon as possible and properly install sediment control BMPs such as silt fences and fiber rolls (see Section 5) located across slopes, at the base of slopes, and at the perimeter of the site (e.g. back of the curb). However, it may still be necessary to protect culvert and storm drain inlets from construction site drainage.

The goal of inlet/outlet protection is to settle out suspended sediment, slow flows, and pond runoff before it enters the storm drain system. This can be

accomplished by placing rock, reinforced silt fencing, fiber rolls, or other barriers around the inlet. **The use of straw bales is not approved for inlet protection.**

In Southern Nevada, use of sediment control BMPs on storm drain inlets is only allowed within the permitted site boundary (e.g. within the project boundaries described in the NOI). This may include BMPs on storm drain inlets located on the new streets of active construction projects that have not yet turned over ownership of the new streets (and the associated catch basins, drop inlets, underground storm drain pipes, etc.) to the appropriate public agency. Blocking of storm drain inlets with BMPs in the public right of way located outside of the permitted project boundary is only allowed in Southern Nevada temporarily during street washing activities. Once street washing activities have been completed, begin the clean up by removing the sediment and debris retained behind the storm drain inlet BMPs. Next, remove and properly dispose of this sediment and debris. Finally, remove all temporary inlet BMPs.

Place sediment traps upstream of inlets with drainage areas greater than one acre. For construction sites with ten or more acres of disturbed soil area, install a sediment basin. For all inlet protection approaches, stabilize upland areas with vegetation to greatly reduce incoming runoff and sediment loads.

Inlets can be protected with structures made of rock, fiber rolls, stone-filled bags, or other commercial inlet protection devices (many new products are available). Place materials to form a small dam around the inlet. For drainages carrying heavier flows, build larger structures farther from inlets. When using rock, mix sizes to allow for slowed drainage. Consider the use of propagated vegetative mats if the hydrology will support growth. Remove accumulated sediment from all types of inlet protection after each storm event to ensure effectiveness, and dispose of at a stable site where material will not be transported by water or wind.

Place removed sediment in areas where it will not wash into inlets, ditches, channels, or streams. **Do not wash sediment or any other materials down storm drain inlets, into streets, or into ditches and channels.**

Good storm drain inlet protection with stone-filled bags (the bag is a heavy duty synthetic material that allows water to pass through). Note that the bare soil at this site is graded below the elevation of the top of the curb. Therefore the back of the curb provides a sediment barrier. No other perimeter sediment controls, such as silt fence, are needed.

Gravel-filled bags and other inlet protection devices located on active streets are prone to damage by traffic. New products are available that are designed to withstand traffic and are reusable for other sites.

Gravel bag inlet protection damaged by contractor truck traffic. Educate workers to protect inlet devices. Remove and replace damaged gravel bags and note on SWPPP maps.

Clogged inlet - BMPs need to be pulled and replaced. Remember that public safety is most important and to pull BMPs in a flood event.

Excellent storm drain inlet protection with gravel-filled bags surrounding the inlet on all sides. Remove and properly dispose of sediment before a storm event occurs.

Good storm drain inlet protection with fiber rolls weighted down with sand bags, but they have a limited period of functionality and they are prone to vehicle damage.

Extremely poor sediment and waste management.

Excellent use of concrete blocks and rock in mesh bags to protect a large storm drain inlet located within a large construction site. Note the 2" x 4" board through the concrete blocks for reinforcement.

Good use of wire-reinforced silt fence to protect a low flow inlet. Note the diagonal bracing to protect against incoming flow pressures.

Good inlet protection and good rock pad on a stabilized construction site entrance/exit.

*Straw bales are NOT appropriate drop inlet protection. Concrete apron and drop inlet grate are nearly covered in sediment. Use straw for mulch only. *Upslope erosion control is needed!*

Poor erosion and sediment control. Although the wire-reinforced silt fence enclosure is well constructed, the ponding area is too small and it will not be able to protect this high flow storm drain inlet. Do not use straw bales in drainage channels. Regrade and line the rock check dams installed to prevent further erosion.

Protect storm drain inlets from pavement and concrete cutting slurry with gravel bags, filter fabric lining the inlet, and fiber rolls. This slurry material is toxic to aquatic life and must not be washed down storm drains. Remove with vacuum type street sweepers as soon as possible.

Remove pavement and concrete cutting slurry as soon as possible with a vacuum street sweeper. Do not wash this material into storm drain inlets.

Culvert and Storm Drain Outlet Protection

The table below provides general information for sizing rock and outlet aprons for various sized pipes. Key in the perimeter of the filter fabric into the soil 6 to 9 inches deep. Consult a Nevada-Registered Civil Engineer for proper rock sizing and apron length (per local design standards). For outlets that discharge high flows, follow the maximum suggested sizing criteria.

Sizing for flow dissipaters at outlets

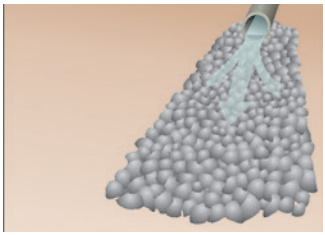
Culvert size	Avg. rock diameter	Apron width*	Apron length**	Apron length***
8"	3"	2–3 ft.	3–5 ft.	5–7 ft.
12"	5"	3–4 ft.	4–6 ft.	8–12 ft.
18"	8"	4–6 ft.	6–8 ft.	12–18 ft.
24"	10"	6–8 ft.	8–12 ft.	18–22 ft.
30"	12"	8–10 ft.	12–14 ft.	22–28 ft.
36"	14"	10–12 ft.	14–16 ft.	28–32 ft.
42"	16"	12–14 ft	16–18 ft.	32–38 ft
48"	20"	14–16 ft.	18–25 ft.	38–44 ft.

** Apron width at the narrow end (pipe or channel outlet)*

*** Apron length for slow-flow (no pressure head) outlets*

**** Apron length for high flow (pressure head) outlets*

Low-flow energy dissipation aprons are shorter than those for high-flow outlets.



When velocities are high, rock armor outlets for storm drains, culverts, and channels that discharge into natural or constructed channels to prevent erosion when flow velocities are high.

Install the rock-lined “apron” at the outlet so that the rock is flat and straight. Armor the sides up and around the outlet. The apron is typically shaped like a long triangle, with the narrow end located at the outlet and sized about 3x the diameter of the outlet pipe. The width of the downstream end of the apron will be wider, tied into the channel, and may vary according to the shape of the receiving channel.

If the outlet and receiving channel do not line up straight, the channel bank receiving the brunt of the outlet flow must be lined or it will erode quickly. If rock is used, double the average diameter when sizing the rock needed. Gabion baskets, galvanized wire mesh boxes filled with rock, can also be used, and can be stacked to form a wall if necessary.

Good placement and construction of rock apron at a high-flow storm drain outlet. If flow from culvert enters a channel, make sure the channel is lined with rock, vegetation, and blankets or mats, if necessary, to prevent erosion.

Excellent placement and construction of rock apron to dissipate flows from culvert outlet. Bare soil areas need to be stabilized.

Poor placement and construction of flow dissipater apron at culvert outlet. The apron is not in line with the culvert pipe and the exposed channel bank will erode quickly. Ponded water may lead to mosquito breeding.

No outlet protection. No rock apron or flow dissipater at culvert outlet and the silt fence is incorrectly installed across the drainage flow path. Note the dozer is properly tracking up and down the slope leaving imprints horizontal to the flow path, ponding water if wet. However, tracking alone is not enough. Stabilize outlet with a rock apron and down drain, stabilize ports and revegetate during seeding windows.

Improper location of silt fences.

No rock apron or flow dissipater at culvert outlet. Culvert pipes are clogged with sediment and debris and slopes around headwall are severely eroded and need stabilization.

