

Recommended
Best Management Practices
For Management of Animal Waste,
Compost and Sediment
On Creeks

For
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Introduction

Maintaining water quality in the creeks of Santa Clara and San Mateo Counties is a high environmental priority. Since rainwater run-off naturally drains into the creeks, land management practices on the lands adjoining the creeks are particularly important to the water quality of the creeks. Irrigation water and wastewater from domestic and recreational activities, if drained into the creeks, are also of concern.

This report is a practical guide to prevent discharges of pollutants into local creeks. This report recommends Best Management Practices (BMP) for the handling of animal waste and other materials generated or stockpiled near watercourses and for the maintenance of unpaved roads adjacent to creeks.

The report was prepared for agricultural tenants on lands owned by Stanford University. Tenants are responsible for ensuring that activities on their leaseholds do not cause polluting discharges to local watercourses. Because each leasehold property is different, it is important that each tenant tailor these recommended practices in a way that is appropriate for his or her individual operations and leasehold characteristics.

Effect of Animal Waste and Compost on Water Quality

As noted by the Council of Bay Area Resource Conservation Districts publication, *Horse Owners Guide to Water Quality Protection*, animal wastes (manure, urine and any material that comes in contact with manure and urine, such as bedding) have biological and chemical properties that can be toxic to fish and other aquatic life if those wastes get into local watercourses. Moreover, any water that comes in contact with compost or animal waste can acquire high levels of dissolved nutrients.

Organic matter and dissolved nutrients are a food source for microorganisms in the water, such as algae and bacteria, stimulating their activity and reproduction. With this extra food, their populations increase rapidly, using dissolved oxygen in the water that would normally be available for other aquatic life. Since all aquatic life depends on the limited amount of dissolved oxygen found in water, the habitat is altered and degraded as dissolved oxygen is less available; fewer species thrive.

Animal waste and compost can also be a source of ammonia, which is toxic to fish in even low concentrations. Salts naturally found in animal waste and compost are also water soluble, mobile, and can increase the salt load of watercourses to levels intolerable to many local species.

Effect of Sediment on Water Quality

Sediment from eroded areas, mud puddles in roads, and dust on roads often can be washed into watercourses during rainstorms. Sediment is detrimental to aquatic life because it can fill pools, smother fish spawning beds, cover food

supplies, increase water temperature, block light for aquatic plants, and clog fish gills. It can also bring additional nutrients into the water, as well as toxic substances—hydrocarbons, heavy metals, and pesticides.

Cumulative Effect

Because each of these substances—organic matter, ammonia, salt, and sediments—cause different problems, their cumulative impact can be significant. Discharges of water containing large quantities of these substances can alter the ecology of a watercourse.

What is a Watercourse?

As used in this report, a watercourse refers to all creeks, intermittent streams, and drains, whether natural or man-made.

RECOMMENDED BEST MANAGEMENT PRACTICES

The following recommendations are guidelines for best management practices in the following operations and uses:

- Animal washing
- Horse boarding, pasturing, and training
- Stockpiling animal waste, compost, or nursery-container materials
- Disposing of animal waste
- Land application of manure and compost
- Maintaining unpaved roads adjacent to creeks
- Other sediment producing activities adjacent to creeks

Not all of the suggested practices may apply or be appropriate in all locations. Each tenant should use these guidelines to develop a management plan that is appropriate for their site.

These recommendations are based on numerous sources, listed in the Reference section of this report, as well as our own extensive experience in agricultural management. For easy reference, these recommendations are summarized in Table 1, "Recommended Best Management Practices," of this report. Supplemental equine management literature from the Bay Area Resource Conservation District is also included in Appendix B.

Tenants located in the Town of Portola Valley and the Town of Woodside must also comply with their respective stable ordinances, which are included in Appendix A of this report.

The United States Department of Agriculture Natural Resource Conservation Service (NRCS) is an excellent source of additional literature and recommended practices that meet federal and state soil and water conservation guidelines. The University of California Cooperative Extension also has many publications dealing with animal waste management.

Each county in California has a NRCS office with technical advice available for the actual implementation of these recommendations. Each tenant should contact NRCS and the Regional Water Quality Control Board (RWQCB) to obtain advice. The phone numbers for each office is as follows:

- Santa Clara County NRCS (925) 672-4577
- San Mateo County NRCS (650) 726-4660
- RWQCB (510) 622-2300

Santa Clara County has a special ordinance regulating activities near watercourses. Beginning on July 26, 1983, the Santa Clara Valley Water District (SCVWD) required a permit to (1) construct a structure or perform grading within

50 feet of the banks of a watercourse and (2) to excavate or deposit material on the bank of a watercourse. San Mateo County has similar recommendations, although no formal regulations. Copies of the applicable regulations and recommendations are included in Appendix A of this report.

