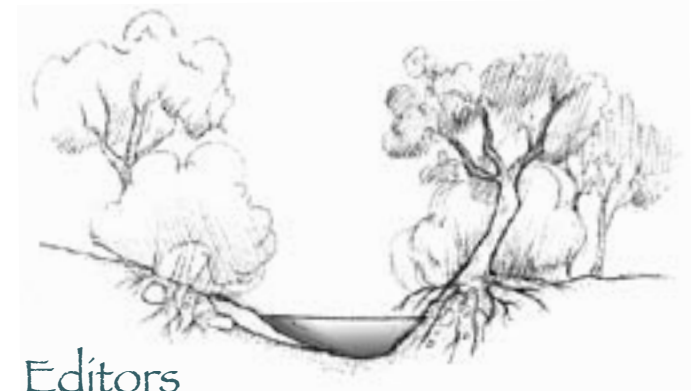


Santa Barbara County Creek Care Guide

What you can do to protect our creeks



Editors

Bob Thiel
Community Environmental Council

Darcy Aston
Santa Barbara County Water Agency

Maureen Spencer
Santa Barbara County Flood Control District

Art & Design

Jan French
Santa Barbara County Environmental Health Services

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Acknowledgements

Some of the material in the *Santa Barbara County Creek Care Guide* is based on sections from several excellent references:

Bay Area Stormwater Management Agencies Association, *Start at the Source* (1999); Luna B. Leopold, *Waters Rivers & Creeks* (1997); William M. Marsh, *Landscape Planning: Environmental Applications* (3rd ed., 1998); and Thomas R. Schueler and Heather K. Holland, *The Practice of Watershed Protection* (2000).

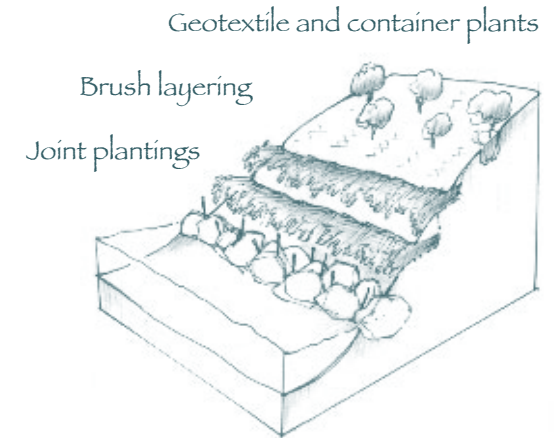
We would also like to thank the following agencies whose publications were also used in preparing this manual:

Alameda County Public Works Agency; Dry Creek Watershed Group and Placer County Resource Conservation District; the Isaac Walton League's Save Our Streams Project; King County (Washington) Department of Natural Resources; Marin County Stormwater Pollution Prevention Program; Redwood Community Action Agency; the Rivers, Trails and Conservation Assistance Program of the National Park Service; the US Forest Service's National Riparian Service Team; Virginia Cooperative Extension; Washington State Department of Ecology; and the Water Education Foundation.

What does it mean?

As you read through this guide, you may come across terms that are unfamiliar. The Glossary on page 35 contains most of the technical terms used in this booklet. The Appendix on page 37 contains descriptions and illustrations of many creek bank stabilization techniques.

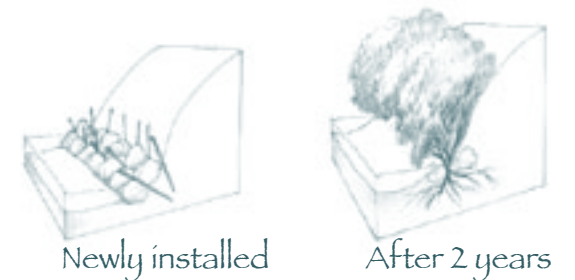
geotextiles available, designed for various flow conditions. For banks in low flow conditions, geotextiles are placed across the face of a slope and cuttings or container plants are installed through the mesh. In more erosive conditions, geotextiles are placed between brush layers that are buried in trenches along the bank.



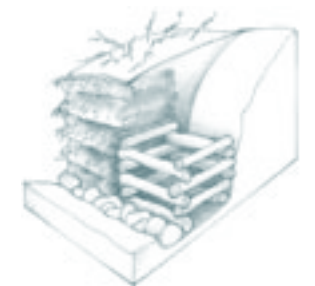
Coconut fiber roll: Cylindrical structures composed of coconut husk fibers bound together with twine are placed parallel to the slope to reduce erosion and trap sediment.

Reed rolls: Soil and rootballs of herbaceous plants are placed in burlap rolls and partially buried and staked along the bank.

Joint planting: Easily sprouting species such as willow or cottonwood are planted amongst ungrouted rock rip-rap or "A-jacks" at the base of eroded slopes.



Live cribwall: Hollow, box-like interlocking arrangement of timber placed at the base of a slope and filled with alternating layers of soil and live branch cuttings. Live cribwalls should be reserved for the particularly difficult projects in urban settings that require a substantial structural solution.



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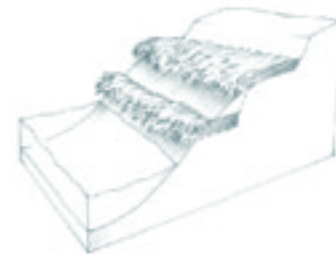
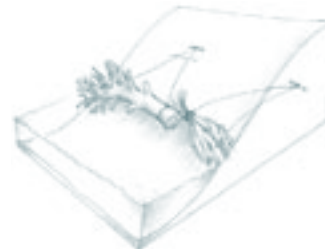
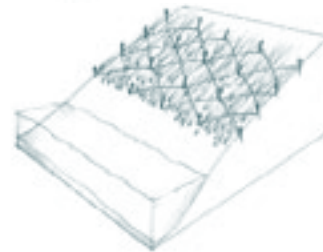
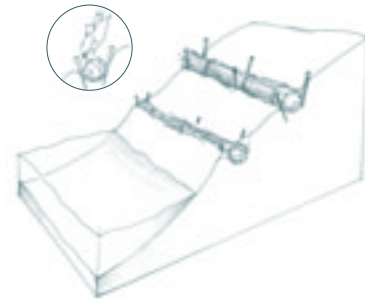
Live fascines: Fascines are dormant branch cuttings of willows bound together into long cylindrical bundles that are placed in shallow trenches parallel to the bank and buried. The branches will sprout and create a mass of new woody plants.

Brush mattress: A combination of live willow stakes, fascines and individual branch cuttings are interwoven and pinned to the bank with jute cord or wired and held in place with stakes. The “mattress” is then covered with soil to facilitate sprouting of the willows.

Tree revetment: A row of downed trees are laid parallel to the base of the bank and anchored together and to the bank with steel cable. The trees reduce flow velocities along the base of the slope, trap sediment and provide substrate for plant establishment.

Brush layers: Cuttings of willow are placed into trenches cut into the bank so that the branches stick outward from the bank. Alternating layers of cuttings and soils are placed up the bank.

Geotextiles: Plastic or biodegradable mesh materials hold soils in place to allow plants to become established through the mesh. There are many types of



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Appendix

Bio-technical bank stabilization techniques

Bio-technical approaches to bank stabilization use woody, readily sprouting plant species, which are inserted into creek banks or anchored in various ways to create structure and stabilization by providing direct protection from erosive flows. Quickly developing root systems and above ground growth further stabilize the bank. Bio-technical bank stabilization is not appropriate in all circumstances and care must be taken to select the correct technique or combination of techniques that fit the hydrology of the site and don't result in erosion of nearby banks due to poor design.

District has successfully used bio-technical techniques in its restoration efforts. For questions regarding restoration of your property or to explore the possibility of the District restoring your creek bank as mitigation for its creek maintenance, you can contact the District's Biologist at (805) 568-3440.

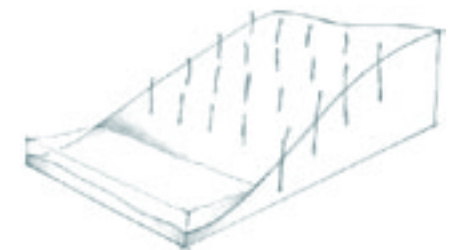
The following describes common types of bio-technical techniques and the figures show some examples of combined techniques.

Anchored cuttings: This technique employs

The Santa Barbara County Flood Control

large numbers of cuttings arranged in layers or bundles, which are secured to creek banks and partially buried. They provide direct protection from erosive flows, prevent over bank erosion, promote sediment capture and quickly develop roots.

Live stakes: This is the simplest form of bio-technical slope protection in which live cuttings of willows, mulefat or cottonwood trees are tamped into the banks to root and grow, creating a thicket of new trees.



Santa Barbara County Creek Care Guide

What you can do to protect our creeks

rural areas is the principal source of nonpoint water pollution.

Peak flow: the highest amount of stream or river flow occurring in a year or from a single storm event.

Perennial stream: A stream that flows continuously throughout the year. Perennial streams are generally fed by groundwater, which sustains the streamflow between periods of rainfall.

Pool: A deep, scoured portion of stream where water flows slowly. Pools provide feeding and resting places for steelhead.

Riffle: Shallow rapids in a stream where water flows over gravel.

Riparian: Refers to features or land use along the banks of a stream or a river. Riparian areas are the corridors located immediately next to a stream; the term is often used to refer to the zone where plants grow rooted in the water table of the stream. A riparian area provides a transition between aquatic and upland habitat and may contain wetlands. The relative health of the riparian corridor directly affects the water and habitat quality of the stream.

Sedimentation: The deposition of eroded soil materials suspended in the water of rivers and creeks, occurring usually when the velocity of the current drops below the point where the streamflow can continue carrying the suspended particles.