Excellent rock rip rap protection for this roadside channel and the culvert pipe inlets and outlets. Stabilize bare soils upslope.

Excellent slope protection of highly erodible soils with fiber rolls, seed and hydromulch. Very good outlet protection and lining of a sediment retention basin with articulated concrete blocks.

Large storm drain outlets may require concrete structures for conveyance, velocity dissipation and erosion control designed by registered civil engineers. The slopes in this photo appear to be stabilized. Now it's time to remove silt fence and stabilize the keyed trench.

c. Sediment Traps and Sediment Basins

Sediment traps and basins allow settling of sediment laden water in natural drainage areas. Install sediment traps as a temporary or permanent BMP before excavation or fill work begins. **Do not depend on sediment traps and basins alone to control sediment loss from your construction site.** Other uphill controls on bare areas, slopes, and in ditches and channels are needed to prevent overloading traps and basins. **Do not put sediment traps or basins in or next to flowing streams or other waterways.** Make sure pooled water does not flood buildings, roadways, or other structures.

Containment basins can be an excavated pit or a dike made of earth, stone, k-rail, or other approved materials. Do not use straw bales or silt fence for temporary concentrated runoff. The lowermost point of the trap or basin must have a stabilized rock overflow structure to prevent erosion during large storm events. Design the rock check dam to prevent extended ponding (e.g. traps and basins must drain within 7 days).

Locations for Sediment Traps and Sediment Basins

Low-lying sites on the downhill side of bare soil areas where flows converge are ideal places to install temporary sediment traps and basins. In general, sediment traps are designed to treat runoff from drainage areas of about one acre or less.

Sediment basins are larger than sediment traps and serve areas of about 1 - 20 acres. The maximum drainage area for temporary sediment basins is 20 acres. The Nevada General Construction Permit requires sediment basins for sites with drainage areas that have 10 or more acres of disturbed soils.

Sediment Traps

Any depression, swale, or low-lying place that receives muddy flows from exposed soil areas can serve as a sediment trap. Installing several small sediment traps at strategic locations is often better than building one large basin. The simplest approach is to dig a pit or build a dike (berm) of soil or rock where concentrated flows are present. This will help to detain runoff so sediment can settle out. The outlet can be a rock-lined depression in the containment berm. Sediment traps should be located upstream of storm drain inlets that drain areas 1 acre or larger. Sediment traps should not hold standing water for longer than 7 days during the mosquito breeding season (May - October: northern NV and March – October: southern NV). They should either allow water to drain through a rock check dam outlet, be located over permeable soils that allow drainage, or be pumped out with appropriate dewatering pumps, and de-silting devices.

Sediment Basins

Although sediment basins are typically larger than sediment traps, the design and construction approach is generally similar. Sediment basins usually have more spillway protection due to their larger flows. Most also have overflow outlet pipes to drain excess runoff from relatively large storm events. They also have outlet drain structures, such as perforated riser pipes that slowly drain the captured storm water from relatively small storm events in 48 - 72 hours.

Sediment basins are often designed to later serve as storm water treatment ponds (permanent BMPs). If this is the case, agreements are required for long-term sediment removal and general maintenance. Construction of a permanent, stable outlet that is regularly maintained is key to long-term performance. If a sediment basin is designed to provide long-term stormwater treatment, it must be built with an access road or driveway adjacent before the local agency will accept the design.

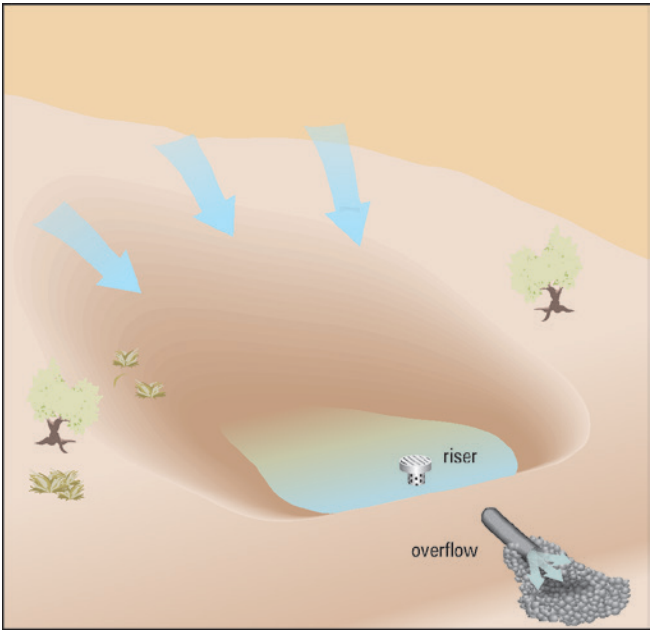
Sediment basins should not hold standing water for longer than 7 days during the mosquito breeding season. They should be designed with outlet drain structures that slowly drain the captured water in 48 - 72 hours. Sediment basins that pond water for more than 7 consecutive days should be pumped out and the excess sediment removed and placed where it will not re-enter the basin or the storm drain system. Check the outlet drain structure after storm events and remove any sediment and debris on the outlet screen or riser pipe perforations.

Sizing and Design Considerations

The NDEP General Construction Permit requires the installation of temporary or permanent sediment basins for sites with drainage areas of 10 or more acres of bare soil area. Sediment basins must provide storage volume for the 2-year, 24-hour storm, or 3,600 cubic feet of storage per acre drained. Sediment traps and basins should be designed so that flow paths through the trap or basin are as long as possible, to promote greater settling of soil particles. Sediment basin length should be twice the width or more if possible—the longer the flow path through the basin, the better the sediment removal.

Construct side slopes for the excavation of earthen containment berms with 3H:1V slopes or flatter. Berms should be made of well-compacted clayey soil, with a height of 5 feet or less. Well mixed rock can also be used as a containment berm for traps. Place soil fill for the berm or dam in 6-inch layers and compact. The entire trap or basin, including the ponding area, berms, outlet, and discharge area, must be stabilized immediately after construction.

An overflow outlet can be made by making a notch in the containment berm and lining it with rock. Rock in the



Sediment basins often have perforated pipe risers to slowly drain captured runoff from relatively small storm events. They should also have well-constructed rock overflow spillways to protect from erosion and failure.

notch must be large enough to handle overflows, and the downhill outlet should be stabilized with rock or other flow dissipaters similar to a culvert outlet. Overflow should be at an elevation so dam will not overtop. Allow at least 1 foot of freeboard. Outlets must be designed to promote sheet flow of discharges onto vegetated areas if possible. If the discharge will enter a ditch or channel, make sure it is stabilized with vegetation or lined.

If used, outlet risers and discharge pipes must be 12-inches in diameter or larger. Corrugated metal pipe works best for risers. Plastic or other pipe can also be used for temporary applications. Risers should be topped with trash racks and anti-vortex baffles, and have ½-inch holes every 3 - 6 inches apart. Large holes or slots, if used, should not appear in the lower two-thirds of the riser. Risers should be anchored to a concrete base, and should be bedded in a pile of 1- to 5-inch rock to a height of at least 2 - 3 feet to promote sediment filtration during drain down. Riser tops must be at least 2 feet below the top of the containment berm or dike. If risers or outlet pipes that do not comply with these design criteria are used for temporary applications, inflows must pass through a filter made of mixed rock piled around the pipe. Rock should be removed after upland area is well vegetated.

No sediment basin at this large construction site. Perimeter fiber rolls alone are not an effective method of sediment control. The Nevada General Construction Permit requires the installation of temporary or permanent sediment basins for sites with drainage areas of 10 or more acres of bare soil area. Sediment basins must provide storage volume for the 2-year, 24-hour storm or 3,600 ft^3 storage per acre drained. They can become permanent features or removed once final site stabilization is accomplished.