It is best to schedule major BMP construction projects during the dry season. In addition, tenants should avoid driving heavy equipment within 300 feet of creeks when the soil is saturated with water.

The agricultural leaseholds may have habitat for threatened or endangered species and may contain archaeological resources. Each tenant should contact and obtain approval from Stanford Management Company before performing any of the following activities:

- Locating or relocating stockpiles of any materials, including but not limited to manure, compost, debris, shavings, dirt, or sand
- Grading, trenching, excavating, or other activities that disturb native soil
- Introducing fill soils, base rock, sand, or other foreign materials in or onto the ground
- Moving nursery container boxes within 50 feet of a watercourse

Stanford Management Company will evaluate the proposed activity to avoid impacts on archaeological and/or biological resources. Monitoring may be required.

Animal Washing

Wastewater from animal washing can contain soap, surfactants, pesticides, and other chemicals, as well as urine and organic matter. Tenants should not drain animal wash water directly into watercourses. If animal wash water is commingled with clean run-off water, tenants should not drain any of the water directly into watercourses.

The preferred method to dispose of animal wash water is to drain it into a septic system or dry well. If this method is not possible, the wash water can be directed across a 100-foot vegetated buffer. The buffer should be wide and flat to slow the velocity of the water and permit infiltration into the soil of the buffer. The edges of this buffer should be raised to prevent the wastewater from draining into watercourses. Refer to the section titled "Buffers as Filter Strips", below. If no septic system or dry well exists for animal washing areas, tenants should avoid washing animals during rainstorms.

Arenas and Riding Rings

Arenas and riding rings are fenced or unfenced broad, flat areas for exercising and training horses. Typically they are not vegetated and their surface is sand or mulched soil that is periodically raked or tilled to keep smooth and soft.

Arenas and riding rings do not need to be cleaned of manure provided the manure is periodically incorporated into the soil and at no time could wash into a

watercourse. Arenas and riding rings should be located at least 50 feet from any watercourse. This minimum distance is a buffer to protect the water quality of the watercourses. Refer to the section titled "Buffers as Filter Strips", below.

As a BMP, any existing arenas or riding rings should be relocated more than 50 feet from watercourse, or their use should be discontinued unless it is infeasible to do so. If it is not feasible to relocate or discontinue use, then tenants should take steps to prevent run-off.

If less than the recommended buffer width exists, tenants should avoid using uncovered arenas and riding rings during rainstorms and remove all unincorporated manure from them before the rainstorm.

Stalls, Paddocks and Turnouts

As used in this report, a *stall* is the small enclosure in which horses are boarded typically located in a barn. A *paddock* is a small, open-air boarding pen for horses, typically non-grazable, often with a shelter for the horse. A *turnout* is an open-air corral for the horse; its use is temporary and typically horses boarded in stalls are released into the turnout a few hours per day for exercise.

Operators should remove animal waste from all stalls, paddocks, and turnouts daily and take it to the facility's designated stockpile or collection bin (see section titled "Bins and Stockpiles", below). Employees should pay close attention to removal in order to avoid spilling any waste where it might contact watercourses. Operators or animal owners should not dispose of waste in watercourses, or on creek banks.

New construction should be placed at least 50 feet from watercourses. This minimum distance is a buffer to protect the water quality of the watercourses. Refer to the section titled "Buffers as Filter Strips", below.

As a BMP, any existing stalls, paddocks, or turnouts should be relocated more than 50 feet from watercourses, or their use should be discontinued, unless it is infeasible to do so. If it is not feasible to relocate or discontinue use, then tenants should take steps to prevent run-off.

Provided the paddocks, and turnouts are cleaned daily, rain water that falls within these animal confinements can follow natural drainage patterns, but only after passing through an effective buffer. If less than the recommended buffer width exists, tenants should avoid using paddocks and turnouts during rainstorms and make sure all manure is removed before the rainstorm.

Pasture and Equestrian Courses

Pastures are areas with year-round, solid, vegetative ground cover, such as sod or grass. Generally pastures are several acres or more in size where grazing occurs. Equestrian courses are established for the purpose of riding and jumping. Open areas of vegetation that surround an equestrian course are considered pastures although the areas may not be grazed.

Pastures do not need to be cleaned of manure. Provided equestrian courses are surrounded by permanent ground covering vegetation, they do not need to be cleaned of manure. Natural processes will break manure down, and vegetation and soil will filter the nutrients.