Watershed: The drainage basin for a river or stream; the total portion of land area that drains to a particular stream and is usually defined by ridgelines or other geologic features. The geography, geology and land uses in a watershed greatly influence a stream's character.

Wetlands: Transitional areas between dry land and deepwater areas. Bogs, salt marshes, and swamps are examples of different wetland types. Wetlands are usually characterized by water (either at the surface or within the root zone), unique wetland soils, and particular kinds of plants.

Woody debris: Trunks and large branches of trees that have fallen into a stream.

The creeks, wetlands and watersheds of Santa Barbara County are vital parts of our natural economy.

Whether they flow year-round or seasonally, the creeks in our community provide important benefits. They are home to steelhead trout and other wildlife. Creeks recharge groundwater. They carry floodwaters during heavy rains and transport sediment to nourish our beaches and coastlines. Creeks also provide a host of recreational and aesthetic benefits that contribute to our sense of place.

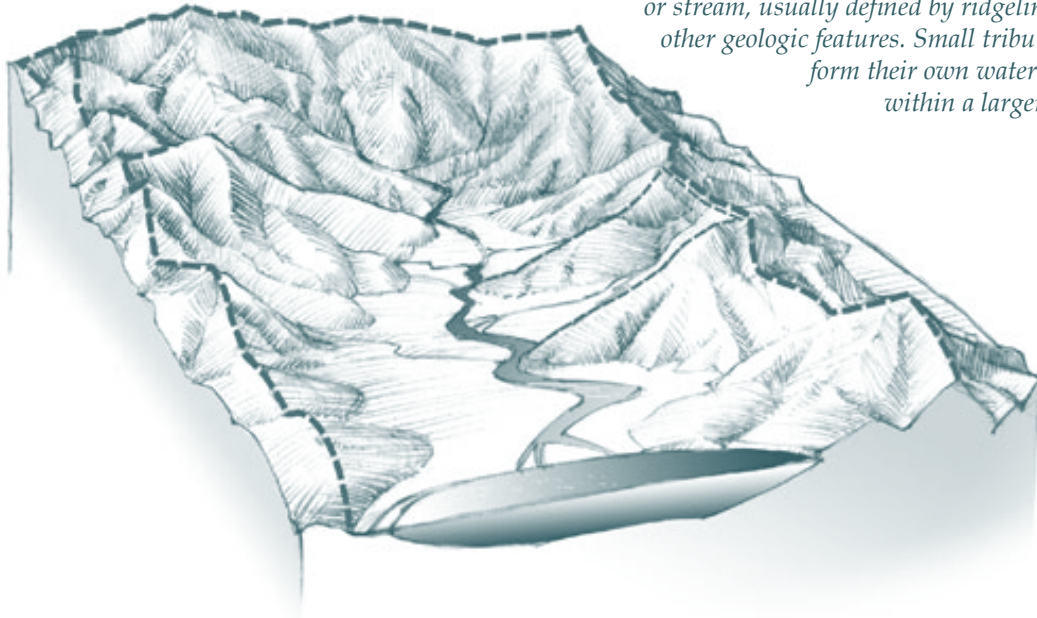
No two creeks are alike, but most creeks in the County share certain characteristics and challenges. The ways in which land is managed in a watershed strongly influence the conditions in the creek. Since most streamside property is privately

owned, much of the responsibility for the life and health of our creeks lies with the people who live or work along them.

This Creek Care Guide will help you understand how our creeks and watersheds function, what factors influence their health, and what you can do to practice good stream stewardship. It also discusses what you can do to improve or restore our creeks. Through proper care of the stream you share, you can enhance your property and help prevent erosion problems, reduce flood losses, preserve water quality, and contribute to the survival of fish and wildlife. Understanding your creek and watershed and your role in protecting them is the first step in sustaining these important natural resources.

How our watersheds work

A **watershed** is a drainage basin for a river or stream, usually defined by ridgelines or other geologic features. Small tributaries form their own watersheds within a larger one.



A watershed is a drainage basin: all of the land that drains into a particular river or creek.

Along the South Coast, each watershed is bounded by ridgelines that separate it from adjacent watersheds. The south slope of the Santa Ynez Mountains from Rincon to Point Conception contains almost 60 individual watersheds, which have short, steep stream channels that carry water rapidly to the ocean during a storm. In the mountains the creeks flow through narrow canyons with steep

slopes of exposed bedrock, large boulders, and thin topsoil. As the creeks drop through the foothills and coastal plains, they deposit cobble, gravel and finer sediments. In less than seven miles, stream channels may drop as much as 4,000 feet from the headwaters to the Pacific. Such steep gradients and the intense level of some storms here can combine to create flows of water and debris that can cause rapid flooding and carry large boulders and stones long distances.

Watershed Glossary

Anadromous: Fish that spend all or part of their adult life in salt water and return to freshwater streams and rivers to spawn. Southern steelhead trout (*Oncorhynchus mykiss*) and salmon are anadromous species.

Aquatic: Pertaining to or dwelling in water.

Aquifer: An underground water supply flowing through rock; an underground geologic formation that stores, transmits and yields significant quantities of water to wells and springs

Ephemeral stream: One that flows only in direct response to rainfall and whose channel is above the water table at all times.

Erosion: The wearing away or other physical removal of rock or soil particles by water, wind, ice or gravity.

Floodplain: The flat land next to a stream or river channel that may be inundated during a flood. The extent of the floodplain varies according to the size of the flood. For example, a 50-year floodplain is defined by the largest flood that would on average occur once within a 50-year period, estimated from historic stream-flow records.

Groundwater: Water stored underground in pore spaces within rocks and other alluvial material, known as aquifers. Replenishment, or recharge, of the groundwater

supply occurs when rainfall penetrates deep into the subsurface and becomes part of the groundwater system. Shallow ground water discharges into creeks where the water table intersects the stream channel, providing base flow to the creek.

Habitat: The place where an animal or plant normally lives or grows; it is often characterized by physical features or by dominant plants.

Headwaters: The source of a river or stream.

Impervious or impermeable surfaces: Any material, such as concrete pavement or rooftops, that prevents or reduces infiltration of water into the soil.

Infiltration: The slow movement of water from the surface to the groundwater.

Intermittent or seasonal stream: One that flows only at certain times of the year when it receives water from springs or from rain or other surface source (such as melting snow in the mountains).

Nonpoint pollution: Pollution that originates with various spatially dispersed, usually nonspecific, sources over a large area and reaches a river or stream at many points, rather than from one distinct identifiable source, such as a factory. Stormwater runoff in both urban and

stock a limited selection of appropriate native plants or can order them for you.

Volunteer opportunities

You can help restore our South Coast creeks and watersheds by contributing your time and energy to volunteer restoration projects. A number of local organizations – Santa Barbara Audubon, Growing Solutions, UCSB’s Natural Reserve program and others – sponsor them.

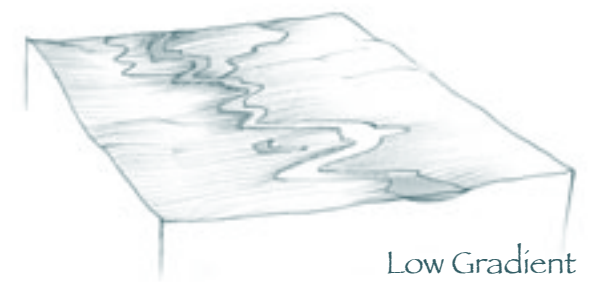
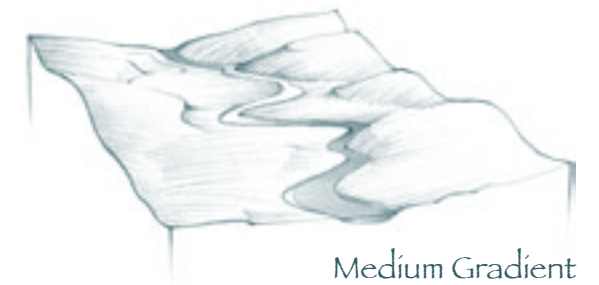
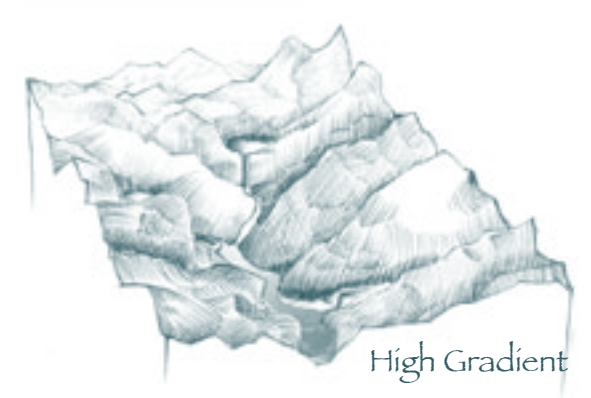
Volunteering for work on weekend restoration projects can be personally rewarding. It offers a chance to work with people on something that is engaging and supportive and to learn firsthand about plants and riparian systems. It can help strengthen your connection to the land and your community, as well as offer you a sense of satisfaction from having made a difference in the world.

For a current schedule of weekend volunteer opportunities, see the Santa Barbara Audubon Society’s website, www.rain.org/~audubon/sbasvolunteeropps.html#resop or call the South Coast Watershed Resource Center at (805) 682-6113.

North of the Santa Ynez Mountains, watersheds tend to be much larger, longer and wider than those along the South Coast. The bulk of North County watersheds are located in the rugged mountains of Los Padres National Forest. The lower reaches generally broaden out into wide, flat valley floors, which were historically floodplains. There are two main river systems – the Santa Maria and the Santa Ynez – which ultimately deliver runoff to the Pacific Ocean. Each system has numerous large and small tributaries that drain smaller basins.