Example of a small sediment basin with rock installed at the inlet to control erosion. Note the staff gage at the back of basin to measure both depth of water and depth of accumulated sediment. Maintain regularly.

Inspection and Maintenance

Inspect inlets, berms, spillways, and outlet areas for erosion after each rain event of ½ inch or more. Remove sediment before it fills half the trap or basin volume. Repair any gullied areas and stabilize any upslope areas that contribute large volumes of sediment. Clean trash and plugged areas from the riser pipe. Repair and re-stabilize any bare areas on the basin floor or side slopes. Check the outlet pipe and/or the overflow spillway for erosion and repair any eroded areas as necessary.

Fair installation of 2 sediment traps above a small lake. However, the temporary traps are located too close to the lake and the bare soil areas around the traps need to be stabilized.

Fair sediment trap construction. The rock dike is undersized and lacks a defined overflow notch. The silt fence is unneccessary and maintenance is poor.

Good sediment trap installation, but poor maintenance has caused the trap to fill and bypass to occur. Remove sediment before traps are half full. Make sure containment dikes have an overflow notch to control the discharge location.

Good trap location; needs cleaning out. Very good channel protection, seeding, and mulching.

Poor sediment trap installation. The overflow notch in the rock dike is too deep and the basin is too small. Bare soils must be stabilized.

Poor sediment trap construction. Dike is poorly built, without an overflow notch. Placement is too close to the pond. No seeding or mulching evident in the drainage area.

Very poor storm water management at this site. No sediment traps, basins, or perimeter sediment controls upstream of the inlet. No seed, mulch, or soil binders on the bare soil areas.

Storm drain inlet protection devices are quickly overwhelmed by muddy runoff due to the lack of BMPs behind the curb. Inlet protection should be the last point of protection. Ponding in the street creates a flooding hazard, and bags should be temporarily pulled in a flood event.

d. Temporary Stream Crossings

Placement of sediment control devices in streams requires one or more permits, including a Temporary Working In Waterways Permit from NDEP.

Need information on temporary storm water permits?

Call NDEP at: 775-687-9418 or visit:
http://ndep.nv.gov/bwpc/temporary_permits.htm

Setback Recommendations

Avoid construction activities near waterways. Maintain vegetation and create buffers by establishing setbacks from all construction activities (see table below for recommendations). Flag off vegetated buffer areas to keep equipment away. Some jurisdictions have mandatory setback requirements. Check with the local planning and zoning office before working near waterways.

Recommended setbacks from waterways

	Soil Type Along Banks		
Bank Slope	**Sandy**	**Silty**	**Clays**
Very Steep (2H:1V or more)	100 ft.	80 ft.	60 ft.
Steep (4H:1V or more)	80 ft.	60 ft.	40 ft.
Moderate (6H:1V or more)	60 ft.	40 ft.	30 ft.
Mostly Flat (less than 10H:1V)	40 ft	30 ft.	20 ft.

Vegetated buffers

Preserve existing vegetation near waterways wherever possible. Where vegetation has been removed or where it is absent, plant native vegetation.

Stream Bank Stabilization

Stream banks are likely to erode if:

- Vegetation has been removed;
- Bank slopes are steeper than 3H:1V;
- Outside curves are not protected, and
- Runoff increases in the drainage area.

A Nevada Professional Registered Civil Engineer must design stream and river crossings. Work in and around a stream or a river will likely require one or more permits. Environmental impacts are regulated by the U.S. Clean Water Act Sections 401 and 404. NRS 278 and local ordinances also regulate the flooding impacts of building in the floodplain of a stream or a river, or directly in a stream or a river. The U.S. Army Corps of Engineers issues 404 permits and the NDEP issues 401 Water Quality Certifications. A permit may be required by the Nevada Division of State Lands and other agencies with jurisdiction over specific streams or rivers.

Keep equipment away from and out of streams and rivers whenever possible. If a temporary crossing is needed, put it where the least stream or bank damage will occur. Look for:

- Hard stream bottom areas.
- Low or gently sloping banks.
- Dense vegetation on both sides.

Good use of silt fence, straw, rock, and other practices for temporary stream crossing. Any work in stream channels—such as installation of culverts—requires a Section 404 permit from the U.S. Army Corps of Engineers and a Section 401 Water Quality Certification from NDEP.

For example, in small streams, use one or more culverts (18-inch diameter minimum) as needed, sized to carry the flow of the stream (if any) plus the additional flow produced by the two-year, 24-hour rain storm. Cover culverts with at least 12 inches of soil and at least 6 inches of mixed rock. A 25-foot long, 6” thick pad of rock should extend down the haul road on each side of the crossing, similar to a construction entrance. Remove culverts and cover material when crossing is no longer needed. Grade,

seed, or otherwise re-plant vegetation removed. Stabilize stream crossings immediately after the removal of structures. Sediment control measures such as turbidity fences may need to be installed in the stream during construction and during removal.

Excellent soil coverage at stream bank stabilization project using native seed and two types of biodegradable erosion control blankets.

Good protection of a waterway located next to a road construction project with fiber rolls and a vegetated buffer. Fiber rolls must be overlapped by ~12" to prevent concentrated flows.

Poor protection of a waterway with fiber rolls being left in the middle of an active channel.

Poor protection of wetlands next to a construction site. Although the rock installed below the drop structure in the photo above protects against erosion, the upstream channel (see photo below) is completely unprotected, actively eroding, and transporting sediment into the wetlands.

Accelerated rill erosion in the side slopes of this channel due to incorrect tracking across the slopes. Instead, tracking up and down creates grooves perpendicular to the runoff - holding water and sediment in place. Stabilize the channel bottom and side slopes at this site immediately after construction.

Poor storm water management and protection of wetlands next to a construction site. A silt fence has failed and sediment and loose fiber rolls and straw bales have washed into the wetlands. Remove sediment and damaged BMPs and replace.

Wetlands provide critical habitat for many bird species as well as a number of other plants, animals and insects. Some are rare and endangered. They are protected under federal, state and local laws. Construction activities near, in and around wetlands typically require several permits and the implementation and proper maintenance of best management practices (BMPs).

5. Dust Control

Control dust at the site by keeping the site clean (good housekeeping practices), street sweeping, watering disturbed soils (water trucks), seeding and mulching bare areas where appropriate, wetting haul roads as needed, and applying approved chemical soil binders and stabilizers. Remove any sediment tracked onto paved roadways daily with street sweepers and keep sediment from washing into storm drains.

Good application of a soil stabilizer to provide erosion control (water and wind) on bare soils exposed at a construction site.

Tracking of mud onto roadways is one of the most common causes of dust on an active construction site. Tracking of mud onto roadways must be avoided. Install and maintain rock pads at entrances/exits to prevent sediment track out.

Water trucks are sometimes used to keep dust from blowing off paved roadways, however, a minimal amount of water should be used. Sweeping is preferred. If this occurs, inlet protection BMPs must be used to keep muddy runoff from directly entering the storm drain system.

Vacuum type street sweepers are the preferred method of removing sediment tracked onto roadways from construction sites.

6. Housekeeping

Erosion, sediment and waste controls need to be inspected and maintained at construction sites. Temporary erosion and sediment control BMPs must be removed and the site permanently stabilized when the project is completed. Stabilization includes all key trenches associated with silt fences and fiber rolls installed as temporary BMPs. Failing to fill, grade, and stabilize temporary sediment traps or basins, or failing to remove silt fences, silt check dams, and other controls can result in legal liabilities and NPDES storm water permit violations. See details of the Nevada NPDES General Construction Permit in Section 4 for more information on post-construction closeout requirements.

a. BMP Maintenance

BMPs must be inspected weekly and within 24 hours of rain events of ½ inch or more. Inspections must be made by qualified personnel familiar with BMPs. Keep records of inspection observations and actions taken, and file with the other paperwork in the project Storm Water Pollution Prevention Plan (SWPPP). Your local agency may charge for additional inspections required by inappropriately installed or maintained BMPs.