Pastures should not be over-stocked. The University of California Cooperative Extension, in its publication *Management of Small Pastures*, recommends a guideline of 1 ½ Animal Units maximum per acre to maintain irrigated pasture in good condition. This recommendation assumes the animals graze the pasture for their food source. The recommended stocking rate may be less than 1 ½ Animal Units per acre for dry, non-irrigated pastures on which animals are given supplemental feed.

Because heavily used feeding areas lack vegetation and manure is likely to accumulate, tenants should not feed animals within 50 feet of a watercourse. If it is not feasible to relocate or discontinue use of such feeding areas, tenants should take precautions to avoid run-off into watercourses and remove manure from these sites daily.

Bins and Stockpiles

Bins and stockpiles are containers and piles used to collect animal waste. Bins may include but not be limited to a covered box, a concrete shed, and trash containers. Stockpiles include but are not limited to piles of animal waste, compost, wood shavings, sand, and soil.

Bins and stockpiles should be located as far as possible and feasible from watercourses, but not less than 150 feet. Distances may vary site by site due to topography, vegetated buffers, physical barriers, and diversions that may exist. Bins and stockpiles should not be located in areas subject to frequent flooding regardless of distance from watercourses.

All drains and surface run-on should be diverted around or away from uncovered bins and stockpiles greater than three cubic yards site regardless of distance. This can be achieved using ditches, berms or drainpipes. Covered bins or stockpiles smaller than three cubic yards can be managed by maintaining the minimum distance with an appropriately vegetated buffer. Refer to the section titled, "Buffers as Filter Strips," below.

Sites of uncovered bins and stockpiles larger than three cubic yards should be designed so that all rain that falls on the collection site is confined within the area or is dispersed in a vegetated filter strip and allowed to infiltrate into the soil. Containment can be achieved by a variety of means, such as visqueen wrapped straw bales, visqueen wrapped straw filter rolls, a berm constructed of compacted soil or other impermeable material, or a lipped concrete enclosure.

Uncovered bin and stockpile sites greater than three cubic yards should have an impermeable surface. California regulations list several types of impermeable surfaces. Soils that contain at least 10% clay and not more than 10% gravel and

artificial materials of equivalent permeability are on the list. Concrete slabs are acceptable, and under some circumstances plastic surfaces may also be acceptable.

If the site is less than the recommended distance from watercourses, it should be covered with a plastic tarp during rainstorms or have a roof (UCD Animal Agriculture Research Center, *Technologies and Management Practices for More Efficient Manure Handling*, pages 39-42; and *California Code of Regulations, Section 2562(f)*). In some locations a walled structure may be appropriate.

If the site is less than the recommended distance from watercourses, it may be necessary to create a water storage structure, such as a retention pond or sump. The structure should be sized to contain the 25-year, 24-hour storm frequency (5 to 6 inches per 24-hours according to US Department of Commerce National Oceanic and Atmospheric Administration) and be protected from 100-year flood events. The structure should be lined with impermeable clay, plastic, or concrete. For safety, public access to this structure must be prohibited; a barred covering is suggested as well.

Provided that there is no run-off from the disposal field and percolation of the discharged water to ground water is minimized, applying impacted water to cropped fields or pastures can prevent overflow of water storage structures. Do not apply impacted water within 150 feet of watercourses. Application can be accomplished using a sump pump and pipeline to the discharge field or by pumping the water into a tank truck and spraying it on the discharge field. (UCD Animal Agriculture Research Center, *Technologies and Management Practices for More Efficient Manure Handling*, pages 39-42.)

Off-site Manure Disposal

Removal of animal waste from the property is in most cases the best disposal option. Stockpiles and bins should be removed or emptied before the containment capacity is exceeded or before offensive, obnoxious, or unsanitary conditions develop. Manure collected for removal in the Towns of Portola Valley and Woodside must be removed at least weekly.

Land Application of Manure and Compost

Animal manure and compost can be applied on pastures, reused as a crop nutrient or soil amendment, and reused as a base for trails, courses, and arenas except within 50 feet of watercourses. In all cases the applied materials should not move into watercourses and water should not run off the applied areas into watercourses. Vegetated buffer strips between the applied area and the watercourse is the most reliable method to assure water quality is protected. The section titled "Buffers as Filter Strips", below, discusses buffers in greater detail.

All applications of manure to agricultural fields must be at rates reasonable for the crop, soil, climate, any special local situations, management system, and type of manure. If the manure is wet or liquefied, discharges to disposal fields

should not result in any surface run-off.