The Santa Maria Valley is very broad and flat, and within more populated areas the river is confined by rock-lined levees to prevent flooding. Because of constant cultivation and the unstable nature of soils, silts and gravels, the banks of many North County creeks are highly susceptible to erosion.

Because of the seasonal pattern of rainfall in Southern California and the fluctuations in annual rainfall from one year to the next, the water levels in County creeks vary quite a bit. Local rainfall averages about 16 to 18 inches per year in coastal areas and between 28 and 30 inches per year in the highest elevations of the Santa Ynez Mountains.



Santa Barbara County streams change from high gradient to low gradient reaches as the stream descends from the mountains to the ocean.

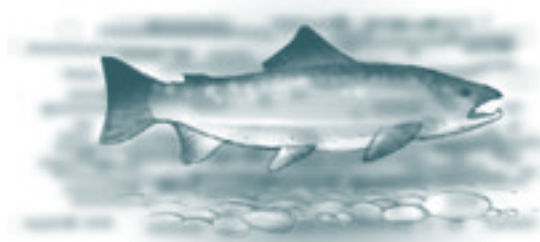
Habitat for steelhead

Fifty years ago, many of the rivers and creeks in Santa Barbara County had large populations of Southern steelhead trout (*Oncorhynchus mykiss*), which spawned in the middle and upper reaches of the stream and its tributaries. But steelhead populations have declined as impacts from human activities have seriously altered many of our creeks and their drainage basins. Today steelhead is a federally-listed endangered species in Santa Barbara County creeks, and many of those creeks are important habitat for these fish.

Like salmon, steelhead are anadromous fish: they are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Because of their migratory habits, steelhead are more sensitive to conditions in a creek than other aquatic life. In almost every watershed along the South Coast, culverts, concrete channels, low-flow crossings, or other structures have created difficult or impassable barriers to the ability of steelhead to migrate to upstream habitat.

What makes a healthy creek?

All our creeks are important, whether they flow year-round, part of the year, or just during storms. Even the small swales that look like ditches need to be cared for because they carry water, soil and



nutrients into larger creeks and recharge groundwater. In many areas of Santa Barbara County, the County or city has mapped and designated stream corridors as Environmentally Sensitive Habitat, and as discussed later in this Guide, special policies may apply to their protection and restoration.

Each creek has a number of common components. The vegetated area growing along the creek is called the *riparian corridor*. The corridor has no particular width, because its area is usually defined by the location of riparian vegetation, whose roots grow in the water table of the creek. A riparian corridor is a transition zone between the creek and the land next to it, and it has plant and soil characteristics that are often much different from the two environments it connects. Historically, the riparian corridors along streams in the County were quite extensive, but many corridors have been narrowed by urban development or agriculture.

Endangered species protection:

All creeks along the South Coast have been designated as critical habitat for Southern steelhead trout, an endangered species. If your proposed project might impact steelhead habitat, you must contact National Oceanic and Atmospheric Association (NOAA) Fisheries (formally known as the National Marine Fisheries Service) to obtain the necessary review of, and permits for, your project. The fisheries biologists who work in the South Coast area of Santa Barbara County can be reached through the NOAA Fisheries office in Long Beach at (562) 980-4061.

Other endangered plant and animal species are present in Santa Barbara County and could be affected by your project. Biologists with DFG, NMFS or US Fish and Wildlife Service can advise you whether your proposed project might require regulatory review to protect them. You can contact the US Fish and Wildlife Service office in Ventura at (805) 644-1766.

Publications and websites

Native plants:

The County Flood Control District has a revegetation guide that includes a list of native plants that are particularly suited for erosion control and habitat restoration on or along streambanks. You can obtain a copy by calling (805) 568-3440. The follow-

ing book, available at many local libraries and bookstores, is also useful: P Faber and R Holland, *Common Riparian Plants of California: A Field Guide for the Layman* (Mill Valley: Pickleweed Press, 1996).

Stream restoration:

The California Department of Fish and Game publishes a detailed manual on stream restoration for steelhead recovery: *California Salmonid Stream Habitat Restoration Manual*. You can request an order form by contacting the DFG in Sacramento at (916) 654-5997 or (916) 653-6194.

Stormwater management and impervious surface reduction:

The Design Resource website of the Low Impact Design Center (www.lid-stormwater.net) offers an excellent introduction to site design and best management practices

Native plant nurseries

To learn how you can order or purchase native riparian plants for your property, contact Growing Solutions, a local non-profit native plant nursery, at (805) 452-7561, or the nursery at the Santa Barbara Botanic Garden at (805) 682-4726. Some commercial nurseries also

- City of Guadalupe
918 Obispo
Guadalupe 343-1340
- City of Lompoc, Planning Division
100 Civic Center Plaza
Lompoc..... 875-8288
- City of Santa Barbara Community Development
630 Garden Street
Santa Barbara..... 564-5470
- City of Santa Maria Community Development
110 South Pine Street
Santa Maria 925-4354 ext.244
- City of Solvang Community Development Department
1644 Oak Street
Solvang 688-4414

wardens and biologists not only issue permits for streambank alterations but can also offer practical advice on how to restore your streambank in ways that both reduce erosion and help wildlife. Contact the DFG locally at (805) 684-6281.

US Army Corps of Engineers 404 Permit:
This permit, required pursuant to the Clean Water Act, may be needed if the project would involve removing or placing any materials in the stream, or if the project area is a wetland. Contact the Corps of Engineers to determine if a permit is necessary; local Corps staff can be reached at (805) 585-2146 or (805) 585-2143.

Section 401 certification:
Section 401 of the Clean Water Act requires that the state Regional Water Quality Control Board determine whether a proposed stream project would be consistent with state and federal laws regulating water quality law. The Central Coast RWQCB in San Luis Obispo, which serves Santa Barbara County, has established procedures for this certification. General information about these requirements and application forms for the certification are available on the Board’s website (www.swrcb.ca.gov/rwqcb3), or you can contact the Board directly at (805) 549-3147.

A healthy riparian corridor is key to maintaining healthy creeks. Streamside vegetation stabilizes streambanks and protects them from erosion. It also slows water during peak flows and traps and filters runoff that may contain sediment or pollutants. Riparian corridors provide food, shelter, shade, nesting areas and travel corridors for fish, amphibians and other wildlife. In fact, riparian areas are used by more species of wildlife than any other type of habitat. In Santa Barbara County, riparian areas provide important habitat for other sensitive species besides steelhead. They include southwestern pond turtles, tidewater gobies, red-legged frogs, and many birds, such as Cooper’s hawks and white-tailed kites.

The sloping area between the water’s edge and level ground is referred to as the *stream* or *creek bank*. The *creek channel* is the area that periodically or continually contains flowing water, and the *bed* of a creek is its bottom. The stream bed is usually composed of a mixture of large boulders, cobble, gravel, sand and silt; it includes *pools*, the deeper portions of the creek where sediments have been scoured and water flows slowly, and *riffles*, shallower areas where water flows quickly, often over gravel or rocks.

Extending away from the wetter riparian area is the *upland area*, which often includes the *floodplain*: the low-lying

area adjacent to the creek where water spreads out when it leaves its banks. In the upper reaches of a creek, where banks are steep, the floodplain may not be much wider than the creek channel. In low-lying areas, it may extend for many hundreds of feet from the ordinary high water line.

How our watersheds have changed

Healthy streams have natural meandering channels and stable, well vegetated banks and overbank areas that help filter out sediment, nutrients, and other pollutants before they enter the water. They have riffles and pools for fish and other aquatic life. Canopies of native vegetation along their banks provide habitat for birds and small mammals, keep water temperatures cool for fish, and help check soil erosion.

But the health of our creeks depends on the health of their watersheds. Everything that goes on within the boundaries of the watershed can affect the creek. Many of our creeks have been severely impacted by development, agriculture and other land uses in the watershed, including the storm drain systems that carry rainwater and runoff from streets and parking lots into the creek. As pavement replaces natural land cover, urban development increases the severity

State and federal permits

Streambed alteration agreement:
Any work that may involve modifications to a stream channel or streambank within the high water mark (including vegetation removal) requires a streambed alteration agreement from the California Department of Fish and Game (DFG), under section 1601 or 1603 of the state fish and game code. This permit must also be obtained before you take anything out of or put anything into a creek. DFG

and frequency of flooding and soil erosion. It often decreases water quality and aquatic life in a stream as well.

Most of our creeks are healthier in the upper, less developed reaches of the watershed, while downstream urban development has paved over large areas of the lower watershed and eliminated much of the natural vegetation. Urban development has built onto historic floodplains, increased the amount of water running off the land during storms, and degraded habitat and water quality. Some agricultural practices that use no cover crops or that eliminate or encroach into the riparian corridor have also adversely impacted our creeks.

Lower sections of many creeks have been straightened, culverted, or hardened with concrete, turning them into canals rather than healthy streams and increasing the velocity and erosive energy of

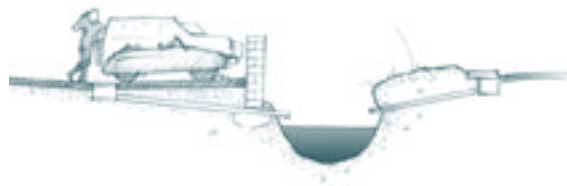
stormflows. Others have become victims of barren banks, too much sedimentation, diverted streamflows, dumped debris, and exotic plants that invade the stream channel or crowd out native vegetation

Urban growth and agriculture next to creeks in the County has increased runoff rates, inhibited groundwater recharge, increased the flashy nature of creek flows, and resulted in greater erosion of hillsides, floodplains and creek banks. While the upper reaches of these watersheds can have excellent water quality, downstream the water quality worsens as a result of surface runoff from urban and agricultural areas.

Two related aspects of urbanization have had an especially detrimental impact on our creeks: the first is development in the flood plain; the other is the increase in impervious surfaces.