Poor BMP maintenance. This silt fence has failed and needs to be replaced or reinforced with additional fence posts and/or wire mesh.

Maintain all BMPs in good working order until project completion and Notice of Termination (NOT) is issued. Remove sediment and other debris from culverts and storm drain inlets, and from sediment traps and basins as needed. Sediment and debris accumulating behind silt fences or other sediment filters should be removed regularly. Do not allow sediment to accumulate behind

silt fences to depths more than 1/3 the height of the fence. Fiber rolls at drop inlets must be cleaned if debris reaches 1/3 the height of the BMP. If the fiber roll is clogged and no longer allowing water to seep through, it must be replaced. Keep rock pads at construction site entrances/exits clean by raking or adding new rock as needed when sediment begins to fill spaces between the rocks. Place the sediment removed from sediment control BMPs where it won't wash back in the storm drain system or waterways. All BMPs that have become dislodged or damaged (such as silt fences, fiber rolls, rock check dams, etc.) shall be repaired as soon as possible and note repair actions in the SWPPP.

b. Storage Management

Store all waste and building materials, and properly contain them so that wind and storm water runoff cannot transport materials off site. **Keep your site clean!** Chemicals, paints, and hazardous waste products should be stored in closed containers in a trailer, on a pallet (covered), or in other structures to avoid spills and runoff. Waste materials such as concrete washout, excess paint, cleaning supplies and used oil must be contained and disposed of properly. **Do not discard construction site waste on the ground or in the storm drain inlets.** Portable toilets must be placed on bare soil areas (not on pavement or concrete) and staked down so they don't blow over. If possible, they should be positioned or stored away from waterways and storm drain inlets. Provide for proper sanitary sewage disposal.

Have a plan to properly handle fuel, oil, or other chemicals. Provide secondary containment for portable fuel tanks and keep spill cleanup kits and containment materials on-site. Place portable equipment such as generators and air compressors on bare soil areas (not on pavement or concrete). Try to maintain vehicles and equipment away from the site if possible. If maintenance must occur on-site, use drip pans and clean up any spills promptly.

Sediment tracked onto roadways must be removed. Vacuum type street sweepers work best.

This has numerous problems that could result in pollutants discharging to a nearby stream, significant fines by regulatory agencies, and potentially a job site closure. The site has improper paint disposal in the gutter, improper paint storage, and improper location and installation of a portable toilet.

Good housekeeping practices prevent pollutants from discharging to the storm drain system and help maintain permit compliance. The site above has appropriate BMPs such as fiber rolls that provide perimeter sediment control and a portable toilet that is properly located and anchored. However, note the lack of staking of fiber rolls.

Provide secondary containment for fuel tanks and other containerized hazardous materials at the work site. The volume of the secondary containment area should be 1.5 times the volume of the primary container. Control non-storm water runoff, trash and other wastes, and post-construction runoff. Cover to prevent rain/snow contact.

Very poor management of landscaping materials and trash. Do not store unprotected materials in the right of way overnight. Remove waste and sediment from streets daily. Storm drain inlet BMPs must be maintained and cleaned.

Good storage of supplies in sealed containers off the ground on pallets. When available, store construction materials such as paints, solvents, fuels, oil and lubricants in sealed containers in a jobsite storage trailer. Store and maintain spill cleanup supplies so they are readily available when needed. Store behind lock and key with top and sides covered to prevent contact with rain/snow. This site has no containment of storm water runoff, which likely would include chemicals from paint and other containers.

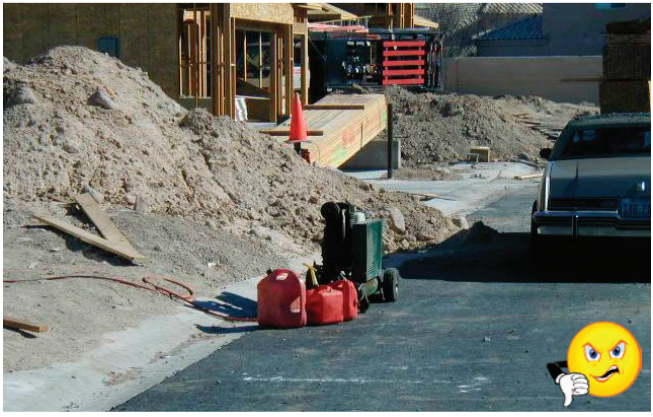
Portable paint washout containers can be rented to help keep contractors from improperly disposing of paint waste.

Very poor housekeeping; painting supplies and gasoline are spilled in the gutter, sediment has been tracked onto the roadway, and the portable toilet is improperly placed on the road and not staked down.

Spills and sediment removed; portable toilet on soil and staked down.

Port-a-potties must be placed on soil and staked down. Any spills must be cleaned up immediately. Do not wash spills into storm drain inlets.

Do not overfill dumpsters. Keep all dumpsters closed when not in use and during off hours to keep trash from blowing offsite. Regularly empty all dumpsters to prevent blowout or vandalism.



Do not place portable power equipment and fuels on paved roadways and concrete gutters, sidewalks or driveways. Place them on level soil areas. Maintain spill control kits on site and clean up any spills immediately.

Clean up spills immediately with appropriate cleanup supplies (e.g. dry absorbent materials), then dispose of in a timely manner. Do not allow spills, or cleanup materials to enter storm drain inlets, drainage channels, ditches or waterways.

Fair secondary containment, must replace the torn liner.

Good example of storing jobsite materials under lock and key which prevents any leakage, weather impacts, or vandalism.

c. Concrete and Asphalt Management

Concrete must be disposed of properly on each construction site. Construction sites are required to have designated concrete washout areas that are appropriate and specific to concrete handling and disposal. Washout areas should be lined and clearly marked with signage.

- Good asphalt management practices are important to implement to prevent petroleum and oil products from reaching the storm drain.
- Asphalt should be inspected and maintained on a regular basis to prevent off-site contamination.
- Repair and seal coat asphalt as-needed and contain seal coating material to prevent off-site contamination.
- Reprocess and reuse, or dispose of excess material in an approved off-site location.

Excellent paving with no offsite contamination.

Wash concrete delivery truck chutes and equipment in dedicated concrete washout areas. Straw bales covered in plastic sheeting or plastic kiddie pools may be used. This area must be labelled in the SWPPP maps and marked with signage on-site.

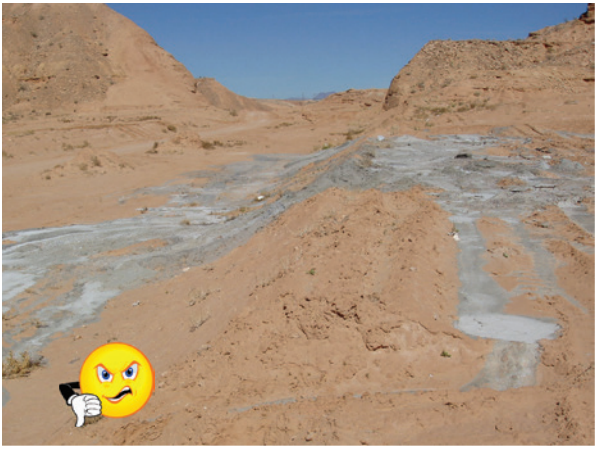
Do not dispose of excess concrete or wash chutes and equipment onto bare soils at the construction site. This illegal practice may lead to a Notice of Violation (NOV) and fines. Concrete washout areas should be lined in Nevada, especially in high groundwater areas.