All land application rates to crop fields should be based on soil sample test results and crop needs. Compost application rates should not exceed 50 dry tons per acre per year (Northeast Regional Agricultural Engineering Service, *On-Farm Composting Handbook*).

Tenants spreading manure or compost on crop fields should incorporate it into the soil immediately to avoid impacts on rain and/or irrigation water that may run off the applied fields. Under no circumstances should manure or compost be spread where the area is subject to frequent flooding regardless of distance from watercourses.

Unpaved Roads Adjacent to Creek

Loose soil from unpaved roads, including driveways, is a potential source of sediment that can wash into watercourses during rainstorms.

Dirt roads should maintain a minimum of an 8- to 10-foot buffer from the top of the creek bank. The buffer should be appropriately vegetated, or run-off should not be allowed to flow directly into the creek. Where the buffer is insufficient and the road slopes towards the creek, run-off should be diverted into a settling basin, such as a pond, a flat-bottomed roadside ditch, or a vegetated filter strip, or the road should be graded away from the creek.

When grading roads, the new road grade should allow for sheet flow, preventing concentration of run-off toward the creek. After grading, the road's surface should be re-compacted with a drum roller or similar device.

Roads with improved surfaces (such as aggregate base) and with minimal loose soil should maintain, at a minimum, a 3- to 4-foot buffer from the top of the creek bank. The buffer should be vegetated, or run-off should be barred from flowing directly into the watercourse.

Periodic inspections of the roads after rainstorms should be made for evidence of erosion and sediment generation. Where erosion gullies are present, eroded areas should be filled in with approved fill material or the gully lined with an erosion blanket and appropriately vegetated.

New roads should be located at a minimum of 50 feet away from any watercourse.

Other Sediment-Producing Activities Adjacent to Creek

Avoid all activities that might produce sediment that may flow into watercourses:

- Operations, such as potting plants or operating heavy farm equipment, should not be conducted within 50 feet of the creek if no berm or vegetation buffer is present.
- Drains and culverts that discharge into creeks should be maintained and cleaned of sediment regularly.

- When watering plants or livestock, avoid over watering and thus generating man-made run-off that could carry sediment into creeks.
- All operations should be performed in compliance with Santa Clara Valley Water District and other local ordinances and under proper guidance from the Stanford Management Company.

Buffers as Filter Strips

One of the best ways to protect water quality of creeks and intermittent streams is to provide distance between the waterway and the activity that may impinge upon water quality. The area created by the distance is commonly called a buffer.

This report recommends certain buffers for particular activities. The width of an appropriate buffer will depend on the purpose and degree of protection needed. The buffer distances are to be measured from the edge of the waterway, which in most situations is well defined by a sharp drop in elevation into the water channel. Tenants wishing to vary from the recommended buffer widths should consult with the Regional Water Quality Control Board (RWQCB) and/or the Santa Clara Valley Water District for specifics.

To obtain greatest benefit from the buffer, it should be vegetated with grass, trees, shrubs or permanent ground cover. The vegetated buffer acts as a filter and a site for removing sediment, organic matter, and other pollutants from run-off and wastewater by deposition, filtration, absorption, adsorption, decomposition, and volatilization.

Appropriate plant species are listed in Table 2. The use of plant materials not on the list requires prior approval of the Stanford Management Company.

Any water that comes in contact with animal waste, compost, or stockpiled materials should be handled according to the recommendations of this report and pass through the vegetated buffer strip before entering any waterways.

Existing riding trails that cross waterways may cross the buffer and waterways if it is safe to do so. Access of horses to the buffer for other purposes should be limited to avoid trampling of vegetation, heavy grazing and damage to waterway banks.

Conclusion

The recommendations of this report are practical measures to protect the water quality of creeks and intermittent streams. Each leasehold is different; each tenant should develop a plan that includes measures appropriate to his or her leasehold. The county Natural Resource Conservation Service gives free technical support for such plans, as well as specific instructions on implementation. The Regional Water Quality Board is also a source of information and advice.

Because many of the leaseholds contain archaeological resources or may contain habitat for threatened or endangered species, tenants should contact Stanford Management Company prior to the activities specifically noted above to insure that these resources are protected and preserved.