Natural Channel



Urban Development

Permits that may be needed for restoration or other work

Depending upon the extent and nature of your proposed restoration work, you may be required to obtain permits to work within or adjacent to the creek. Local, state and federal agencies are responsible for administering policies that protect riparian habitats and the wildlife that use them. Although the idea of obtaining permits may seem burdensome, the process is often relatively simple and helps ensure that whatever work you're planning will be done correctly. Often times, you'll find that permits are not needed from as many agencies as you might have thought.

Local land use and coastal development permits

The Santa Barbara County Planning and Development department, and the planning departments of each city within the County, administer zoning and grading ordinances that regulate the creeks and other environmentally sensitive habitat areas under their jurisdiction. For example, County ordinances require a permit for any grading or other work to your streambank or streambed, as well as building permits for any structures in the riparian zone. Habitat restoration projects may also require environmental review

under the terms of the state's environmental quality act, known as CEQA.

Depending on where your property is located (i.e., within a city or the unincorporated area of the County), you should contact the appropriate local agency about your proposed project.

Each agency has counter staff who are available to talk with landowners or contractors regarding the regulations and permits that apply to stream restoration work. All numbers listed below are within the 805 area code.

Santa Barbara County Planning and Development
 123 East Anapamu Street
 Santa Barbara..... 568-2000
 624 West Foster Road, Suite C,
 Santa Maria 934-6250

City of Buellton, Planning & Building Department
 107 West Highway 246
 Buellton 688-7475

City of Carpinteria, Planning Department
 5775 Carpinteria Avenue
 Carpinteria 684-5405

City of Goleta
 6500 Hollister Avenue, Suite 120
 Goleta..... 961-7500

Resources

Reporting a creek problem

If you notice illegal dumping, a clogged storm drain, or unusual substances in or around a storm drain, creek or flood control channel, or to report any other creek problem, call the Project Clean Water Hotline at 1-877-OUR-OCEAN.

Used oil recycling

Along the South Coast, you can recycle used motor oil at one of more than 400 collection facilities throughout Santa Barbara County. Contact the Used Oil Hotline at 1-800-CLEAN-UP (1-800-253-2687) or call the Community Environmental Council at (805) 963-0583, extension 104 or 105, for more information.

Hazardous waste disposal

To dispose of batteries, used antifreeze or transmission fluid, pesticides, oil-based paints or other hazardous materials, take them to the hazardous waste disposal facility that serves your community. For the household hazardous waste collection center nearest you, call 1-800-CLEAN-UP (1-800-253-2687) and enter your zip code, or call the Community Environmental Council at (805) 963-0583.

Technical assistance with

restoration

Before starting any restoration work along the streambank or riparian corridor, please obtain the advice of a qualified professional, such as a biologist, restoration ecologist or landscape architect. You must also consult with the appropriate local, state and federal regulatory agencies.

Staff of the County Flood Control District conducts site visits with property owners, as well as guidance on an as-needed basis. Restoration on your property might qualify as a project by the Flood Control District under its annual maintenance program. Call (805) 568-3440 for more information.

If you are a grower or rancher, you can obtain advice and assistance on stream restoration by contacting the Cachuma Resource Conservation District or the Natural Resources Conservation Service; they are both located at 920 East Stowell Road in Santa Maria, (805) 928-9269.

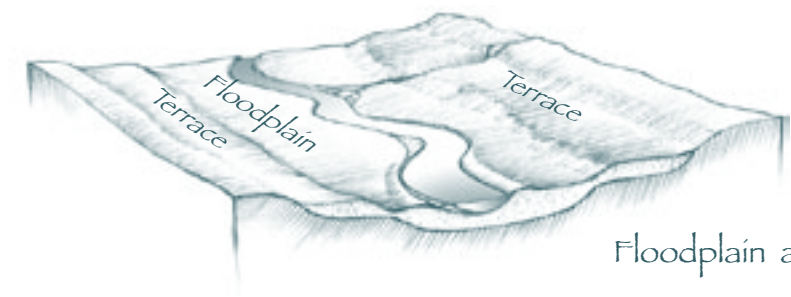
Development in the floodplain

Flooding is a natural phenomenon, a normal and expected characteristic of all streams. All rivers and streams experience high flows and flooding in times of heavy rainfall because they don't form channels that are able to carry high flows. Within its banks, a channel can contain only streamflows of modest size. Floodplains function as a sort of natural safety valve by providing a place for floodwaters to slow down and spread out. When people use this part of the creek or river for agriculture or development, they are encroaching on the creek and its natural functions.

As people built communities in the County and other parts of California during the past century, they put farms, businesses and houses in floodplains. At that time, they didn't consider the environmental or other ramifications of altering or building on floodplains. Flash floods are common in urbanized floodplains in Southern California. When floods damaged property in the floodplain, people

began to look at creeks as simply a threat to their property. And so creeks were culverted and lined with concrete to provide flood protection. Even a creek that has retained its natural banks and channel may require flood control maintenance because development and agriculture have eliminated the floodplain and the creek's ability to meander.

Today, we realize the upstream and downstream impacts of flood development within the floodplain and the advantages of using nonstructural techniques and sound planning for flood management. But many floodplain areas, especially along the South Coast, are already heavily developed or farmed, and returning them to a natural state is controversial, expensive and nearly impossible. Buyouts and relocations are very costly and disruptive, especially in areas where homes and businesses have been built on the floodplain.



Floodplain and Terraces

The impacts of impervious surfaces

When rain falls on forest and fields, most of it gradually soaks into the ground. Some water flows overland to creeks or wetlands, but most flows slowly below ground to recharge aquifers and the base flows of streams. However, when urban and suburban development covers the land with buildings, houses and streets, the plants and topsoil of forests and fields are replaced by concrete and asphalt.

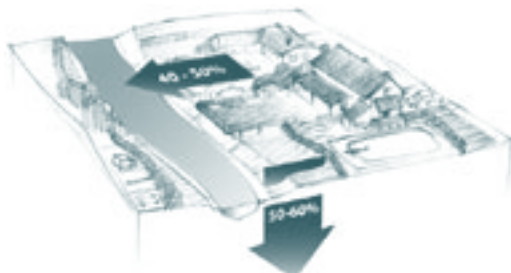
Lands stripped of their natural vegetation and covered with hard surfaces lose their ability to absorb, hold or even slow down runoff.

Rooftops, parking lots and sidewalks shed rainfall almost instantly, increasing the pace and peaks of runoff. Less rain soaks into the ground. Stormwater then runs off roofs and pavement into storm drains and ditches, then directly into creeks and the ocean. In addition to more

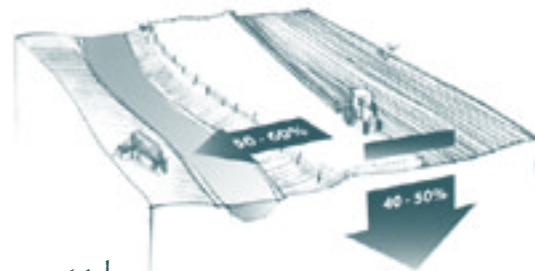
Forest



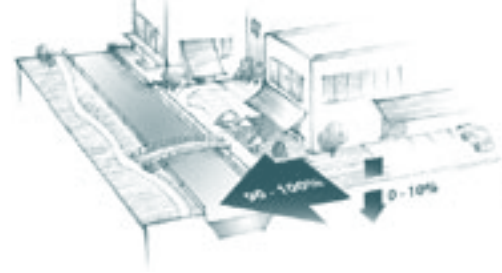
Residential



Cultivated



Urban



As land use changes, rainfall that was once absorbed into the soil now flows directly into the creek, increasing the amount and frequency of flooding and the amount of polluted runoff that goes directly into creeks.

Animals and creeks

Livestock manure can be a valuable fertilizer and soil builder when used wisely. But if it gets into the stream, it can cause serious problems for water quality and aquatic life.

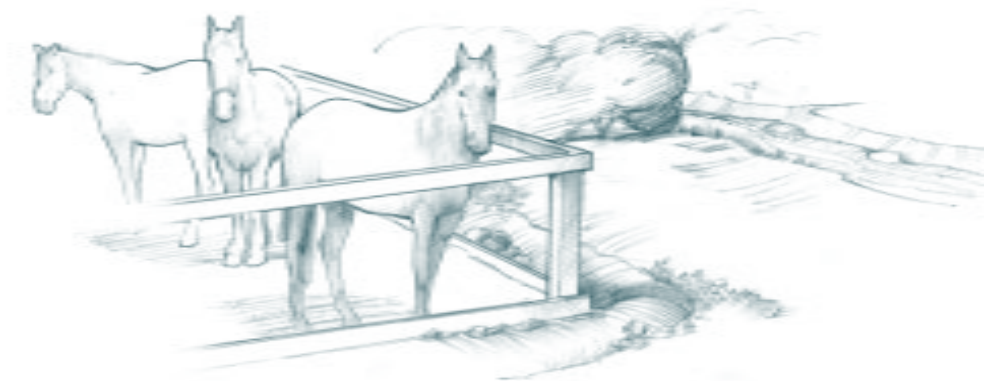
Like other fertilizers, animal wastes contain nutrients that can promote algae blooms, deplete the dissolved oxygen fish need, and produce poisonous methane and ammonia that kill fish and other aquatic life. Animal wastes also contain bacteria, which can cause beach advisories if carried downstream to our beaches.

Land near creeks should not be used for corrals, paddocks, feedlots, stalls or equestrian trails. Livestock holding areas should be kept as far from streams and drainage ditches as possible, and with a dense plant cover maintained along a wide riparian buffer. Make sure ani-

mals have plenty of room to drop their wastes over grassy areas and away from streams.