The concrete washout containment is full and excess concrete has been inappropriately disposed of on the ground. Waste materials (old pallets, plastic sheeting and other trash) are also improperly discarded and mixed with soil stockpiles. This is a violation of the Nevada General Permit.

Portable concrete washout containers can be located at construction sites and hauled off when full. The waste materials are often recycled.

The interior of building foundations are an acceptable location for the disposal of excess concrete waste. Washouts contain water which transports harmful chemicals in mixes to nearby waters.

Great containment for portable concrete washout area. Excellent placement of portable toilet on softscape.



Concrete washout not contained and labeled, signage is needed. Should not locate a washout on a slope.

7. Weed Control

Invasive plant species, such as tall whitetop (above), will quickly dominate disturbed soils if not controlled. Establish area-appropriate native plant species as soon as possible and keep invasive plant species from becoming well established, especially along stream banks. The silt fence at this site also needs to be repaired.

8. Stockpile Management

a. Apply water to form a crust to control dust.

b. Apply mulch or tackifier to control weeds.

c. Install fiber rolls around the perimeter of the base of the pile (remove if non-biodegradable).

Good use of a fiber roll for temporary sediment control around the base of a stockpile. It should be removed when construction activities resume. Eliminate roof runoff affecting the stockpile by placing the fiber rolls around the entire stockpile.

Stockpiles should be considered temporary, and should always be protected with appropriate BMPs. Stockpile in windrows or in piles on site. Stabilize and protect from wind, rain, and weeds. The 14-day rule applies to stockpiles. Use one or more of the following methods to stabilize a stockpile:

Whenever possible, salvage the top six inches of native material and stockpile this material, keeping it separate from other, deeper excavated soils. This material is critical for erosion control and can be used later as dust control, revegetation, stabilization, etc. if topsoil is contaminated with noxious weeds, it will need to be removed from the site and clean topsoil will need to be imported, to prevent violation of NRS.

Salvaging, stockpiling and reusing topsoil is the best way to ensure re-vegetation success, particularly on slopes. Above, uncontaminated and uninfested topsoil is being stockpiled. Reuse of this material significantly improved, and shortened the time for the re-establishment of vegetation and the stabilization of the cut slopes created as part of this project. However, in this photo you can see that topsoil is unprotected and exposed to wind and water erosion and vulnerable to weed colonization.

Excellent example of stockpile management. Fiber roll along base of the pile, with cover over loose soil to protect against wind, rain, and spreading of invasive species.

Post Construction / Permanent BMPs

1. Slope and Toe Stabilization

Slopes, especially long ones, must be protected to prevent sheet, rill, and gully erosion. Stabilize slopes immediately after final grading.

Approximate Slope Conversions

Percent	Slope ratio	Degrees
100%	1H:1V	45°
50%	2H:1V	27°
33%	3H:1V	18°
25%	4H:1V	14°
10%	10H:1V	6°
5%	20H:1V	3°

Assessing Slopes and Soils

Steeper slopes (3H:1V or steeper) require more protection than flatter slopes. Slopes with highly erodible soils (silty soils) need more protection than those with less erodible soils (sands and gravels). Long slopes (greater than 50 feet) are at greater risk for erosion than short slopes.

Seed Bed Preparation Rates

If soil is:	Erosion will be:
Compacted and smooth	30% more
Tracks across slopes	20% more
Tracks up & down slopes	10% less
Rough and irregular	10% less
Rough & loose to 12" deep	20% less

Fiber Roll Placement

Slope Steepness :	Fiber Roll Spacing:
2H:1V or steeper	10 feet or less
4H:1V to 2H:1V	**15 feet or less**
4H:1V or flatter	**20 feet or less**

Good re-establishment of native vegetation on a long fill slope 2 years after seed applied.

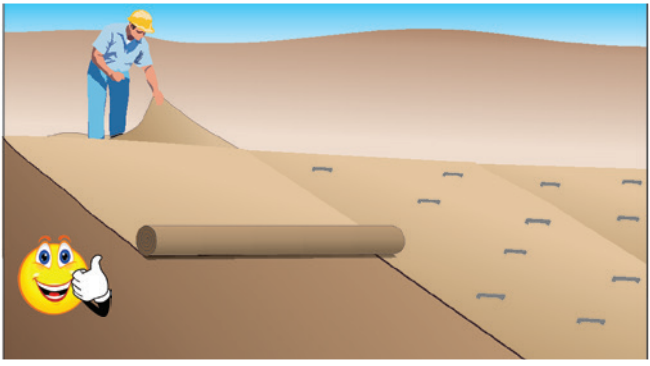
Excellent % slope reduction and soil roughness with a combination of techniques. However, fiber rolls are spaced too far apart (more than 20').

Rolled Erosion Control Products

Rolled erosion control products (RECPs) include geotextiles, erosion control blankets, turf reinforcement mats, cellular confinement systems. RECPs are used to protect steep slopes (3H:1V or greater) with highly erodible soils, drainage ditches and channels, and other areas where erosion potential is high. Most RECPs are designed to provide temporary stabilization until vegetation is established. Turf reinforced mats (TRMs) and cellar confinement systems (CCS) have limited value in arid climates. Erosion control blankets typically degrade within 6 - 24 months, depending on their makeup. They can consist of a layer of straw, coconut fiber, wood shavings, or jute sandwiched between layers

of plastic or biodegradable mesh. May also include open weave netting. Use in drainage ditches and channels with slopes less than 20H:1V. For short slopes (8 feet or less) above channels, install erosion control blankets across the slope (horizontal). Install blankets perpendicular on long slopes. Erosion control blankets are not appropriate for rocky slopes. Walk on erosion control blankets to ensure good contact with the soil. Use plenty of soil stakes (preferably hard wood) to keep blankets flat. Overlap blankets at 6 - 8 inches on sides, tops, and bottoms. Do not stretch blankets, and do not exceed manufacturer's directions on maximum slope angle for the product. Only use plastic sheeting for temporary, short term slope protection and stockpiles when storms are predicted.

Steep, long slopes need erosion control blankets or turf reinforcement mats. Install blankets and mats up and down long slopes. For channels below slopes, install blankets and mats horizontally along the length the channel. Don't forget to apply seed, soil amendments and fertilizer (if needed) before installing blankets and mats.

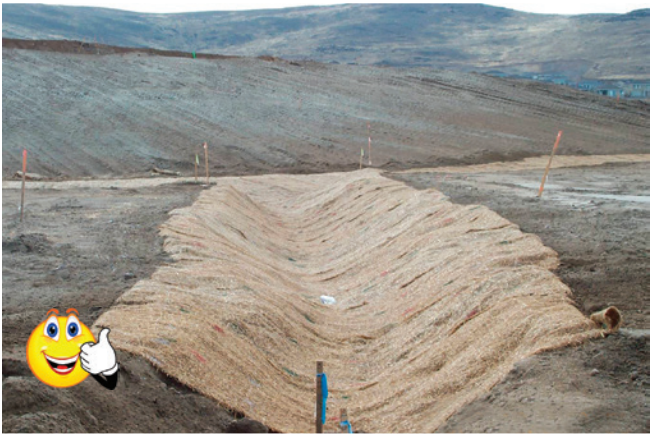


Install blankets and mats vertically on long slopes. Unroll from top of hill, staple as you unroll it. Do not stretch blankets.