TABLES

- Table 1: Recommended Best Management Practices
- Table 2: Approved List of Plants for Vegetated Buffers

**TABLE 1
RECOMMENDED BEST MANAGEMENT PRACTICES**

	Animal Washing	Arenas & Riding Rings	Stalls, Paddock, & Turnouts	Pasture & Equestrian Courses	Bins & Stockpiles	Off-site Manure Disposal	Land Application of Manure and Compost	Unpaved Roads Adjacent to Creek	Other Sediment Producing Activities
1. Sanitation/Maintenance Practices (see note #1, below)	Do not commingle with rain run-off or drain directly into watercourses. Preferably drain washwater into septic field or dry well, if lacking septic or dry well, maintain extra buffer, see below.	Manure does not have to be removed, but should be incorporated into the soil as needed.	Clean daily.	Do not overstock or overgraze; maintain permanent vegetation (see note #2, below); if feeding within 50 feet of watercourse clean manure from feeding site daily and prevent run-off.	Divert drains and run-off away from sites of uncovered bins or stockpiles larger than 3 cubic yards; these sites also should have impermeable base and prevent run-off with raised edges, e. g. berms or barriers or disperse to vegetated buffer. If less than 150 feet, retention pond or sump may be required.	Remove before pile exceeds capacity of containment area or unsanitary conditions develop. Remove at least every week in Towns of Portola Valley and Woodside.	Acceptable on cropped fields, pastures, arenas, equestrian courses, and riding trails (see note #3, below)	Where erosion gullies are present, place erosion blanket and vegetate, or grade road away from watercourse in areas of erosion. When grading roads, grade to allow sheet flow and re-compact road surface. For dirt roads with loose soil that grade toward watercourse and have insufficient vegetation buffer, divert run-off away from watercourse into settling basins (i.e. roadside ditch, pond, etc), or filler strips; or grade away from watercourse.	Operations, such as potting and vehicular use, should not be conducted in the vicinity of the creek if no berm or vegetation buffer is present. Maintain drains and culverts (e.g. clean out sediment) that discharge into creeks. Do not over water when irrigating or watering animals.
2. Buffer from Watercourses (creeks, intermittent streams, or drains whether man-made or natural—see note #4 and #5, below)	50 feet (or 100 feet if no septic field) and appropriately vegetated (see note #6, below)	50 feet and appropriately vegetated (see note #6, below).	50 feet and appropriately vegetated (see note #6, below).	Do not spread manure within 50 feet. Do not feed within 50 feet.	150 feet and appropriately vegetated (see note #6, below).	Do not spread within 50 feet.	Do not spread within 50 feet.	For roads with improved surfaces (e.g. aggregate base) and minimal loose soil, 3 to 4 feet from top of creek bank and appropriately vegetated, or create barrier. For dirt roads with potentially loose soil, 8 to 10 feet from top of creek bank and appropriately vegetated, or create barrier. Locate new roads at least 50 feet away from creeks.	Comply with Santa Clara Valley Water District and other local ordinances.
3. Rainstorm Precautions	If no septic field or dry well, avoid use in rainstorm.	If uncovered and less than 50-foot buffer, avoid use of in rainstorms, clean up unincorporated manure.	If possible avoid use of paddocks and turnouts in rainstorms if less than 50-foot buffer.	Cover with roof or tarp during rainstorms, if lacking appropriate buffer.		Surface run-off from application sites must not flow into watercourses	Periodic inspection after rain events for evidence of erosion and sediment generation.		

Notes:
 #1: Contact Stanford Management Company for biological and archaeological review prior to earth moving, depositing fill material, relocation of structures, relocation of piles, or relocation of drains.
 #2: Pastures by definition have permanent, ground covering vegetation.
 #3: Application must not exceed 50 dry tons per acre per year and must be incorporated into soil before rain or irrigation on cropped fields and arenas.
 #4: Topography and site conditions may allow variation in the buffers and practices.
 #5: A permit is required in Santa Clara County to (1) construct structures or perform grading within 50 feet of the banks of a watercourse or (2) to excavate or deposit materials on banks.
 #6: Appropriately vegetated densely populated grasses/sedges that filter contaminants. See Table 2 for approved list of plants.

Table 2:
Approved List of Plants for Vegetated Buffers

- ~~■ Phragmites sp. (Common reed)~~
- Malacothamnus arcuatus (Northern malacothamnus)
- Chenopodium californicum (California goosefoot)
- Conyza canadensis (Horseweed)
- Apocynum cannabinum (Indian hemp)
- Chlorogalum pomeridianum (Soaproot)
- Calochortus sp. (Mariposa lily)
- Fritillaria lanceolata (Checker lily)
- Trillium chloropetalum (Giant wake robin)
- Eschscholzia califonica (California poppy)

*The use of plant materials not on this list requires the prior approval of the Stanford Management Company.

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