Store and dispose of livestock manure properly, and keep all animal waste away from paved surfaces or other areas to prevent it from being washed into the creek or a drainage ditch. When possible, fence livestock away from streams and wetlands and build watering tanks for them to use. On the South Coast, Marborg Industries collects and composts horse waste. Call Marborg at (805) 963-1052 to arrange for a dumpster at your stable.

For smaller pets, such as dogs and cats, scoop up their waste and dispose of it properly in the toilet or the trash. Control their behavior when you're with them near creeks: dogs and cats scare off fish and wildlife and can muddy the creek water.



Creek friendly recreation

Most reaches of County creeks run through private property, and you should not walk along or next to the creek without the landowner's permission. However, some sections are located next to city or county parks, and those areas provide great opportunities to enjoy the serenity and beauty that our creeks have to offer.

When hiking, walking or playing next to creeks, please observe a few guidelines:

Look for fish, but don't try to catch them. Steelhead trout are an endangered species in Santa Barbara County, and it is unlawful to fish for, capture, harass or keep them under any circumstances. If you violate those restrictions, you could be liable for civil and criminal penalties.

Supervise children. They are naturally curi-



ous, but they can unintentionally harm aquatic life.

Avoid walking on bare creek banks or in the channel itself, especially in the winter rainy season. Stay on designated trails: using social trails or other shortcuts can contribute to erosion problems and add sediment to the creek.

Keep your pets out of the creek. If uncontrolled, dogs and cats can terrorize wildlife along the creek, spook fish, and stir up sediment in the stream channel.

Pack out your trash. Styrofoam and plastic (such as six-pack rings) can harm fish and other animals in the creek, as well as marine mammals and seabirds along the coast.

flooding and accelerated erosion, the loss of permeable area leads to more pollution flowing directly into the creek.

Nonpoint source pollution and the storm drain connection

Pollution from urban runoff is difficult to prevent because it is "nonpoint source pollution." That is, instead of originating from a single "point source", such as a factory or sewage treatment plant, the sources of urban runoff are spread throughout an urban area. While point source pollutants are significant, the majority of stream pollution in the United States comes from nonpoint sources.

By definition, the sources of nonpoint source pollution are not confined to pipes, which can be diverted to treatment plants. Nonpoint source pollution is generated over large areas from many activities and is discharged into our creeks at countless places. The potential for runoff to become contaminated lurks every place that water falls on the landscape, and the pollutants themselves exist everywhere in an urban area: oil and grease dripped onto city streets, fertilizers used to keep yards green, or pesticides sprayed onto farm fields.

The stormwater that runs off lawns, roofs, streets, and parking lots empties into the storm drain system: street gutters, catch basins, underground pipes, open channels, and culverts, and

it ultimately discharges into our creeks and coastal waters. Discharges into the sanitary sewer are treated at a wastewater treatment plant before being discharged into the ocean. But unlike sanitary sewers, storm drain systems carry stormwater runoff directly into creeks and the ocean without any treatment to remove pollutants. Unless we exercise good watershed management, every pollutant that is deposited on the land can end up in our creeks or at our beaches.

The value of stream stewardship and restoration

Because of the many human impacts on our creeks, it is important for everyone to exercise good stream stewardship, no matter where you live in the watershed. What is stream stewardship? It means taking responsibility for the health of our rivers and creeks and ensuring that our activities promote, and don't degrade, the health of the stream. The next section of this Guide discusses a number of things that you can do to protect or enhance your property.

Stream restoration means preserving or returning the stream and the life it supports to a natural, healthy and functioning state. Restoration may involve simply

native plants—such as giant reed (*Arun-
do donax*), Cape ivy, or iceplant—and revegetating the area with native trees and understory plants. It might involve stabilizing the streambank with root wads or other plant material combined with large rocks to protect against erosion or undercutting, or perhaps removing concrete from the bank and replacing it with vegetation. Sometimes restoration includes physically changing the shape of the channel to ensure that the stream can handle high flows.

Because watershed damage occurs over many decades, stream restoration must address the underlying causes of degradation, not merely the symptoms. Improving watershed health often requires improving land management practices that have led to increased sedimentation, pollution, or the degraded habitat value of a creek.

Successful stream improvement requires careful planning. Before starting a project, examine your stream, analyze its problems and understand what has caused them. Get advice and assistance from professionals and appropriate agency staff to determine what should be done, and understand the amount of effort, money and permits needed to complete and maintain the project.

Before beginning any landscaping, stream enhancement, or bank stabilization project, remember to check with the County or city planning department. There are many federal, state and local regulations governing streams and wetlands, and you may need a permit to do any work. The contacts listed in the back of this Guide are a good source of information. These agencies work to protect stream habitat and provide guidance to property owners to ensure that restoration work will be beneficial and successful.

The County of Santa Barbara has developed an assessment tool, known as a hydrogeomorphic (HGM) guidebook, to determine the level at which a creek is performing certain functions.

The hydrogeomorphic method considers how the creek is functioning in terms of plant community, animal habitat, hydrology, soils and transport of sediment, and biochemical processes. The HGM guidebook can be useful in assessing current conditions and developing restoration plans to improve degraded functions. If you're interested in how the HGM guidebook can be used to design restoration efforts for your property, please contact the County Water Agency at (805) 568-3440.

Special tips for businesses

You can help improve the health of our creeks by operating your business to keep pollutants out of storm drains.

Never pour oil or grease down a storm drain or sanitary sewer. Restaurants and other food service businesses produce wastes such as oil, grease, detergents and food scraps that can pollute a creek. Grease and oil discharged into storm drains can enter the stream and decrease the oxygen needed by fish and other aquatic life, and food scraps can cause excessive nutrient loading in the stream. Label storm drains and make sure that all employees understand and implement appropriate practices to prevent wastes from going into creeks or storm drains.

Keep pollutants off of exposed surfaces. Place trash cans around your business to minimize litter. Dispose of wastes appro-

priately in covered dumpsters or recycling receptacles. Clean up leaks, drips, and other spills without water whenever possible. Use rags for small spills, a damp mop for general cleanup, and absorbent materials (such as cat litter) for larger spills. Avoid hosing or wet-mopping outdoor work areas. Dispose of cleanup materials properly.

Cover and maintain dumpsters. Open or leaking dumpsters are common causes of water pollution. Locate dumpsters away from creeks and storm drains, and close dumpster lids at the end of each work day and during rainy weather. Inspect dumpsters regularly for leaks, and repair or replace any dumpster that is not watertight. Return dumpsters to the trash hauler for cleaning; don't hose them down or clean them on site.

Drain water from pools and spas into the sanitary sewer system, not into a creek, street or storm drain. The chlorine and algaecides used in pools and spas are toxic to plants and aquatic life. Avoid using copper-based algaecides; if your pool water contains these chemicals, contact your local waste water treatment plant before discharging this water into the sanitary sewer line.

For the household hazardous waste collection center nearest you, call 1-800-CLEAN-UP (1-800-253-2687) and enter your zip code, or call the Community Environmental Council at (805) 963-0583.

Washing vehicles and equipment

Avoid hosing down paved surfaces or washing your car or truck on a paved driveway or street. Even biodegradable soaps are toxic to fish and wildlife. Wash cars on a lawn or unpaved area, or use a commercial car wash. Use cat litter or other absorbent materials to remove oil drips and other spills from driveways and other paved surfaces, and dispose of the absorbent materials properly in the garbage can or at a hazardous waste collection site. If you must use water as a final cleanup step, direct the runoff to a lawn area – not to the street, gutter, or storm drain.

Maintain your septic system

If you have a septic system on your property, you should know where it's located and how to maintain it. Have your septic tank professionally checked every other year and serviced as needed. Conserve water to avoid stressing the system, and keep solvents, phosphate detergents, additives and other hazardous materials out of the system.

What you can do to protect our creeks

Stewardship tips for residents, ranches and businesses

Good stewardship is essential for healthy creeks. The people who live along or near County creeks play one of the most important roles in protecting and restoring our creeks, because their actions will have a big influence on whether we can improve the habitat and water quality in our creeks and coastal wetlands.

Whether or not you live right next to a creek, you can do to help in this effort.

Protecting and restoring riparian vegetation

One of the best ways to help is to keep your streambank and riparian corridor naturally vegetated with native plants. A lush growth of native grasses, shrubs, and trees is essential to the health of a stream. The wider this buffer, the better for the creek and the creatures that live in it.

Riparian plants help protect water quality by slowing runoff and filtering out sediment, nutrients and other pollutants before they can enter the water. Roots reinforce the streambank, binding the soil and helping prevent the bank from undercutting and collapsing. During high stream flows, riparian vegetation slows

creek, you should be a good watershed steward. Everyone lives in a watershed. A strong understanding of how a creek functions and the practices we should each follow as stream stewards will determine whether we can protect and restore these vital community assets.

The following guidelines suggest what you

and dissipates the energy of floodwaters. Overhanging trees and shrubs shade and cool the stream during summer, moderating water temperatures for steelhead and the aquatic creatures they depend on for food. Plant life along the stream provides food and shelter for fish and a variety of other wildlife. And a healthy stand of riparian trees and understory helps maintain the natural beauty of the creek.

The best way to protect or restore a streambank or riparian corridor is with native plants, such as willow, cottonwood and sycamore. Native trees, grasses and shrubs are adapted to Santa Barbara County; they don't need fertilizers and pesticides, and once they become established, they need much less water

and maintenance than exotic (nonnative) species. Many native plants not only provide excellent erosion control during high flows, but also recover quickly when floodwaters subside.

Plants that are not native to the area, on the other hand, can seriously degrade the health of a creek. Exotic species often take over and crowd out native plants, reducing the diversity of the native plant community and the animals that depend on it. Invasive nonnatives offer little or no habitat value to wildlife and little, if any, erosion protection. The aggressive growth patterns of an invasive species like *Arundo donax* (giant reed) can clog an entire stream channel and pose a serious flood and fire risk to the riparian corridor and adjacent homes.