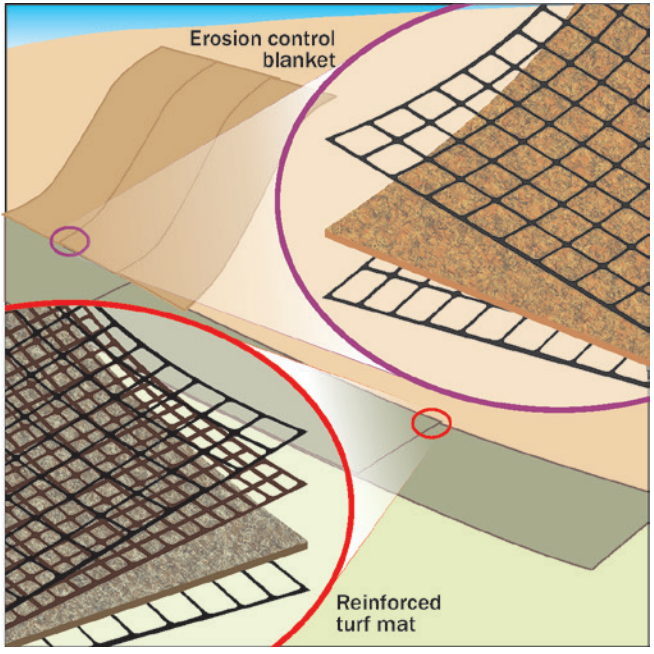
Slope protection basics

Site conditions	Erosion blanket installation notes
Side slopes on ditches and channels (from high flow line to ditch bottom)	▸ Grade, disk, and prepare seedbed ▸ Spread stockpiled topsoil (if available) ▸ Seed, amend, and inoculate (if needed) ▸ Install horizontally (across slope) ▸ Start at ditch bottom ▸ Use biodegradable stakes ▸ Stake down blanket center line first ▸ Stake & bury top in 8" deep trench. ▸ Top staples should be 12" apart ▸ Uphill layers overlap bottom layers ▸ Side overlap should be 6"– 8" ▸ Side & middle staples = 24" apart. ▸ Staple below the flow level every 12" ▸ Staple thru both blankets at overlaps
Long slopes (including areas above ditch and channel high flow line levels)	▸ Grade, disk, and prepare seedbed ▸ Spread stockpiled topsoil (if available) ▸ Seed, amend, and inoculate (if needed) ▸ Install vertically (up & down hill) ▸ Unroll from top of hill if possible ▸ Staple down center line of blanket first ▸ Staple & bury top in 8" deep trench ▸ Top staples should be 12" apart ▸ Side & middle staples = 24" apart ▸ Uphill layers overlap downhill layers ▸ Overlaps should be 6"–8" ▸ Staple thru both blankets at overlap

Good application of erosion control blankets to stabilize highly erodible soils on new cut slopes at this construction site.



Good application of erosion control blankets on this drainage channel. However, blankets should typically be installed horizontally along the length of the channel with overlapping sections facing downstream. If installed vertically, as shown in the photo above, make sure to start the installation at the bottom of the channel and work your way up the channel so the seams are not facing upstream.



Check manufacturer's product information for degradation rate (life span), slope limitations, and installation. Remember to apply seed, fertilizer, and lime (if necessary) before covering slopes with blankets or mats!

Great use of erosion control blanket with dowel anchoring system.

Good use of rock-filled stacked gabion baskets to protect steep slope. Soil and bark mulch can be used in or over gabions and planted with live willow or cottonwood cuttings to reduce the "hardened" look of gabions.

Rock riprap with salvaged topsopil and revegetation.

Good use of an engineered retaining wall to break up slope, reduce slope angle, and reduce erosion potential. Retaining walls can also increase the amount of land available for development. Geotechnical conditions, local design standards, and customer preferences dictate the type of materials to be used.

Good example of a rockery wall. Immediately remove spilled building materials in the foreground (cement powder), they will become a pollutant in storm water runoff.

2. Drainage Control

Man-made drainage ditches with gently sloping bottoms (less than 3%) can be stabilized with vegetation and erosion control blankets. Ditches with greater than 10% slope require heavy armor (concrete, riprap, gabions, retaining walls, etc.). *Natural (i.e., not "man-made") drainage channels and creeks or streams cannot be cleared, re-routed, or otherwise altered without one or more permits from the U.S. Army Corps of Engineers and the NDEP.*

Drainage Ditch Slopes and Soils

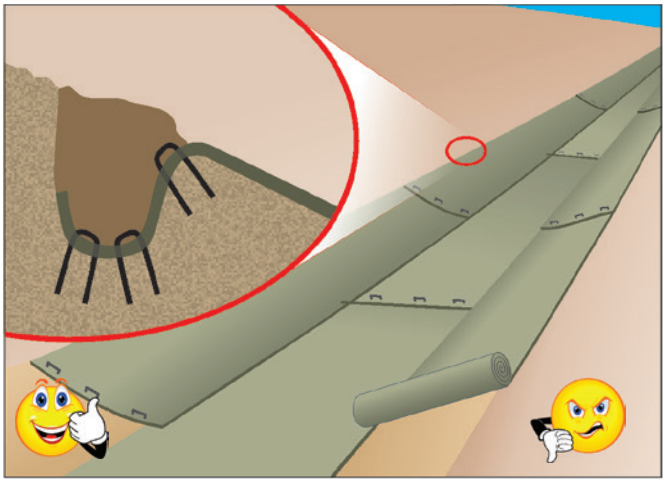
As noted in Section 1, silty soils are the most erodible and sand is the least erodible. Steeper ditches and

those with highly erodible soils need more protection. Drainage ditch bank side slopes must not exceed 2H:1V (50%). If tractor mowers or other equipment will cross channels in the future, bank slopes must be 3H:1V (33%) or flatter. The outlet must be installed, stabilized, and protected before the ditch receives incoming flows.

Stabilization Approaches for Drainage Ditches

	Soil Type in Ditch		
Ditch Slope	**Sandy**	**Silty**	**Clays**
Steep (>10%)	Concrete or riprap with filter fabric	Concrete or riprap	Riprap
Moderate (5 - 10%)	Riprap with filter fabric	Riprap	Riprap
Slight (3 - 5%)	Riprap or erosrion control blankets & seeding	Seeding & erosion control blankets	Seeding & erosion control blankets
Mostly Flat (<3%)	Seeding & blankets	Seeding & mulching	Seeding & mulching

Note: All seeding activities in Nevada should occur during the Fall or Winter and sometimes Spring months when weather is condusive to planting.



Apply seed and specified amendments. Lay in ditch blankets similar to roof shingles; start at the lowest part of the ditch, then work your way up. Uphill pieces lap over downhill sections. Staple through both layers around edges. Trench, tuck, and tamp down ends at the top of the slope. Do not stretch blankets or mats. Unlike this photo, blankets need to start from the bottom of the drainage and work your way up the channel.

Erosion Control Blanket and Turf Reinforcement Mats (TRMs)

All ditches steeper than 10% require rock, concrete, or other armored liners and/or grade control structures. Ditches of 10% or less can be stabilized with erosion control blankets if they are installed in the Fall and Winter over seed and mulch. Only use TRMs if the hydrology will support dense wetland vegetation.

Check Dams of Rock, Brush, or Other Products

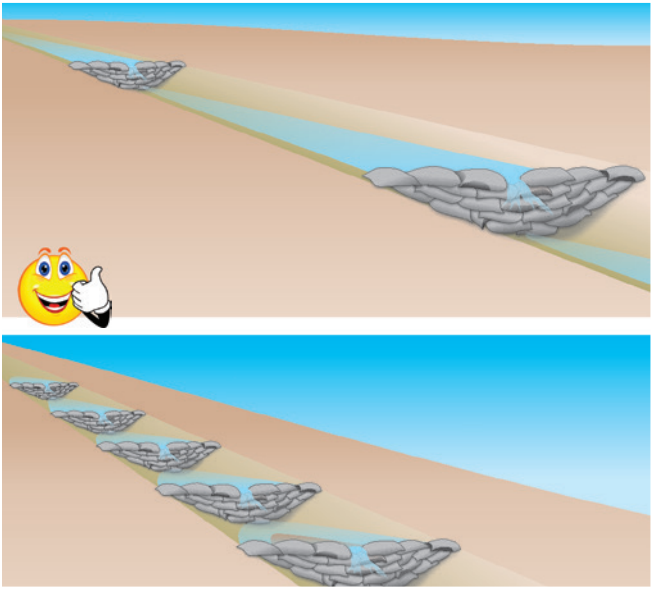
Drainage ditches may require temporary check dams to slow flow velocity, capture sediment, and reduce ditch bottom slope and down cutting. Silt dikes or check dams can be made of rock, stone-filled bags, fiber rolls, or brush. These are only effective when the drainage area is 10 acres or less.