Among the most destructive of invasive species along our creeks are Cape ivy, English ivy, ice plant, periwinkle (*Vinca major*), fountain grass, giant reed (*Arundo donax*), pampas grass, French broom, myoporum, blue gum eucalyptus, and Peruvian pepper tree. The California Exotic Pest Plant Council (www.CalEPPC.org) publishes a list of invasive species that you can consult.

Invasive species have such an impact on stream health that County policies regarding new development generally prohibit any use of invasive species near a creek or other Environmentally Sensitive Area, requiring instead the use of appropriate native plants. Even if you don't plan to remodel or build on to your house, you can help restore your reach of the creek by removing invasive species from the riparian zone.

Exotic species often spread so rapidly that the longer you wait to get rid of them, the more entrenched they become. Usually the best method of removing them is by hand. When removing exotic species, take steps to prevent the soil from eroding and replant soon with native vegetation. If you want to restore the riparian corridor on your property, keep landscaped areas from extending to the edge of the bank; instead, create a wide, unlandscaped buffer of native plants between any building and the streambank.

Protecting instream habitat
Instream conditions are critical to restoring steelhead runs and protecting other aquatic species in our creeks. Fish need cool, clean water and diverse habitat



Household waste

Never store old tires, garbage, or litter along the streambank, since they can be carried away during storms. Carefully remove trash, litter and other debris that others may have dumped on your land. Unfortunately, some people regard our creeks as garbage dumps, and South Coast creeks are often used illegally to dispose of old shopping carts, appliances, mattresses, car parts, bottles, cans, plastic and other litter. This debris creates water quality problems and flood hazards and can create breeding places for rodents and mosquitoes. If you need help cleaning trash or litter out of your creek, contact Project Clean Water at (805) 568-3440 for ideas or assistance.

Motor oil and antifreeze

Even in low concentrations, automotive fluids are extremely toxic to fish and other aquatic wildlife. *Never dump gasoline, motor oil, antifreeze, battery acid or other automotive fluids into a stream or a storm drain or onto the ground.* Place used motor oil, antifreeze and other fluids in sturdy, sealed containers. You can recycle used motor oil at one of more than 400 collection facilities throughout the County; contact the Used Oil Hotline at 1-800-CLEAN-UP (1-800-253-2687) or call the Community Environmental Council at (805) 963-0583 for more information. Take other automotive fluids and materials – such as batteries – to the household hazardous waste collection center in your community.

Paints, solvents and pool chemicals

Use water-based latex paints whenever possible. They are less toxic than oil-based paints, thinners, and turpentine, and they can be recycled. Wash out brushes with latex paint in a sink, and use thinner or turpentine to clean brushes with oil-based varnish or paint. Never clean brushes, paint buckets or roller pans in a gutter or near a storm drain or stream. Dispose of used and surplus paints and paint products at a household hazardous waste facility.

Never dump detergents or wastewater from carpet or upholstery cleaning into a stream or storm drain. Dispose of water used to clean carpets, upholstery or floors down sinks or toilets. Professional carpet and upholstery cleaners are required to put their wastewater into the sanitary sewer.

Trash and lawn clippings

Dispose of yard waste properly. Never dump it into a creek, storm drain, or along a streambank. Soil and landscape clippings deposited in streams become unsightly, destroy aquatic habitat and may worsen flooding. Even though they are biodegradable, organic wastes raise bacteria levels and deplete the oxygen that fish, aquatic insects and native plants need to survive.

The best practice is to add leaves and lawn clippings to a compost pile to make fertilizer for your yard. Keep compost and mulch piles away from the streambank to prevent nutrients and bacteria from leaching into the water. If composting isn't feasible, rake or sweep up clippings and store for the local curbside collection for yard waste. If you use a gardener or landscape service, insist that they haul away pruning debris, leaves, lawn clippings, and other yard material for composting. To hire a gardener whose maintenance practices protect water quality, consult the website for the Green Gardener Certification Program at www.greengardner.org.

Composting Systems



Anaerobic System

Cut the bottom off of a 32- or 50-gallon trash can with a tightly fitting lid. Microorganisms that thrive in a low-oxygen environment cause slow decay. Useful for non-fatty food waste and soft green trimmings. Soil and water must be added about once a month. No turning of the material is required.



Aerobic System

A cylinder of 3' high coated wire fencing or a bin of cinder blocks stacked with air spaces between blocks. Organic matter is broken down by air-breathing microorganisms and larger lifeforms. Best for yard waste such as shredded limbs, leaves, and grass clippings; no fatty food waste. Weekly to biweekly turning and watering of the material is recommended. May be in a pile on open ground, or contained in a 3-sided or closed box with air vents.



Vermicomposting System

A wooden bin with a lid, bedding material and red worms. A smaller container is used to hold worms which consume organic waste, producing nutrient-rich worm castings. Best for small amounts of non-fatty food scraps, leaves, and soft green trimmings. Bedding must be kept moist, but no turning is required.

with quiet pools and shallow rocky areas. They also need an adequate food supply of insects and an abundance of cover — undercut banks, rocks, tree roots, overhanging vegetation, and woody debris.

As dying or uprooted trees fall into a stream, their trunks, root wads, and branches slow the flow of water. Large snags create fish habitat by forming pools, eddies, and riffles in the stream. Riffles are shallow gravelly sections of the stream where water runs faster. Many aquatic insects that steelhead eat live in riffles, and steelhead also need riffles to spawn. They use pools for resting, rearing and refuge.

In order to protect this habitat, avoid removing natural debris from the stream channel unless it poses an erosion or flood hazard. Woody debris — such as fallen branches, logs and root wads — provides an important source of cover, food, and shelter for fish and wildlife. A moderate amount of woody debris also provides natural protection for streambanks. In general, don't remove woody debris or other natural material from a stream channel unless it has or will cause a problem. Removing branches, boulders, and dead vegetation from a stream can harm fish and wildlife. Although well intentioned, any changes you make could destroy spawning beds and fish eggs or block fish migration.

Contact the California Department of Fish and Game (CDFG), the County Flood Control District or Project Clean Water if you have any questions about the condition of your creek. Remember that you must obtain a 1603 Stream Alteration Agreement from the state Department of Fish and Game before you make any changes to a stream. (Depending on the location and nature of your project, you may also need permits from the city or county planning department, the California Coastal Commission, US Fish and Wildlife Service, the National Marine Fisheries Service and/or the US Army Corps of Engineers.) Constructing or modifying a dam, creating an Arizona crossing, or making any other modification to the creek always requires a permit.

Water diversion

Avoid taking water directly from the stream. Creeks can be heavily impacted by even small diversions during months when streamflow is low. During those months, the life that a creek supports is directly related to the amount of water in the channel.

To divert any water from a creek, you must have a legal right to do so. You must obtain a water rights permit from the appropriate regulatory agency and leave enough water to meet the needs of



If you do use fertilizers and pesticides, follow the application directions carefully; many home gardeners over-apply these chemicals. When using pesticides, use products that degrade quickly and apply them only when and where they're needed. Avoid using fertilizers and pesticides near streams or drainage ditches and properly dispose of old or unused pesticides and their containers. You can limit runoff of these chemicals by watering your yard correctly. Overwatering not only washes pollutants into the creek or storm drain, it is also a common cause of streambank erosion and slumping. Avoid applying fertilizers and pesticides when rain is forecast.

Dispose of unused pesticides and empty containers at your local household hazardous waste facility. For the household hazardous waste collection center nearest you, call 1-800-CLEAN-UP (1-800-253-2687) and enter your zip code, or call the Community Environmental Council at (805) 963-0583.

Some restricted use of pesticides may be needed along our creeks if we are to control invasive or other destructive vegetation. For example, the Santa Barbara County Flood Control District conducts maintenance of many creeks and drainage facilities. Maintenance in the creeks can include the use of herbicides that are applied to obstructive and nonnative vegetation. The District uses Aquamaster, an herbicide approved for aquatic use, as well as Roundup in dry upland areas.

The District follows mitigation measures to ensure responsible herbicide application. Specifically, to the extent feasible, herbicides are applied during the months of August-November when streamflows are minimal. Herbicides are applied using hand-held sprayers rather than from truck-mounted sprayers where feasible. All applications are conducted in strict accordance with label recommendations, including all restrictions related to public health, worker safety and the protection of aquatic organisms. Herbicides are carefully applied to plant surfaces to minimize drift to nontarget plants and over spray onto the ground or to open water. Herbicides are not applied when winds exceed five mph, within 12 hours of forecasted rain, or when plant surfaces are covered with water from recent rainfall or dew. The District posts signs if herbicides will be applied within 50 feet of any public recreation location, and signs are left in place for 48 hours after the application. The District also conducts water quality testing on large projects to monitor affects of herbicide application on water quality and ensure that the effects are minimal.

downstream users. Water diversions from creeks are legal only if you have a riparian right, an appropriative water right permit, or a small domestic registration (For more information about these permits, contact the State Water Resources Control Board, Division of Water Rights, in Sacramento at 916-657-2170). Water rights in California are complex; but any diversion must constitute a reasonable use and may be subject to conditions that protect public trust values.