Silt fencing, sediment logs, and straw bales are not approved for use as check dams, and must not be used in drainage ditches that carry flowing water. Do not place check dams in creeks or streams.

If possible, install drainage ditches in the Fall, then seed and install check dams before excavating, filling or grading uphill areas. Otherwise install other erosion controls promptly after ditch installation. Inspect, repair, and clean out sediment from upstream side of check dams after each rainfall exceeding ½ inch. Remove temporary check dams after the site is stabilized and vegetation is established. Gravel bag check dams are easiest to remove, and can be re-used. Stabilize footprint of check dams following removal.

Spacing for check dams

Ditch slope	Check dam spacing	Additional information
30%	10 ft.	▸ Calculated for 3' high check dams. ▸ Center of dam should be 6" lower than sides. ▸ Use 8 -12" diameter rock riprap, gravel bags, or other approved commercial products.
20%	15 ft.	
15%	20 ft.	
10%	35 ft.	
5%	55 ft.	
3%	100 ft.	
2%	150 ft.	
1%	300 ft.	
0.5%	600 ft.	



Check dams of gravel, stone-filled bags, or commercial products must be installed before uphill excavation or fill activities begin.

Check dams of rock, stone-filled bags, or commercial products must be installed before uphill excavation or fill activities begin. See table for correct silt check spacing for various channel slopes. Tied end of bag goes on downstream side. Check dams are spaced according to the slope of the ditch bottom (see table above). Extend the ends of the check dam to the top of the bank to prevent bypassing and side cutting. Keep the middle part lower and relatively flat so overflows aren't concentrated and bypasses are prevented. Key in (trench in) check dam materials at least 6 inches into the sides and bottom of the ditch or channel.

Lining steep Ditches and Channels

Permanent man-made ditches and channels must be designed by registered professional engineers according to the design criteria in the local jurisdiction's drainage design manual. The jurisdiction typically provides required criteria for velocity limitations, ditch and channel liners, drop structures, and the design of energy dissipation devices. The following information provides general design guidance that must be confirmed by the local jurisdiction responsible for the design and approval of storm drain systems.

Rock sizing for ditch & channel liners

Flow velocity	Average rock diameter
6 ft. per second	5“
8 ft. per second	10“
10 ft. per second	14“
12 ft. per second	20”

Use riprap to line sides and bottoms of steep man-made ditches and channels. Use material of various sizes to fill gaps in larger material.

As ditch and channel depth and steepness increase, rock size increases. Line the bottom and sides of bare ditches and channels with non-woven filter fabric to prevent undercutting and washouts. If flows are 10 feet per second or faster, use smaller rock as a bottom liner, below the larger rock. Rock must be placed along the ditch bottom first, then up the sides. Rock layer thickness should be at least 1½ times the average diameter of the largest rocks.

Install a protected outlet first by excavating a 1½ - 2-foot deep trench at the toe of the slope and filling it with riprap. See Section 2 for details on outlet protection. Replace dislodged rock after storms as needed.

Good use of rock check dams to reduce erosion in a drainage ditch. Stabilize bare soils on either side of the channel with seed and mulch. Rock check dams should be inspected and maintained. They can be used as both temporary and permanent BMPs, but are likely to remain as temporary. Rock check dams should be engineered to be sure they are built to accommodate flows.

Good rock liner protection on this roadside ditch.

Poor application of commercial check dam product (note erosion around edges). The check dam needs to be longer (tied into the banks), and more check dams are needed, at the correct spacing for channel slope.

Poor check dam installation. Straw bales should not be used as check dams due to rotting, installation difficulties, and high failure rates. This check dam application should be longer for the volume of runoff and the BMPs should be spaced properly to stop/slow the water.

Good use of a geosynthetic liner on the slightly sloping channel section and rock rip rap on the steep channel section (foreground). Do not install fence across a ditch or channel. Do not use geosynthetic TRMs if hydrology won't support dense wetland vegetation.

Poor protection of a steep drainage channel located below a culvert outlet discharging concentrated runoff from a new development. Culvert should connect to channel bottom to prevent such erosion.

Good placement and spacing of fiber-roll check dams. Fiber rolls and other commercial products can be used in small drainage ditches where channel slopes do not exceed 3%.

Conduct soil tests in place at finish grade. Verify specified amendments and soil inoculants (mycorrhiza, bacteria).

3. Revegetation

Per the Nevada General Construction Permit, bare soil areas must be seeded, mulched, or otherwise covered with other appropriate stabilization methods where construction activities have ceased for 14 days and will not resume during the following 7 days (i.e., 21 consecutive days). This includes soil stockpiles if they will not be used for 21 days or more.

Seed and cover bare soils with mulch, binders, or erosion control blankets.

Seed Bed Preparation

Decompact top 6" of soil to 85% or less, on contour, with rippers, discs or other suitable equipment perpendicular to flow line. Create soil roughness: imprint, trackwalk, create divots, place organic matter, rock. Soil roughening can be conducted with bulldozers by track walking perpendicular to the flow line.

Protect bare areas during the cold season by applying recycled paper mulch with tackifier or other suitable mulch. Sow permanent seed within seeding windows when irrigation is generally not necessary (during the Fall or Winter months).

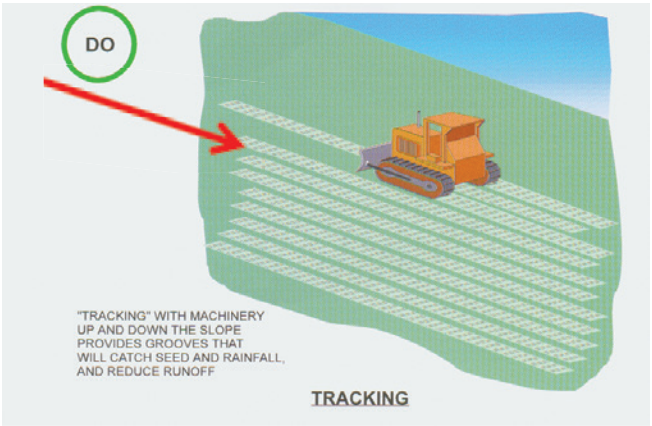
Great example of divots created for seed bed preparation.

Great example of soil roughness - preparing for seeding

Remove rill and gully erosion from slopes, roughen soils, and reapply seed (in the Fall or Winter), mulch, fiber rolls and other erosion and sediment control BMPs as necessary until new vegetation is established and slopes are stabilized. Evidence of erosion at bottom suggests stabilization should occur soon on this site.

Excellent soil preparation by tracking the slopes perpendicular to flow line prior to seeding and mulching.

Installing sod immediately after grading work is complete can reduce erosion and sediment loss to near zero for landscaping applications. However, sod requires regular watering and fertilizer. Irrigation overspray from sod located adjacent to roadways and other paved surfaces also creates runoff and pollution. Install mulch, rock and low water use plant buffers between sod and paved surfaces to prevent runoff from entering the storm drain system.



Trackwalk perpendicular to the flow line.