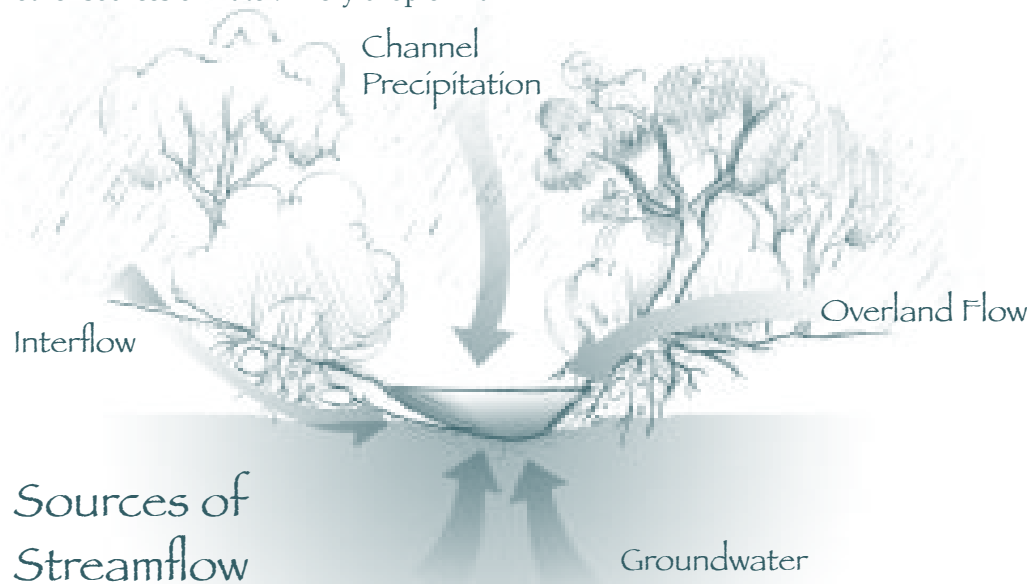
In any event, please use water wisely. Impacts to a stream can be reduced by using water efficiently or by relying on other sources of water. Every drop of wa-

ter you save contributes to maintaining a healthy stream environment.

Minimizing runoff from your property

Another important way to protect the creek is to preserve or restore the natural ability of your property to absorb rainfall.

As discussed earlier, one of the major causes of degraded streams is impervious cover.



Creek-friendly maintenance of homes and businesses

Much of the pollution in South Coast creeks results from household chemicals washing off into streams and storm drains. You can help improve the habitat and water quality in your creek by knowing which chemicals are harmful and by using and disposing of them properly.

Even in small amounts, fertilizers, pesticides, paint, motor oil, pool chemicals and many cleaners will contaminate a creek and can harm fish, wildlife and people. Never dump chemicals down storm drains, ditches, culverts or creeks. County environmental health regulations prohibit their disposal into storm drains or creeks,

Fertilizers and pesticides

Pesticides, herbicides and fertilizers can run off into nearby streams and creeks. Fertilizers add excess amounts of some nutrients that can be toxic to aquatic life. Pesticides (insecticides and herbicides) are poisonous chemicals that can pose serious threats to stream water quality, groundwater and aquatic habitat. Some pesticides remain in the environment for a long time, often accumulating up the food chain and concentrating in animals. Low doses of certain pesticides can cripple fish and amphibians, sterilize them or increase their susceptibility to diseases and parasites. And while some pesticides may not be toxic alone, they can become deadly when mixed with other compounds in the environment.

Avoid or minimize the use of fertilizers and pesticides in your yard. Consider using compost and organic soil amendments instead of chemical fertilizers. An alternative is to replace your lawn with ground cover or shrubs, since native and other drought-tolerant plants require little maintenance and look great. The use of wood chips or other mulch around trees and shrubs can aid in weed control and preserve soil moisture.

and violators are liable for fines and cleanup costs.

Certain chemicals, such as pesticides, antifreeze and oil-based paints, are considered to be particularly hazardous and should be disposed of at a local hazardous waste collection center. For the household hazardous waste collection center nearest you, call 1-800-CLEAN-UP and enter your zip code, or call the Community Environmental Council at (805) 963-0583. For a brochure on alternatives to toxic household products, call the County's Project Clean Water at (805) 568-3440.

The roads, parking lots, roofs, and other impervious surfaces that accompany urban development cover soils that used to absorb and treat stormwater. Depriving the land of its natural infiltration capacity degrades our creeks and watersheds in a number of serious ways.

Because rain isn't absorbed into the ground, more rainwater runs off the landscape and does so more quickly, accelerating erosion and damaging the habitat quality of our streams. Increased stormwater runoff means that floods occur more often and are more severe. As the runoff moves over streets and parking lots, it also collects and concentrates nonpoint source pollutants — such as bacteria, metals (lead, copper and zinc), chlorides, and nitrates — and washes them directly into the creek. By keeping rainfall from infiltrating into the ground, impervious cover reduces the amount of water available to recharge groundwater and provide base flows to the creek during the dry season. By almost every measure of watershed health, the creeks and estuaries that are surrounded by hardened watersheds are less diverse, less stable and less productive than those in natural watersheds.

The old approach to stormwater management was to get rid of stormwater as quickly as possible. For decades, planners, engineers and builders were trained to expedite runoff through “con-

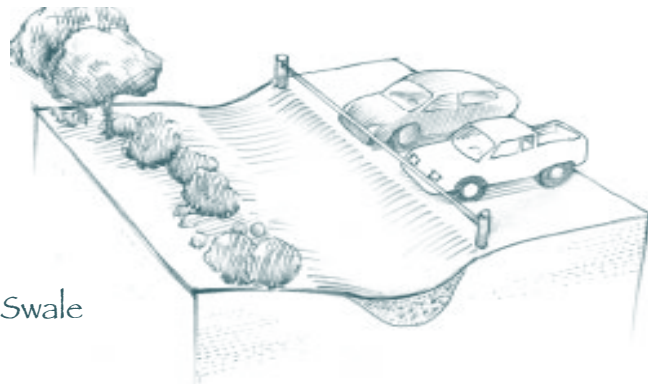
veyance systems” that connected parking lots and other impervious areas directly to storm sewers or a creek. Conveyance systems collect and concentrate runoff through networks of gutters, storm drains, and underground pipes.

The new approach to stormwater management encourages runoff to return to the soil, allowing pollutants to settle into the ground where they can be naturally mitigated. By designing for infiltration, this approach reduces the quantity and severity of pollutants reaching our creeks and beaches. It also reduces flooding impacts and makes more water available to both replenish groundwater and maintain stream base flows.

The infiltration approach relies on a series of simple techniques. One strategy is better site design. A development designed specifically for stormwater quality generates less runoff because clustering buildings and preserving green space reduces impervious land coverage. Site design for stormwater management fits buildings into contours, protects trees and native understory plants, and uses a drainage system that slows runoff and provides opportunities for rainfall to filter into the soil.

One of the best strategies involves rethinking road widths and parking lot designs. As one writer has pointed out, as much as 65 percent of the total imper-

Vegetated Swale



vious cover in our landscape is “habitat for cars:” driveways, parking lots, streets and other surfaces that are designed just for the automobile. We can reduce the amount of impervious cover by reducing the size of parking lots and roadways and by using pervious materials to create them. Driveways can be shortened or shared. The size of parking lots can be reduced with grassed or gravel overflow parking areas. And a number of porous paving materials suited for the climate of Southern California – such as open cell pavers, porous concrete, porous asphalt, or stabilized soil mixtures – offer an excellent substitute for conventional asphalt or concrete.

Another important tool is to use drainage as a design element. Directing stormwater into vegetated areas – such as infiltration beds, rain gardens or grassed swales – allows rainfall to percolate into the ground rather than moving directly onto the street or into a storm drain. These natural areas can be planted with wet- and dry-tolerant native species that add to the biodiversity of an urban area. Runoff from rooftops can be directed to yards (instead of storm drains) or into

cisterns or rain barrels that allow rainwater to be used later to irrigate lawns, gardens or trees during dry periods.

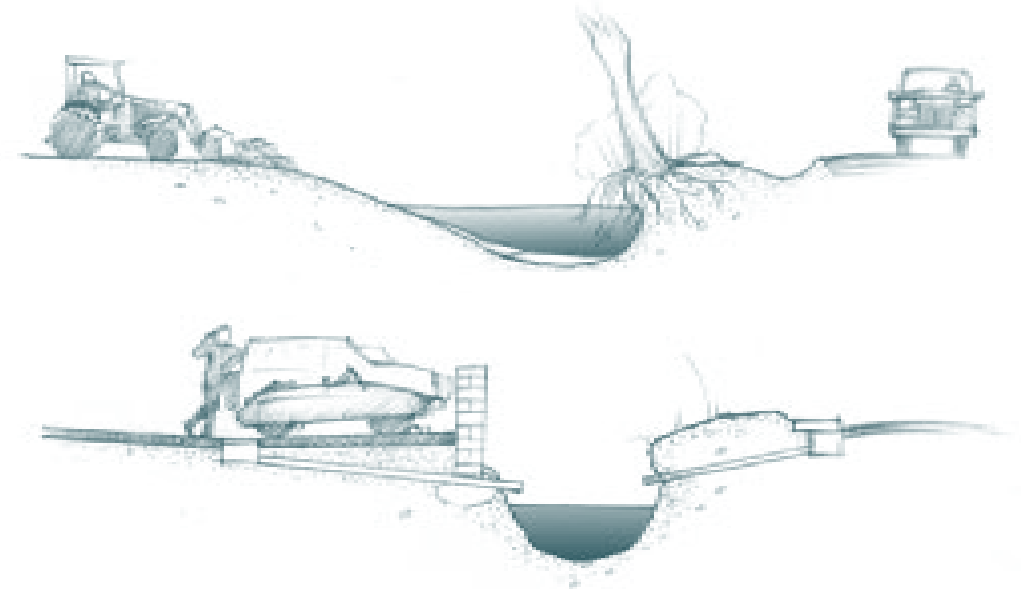
The most successful stormwater management usually requires a combination of strategies. The new toolbox is sometimes termed “low impact development”, and regulatory agencies often refer to the tools as “best management practices” or “BMPs.” In our region, county and city agencies are all moving to require the use of these strategies in new development.