Mulches and Soil Binders

There are many different types of mulch and soil binders (see tables on following pages). Organic mulch products applied over seed provides excellent erosion protection. To apply, bring site to final grade and clear wood, trash, and other debris. Apply seed first. Performance of soil binders depends on temperature, humidity, and traffic across treated areas. Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

*Good application of straw mulch in new residential subdivision. Remove excess straw from the concrete gutter and the street. Fiber rolls installed at the back of the curb will prevent additional straw from moving off the site where it can be washed into the storm drain system. Seed and mulch or stabilize with soil binders as soon as possible after final grade is established **(no later than 21 days)**. Crimp mulch into the soil and use a tackifier to prevent straw from blowing offsite.*

Good application of rock mulch over a bare soil area located between the sidewalk and the roadway.

Excellent use of rock mulch and containerized drought tolerant desert vegetation to cover and stabilize this area. No irrigation decreases the likelihood of runoff and possible pollution.

Inadequate run-on slope protection. Fiber rolls were spaced too far apart (greater than 20'), given the slope, and insufficient erosion control BMPs were applied. However, some erosion on large cut slopes is often inevitable. Maintenance and reapplication of erosion control BMPs for 2 - 3 years is often necessary, especially on large cut slopes, until they become stabilized with vegetation.

Good application of hydraulically applied soil stabilizers to disturbed soils on a cut slope.

Success Criteria

No site is closed out properly until it is stabilized, preferably with vegetation established on all bare soil areas. Check seeded areas, and reseed areas where vegetation is thin or absent (reseed in the Fall or Winter). This is especially important for slopes, ditches, and channels.

Final stabilization is defined by NDEP as 70% of the native background vegetative cover (applied uniformly) on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (rock, geotextiles, erosion control blankets, etc.).

4. Closeout

When project is completed and stabilized:

- Remove all silt fencing and stakes. Grade or remove accumulated sediment and dispose of off-site. Prepare soils where silt fencing is removed with seed and mulch or with other appropriate soil stabilization methods.
- Stabilize culvert inlets with vegetation and/or rock and grade any visible gullies. Replace any rock or soil that has been washed away by runoff or upstream flows. Remove any brush, debris, trash or sediment that could clog inlets and culvert pipes.
- Check ditches and channels to make sure banks and ditch bottoms are stabilized with vegetation, rock, or other appropriate methods.
- Check areas where erosion control blankets or matting were installed. Cut away and remove all loose, exposed material, especially in areas where there is foot traffic or flowing water. Reseed all bare soil areas in the Fall and Winter.
- Replace rock washouts near culvert and channel outlets. Fill, grade, and add rock riprap to eroded areas around inlets and outlets. Make sure downstream ditches and channels are stabilized with vegetation and/or other erosion control BMPs. Fill and seed any gullies along the banks or other slopes.
- Fill in, grade, and stabilize all temporary sediment traps and basins that will not become permanent site features. Provide additional erosion protection where runoff flows might converge or high velocity flows are expected.

- Remove temporary stream crossings and grade and stabilize stream banks with rock, erosion control blankets and turf reinforcement mats. Seed, mulch or re-plant vegetation removed during crossing installation. Use drip irrigation on containerized plants until established. If available, it is preferable to utilize vegetation that will not rely on supplemental irrigation for its establishment.

Final Site Stabilization

Make sure all subcontractors have repaired their work areas prior to final site closeout. Conduct a final inspection of all work areas, vegetation, storm water flow structures, and downstream receiving waters to make sure no visible gullies or sediment movement is evident. Notify site owner or manager after all temporary erosion and sediment controls have been removed and final stabilization has been completed. Final stabilization is required to obtain a Notice of Termination (NOT) approval from NDEP. Final stabilization is revegetation showing 70% of the original vegetative cover. Any photos taken of the site before grading begins can be used to support the 70% revegetation requirement.

If the site is one acre or larger and covered under the NPDES General Construction Permit, submit a Notice of Termination (NOT) to the NDEP (see http://ndep.nv.gov/bwpc/storm_cont03.htm)

Federal and State Storm Water Permit Requirements

U.S. Environmental Protection Agency (EPA) regulations (40 CFR 122.26(b)(14)(x) and 122.26(b)(15)) require National Pollutant Discharge Elimination System (NPDES) storm water discharge permit coverage for discharges from construction activities that disturb 1 or more acres. These nationwide regulations are implemented by general NPDES permits, which are issued by EPA and authorized State agencies such as the Nevada Division of Environmental Protection (NDEP).

The NDEP Stormwater General Permit NVR100000 (the General Construction Permit) was developed to satisfy federal storm water permitting requirements. The NDEP General Construction Permit meets all federal permit requirements and most of the requirements of the local governments in Nevada, though some local governments have additional requirements that must also be addressed by the applicant. See below for a summary of the NDEP General Construction Permit requirements.

A copy of the NDEP General Construction Permit can be downloaded from the following NDEP website link:
http://ndep.nv.gov/bwpc/conperm02.pdf

The permit requires the owners and/or operators[1] of all construction activity in Nevada disturbing 1 acre or more to:

- Develop a Storm Water Pollution Prevention Plan (SWPPP) prior to submitting a Notice of Intent (NOI).
- Submit a signed Notice of Intent (NOI) form to the NDEP at least 48 hours before construction activity begins.
- Implement the SWPPP during construction activities, maintain all BMPs, and implement new BMPs as necessary.

[1] The land owner and/or operator of a construction site is the permittee who is responsible for complying with the NDEP Construction General Permit. The permittee is the person that has operational control of the construction plans and specifications, or has day-to-day operational control of the activities necessary to ensure compliance with the SWPPP.

- Conduct inspections every 7 days and after each rain event of ½ inch or more and record inspections and any corrective actions on the SWPPP (e.g. the SWPPP is a living document).
- Submit a signed Notice of Termination (NOT) form to NDEP after the site has reached final stabilization[2].

The SWPPP must be developed in accordance with good engineering practices. The SWPPP must identify expected sources of pollution and describe how they will be controlled. The SWPPP must be completed prior to commencing construction activities at the site and it must be signed and kept onsite. SWPPPs required by this permit are considered public documents that shall be made available to federal, state and local inspectors upon request. They must also be made available to the general public, upon written request, in accordance with CWA Section 308(b). Deficient SWPPPs may require modification upon notification by NDEP or the local regulatory authority (typically the local City or County).

Construction Site SWPPP Requirements

Model SWPPP template: A model Storm Water Pollution Prevention Plan (SWPPP) template, that is preferred for use in Nevada, is available for download at: http://ndep.bwpcnv.gov//tempalte%20swppp.doc
The model SWPPP template follows requirements listed in NDEP's General Construction Permit. Each construction site SWPPP must include, at a minimum, the following:

- **Project Description**
- **Receiving Waters**
- **Sediment and Erosion Control BMPs**
- **Post-Construction Storm Water Management**
- **Inspection & Maintenance**
- **Owner/Operator Certification Statement**
- **Contractors and Subcontractors**

SWPPP Guidance

The NDEP has references and documents that provide guidance in the preparation of a Storm Water Pollution Prevention Plan (SWPPP). This information is available for download at:
http://ndep.nv.gov/bwpc/storm_cont03.htm

FARR WEST
ENGINEERING
RENO / ELKO, NEVADA
(775) 851-4788
(775) 738-2121

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City of Reno
Storm Water Program Coordinator
P.O. Box 1900
Reno, NV 89505
(775) 334-2350
www.tmstormwater.com

SPILL RESPONSE

In case of a spill or discharge into the storm water system and Truckee River contact the following:

City of Reno

(775) 334-4636

City of Sparks

(775) 691-9227

Washoe County

(775) 328-2436

Nevada Division of Environmental Protection (NDEP)

(888) 331-6337