The County of Santa Barbara, for example, now requires a stormwater quality management plan from any proposed residential subdivision, commercial development and other project (except agricultural grading) that would disturb at least one acre of land. That plan must incorporate stormwater best management practices into project design to the maximum extent feasible. The City of Carpinteria’s stormwater management program also specifies the use of BMPs to treat surface water runoff before it reaches the creeks and ocean.

unincorporated areas of the South Coast, for example, the setbacks established by County policies are generally 100 feet in rural areas and 50 feet in urban areas, a distance measured from the top of the bank or the edge of the riparian vegetation, whichever is further. In mountainous areas, the required setback can be as much as 200 feet. Most cities within the county have their own setback standards. As a result, you should check with the appropriate planning or building department before considering any project.

If you receive a permit to build outside the setback buffer along a creek, you should still take steps to avoid impacting streamside areas during construction. Your permit will likely require you to protect riparian habitat by installing a temporary protective fence along the outer boundary of the buffer and to prevent any grading, vegetation removal or other activities from disturbing the buffer area. If a project damages riparian vegetation or habitat, the City or County will likely require the landowner to restore the riparian buffer with appropriate native plants.

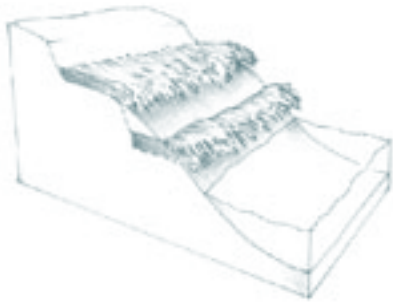
Effects of Poorly Managed Construction



Such damage to stream systems can be avoided by adhering to setback requirements and taking steps to avoid impacting streamside areas during construction.

Brush Layering

Live cuttings of willow or cottonwood are placed into trenches cut into the bank so that branches stick outward from the bank. Brush layering provides live material that will root and go along with a structural component to reduce flow velocities along the bank.



In another, called brush layering, rows of live branch cuttings are used to break up slope length and provide a stable base for more vegetation. The embedded plants not only reinforce soils, but also act as moisture wicks and barriers to earth movement.

A special Appendix to the Resources section of this Guide discusses various Biotechnical Bank Stabilization Techniques in detail, as well as assistance offered to landowners on bank stabilization by the County Flood Control District.

Unlike artificial structures, a slope stabilized with living plants is not only strong initially, but grows even stronger with time as the vegetation becomes established. Even if plants die, roots and surface organic litter continue to play an important role in helping to reestablish other plants.

There are many advantages to choosing soil bioengineering rather than traditional “hard bank” engineering techniques. Soil bioengineering projects cost much less than structural engineering and are usually easier to maintain. Bioengineering not only stabilizes streambanks, but also creates habitat for aquatic organisms and improves water quality. Plants used to stabilize streambanks provide food for aquatic organisms and shade the stream.

In any event, never use tires or concrete rubble to repair erosion problems. These items can be washed away by water and cause further damage; they also contain materials that can be toxic to creek life.

Building away from the creekbank and floodplain

To protect riparian areas, avoid locating structures near the creek or farming right up to the creekbank. Building even small improvements — such as a deck, patio or storage shed — can damage the riparian corridor and expose the structure to flood damage. Streamside development disturbs soils, vegetation and wildlife habitat. It can also decrease the stream’s ability to accommodate floods by destabilizing vulnerable slopes.

City and County zoning ordinances contain setback standards that prohibit structures from being built within a specified distance from a creek. In the

Even if you are not considering any major new development, however, you can help protect and restore your property’s capacity to infiltrate and treat stormwater. Check rain gutters and other pipes to see where they drain. Make sure they don’t carry water directly into the stream. Pipes that direct runoff directly onto a streambank cause erosion. Consider using cisterns, French drains, or other on-site systems to capture, treat or store roof runoff.

When renovating or installing patios, driveways or parking areas, use porous materials, such as sand-laid brick, open-cell pavers, or porous concrete. The cost is competitive with that of conventional concrete, and permeable surfaces are much better for the environment.

Minimizing soil erosion

Soil erosion is a natural process. In fact, one of the functions of a creek is to move sediment.

When it rains, the water in a creek becomes muddy because it is carrying sediment that has accumulated in runoff from the landscape and from the cobbles, gravels, and silt particles in the stream channel. However, too much sediment will fill in the streambed and reduce its ability to carry floodwaters. Excessive sediment can also destroy pools, bury streambed vegetation, eliminate shelter

and fish spawning habitat, and diminish food supplies for fish and aquatic insects.

When rainfall meets unprotected soil, erosion almost always results. Soil erosion can occur on streambanks, in fields and pastures, on unpaved roads, driveways, construction sites or any other area where soil is not protected from the erosive forces of rainfall, storm runoff, wind and gravity. Eroded soil almost always ends up in a stream. Much of the water quality degradation that occurs in County creeks results from too much sedimentation.

Preventing erosion problems

You can minimize erosion by following a few simple practices. One is preserving the streamside vegetation on your property. Native riparian plants growing within a stream corridor provide important habitat and help to stabilize banks. When flooding occurs, a well-vegetated stream bank may be your property’s best protection.

Invasive species such as *Arundo*, on the other hand, can actually impede stream flow and contribute to flooding. If you remove non-native plants, remember that clearing can promote erosion unless you replant the streambank or riparian corridor as soon as possible with native vegetation or other suitable plants. Seek professional advice before removing

invasive species like *Arundo*; you may need a permit to work in the stream corridor.

If you undertake any grading, construction or vegetation clearing on your property, protect exposed soil with adequate erosion control practices and materials. Most grading or site construction will require a permit from the City or County, which have policies or ordinances requiring the landowner to implement particular sediment control measures in such projects. Even if you are simply renovating your yard, remember that any exposed soil erodes easily. Even small projects require good stream stewardship.

Minimize needless clearing and grading, and avoid any clearing adjacent to a creek. If the project requires clearing or grading of a large area, phase construction in stages to limit soil exposure by disturbing only one portion of the site at any one time. Once a section has been cleared, stabilize all exposed soils immediately with a grass or mulch cover or geotextile fabric. Spreading straw and native grass seed can be an inexpensive way to protect soil until more permanent plants are planted or become established.

When working on steep slopes and cuts, use adequate erosion control techniques. The mitigation practices used on many construction sites are inadequate, of-

ten because of inadequate attention to drainage patterns and runoff volumes or because the contractor relied too much on silt fences to retain sediment washing off a slope. Silt fences can retain only small amounts of runoff and sediment. At the toe of a slope, be careful in using silt fencing because high flows, rapid runoff, and sediment movement down-slope can quickly overload the silt fence or knock it down. On steep slopes, consider using perimeter berms and terraces to slow runoff and capture sediment before it reaches the edge of the site. Additional ground covers, such as jute netting or erosion control blankets may be needed to supplement seeding or mulch.

Avoid grading or vegetation clearing during the rainy season. Schedule cleaning and grubbing or heavy earth moving activities for periods of dry weather. If you must work during the winter, assess your erosion and sediment control practices after each storm. Cover exposed piles of soil, construction materials and waste with plastic sheeting or temporary roofs. Before it rains, sweep and remove materials from surfaces that drain to catch basins, storm drains or creek channels.

Correcting erosion problems

Check for sources of erosion on your property, especially after storms, and correct problems promptly. Bare, vertical and actively eroding streambanks can

lead to extensive bank failures and add large volumes of sediment to the stream. A vegetated slope is the best defense against undercutting and slumping banks. If the native riparian vegetation has been depleted or removed, but severe bank erosion has not occurred yet, you may be able to re-establish or add to the remaining vegetation on your own. Find out what types of native vegetation to use on your site and how to plant and care for them.

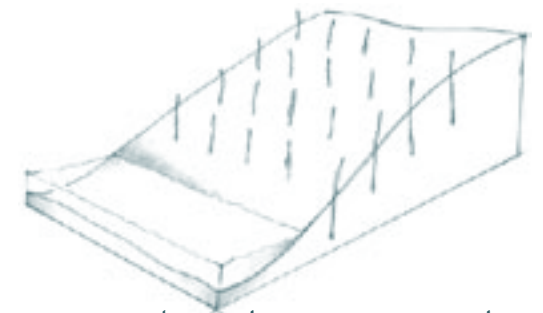
Remember that creeks are complex systems. Stabilizing banks is seldom a simple matter; it requires knowledge and expertise. The appropriate solution must be tailored to the particular conditions at the site, since actions taken to protect your bank may create unforeseen consequences downstream, resulting in your unintentionally passing erosion problems on to your neighbor.

If you have a serious erosion problem, consult with permitting agencies and a qualified professional in streambank stabilization and repair. Virtually any work along the creek channel requires a permit. You may need a Stream Alteration Agreement from the CDFG, as well as a grading permit from the County, before you do anything to your streambank. You may also require permits from the Army Corps of Engineers, the state Regional Water Quality Control Board, US Fish and Wildlife Service or National

Marine Fisheries Service.

Streambank stabilization often involves one or a combination of remedial steps, such as regrading the bank to a more moderate slope and then replanting it with willows and other native plants that can provide good erosion control.

One of the best solutions involves the use of what is called soil bioengineering, in which native plants provide the main structural support. Easily rooting native vegetation cuttings are installed in specific patterns to maximize bank stability. Dead vegetation and rocks may also be used to provide additional support. In one common technique, willow cuttings are driven into the bank to retain the slope.



Live Stake Soil Erosion Control

Live woody cuttings are pushed or tamped into the soil to root, grow and create a root matrix that stabilizes the soil. The above-ground structure that results reduces overland erosive forces such as raindrops or sheet flow across the site.